AAOS
American Academy of Orthopaedic Surgeons

Surgical Management of Osteoarthritis of the Knee

Evidence-Based Clinical Practice Guideline

Adapted by:
The American Academy of Orthopaedic Surgeons Board of Directors
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Military Orthopaedic Surgeons Society

AAHKS — American Association of Hip and Knee Surgeons

AGS Geriatrics Healthcare Professionals

ACR American College of Radiology

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**See Appendix XIII for details regarding support*

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Disclaimer

This Clinical Practice Guideline was developed by an AAOS physician volunteer Guideline development group based on a systematic review of the current scientific and clinical information and accepted approaches to treatment and/or diagnosis. This Clinical Practice Guideline is not intended to be a fixed protocol, as some patients may require more or less treatment or different means of diagnosis. Clinical patients may not necessarily be the same as those found in a clinical trial. Patient care and treatment should always be based on a clinician's independent medical judgment, given the individual patient's clinical circumstances.

Disclosure Requirement
In accordance with AAOS policy, all individuals whose names appear as authors or contributors to Clinical Practice Guideline filed a disclosure statement as part of the submission process. All panel members provided full disclosure of potential conflicts of interest prior to voting on the recommendations contained within this Clinical Practice Guidelines.

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FDA Clearance
Some drugs or medical devices referenced or described in this Clinical Practice Guideline may not have been cleared by the Food and Drug Administration (FDA) or may have been cleared for a specific use only. The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or device he or she wishes to use in clinical practice.

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SUMMARY OF RECOMMENDATIONS

The following is a summary of the recommendations of the AAOS Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. All readers of this summary are strongly urged to consult the full guideline and evidence report for this information. We are confident that those who read the full guideline and evidence report will see that the recommendations were developed using systematic evidence-based processes designed to combat bias, enhance transparency, and promote reproducibility.

This summary of recommendations is not intended to stand alone. Treatment decisions should be made in light of all circumstances presented by the patient. Treatments and procedures applicable to the individual patient rely on mutual communication between patient, physician, and other healthcare practitioners.

Strength of Recommendation Descriptions

Strength	Overall Strength of Evidence	Description of Evidence Quality	Strength Visual
Strong	Strong	Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.	
Moderate	Moderate	Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.	
Limited	Low Strength Evidence or Conflicting Evidence	Evidence from two or more "Low" quality studies with consistent findings **or** evidence from a single "Moderate" quality study recommending for against the intervention or diagnostic or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.	
Consensus*	No Evidence	There is no supporting evidence. In the absence of reliable evidence, the guideline development group is making a recommendation based on their clinical opinion. Consensus statements are published in a separate, complimentary document.	

BMI AS A RISK FACTOR

Strong evidence supports that obese patients have less improvement in outcomes with total knee arthroplasty (TKA).

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

DIABETES AS A RISK FACTOR

Moderate evidence supports that patients with diabetes are at higher risk for complications with total knee arthroplasty (TKA).

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

CHRONIC PAIN AS A RISK FACTOR

Moderate evidence supports that patients with select chronic pain conditions have less improvement in patient reported outcomes with TKA.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

DEPRESSION/ANXIETY AS A RISK FACTOR

Limited evidence supports that patients with depression and/or anxiety symptoms have less improvement in patient reported outcomes with total knee arthroplasty (TKA).

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

CIRRHOSIS/HEPATITIS C AS A RISK FACTOR

Limited evidence supports that patients with cirrhosis or hepatitis C are at higher risk for complications with total knee arthroplasty (TKA).

Strength of Recommendation: Limited Evidence ★★☆☆

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

PREOPERATIVE PHYSICAL THERAPY

Limited evidence supports that supervised exercise before total knee arthroplasty (TKA) might improve pain and physical function after surgery.

Strength of Recommendation: Limited Evidence ★★☆☆

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

DELAY TKA

Moderate evidence supports that an eight month delay to total knee arthroplasty (TKA) does not worsen outcomes.

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

PERIARTICULAR LOCAL ANESTHETIC INFILTRATION

Strong evidence supports the use of peri-articular local anesthetic infiltration compared to placebo in total knee arthroplasty (TKA) to decrease pain and opioid use.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

PERIPHERAL NERVE BLOCKADE

Strong evidence supports that peripheral nerve blockade for total knee arthroplasty (TKA) decreases postoperative pain and opioid requirements.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more “High” strength studies with consistent findings for recommending for or against the intervention.

NEURAXIAL ANESTHESIA

Moderate evidence supports that neuraxial anesthesia could be used in total knee arthroplasty (TKA) to improve select perioperative outcomes and complication rates compared to general anesthesia.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more “Moderate” strength studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

TOURNIQUET: BLOOD LOSS REDUCTION

Moderate evidence supports that the use of a tourniquet in total knee arthroplasty (TKA) decreases intraoperative blood loss.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more “Moderate” strength studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

TOURNIQUET: POSTOPERATIVE PAIN REDUCTION

Strong evidence supports that tourniquet use in total knee arthroplasty (TKA) increases short term post-operative pain.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more “High” strength studies with consistent findings for recommending for or against the intervention.

TOURNIQUET: POSTOPERATIVE FUNCTION

Limited evidence supports that tourniquet use in total knee arthroplasty (TKA) decreases short term post-operative function.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

TRANEXAMIC ACID

Strong evidence supports that, in patients with no known contraindications, treatment with tranexamic acid decreases postoperative blood loss and reduces the necessity of postoperative transfusions following total knee arthroplasty (TKA).

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

ANTIBIOTIC BONE CEMENT

Limited evidence does not support the routine use of antibiotics in the cement for primary total knee arthroplasty (TKA).

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

CRUCIATE RETAINING ARTHROPLASTY

Strong evidence supports no difference in outcomes or complications between posterior stabilized and posterior cruciate retaining arthroplasty designs.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

POLYETHYLENE TIBIAL COMPONENT

Strong evidence supports use of either all-polyethylene or modular tibial components in knee arthroplasty (KA) because of no difference in outcomes.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more “High” strength studies with consistent findings for recommending for or against the intervention.

PATELLAR RESURFACING: PAIN AND FUNCTION

Strong evidence supports no difference in pain or function with or without patellar resurfacing in total knee arthroplasty.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more “High” strength studies with consistent findings for recommending for or against the intervention.

PATELLAR RESURFACING: REOPERATIONS

Moderate evidence supports that patellar resurfacing in total knee arthroplasty (TKA) could decrease cumulative reoperations after 5 years when compared to no patellar resurfacing in total knee arthroplasty (TKA).

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more “Moderate” strength studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

CEMENTED TIBIAL COMPONENTS VERSUS CEMENTLESS TIBIAL COMPONENTS

Strong evidence supports the use of tibial component fixation that is cemented or cementless in total knee arthroplasty due to similar functional outcomes and rates of complications and reoperations.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more “High” strength studies with consistent findings for recommending for or against the intervention.

CEMENTED FEMORAL & TIBIAL COMPONENTS VERSUS CEMENTLESS FEMORAL & TIBIAL COMPONENTS

Moderate evidence supports the use of either cemented femoral and tibial components or cementless femoral and tibial components in knee arthroplasty due to similar rates of complications and reoperations.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more “Moderate” strength studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

ALL CEMENTED COMPONENTS VERSUS HYBRID FIXATION (CEMENTLESS FEMORAL COMPONENT)

Moderate evidence supports the use of either cementing all components or hybrid fixation (cementless femur) in total knee arthroplasty due to similar functional outcomes and rates of complications and reoperations.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more “Moderate” strength studies with consistent findings, or evidence from a single “High” quality study for recommending for or against the intervention.

ALL CEMENTLESS COMPONENTS VERSUS HYBRID FIXATION (CEMENTLESS FEMORAL COMPONENT)

Limited evidence supports the use of either all cementless components or hybrid fixation (cementless femur) in total knee arthroplasty due to similar rates of complications and reoperations.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more “Low” strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

BILATERAL TKA

Limited evidence supports simultaneous bilateral total knee arthroplasty (TKA) for patients aged 70 or younger or ASA status 1-2, because there are no increased complications.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

UKA: REVISIONS

Moderate evidence supports that total knee arthroplasty (TKA) could be used to decrease revision surgery risk compared to unicompartmental knee arthroplasty (UKA) for medial compartment osteoarthritis.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

UKA: DVT & MANIPULATION UNDER ANESTHESIA

Limited evidence supports that unicompartmental knee arthroplasty might be used to decrease the risk of deep vein thrombosis (DVT) and manipulation under anesthesia compared to total knee arthroplasty (TKA) for medial compartment osteoarthritis.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

UKA VERSUS OSTEOTOMY

Moderate evidence supports no difference between unicompartmental knee arthroplasty (UKA) or valgus-producing proximal tibial osteotomy in outcomes and complications in patients with medial compartment knee osteoarthritis.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

SURGICAL NAVIGATION

Strong evidence supports not using intraoperative navigation in total knee arthroplasty (TKA) because there is no difference in outcomes or complications.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

PATIENT SPECIFIC INSTRUMENTATION: PAIN AND FUNCTION

Strong evidence supports not using patient specific instrumentation compared to conventional instrumentation for total knee arthroplasty (TKA) because there is no difference in pain or functional outcomes.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

PATIENT SPECIFIC INSTRUMENTATION: TRANSFUSIONS AND COMPLICATIONS

Moderate evidence supports not using patient specific instrumentation compared to conventional instrumentation for total knee arthroplasty (TKA) because there is no difference in transfusions or complications.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

DRAINS

Strong evidence supports not using a drain with total knee arthroplasty (TKA) because there is no difference in complications or outcomes.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

CRYOTHERAPY DEVICES

Moderate evidence supports that cryotherapy devices after knee arthroplasty (KA) do not improve outcomes.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

CONTINUOUS PASSIVE MOTION

Strong evidence supports that CPM after knee arthroplasty (KA) does not improve outcomes.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

POSTOPERATIVE MOBILIZATION: LENGTH OF STAY

Strong evidence supports that rehabilitation started on the day of the total knee arthroplasty (TKA) reduces length of hospital stay.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

POSTOPERATIVE MOBILIZATION: PAIN AND FUNCTION

Moderate evidence supports that rehabilitation started on day of total knee arthroplasty (TKA) compared to rehabilitation started on postop day 1 reduces pain and improves function.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

EARLY STAGE SUPERVISED EXERCISE PROGRAM: FUNCTION

Moderate evidence supports that a supervised exercise program during the first two months after total knee arthroplasty (TKA) improves physical function.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

EARLY STAGE SUPERVISED EXERCISE PROGRAM: PAIN

Limited evidence supports that a supervised exercise program during the first two months after total knee arthroplasty (TKA) decreases pain.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

LATE STAGE POSTOPERATIVE SUPERVISED EXERCISE PROGRAM: FUNCTION

Limited evidence supports that selected patients might be referred to an intensive supervised exercise program during late stage post total knee arthroplasty (TKA) to improve physical function.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

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INTRODUCTION

OVERVIEW

This clinical practice guideline is based on a systematic review of peer-reviewed articles published from 1966 to January 27th, 2015 with regard to the surgical management of osteoarthritis of the knee in patients over the age of 18 years. The guideline development group opted to include more contemporary literature to make our conclusions as relevant as possible to the current practice of orthopaedic surgeons. In addition to providing practice recommendations, this guideline also highlights limitations in the literature and areas that require future research.

This guideline is intended to be used by all qualified and appropriately trained physicians and surgeons involved in the management of surgical management of osteoarthritis of the knee. It is also intended to serve as an information resource for decision makers and developers of practice guidelines and recommendations.

GOALS AND RATIONALE

The purpose of this clinical practice guideline is to help improve treatment based on the current best evidence. Current evidence-based medicine (EBM) standards demand that physicians use the best available evidence in their clinical decision making. To assist them, this clinical practice guideline consists of a systematic review of the available literature regarding the management of surgical management of knee osteoarthritis in adults. The systematic review detailed herein was conducted between April 2013 and September 2015 and demonstrates where there is good evidence, where evidence is lacking, and what topics future research must target in order to improve the management of adult patients (defined as age 18 years or older) with osteoarthritis of the knee. AAOS staff and the physician work group systematically reviewed the available literature and subsequently wrote the following recommendations based on a rigorous, standardized process.

Musculoskeletal care is provided in many different settings by many different providers. We created this guideline as an educational tool to guide qualified physicians through a series of treatment decisions in an effort to improve the quality and efficiency of care. This guideline should not be construed as including all proper methods of care or excluding methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment must be made in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution.

INTENDED USERS

This guideline is intended to be used by orthopaedic surgeons and physicians managing adult patients with osteoarthritis of the knee. Typically, orthopaedic surgeons will have completed medical training, a qualified residency in orthopaedic surgery, and some may have completed additional sub-specialty training. Anesthesiologists, rheumatologists, physiatrists, adult primary care physicians, geriatricians, hospital based adult medicine specialists, physical therapists, occupational therapists, nurse practitioners, physician assistants, emergency physicians, and other healthcare professionals who routinely see this type of patient in various practice settings may also benefit from this guideline. This guideline is not intended for use as a benefits determination document. Making these determinations involves many factors not considered in

the present document, including available resources, business and ethical considerations, and need.

Knee osteoarthritis management is based on the assumption that decisions are predicated on the patient and/or the patient's qualified heath care advocate having communication with the physician about available treatments and procedures applicable to the individual patient. Once the patient and or their advocate have been informed of available therapies and have discussed these options with his/her physician, an informed decision can be made. Clinician input based on experience with conservative management and the clinician's surgical experience and skills increases the probability of identifying patients who will benefit from specific treatment options.

PATIENT POPULATION

This document addresses the management osteoarthritis of the knee in adult patients defined as those 18 years of age and older. It is not intended to address management of pediatric patients with osteoarthritis or patients with inflammatory arthritis of the knee.

BURDEN OF DISEASE

The burden of osteoarthritis (OA) of the knee is largely attributable to the effects of disability, comorbid disease, and the expense of treatment. OA is the most frequent cause of disability among adults in the United States (US), and the burden is increasing both as the prevalence of OA increases and also as patient expectations for treatment rise. Twenty seven million adults (more than 10 percent) of the US adult population had clinical osteoarthritis (OA) in 2005, and in 2009 OA was the fourth most common cause of hospitalization (Murphy & Helmick, 2012).

OA is the leading indication for joint replacement surgery; 905,000 knee and hip replacements were performed in 2009 at a cost of 42.3 billion dollars (Murphy & Helmick, 2012).

Costs to be considered include:
1.Direct Medical Cost
2.Long-term Medical Cost
3.Home Modification Costs
4.Nursing Home Costs

ETIOLOGY

Patients who require surgical treatment for osteoarthritis of the knee have developed the condition naturally over time due to a variety of risk factors or in an accelerated fashion due to prior trauma about the knee. Osteoarthritis is the imbalance of breakdown and repair of tissues within a synovial joint. The etiology of osteoarthritis is varied and includes genetic factors, trauma, prior meniscectomy, overuse, and infection.

INCIDENCE AND PREVALENCE

Twenty seven million adults (more than 10 percent) of the US adult population had clinical osteoarthritis (OA) in 2005, and in 2009 OA was the fourth most common cause of hospitalization (Murphy & Helmick, 2012). The incidence of knee osteoarthritis is estimated to affect 240 persons per 100,000/year. It is estimated that 9.9 million adults had symptomatic osteoarthritis of the knee in 2010.

With rising life expectancy, it is estimated that the prevalence of knee osteoarthritis will continue to increase. The number of people older than age 65 years is expected to increase from 37.1 million to 77.2 million by the year 2040.

RISK FACTORS

Factors that increase the risk for developing osteoarthritis of the knee such that surgical treatment is required include joint degeneration over time due to hereditary vulnerability, large body mass, certain occupations, past trauma affecting the joint or subchondral bone adjacent to the joint, or prior intraarticular damage (meniscal tear or removal, anterior cruciate ligament tear). For information regarding the evidence base behind various risk factors, please refer to the recommendations within this document regarding risk stratification.

EMOTIONAL AND PHYSICAL IMPACT

Older adults with self-reported osteoarthritis of the knee visit their physicians more frequently and experience greater functional limitations than others in the same age group. Patients who have moderate to severe osteoarthritis of the knee requiring surgery experience:

1. Inability to return to prior living circumstances
2. Need for increased level of care and supervision
3. Decreased quality of life
4. Decreased level of mobility and ambulation

POTENTIAL BENEFITS, HARMS, AND CONTRAINDICATIONS

The benefits of surgical treatment of osteoarthritis of the knee include relief of pain and improved function. Most invasive operative treatments, primarily arthroplasty, are associated with known risks.

Early postoperative complications include prosthetic infection, venous thromboembolic disease, arthrofibrosis, and pain. Late postoperative complications include infection, prosthetic aseptic loosening, and pain. All can lead to a need for revision arthroplasty.

Contraindications are relative and require an in depth discussion with the patient and physician (surgeon, anesthesiologist) about their individual risk factors. Additional factors, such as the individual's co-morbidities, and/or specific patient characteristics may affect the physician's choice of treatment. Clinician input based on experience increases the probability of identifying patients who will benefit from specific treatment options. The individual patient and/or their decision surrogate dynamic will also influence treatment decisions, therefore, discussion of available treatments and procedures applicable to the individual patient rely on mutual communication between the patient and/or decision surrogate and physician, weighing the potential risks and benefits for that patient. Once the patient and/or their decision surrogate have been informed of available therapies and have discussed these options with the patient's physician, an informed decision can be made.

FUTURE RESEARCH

Consideration for future research is provided for each recommendation within this document.

METHODS

The methods used to perform this systematic review were employed to minimize bias and enhance transparency in the selection, appraisal, and analysis of the available evidence. These processes are vital to the development of reliable, transparent, and accurate clinical recommendations for treating osteoarthritis of the knee.

This clinical practice guideline and the systematic review upon which it is based evaluate the effectiveness of surgical treatments for osteoarthritis of the knee. This section describes the methods used to prepare this guideline and systematic review, including search strategies used to identify literature, criteria for selecting eligible articles, determining the strength of the evidence, data extraction, methods of statistical analysis, and the review and approval of the guideline. The AAOS approach incorporates practicing physicians (clinical experts) and methodologists who are free of potential conflicts of interest as recommended by guideline development experts.

The AAOS understands that only high-quality guidelines are credible, and we go to great lengths to ensure the integrity of our evidence analyses. The AAOS addresses bias beginning with the selection of guideline development group members. Applicants with financial conflicts of interest (COI) related to the guideline topic cannot participate if the conflict occurred within one year of the start date of the guideline's development or if an immediate family member has, or has had, a relevant financial conflict. Additionally, all guideline development group members sign an attestation form agreeing to remain free of relevant financial conflicts for one year following the publication of the guideline.

This guideline and systematic review were prepared by the AAOS Surgical Management of Osteoarthritis of the Knee guideline physician guideline development group (clinical experts) with the assistance of the AAOS Evidence-Based Medicine (EBM) Unit in the Department of Research and Scientific Affairs (methodologists) at the AAOS. To develop this guideline, the guideline development group held an introductory meeting on August 16, 2013 to establish the scope of the guideline and the systematic reviews. As the physician experts, the guideline development group defined the scope of the guideline by creating PICO Questions (i.e. population, intervention, comparison, and outcome) that directed the literature search. The original PICO questions developed at the introductory meeting can be viewed in Appendix III. When necessary, these clinical experts also provided content help, search terms and additional clarification for the AAOS Medical Librarian. The Medical Librarian created and executed the search(es). The supporting group of methodologists (AAOS EBM Unit) reviewed all abstracts, recalled pertinent full-text articles for review and evaluated the quality of studies meeting the inclusion criteria. They also abstracted, analyzed, interpreted, and/or summarized the relevant data for each recommendation and prepared the initial draft for the final meeting. Upon completion of the systematic reviews, the physician guideline development group participated in a three-day recommendation meeting on April 10-12, 2015. At this meeting, the physician experts and methodologists evaluated and integrated all material to develop the final recommendations. The final recommendations and rationales were edited, written and voted on at the final meeting. Additional edits to the rationales were approved by the guideline

development group on webinars after the meeting. The draft guideline recommendations and rationales received final review by the methodologists to ensure that these recommendations and rationales were consistent with the data. The draft was then completed and submitted for peer review on July 6, 2015.

The resulting draft guidelines were then peer-reviewed, edited in response to that review and subsequently distributed for public commentary. Thereafter, the draft guideline was sequentially approved by the AAOS Committee on Evidence-Based Quality and Value, AAOS Council on Research and Quality, and the AAOS Board of Directors (see Appendix II for a description of the AAOS bodies involved in the approval process). All AAOS guidelines are reviewed and updated or retired every five years in accordance with the criteria of the National Guideline Clearinghouse.

Thus the process of AAOS guideline development incorporates the benefits from clinical physician expertise as well as the statistical knowledge and interpretation of non-conflicted methodologists. The process also includes an extensive review process offering the opportunity for over 200 clinical physician experts to provide input into the draft prior to publication. This process provides a sound basis for minimizing bias, enhancing transparency and ensuring the highest level of accuracy for interpretation of the evidence.

FORMULATING PICO QUESTIONS

The guideline development group began work on this guideline by constructing a set of PICO questions. These questions specify the patient population of interest (P), the intervention of interest (I), the comparisons of interest (C), and the patient-oriented outcomes of interest (O). They function as questions for the systematic review, not as final recommendations or conclusions. A full list of the original PICO questions can be viewed in Appendix III. Once established, these *a priori* PICO questions cannot be modified until the final guideline development group meeting.

STUDY SELECTION CRITERIA

We developed *a priori* article inclusion criteria for our review. These criteria are our "rules of evidence" and articles that did not meet them are, for the purposes of this guideline, not evidence.

To be included in our systematic reviews (and hence, in this guideline) an article had to meet the following criteria:

Work Group Defined Criteria

1. Study must be of an *osteoarthritis-related* injury or prevention thereof and at least 90% of patient population should have osteoarthritis.
2. Study must be published in or after 1966 for *surgical treatment, rehabilitation, bracing, prevention and MRI*
3. Study must be published in or after 1966 for *x rays* and *nonoperative treatment*
4. Study must be published in or after 1966 for all others non specified
5. Study should have 10 or more patients per group

6. For surgical treatment a minimum of N days/months/year (refer to PICO questions for detailed follow up duration) For *nonoperative treatment* a minimum of N days/months/year (refer to PICO questions for detailed follow up duration)
7. For *prevention studies* a minimum of N days/months/year (refer to PICO questions for detailed follow up duration)

Standard Criteria for all CPGs

Article must be a full article report of a clinical study.
Retrospective non-comparative case series, medical records review, meeting abstracts, meta-analyses, systematic reviews, historical articles, editorials, letters, and commentaries are ***excluded***. Bibliographies of meta-analyses and systematic reviews will be examined to ensure inclusion of all relevant literature.
Confounded studies (i.e. studies that give patients the treatment of interest AND another treatment) are ***excluded***.
Case series studies that have non-consecutive enrollment of patients are ***excluded***.
Controlled trials in which patients were not stochastically assigned to groups AND in which there was either a difference in patient characteristics or outcomes at baseline AND where the authors did not statistically adjust for these differences when analyzing the results are ***excluded***.
All studies evaluated as "very low quality" will be ***excluded***.
Composite measures or outcomes are ***excluded*** even if they are patient-oriented.
Study must appear in a peer-reviewed publication
For any included study that uses "paper-and-pencil" outcome measures (e.g., SF-36), only those outcome measures that have been validated will be included
For any given follow-up time point in any included study, there must be ≥ 50% patient follow-up (if the follow-up is >50% but <80%, the study quality will be downgraded by one Level)
Study must be of humans
Study must be published in English
Study results must be quantitatively presented
Study must not be an in vitro study
Study must not be a biomechanical study
Study must not have been performed on cadavers

We will only evaluate surrogate outcomes when no patient oriented outcomes are available.

BEST EVIDENCE SYNTHESIS

We included only the best available evidence for any given outcome addressing a recommendation. Accordingly, we first included the highest quality evidence for any given outcome if it was available. In the absence of two or more occurrences of an outcome at this quality, we considered outcomes of the next lowest quality until at least two or more occurrences of an outcome had been acquired. For example, if there were two 'moderate' quality occurrences of an outcome that addressed a recommendation, we did not include 'low' quality occurrences of this outcome. A summary of the evidence that met the inclusion criteria, but was not best available evidence was created and can be viewed by recommendation in Appendix XII.

RECOMMENDING FOR OR AGAINST A PROCEDURE

The guideline work group considers the procedure of interest and comparison procedure when recommending or not recommending a procedure for clinical use. If the procedure of interest

results in outcomes that are similar to the comparison procedure, the work group may recommend both procedures due to no statistical difference in outcomes. If the procedure of interest results in outcomes that are not statistically different than a placebo or no procedure, the work group may recommend against the procedure of interest, because it adds no measurable benefit to a patient's outcomes.

MINIMALLY CLINICALLY IMPORTANT IMPROVEMENT

Wherever possible, we consider the effects of treatments in terms of the minimally clinically important difference (MCID) in addition to whether their effects are statistically significant. The MCID is the smallest clinical change that is important to patients, and recognizes the fact that there are some treatment-induced statistically significant improvements that are too small to matter to patients. However, there were no occurrences of validated MCID outcomes in the studies included in this clinical practice guideline.

When MCID values from the specific guideline patient population are not available, we use the following measures listed in order of priority:

MCID/MID
PASS or Impact
Another validated measure
Statistical Significance

LITERATURE SEARCHES

We begin the systematic review with a comprehensive search of the literature. Articles we consider were published prior to January 2015 in four electronic databases; PubMed, EMBASE, CINAHL, and The Cochrane Central Register of Controlled Trials. The medical librarian conducts the search using key terms determined from the guideline development group's PICO questions.

We supplement the electronic search with a manual search of the bibliographies of all retrieved publications, recent systematic reviews, and other review articles for potentially relevant citations. Recalled articles are evaluated for possible inclusion based on the study selection criteria and are summarized for the guideline development group who assist with reconciling possible errors and omissions.

The study attrition diagram in Appendix IV provides a detailed description of the numbers of identified abstracts and recalled and selected studies that were evaluated in the systematic review of this guideline. The search strategies used to identify the abstracts are contained in Appendix V.

METHODS FOR EVALUATING EVIDENCE

PROGNOSTIC STUDY QUALITY APPRAISAL QUESTIONS

The following questions are used to evaluate the study quality of prognostic study designs.

- Was the spectrum of patients studied for this prognostic variable representative of the patient spectrum seen in actual clinical practice?
- Was loss to follow up unrelated to key characteristics?

- Was the prognostic factor of interest adequately measured in the study to limit potential bias?
- Was the outcome of interest adequately measured in study participants to sufficiently limit bias?
- Were all important confounders adequately measured in study participants to sufficiently limit potential bias?
- Was the statistical analysis appropriate for the design of the study, limiting potential for presentation of invalid results?

Prognostic Study Design Quality Key

High Quality Study	<1 Flaw
Moderate Quality Study	≥1 and <2 Flaws
Low Quality Study	≥2 and <3 Flaws
Very Low Quality Study	≥3 Flaws

RANDOMIZED STUDY QUALITY APPRAISAL QUESTIONS

The following domains are evaluated to determine the study quality of randomized study designs.

- Random Sequence Generation
- Allocation Concealment
- Blinding of Participants and Personnel
- Incomplete Outcome Data
- Selective Reporting
- Other Bias

Upgrading Randomized Study Quality Questions

- Is there a large magnitude of effect?
- Influence of All Plausible Residual Confounding
- Dose-Response Gradient

Randomized Study Design Quality Key

High Quality Study	<2 Flaw
Moderate Quality Study	≥2 and <4 Flaws
Low Quality Study	≥4 and <6 Flaws
Very Low Quality Study	≥6 Flaws

OBSERVATIONAL STUDY DESIGN QUALITY APPRAISAL QUESTIONS

The following questions are used to evaluate the study quality of observational study designs. Note that all observation studies begin the appraisal process at "low quality" due to design flaws inherent in observational studies.

- Is this observational study a prospective case series?
- Does the strategy for recruiting participants into the study differ across groups?
- Did the study fail to balance the allocation between the groups or match groups (e.g., through stratification, matching, propensity scores)?
- Were important confounding variables not taken into account in the design and/or analysis (e.g., through matching, stratification, interaction terms, multivariate analysis, or other statistical adjustment such as instrumental variables)?
- Was the length of follow-up different across study groups?
- Other Bias?

Upgrading Observational Study Quality Questions

- Is there a large magnitude of effect?
- Influence of All Plausible Residual Confounding
- Dose-Response Gradient

Observational Study Design Quality Key

High Quality Study	<2 Flaw
Moderate Quality Study	≥2 and <4 Flaws
Low Quality Study	≥4 and <6 Flaws
Very Low Quality Study	≥6 Flaws

DEFINING THE STRENGTH OF THE RECOMMENDATIONS

Judging the quality of evidence is only a stepping stone towards arriving at the strength of a guideline recommendation. The strength of recommendation also takes into account the quality, quantity, and the trade-off between the benefits and harms of a treatment, the magnitude of a treatment's effect, and whether there is data on critical outcomes.

Strength of recommendation expresses the degree of confidence one can have in a recommendation. As such, the strength expresses how possible it is that a recommendation will be overturned by future evidence. It is very difficult for future evidence to overturn a recommendation that is based on many high quality randomized controlled trials that show a large effect. It is much more likely that future evidence will overturn recommendations derived from a few small retrospective comparative studies. Consequently, recommendations based on the former kind of evidence are given a high strength of recommendation and recommendations based on the latter kind of evidence are given a low strength.

To develop the strength of a recommendation, AAOS staff first assigned a preliminary strength for each recommendation that took only the final quality and the quantity of evidence (see

Table 1).

Table 1. Strength of Recommendation Descriptions

Strength	Overall Strength of Evidence	Description of Evidence Quality	Strength Visual
Strong	Strong	Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.	
Moderate	Moderate	Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.	
Limited	Low Strength Evidence or Conflicting Evidence	Evidence from two or more "Low" quality studies with consistent findings **or** evidence from a single "Moderate" quality study recommending for against the intervention or diagnostic or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.	
Consensus*	No Evidence	There is no supporting evidence. In the absence of reliable evidence, the guideline development group is making a recommendation based on their clinical opinion. Consensus statements are published in a separate, complimentary document.	

WORDING OF THE FINAL RECOMMENDATIONS

To prevent bias in the way recommendations are worded, the AAOS uses specific predetermined language stems that are governed by the evidence strengths. Each recommendation was written using language that accounts for the final strength of the recommendation. This language, and the corresponding strength, is shown in Table 2.

Table 2. AAOS Guideline Language Stems

Guideline Language	Strength of Recommendation
Strong evidence supports that the practitioner should/should not do X, because…	Strong
Moderate evidence supports that the practitioner could/could not do X, because…	Moderate
Limited evidence supports that the practitioner might/might not do X, because…	Limited
In the absence of reliable evidence, it is the ***opinion*** of this guideline development group that…*	Consensus*

**Consensus based recommendations are made according to specific criteria. These criteria can be found in Appendix VII.*

APPLYING THE RECOMMENDATIONS TO CLINICAL PRACTICE

To increase the practicality and applicability of the guideline recommendations in this document, the information listed in Table 3 provides assistance in interpreting the correlation between the strength of a recommendation and patient counseling time, use of decision aids, and the impact of future research

Table 3. Clinical Applicability: Interpreting the Strength of a Recommendation

Strength of Recommendation	Patient Counseling (Time)	Decision Aids	Impact of Future Research
Strong	Least	Least Important, unless the evidence supports no difference between two alternative interventions	Not likely to change
Moderate	Less	Less Important	Less likely to change
Limited	More	Important	Change possible/anticipated
Consensus	Most	Most Important	Impact unknown

VOTING ON THE RECOMMENDATIONS

The recommendations and their strength were voted on by the guideline development group members during the final meeting. If disagreement between the guideline development group occurred, there was further discussion to see whether the disagreement(s) could be resolved. Recommendations were approved and adopted in instances where a simple majority (60%) of the guideline development group voted to approve.

STATISTICAL METHODS

ANALYSIS OF INTERVENTION/PREVENTION DATA

When possible, the AAOS EBM Unit recalculates the results reported in individual studies and compile them to answer the recommendations. The results of all statistical analysis conducted by the AAOS EBM Unit are conducted using SAS 9.4. SAS was used to determine the magnitude, direction, and/or 95% confidence intervals of the treatment effect. For data reported as means (and associated measures of dispersion) the mean difference between groups and the 95% confidence interval was calculated and a two-tailed t-test of independent groups was used to determine statistical significance. When published studies report measures of dispersion other than the standard deviation the value was estimated to facilitate calculation of the treatment effect. In studies that report standard errors or confidence intervals the standard deviation was back-calculated. In some circumstances statistical testing was conducted by the authors and measures of dispersion were not reported. In the absence of measures of dispersion, the results of the statistical analyses conducted by the authors (i.e. the p-value) are considered as evidence. For proportions, we report the proportion of patients that experienced an outcome along with the percentage of patients that experienced an outcome. The variance of the arcsine difference was used to determine statistical significance.[M6] P-values < 0.05 were considered statistically significant.

When the data was available, we performed meta-analyses using the random effects method of DerSimonian and Laird.[M1] A minimum of three studies was required for an outcome to be considered by meta-analysis. Heterogeneity was assessed with the I-squared statistic. Meta-analyses with I-squared values less than 50% were considered as evidence. Those with I-squared

larger than 50% were not considered as evidence for this guideline. All meta-analyses were performed using SAS 9.4. The arcsine difference was used in meta-analysis of proportions. In order to overcome the difficulty of interpreting the magnitude of the arcsine difference, a summary odds ratio is calculated based on random effects meta-analysis of proportions and the number needed to treat (or harm) is calculated. The standardized mean difference was used for meta-analysis of means and magnitude was interpreted using Cohen's definitions of small, medium, and large effect.

PEER REVIEW

Following the final meeting, the guideline draft undergoes peer review for additional input from external content experts. Written comments are provided on the structured review form (see Appendix VII). All peer reviewers are required to disclose their conflicts of interest.
To guide who participates, the guideline development group identifies specialty societies at the introductory meeting. O*rganizations*, not *individuals*, are specified.

The specialty societies are solicited for nominations of individual peer reviewers approximately six weeks before the final meeting. The peer review period is announced as it approaches and others interested are able to volunteer to review the draft. The chairs of the guideline development group and chair of the AAOS committee on Evidence Based Quality and Value reviews the draft of the guideline prior to dissemination.

Some specialty societies (both orthopaedic and non-orthopaedic) ask their evidence-based practice (EBP) committee to provide review of the guideline. The organization is responsible for coordinating the distribution of our materials and consolidating their comments onto one form. The chair of the external EBP committees provides disclosure of their conflicts of interest (COI) and manages the potential conflicts of their members.

Again, the AAOS asks for comments to be assembled into a single response form by the specialty society and for the individual submitting the review to provide disclosure of potentially conflicting interests. The peer review stage gives external stakeholders an opportunity to provide evidence-based direction for modifications that they believe have been overlooked. Since the draft is subject to revisions until its approval by the AAOS Board of Directors as the final step in the guideline development process, confidentiality of all working drafts is essential.

The chairs of the guideline development group and the manager of the AAOS evidence-based medicine unit drafts the initial responses to comments that address methodology. These responses are then reviewed by the chair and co-chair, who respond to questions concerning clinical practice and techniques. The director of the Department of Research and Scientific Affairs may provide input as well. All comments received and the initial drafts of the responses are also reviewed by all members of the guideline development group. All proposed changes to recommendation language as a result of peer review are based on the evidence and undergoes majority vote by the guideline development group members. Final revisions are summarized in a detailed report that is made part of the guideline document throughout the remainder of the review and approval processes.

The AAOS believes in the importance of demonstrating responsiveness to input received during the peer review process and welcomes the critiques of external specialty societies. Following final approval of the guideline, all individual responses are posted on our website http://www.aaos.org/guidelines with a point-by-point reply to each non-editorial comment. Reviewers who wish to remain anonymous notify the AAOS to have their names de-identified; their comments, our responses, and their COI disclosures are still posted.

Review of the Surgical Management of Osteoarthritis of the Knee guideline was requested of 21 organizations. Seven individuals representing six organizations returned comments on the structured review form (see Appendix VII).

PUBLIC COMMENTARY

After modifying the draft in response to peer review, the guideline was subjected to a thirty day period of "Public Commentary." Commentators consist of members of the AAOS Board of Directors (BOD), members of the Council on Research and Quality (CORQ), members of the Board of Councilors (BOC), and members of the Board of Specialty Societies (BOS). The guideline is automatically forwarded to the AAOS BOD and CORQ so that they may review it and provide comment prior to being asked to approve the document. Members of the BOC and BOS are solicited for interest. If they request to see the document, it is forwarded to them for comment. Based on these bodies, over 200 commentators have the opportunity to provide input into this guideline. One organization returned public comments.

THE AAOS GUIDELINE APPROVAL PROCESS

This final guideline draft must be approved by the AAOS Committee on Evidence Based Quality and Value Committee, the AAOS Council on Research and Quality, and the AAOS Board of Directors. These decision-making bodies are described in Appendix II and are not designated to modify the contents. Their charge is to approve or reject its publication by majority vote.

REVISION PLANS

This guideline represents a cross-sectional view of current treatment and may become outdated as new evidence becomes available. This guideline will be revised in accordance with new evidence, changing practice, rapidly emerging treatment options, and new technology. This guideline will be updated or withdrawn in five years in accordance with the standards of the National Guideline Clearinghouse.

GUIDELINE DISSEMINATION PLANS

The primary purpose of the present document is to provide interested readers with full documentation about not only our recommendations, but also about how we arrived at those recommendations.

To view all AAOS published guideline recommendations in a user-friendly app, please visit www.orthoguidelines.org.

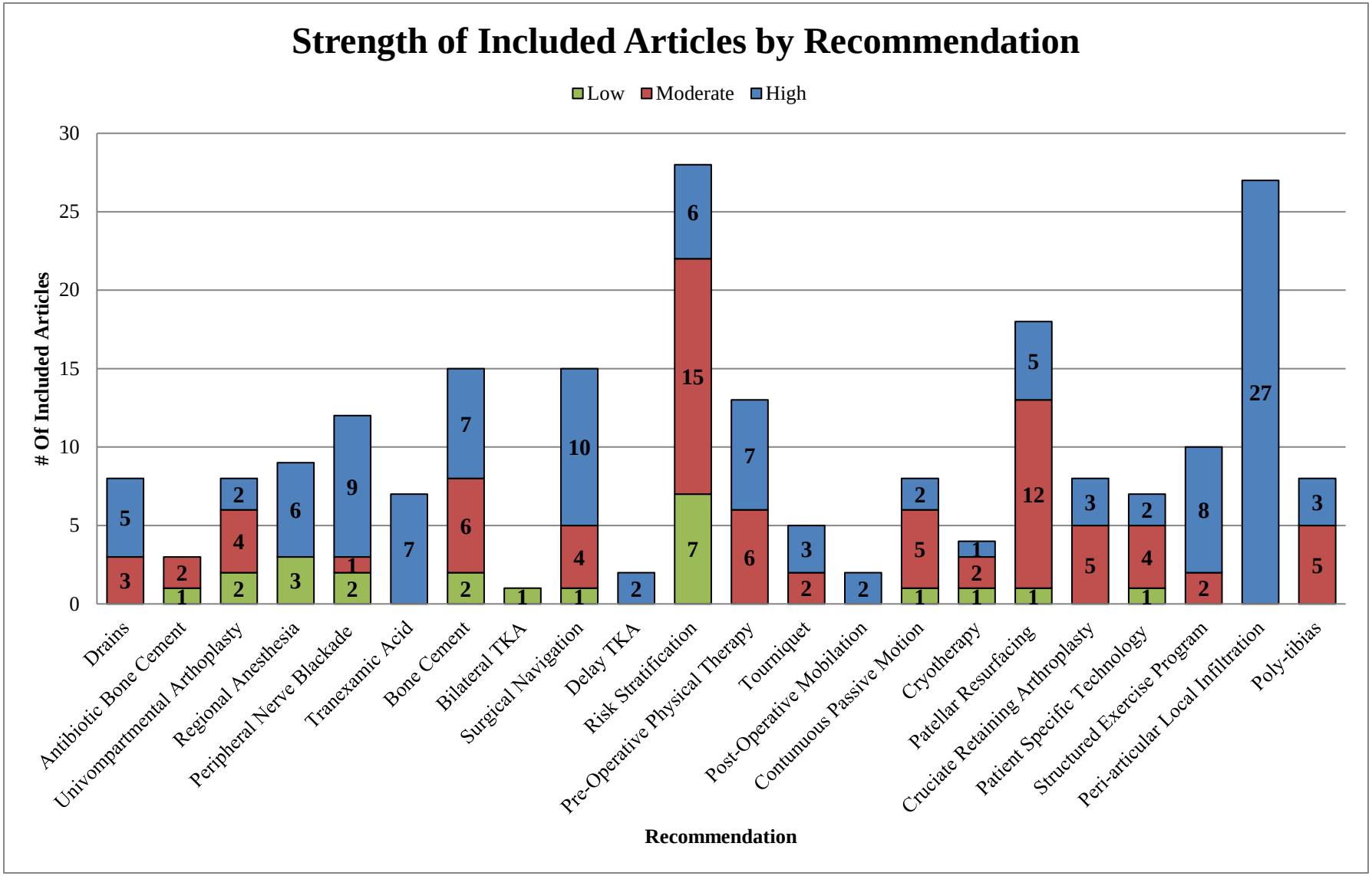
Shorter versions of the guideline are available in other venues. Publication of most guidelines is announced by an Academy press release, articles authored by the guideline development group and published in the Journal of the American Academy of Orthopaedic Surgeons, and articles published in AAOS *Now*. Most guidelines are also distributed at the AAOS Annual Meeting in various venues such as on Academy Row and at Committee Scientific Exhibits.

Selected guidelines are disseminated by webinar, an Online Module for the Orthopaedic Knowledge Online website, Radio Media Tours, Media Briefings, and by distributing them at relevant Continuing Medical Education (CME) courses and at the AAOS Resource Center.

Other dissemination efforts outside of the AAOS will include submitting the guideline to the National Guideline Clearinghouse and distributing the guideline at other medical specialty societies' meetings.

RECOMMENDATIONS

OVERVIEW OF ARTICLES BY RECOMMENDATION



** See Appendix XIII for details regarding support*

RISK STRATIFICATION RECOMMENDATIONS

This AAOS guideline provides risk stratification for various potentially reversible/maximized factors/conditions (obesity, diabetes, chronic pain, depression/anxiety and cirrhosis/hepatitis C). By design the literature was reviewed as pertains to patients having a total knee arthroplasty. That literature is limited in terms of a wide variety of other risks, especially those that are not reversible. Capturing the rates of certain complications such as myocardial infarction, stroke, pneumonia etc., is not statistically possible from the higher quality levels of the literature because they are rare and the numbers of patients available in most studies limited. These areas were considered beyond the methodology of the current guideline.

BMI AS A RISK FACTOR

Strong evidence supports that obese patients have less improvement in outcomes with total knee arthroplasty (TKA).

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

DIABETES AS A RISK FACTOR

Moderate evidence supports that patients with diabetes are at higher risk for complications with total knee arthroplasty (TKA).

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

CHRONIC PAIN AS A RISK FACTOR

Moderate evidence supports that patients with select chronic pain conditions have less improvement in patient reported outcomes with TKA.

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

DEPRESSION/ANXIETY AS A RISK FACTOR

Limited evidence supports that patients with depression and/or anxiety symptoms have less improvement in patient reported outcomes with total knee arthroplasty (TKA).

Strength of Recommendation: Limited Evidence ★★☆☆

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

CIRRHOSIS/HEPATITIS C AS A RISK FACTOR

Limited evidence supports that patients with cirrhosis or hepatitis C are at higher risk for complications with total knee arthroplasty (TKA).

* *See Appendix XIII for details regarding support*

Strength of Recommendation: Limited Evidence ★★☆☆

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALES

RATIONALE: BMI AS A RISK FACTOR

There were four high quality papers extracted that addressed complication rates after total knee arthroplasty for obese patients. Two (Bordini 2009, Judge 2012) demonstrated no higher complication rates in obese patients, whereas the other two (Jamsen, 2013, Amin,2006) did show higher rates of complications. The conflicting high quality papers negate each other and did not allow for a recommendation regarding complications. There were two high quality papers that demonstrated less improvement in functional outcomes in obese patients after total knee arthroplasty (Judge 2012, Amin 2006). As such the recommendation was made that strong evidence supports the risk for less good outcomes after total knee arthroplasty.

RATIONALE: DIABETES AS A RISK FACTOR

There was one high quality paper (Jamsen 2013) that showed a higher rate of complications and an increased risk of revision surgery for diabetics after total knee arthroplasty. Since it was the only high quality paper extracted, the recommendation strength is moderate.

RATIONALE: CHRONIC PAIN AS A RISK FACTOR

One moderate quality paper (Boyle 2014) used low back pain as one form of chronic pain and demonstrated less good outcomes. Another moderate quality paper (Perruccio 2012) showed less good outcomes after total knee arthroplasty for patients with multiple joint and/or spine pain. The two retain a moderate quality of evidence leading to the recommendation that moderate evidence supports that patients with select chronic pain conditions have less improvement in patient reported outcomes with total knee arthroplasty.

RATIONALE: DEPRESSION/ANXIETY AS A RISK FACTOR

One moderate quality study (Duiven 2013) and one low quality paper (Singh 2010) demonstrated less good outcomes in patients with anxiety/depression. There only being one moderate quality paper, the recommendation made was that limited evidence supports that patients with depression and/or anxiety symptoms have less improvement in patient reported outcomes with total knee arthroplasty.

RATIONALE: CIRRHOSIS/HEPATITIS C AS A RISK FACTOR

Given that the liver is the target organ for hepatitis C, these two risk factors were grouped together. Shih (2004) demonstrated higher complication rates after total knee arthroplasty in patients with cirrhosis and was assigned moderate quality. Pour (2011) was lower quality paper that demonstrated the same in patients with hepatitis C virus status alone and without liver damage. Given the one moderate study and one low quality study, the recommendation was made that limited evidence supports that patients with cirrhosis or hepatitis C are at higher risk for complications with total knee arthroplasty.

RISK/HARMS STATEMENT

The above co-morbidity groups each have wide spectrums of disease intensity and subsequent great variability in terms of marginally less good outcomes and higher risk. There is a possible risk of patients being treated as a member of a class, rather than as individuals. This is especially the case given that federal payments are increasingly being linked to rates of readmission and complications as well as cost and outcomes. The risk adjustments are not exact enough to protect hospitals and surgeons if they offer surgery to all patients from co-morbidity classes with higher risk or less

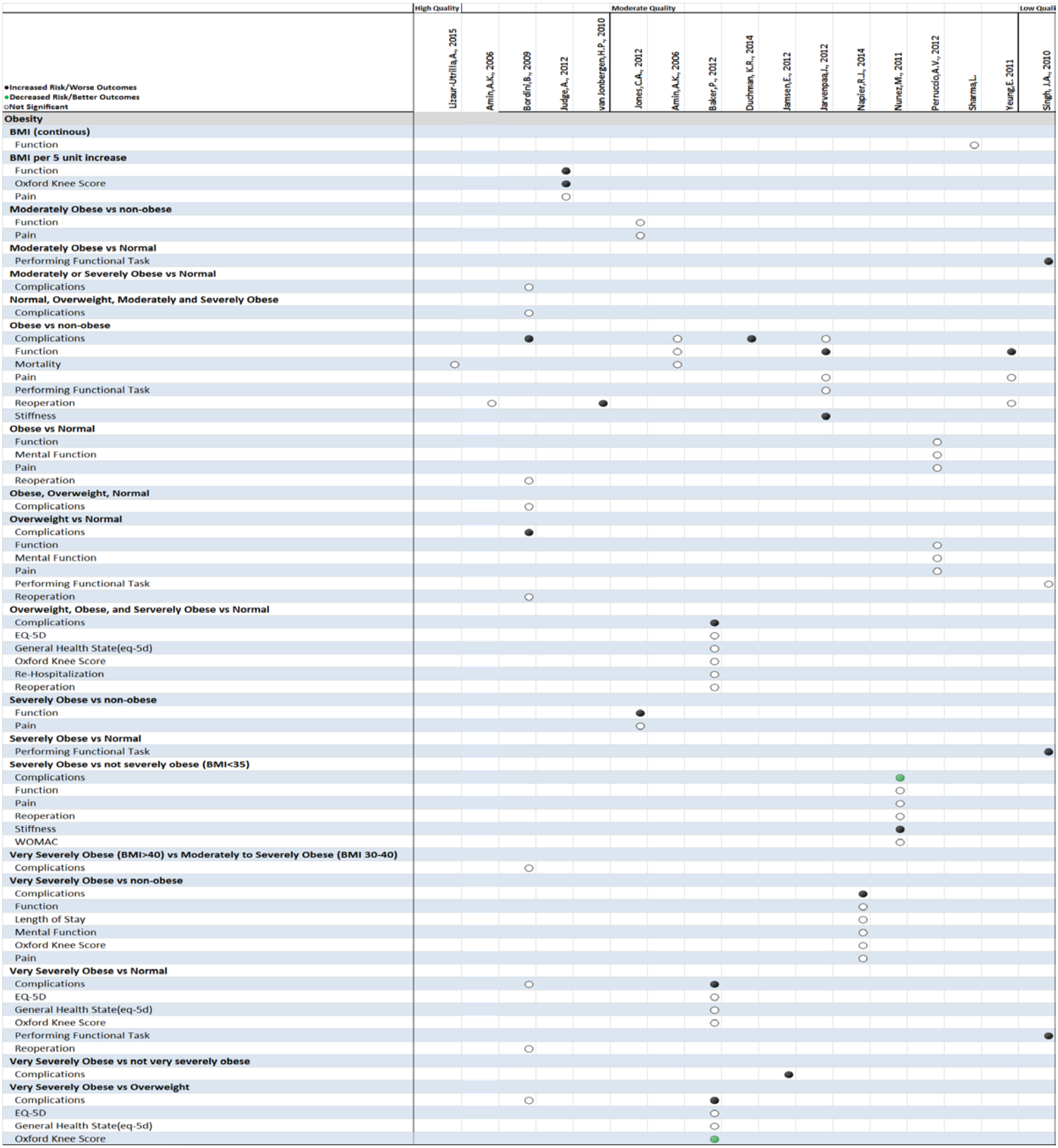
good outcomes. Given the current pressures from value based payments, separating out the patients with lower expression of their co-morbidities for treatment is less likely than avoidance of the particular class as a whole, even if there is a high likelihood of success for selective cases.

FUTURE RESEARCH

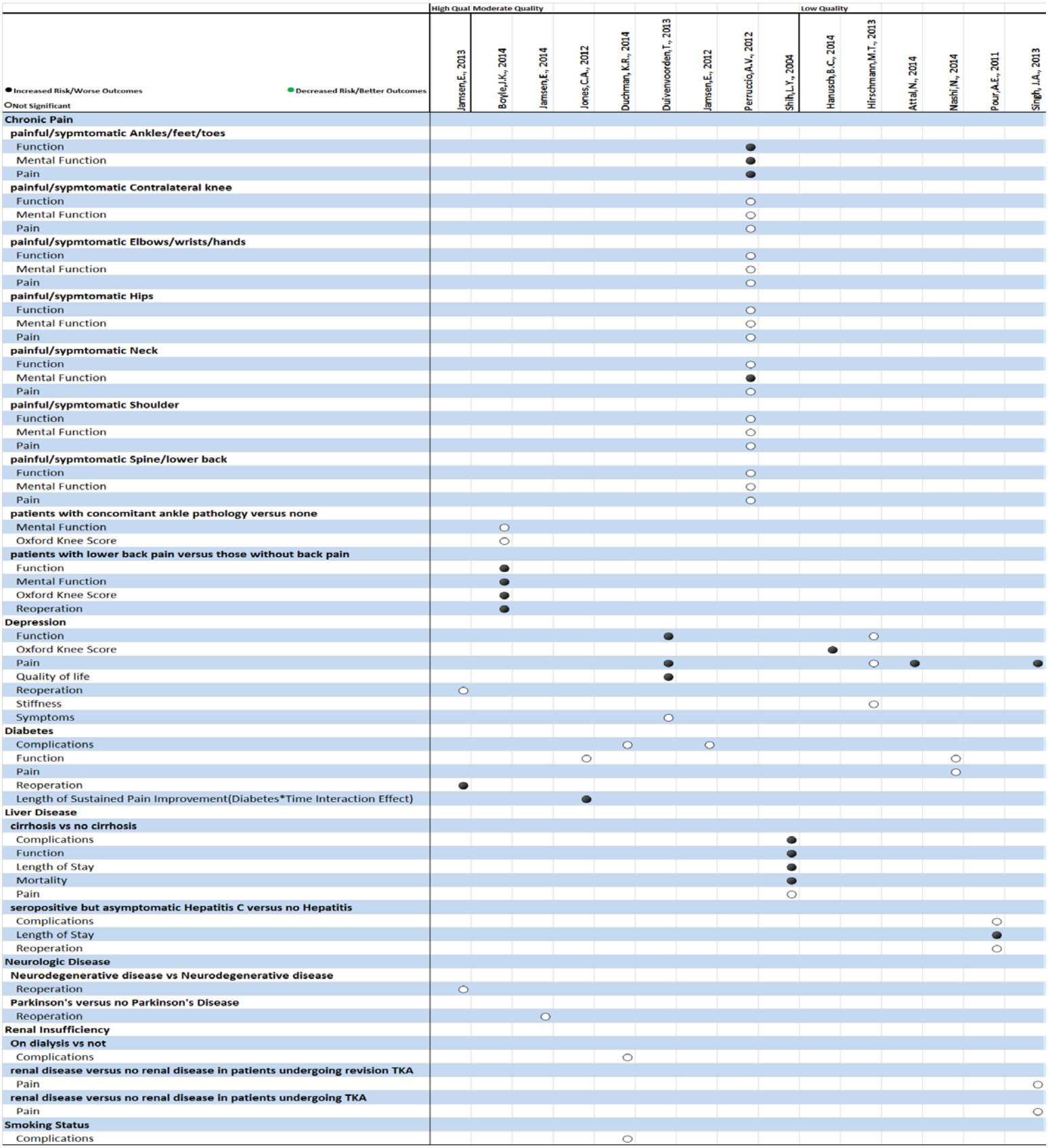
Future research can be directed in several directions. One direction would be the evaluation of patient's outcomes and risks after they have had successful treatment of their co-morbidity. Examples would include patients successfully status post gastric bypass surgery or those patients treated for, and who have eradication of, hepatitis C.
Sub-group analysis of various levels of involvement of the above co-morbidities has been difficult because of smaller cohorts or the use of administrative data sets with only a few non-discriminating utilized codes. Future research could be addressed towards utilization of more complex registry data to better define the marginal increase in risk and less good outcomes for patients with less severe expression of various co-morbidities. It could also address the creation of better models of risk adjustment for performance measures in such sub-groups versus those with more severe expression of disease. Careful analysis of risk category may also be helpful to assess if one or more component of the risk factor contributes significantly or may act as a surrogate (e.g. malnutrition in obesity).

RESULTS

SUMMARY OF FINDINGS TABLE 20: OBESITY



SUMMARY OF FINDINGS TABLE 21: OTHER RISK FACTORS



QUALITY EVALUATION TABLE 11: RISK STRATIFICATION

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Prognostic

Study	Representative Population	Reason for Follow Up Loss	Prognostic Factor Measured	Outcome Measurement	Confounders	Appropriate Statistical Analysis	Inclusion	Strength
Amin,A.K., 2006	◑	●	●	●	●	●	Include	High Quality
Amin,A.K., 2006	●	◑	●	●	○	●	Include	Moderate Quality
Attal,N., 2014	◑	◑	●	●	○	○	Include	Low Quality
Baker,P., 2012	●	◑	●	●	○	●	Include	Moderate Quality
Bordini,B., 2009	●	●	●	●	●	◑	Include	High Quality
Boyle,J.K., 2014	◑	●	○	●	●	●	Include	Moderate Quality
Duchman,K.R., 2014	●	◑	●	●	○	●	Include	Moderate Quality
Duivenvoorden,T., 2013	●	●	○	●	●	●	Include	Moderate Quality
Hanusch,B.C., 2014	◑	◑	●	●	◑	○	Include	Low Quality
Hirschmann,M.T., 2013	◑	◑	◑	●	○	●	Include	Low Quality
Jamsen,E., 2012	●	●	●	●	○	●	Include	Moderate Quality
Jamsen,E., 2013	●	●	●	●	●	●	Include	High Quality
Jamsen,E., 2014	●	●	●	●	○	◑	Include	Moderate Quality
Jarvenpaa,J., 2012	◑	◑	●	●	◑	●	Include	Moderate Quality
Jones,C.A., 2012	●	◑	●	●	●	◑	Include	Moderate Quality
Judge,A., 2012	●	◑	●	●	●	●	Include	High Quality
Lizaur-Utrilla,A., 2015	●	◑	●	●	●	◑	Include	High Quality

** See Appendix XIII for details regarding support*

Study	Representative Population	Reason for Follow Up Loss	Prognostic Factor Measured	Outcome Measurement	Confounders	Appropriate Statistical Analysis	Inclusion	Strength
Napier,R.J., 2014	◑	●	●	●	○	●	Include	Moderate Quality
Nashi,N., 2014	◑	◑	●	○	◑	◑	Include	Low Quality
Nunez,M., 2011	●	●	●	●	○	●	Include	Moderate Quality
Perruccio,A.V., 2012	◑	◑	●	●	●	●	Include	Moderate Quality
Pour,A.E., 2011	◑	●	◑	●	○	○	Include	Low Quality
Sharma,L., 1996	●	●	●	●	●	○	Include	Moderate Quality
Shih,L.Y., 2004	●	◑	●	●	○	●	Include	Moderate Quality
Singh,J.A., 2010	●	◑	●	○	●	○	Include	Low Quality
Singh,J.A., 2013	●	◑	●	●	○	◑	Include	Low Quality
van Jonbergen,H.P., 2010	●	●	●	●	●	◑	Include	High Quality
Yeung,E., 2011	●	●	●	●	○	●	Include	Moderate Quality
Berend,K.R., 2005	●	●	○	●	○	●	Not best available evidence	Low Quality
Cavaignac,E., 2013	●	◑	●	●	○	○	Not best available evidence	Low Quality
Dowsey,M.M., 2010	●	●	●	●	○	○	Not best available evidence	Low Quality
Lizaur-Utrilla,A., 2014	●	◑	●	○	●	○	Not best available evidence	Low Quality
Nafei,A., 1996	●	◑	●	●	○	○	Not best available evidence	Low Quality
Pandit,H., 2011	●	●	◑	○	○	●	Not best available evidence	Low Quality
Stickles,B., 2001	●	●	●	●	○	○	Not best available evidence	Low Quality
Thompson,S.A., 2013	◑	●	●	●	○	○	Not best available evidence	Low Quality
Vazquez-Vela,Johnson G., 2003	●	◑	◑	●	○	○	Not best available evidence	Low Quality

DETAILED DATA TABLES

TABLE 4: - RISK STRATIFICATION: CHRONIC PAIN

Attal,N., 2014	Low Quality	score of 3 or greater on Brief Pain Inventory	none	6 months	Beck Depression Inventory (higher=worse symptom) in patients with and without pain after TKA	81	Mean Difference	2.7 (0.98, 4.42)	patients with pain at 6 months had greater preoperative depression symptoms than thos with out pain
Attal,N., 2014	Low Quality	score of 3 or greater on Brief Pain Inventory	none	1 year	Beck Depression Inventory (higher=worse symptom) in patients with and without pain after TKA	69	Mean Difference	1.7 (-0.05, 3.45)	NS

** See Appendix XIII for details regarding support*

TABLE 5: RISK STRATIFICATION: DIABETES

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Duchman, K.R., 2014	Moderate Quality	Any complication after UKA	Not included in a multivariate analysis since bivariate association was not significant	30 day	Diabetes versus no diabetes	1588	None given	NR	NS
Nashi,N., 2014	Low Quality	Knee Socity Function	unclear	2 years	Diabetes versus no diabetes	357	NR	NR	NS
Jamsen,E., 2012	Moderate Quality	Periprosthetic Joint Infection	none	1 year	Diagnosed with Diabetes at time of surgery	3915	risk ratio	2.31	NS
Jones,C.A., 2012	Moderate Quality	WOMAC function	bmi, diabetes, cardiac disease, gender, age, diabetes*time interaction effect, gender*time interaction, time of measurement	measured at 6 months and 3 years	diabetes	0	regression coefficient	0.96 (-4.31, 6.22)	NS
Jones,C.A., 2012	Moderate Quality	WOMAC pain	bmi, diabetes, cardiac disease, gender, age, diabetes*time interaction effect, gender*time interaction, time of measurement	measured at 6 months and 3 years	diabetes*time interaction effect	0	regression coefficient	0.25 (0.04, 0.46)	pain scores kept continuously decreasing after 6 months to 3 years among non-diabetic patients but slightly increased after 6 monthsamong diabetics.
Nashi,N., 2014	Low Quality	residual knee pain on Knee society pain score	unclear	1 year	Diabetes versus no diabetes	357	NR	NR	NS
Nashi,N., 2014	Low Quality	residual knee pain on Knee society pain score	unclear	2 years	Diabetes versus no diabetes	357	NR	NR	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Jamsen,E., 2013	High Quality	revision	age sex, operation year, laterality of operation, method of prosthesis fixation, type of operating hospital, other comorbidities)	0-5 years	Diabetes versus no Diabetes	53007	Hazard Ratio	1.27(1.08, 1.5)	patients with diabetes had significantly higher revision rates up to 5 years
Jamsen,E., 2013	High Quality	revision	age sex, operation year, laterality of operation, method of prosthesis fixation, type of operating hospital, other comorbidities)	>5 years	Diabetes versus no Diabetes	53007	Hazard Ratio	0.48(0.22, 1.01)	NS

TABLE 6: RISK STRATIFICATION: LIVER DISEASE

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Shih,L.Y., 2004	Moderate Quality	Blood loss (mL)	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	by group continuous	470 (333.55, 606.45)	worse for cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	Blood transfusion (U)	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	by group continuous	0.5 (-0.01, 1.01)	NS
Shih,L.Y., 2004	Moderate Quality	Deep infection	matched by age, gender, date of surgery, follow up duration	>30 days	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	Duration of hospitalization (d)	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	by group continuous	3 (1.76, 4.24)	worse for cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	Hemoglobin (g/dL)	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	by group continuous	-0.8 (-1.33, -0.27)	worse for cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	Knee Society Function	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	by group continuous	-12 (-15.56, -8.44)	worse for cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	Mortality	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	risk ratio	7.5	risk higher in Cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	Patellar sublaxation	matched by age, gender, date of surgery, follow up duration	Perioperative <30 days postop	cirrhosis versus no cirrhosis	102	% risk difference	-1.96	NS
Shih,L.Y., 2004	Moderate Quality	Polyethylene Wear	matched by age, gender, date of surgery, follow up duration	>30 days	cirrhosis versus no cirrhosis	102	risk ratio	1	NS
Shih,L.Y., 2004	Moderate Quality	anterior knee pain	matched by age, gender, date of surgery, follow up duration	>30 days	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	bloody effusion	matched by age, gender, date of surgery, follow up duration	30 days	cirrhosis versus no cirrhosis	102	% risk difference	7.84	worse for cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	deep infection	matched by age, gender, date of surgery, follow up duration	30 days	cirrhosis versus no cirrhosis	102	% risk difference	3.92	NS
Shih,L.Y., 2004	Moderate Quality	encephalopathy	matched by age, gender, date of surgery, follow up duration	Perioperative <30 days postop	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	heart failure	matched by age, gender, date of surgery, follow up duration	Perioperative <30 days postop	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Pour,A.E., 2011	Low Quality	hemoglobin drop (g/l)	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	Mean Difference	0.4	NS
Pour,A.E., 2011	Low Quality	hospital stay	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	Mean Difference	2.5	longer hospital stay in Hepatitis patients
Shih,L.Y., 2004	Moderate Quality	infection	matched by age, gender, date of surgery, follow up duration	Perioperative <30 days postop	cirrhosis versus no cirrhosis	102	% risk difference	7.84	worse for cirrhosis patients
Shih,L.Y., 2004	Moderate Quality	latrogenic fracture	matched by age, gender, date of surgery, follow up duration	30 days	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	limited range of motion	matched by age, gender, date of surgery, follow up duration	30 days	cirrhosis versus no cirrhosis	102	% risk difference	3.92	NS
Pour,A.E., 2011	Low Quality	medical complications	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	OR	0.656(0.065, 6.57)	NS
Pour,A.E., 2011	Low Quality	need for transfusion	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	OR	0.714(0.297, 1.717)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Pour,A.E., 2011	Low Quality	needed manipulation under anesthesia	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	OR	2.032(0.123, 33.583)	NS
Shih,L.Y., 2004	Moderate Quality	pathological fracture	matched by age, gender, date of surgery, follow up duration	>30 days	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	pulmonary edema	matched by age, gender, date of surgery, follow up duration	Perioperative <30 days postop	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Pour,A.E., 2011	Low Quality	revision	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	OR	3.207(0.508, 20.249)	NS
Shih,L.Y., 2004	Moderate Quality	superficial infection	matched by age, gender, date of surgery, follow up duration	30 days	cirrhosis versus no cirrhosis	102	risk ratio	3	NS
Pour,A.E., 2011	Low Quality	surgical complications	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	OR	1.221(0.273, 5.466)	NS
Shih,L.Y., 2004	Moderate Quality	tibial loosening	matched by age, gender, date of surgery, follow up duration	>30 days	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	total complications	matched by age, gender, date of surgery, follow up duration	8-128 months	cirrhosis versus no cirrhosis	102	risk ratio	7.333333333	risk higher in Cirrhosis patients

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Pour,A.E., 2011	Low Quality	units transfused	matched with the patients in thestudy group for age, body-mass index, sex, year of surgery, and medical comorbidities(including diabetes, rheumatoid arthritis, and immunosuppressiveconditions)	postoperative	seropositive but asymptomatic Hepatitis C versus no Hepatitis	96	Mean Difference	-0.02	NS(p=.07)
Shih,L.Y., 2004	Moderate Quality	upper GI bleeding	matched by age, gender, date of surgery, follow up duration	Perioperative <30 days postop	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS
Shih,L.Y., 2004	Moderate Quality	wound dishiscence	matched by age, gender, date of surgery, follow up duration	30 days	cirrhosis versus no cirrhosis	102	% risk difference	1.96	NS

TABLE 7: RISK STRATIFICATION: NEUROLOGIC DISEASE

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Jamsen,E., 2013	High Quality	revision	age sex, operation year, laterality of operation, method of prosthesis fixation, type of operating hospital, other comorbidities)	median 5 years	Neurodegenerative disease versus Neurodegenerative disease	53007	Hazard Ratio	1.32(0.95, 1.82)	NS
Jamsen,E., 2014	Moderate Quality	revision	Age, gender, hospiral districtarea (i.e. geographical region), month and year of surgery,history of other joint replacements and comorbidity	up to 2 years	Parkinson's versus no Parkinson's Disease	0	Hazard Ratio	1.14(.64, 2.03)	NS
Jamsen,E., 2014	Moderate Quality	revision	Age, gender, hospiral districtarea (i.e. geographical region), month and year of surgery,history of other joint replacements and comorbidity	after 2 years	Parkinson's versus no Parkinson's Disease	0	Hazard Ratio	.47(.14, 1.53)	NS

** See Appendix XIII for details regarding support*

TABLE 8: RISK STRATIFICATION: OBESITY

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Duchman, K.R., 2014	Moderate Quality	Any complication after UKA	Baseline functional independence	30 day	BMI>=30,BMI<30	1588	Logistic regression Odds Ratio	2.520 (1.336-4.752)	Higher risk of complications for obese patients
Baker,P., 2012	Moderate Quality	Bleeding problems	none	6 months	BMI(40-60 versus 15-24.9)	2310	risk ratio	1.23	NS
Baker,P., 2012	Moderate Quality	Bleeding problems	none	6 months	BMI(40-60 versus 25-39.9)	12381	risk ratio	1.02	NS
Baker,P., 2012	Moderate Quality	Bleeding problems	none	6 months	BMI(15-24.9 versus 25-39.9)	12655	risk ratio	0.83	NS
Napier,R.J., 2014	Moderate Quality	Deep infection	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	-4 (-9.43, 1.43)	NS
Napier,R.J., 2014	Moderate Quality	Deep infection	matched by age	1 year	BMI over 40 versus BMI less than 30	100	risk difference	0 (0, 0)	NS
Napier,R.J., 2014	Moderate Quality	Deep vein thrombosis	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	0 (0, 0)	NS
Napier,R.J., 2014	Moderate Quality	Deep vein thrombosis	matched by age	1 year	BMI over 40 versus BMI less than 30	100	risk difference	0 (0, 0)	NS
Amin,A.K., 2006	Moderate Quality	Deep venous thrombosis	none	Peri-Op	BMI> 30, BMI <30	320		0.38	NS
Bordini,B., 2009	High Quality	Hematoma		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Perruccio,A.V., 2012	Moderate Quality	Hospital Anxiety and Depression Score-post op Depression	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>25-<30	435	Regression Coefficient	-0.49(-1.36, 0.37)	NS
Perruccio,A.V., 2012	Moderate Quality	Hospital Anxiety and Depression Score-post op Depression	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>=30	435	Regression Coefficient	-0.4(-1.26, 0.46)	NS

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Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Perruccio,A.V., 2012	Moderate Quality	Hospital Anxiety and Depression Score-post op anxiety	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>25-<30	435	Regression Coefficient	-1.26(-2.23, -0.28)	NS
Perruccio,A.V., 2012	Moderate Quality	Hospital Anxiety and Depression Score-post op anxiety	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>=30	435	Regression Coefficient	-0.9(-1.86, 0.06)	NS
Yeung,E. 2011	Moderate Quality	Hospital for Special Surgery Function score	matched for age sex, side of surgery , surgeon, time to follow up	10 years	BMI<30, BMI>=30	100	Mean Difference	1.7	non-obese group
Yeung,E. 2011	Moderate Quality	Hospital for Special Surgery Pain score	matched for age sex, side of surgery , surgeon, time to follow up	10 years	BMI<30, BMI>=30	100	Mean Difference	0.5	NS
Napier,R.J., 2014	Moderate Quality	Hyperesthesia	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	OR	2.042(0.179, 23.271)	NS
Napier,R.J., 2014	Moderate Quality	Hyperesthesia	matched by age	1 year	BMI over 40 versus BMI less than 30	100	risk difference	2 (-1.88, 5.88)	NS
Napier,R.J., 2014	Moderate Quality	Intra-operative tibial plateau fracture	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	-2 (-5.88, 1.88)	NS
Amin,A.K., 2006	Moderate Quality	Knee Society Score-Function-Function	none	6 months	BMI> 30, BMI <30	283	Mean Difference	-4.2	NS
Amin,A.K., 2006	Moderate Quality	Knee Society Score-Function-Function	none	18 months	BMI> 30, BMI <30	283	Mean Difference	5.6	NS
Amin,A.K., 2006	Moderate Quality	Knee Society Score-Function-Function	none	36 months	BMI> 30, BMI <30	283	Mean Difference	7.5	NS
Amin,A.K., 2006	Moderate Quality	Knee Society Score-Function-Function	none	60 months	BMI> 30, BMI <30	283	Mean Difference	0.4	NS
Jarvenpaa,J., 2012	Moderate Quality	Knee society function	none	mean 10.8	BMI>=30,BMI<30	52	mean difference	-12.7	NS
Amin,A.K., 2006	Moderate Quality	Mortality-Mortality	none	hours	BMI> 30, BMI <30	370	risk difference	0.5	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Judge,A., 2012	High Quality	Oxford Knee Score	age, baseline Oxford Knee Score, sex, side of surgery, primary diagnosis, Operation Type(TKR versus UKR, ASA grade,EQ-5D anxiety score, year of surgery	6 months	bmi per 5 unit increase	1991	regression coefficient	0.44 (0.86, 0.01)	for each 5 unit increase in bmi, patients score an average of .44 points worse on the OKS
Baker,P., 2012	Moderate Quality	Oxford Knee Score	BMI(40-60 versus 15-24.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(40-60 versus 15-24.9)	2310	Mean Difference	0.5(-0.5, 1.5)	NS
Baker,P., 2012	Moderate Quality	Oxford Knee Score	BMI(40-60 versus 25-39.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(40-60 versus 25-39.9)	12381	Mean Difference	0.9(0.1, 1.6)	improvement greater in patients with bmi>40 than between 25-39.9
Baker,P., 2012	Moderate Quality	Oxford Knee Score	BMI(15-24.9 versus 25-39.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(15-24.9 versus 25-39.9)	12655	Mean Difference	0.4(-0.3, 1.1)	NS
Napier,R.J., 2014	Moderate Quality	Oxford Knee Score	matched by age	3 months	BMI over 40 versus BMI less than 30	100	Mean Difference	-1 (-4.22, 2.22)	NS
Napier,R.J., 2014	Moderate Quality	Oxford Knee Score	matched by age	1 year	BMI over 40 versus BMI less than 30	100	Mean Difference	-0.9 (-4.59, 2.79)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Judge,A., 2012	High Quality	Oxford Knee Score (OKS) function		6 months	bmi per 5 unit increase	1991	regression coefficient	-0.33 (-0.57, -0.09)	for each 5 unit increase in bmi, patients score an average of .33 points worse on the OKS function
Judge,A., 2012	High Quality	Oxford Knee Score (OKS) function reached Patient Acceptable Symptom State		6 months	bmi per 5 unit increase	1991	OR	0.80 (0.68, 0.94)	for each 5 units increase in BMI the odds of reching the patient acceptable symptom state decreases significantly
Judge,A., 2012	High Quality	Oxford Knee Score (OKS) pain		6 months	bmi per 5 unit increase	1991	regression coefficient	-0.13 (-0.36, 0.09)	NS
Judge,A., 2012	High Quality	Oxford Knee Score (OKS) pain reached Patient Acceptable Symptom State		6 months	bmi per 5 unit increase	1991	OR	0.94 (0.84, 1.06)	NS
Judge,A., 2012	High Quality	Oxford Knee Score (OKS) reached Patient Acceptable Symptom State		6 months	bmi per 5 unit increase	1991	OR	0.90 (0.80, 1.01)	NS
Bordini,B., 2009	High Quality	PE		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Napier,R.J., 2014	Moderate Quality	Peri-operative mortality	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	0 (0, 0)	NS
Jamsen,E., 2012	Moderate Quality	Periprosthetic Joint Infection	none	1 year	BMI>=40, BMI<40	3915	risk ratio	5.78	worse in patients with higher BMI
Napier,R.J., 2014	Moderate Quality	Pes anserinus bursitis	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	-4 (-9.43, 1.43)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Napier,R.J., 2014	Moderate Quality	Pes anserinus bursitis	matched by age	1 year	BMI over 40 versus BMI less than 30	100	risk difference	-2 (-5.88, 1.88)	NS
Napier,R.J., 2014	Moderate Quality	Phlebitis	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	-2 (-5.88, 1.88)	NS
Napier,R.J., 2014	Moderate Quality	Poor Flexion	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	OR	1(0.061, 16.445)	NS
Napier,R.J., 2014	Moderate Quality	Poor Flexion	matched by age	1 year	BMI over 40 versus BMI less than 30	100	risk difference	-2 (-5.88, 1.88)	NS
Napier,R.J., 2014	Moderate Quality	Poor extension	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	4 (-1.43, 9.43)	NS
Perruccio,A.V., 2012	Moderate Quality	Profile of Mood States- post op fatigue	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>25-<30	435	Regression Coefficient	-1.17(-2.55, 0.22)	NS
Perruccio,A.V., 2012	Moderate Quality	Profile of Mood States- post op fatigue	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>=30	435	Regression Coefficient	-0.67(-2.05, 0.7)	NS
Napier,R.J., 2014	Moderate Quality	Prolonged wound ooze	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	OR	5.444(0.612, 48.395)	NS
Napier,R.J., 2014	Moderate Quality	Rash	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	2 (-1.88, 5.88)	NS
Baker,P., 2012	Moderate Quality	Reoperation	none	6 months	BMI(15-24.9 versus 25-39.9)	2310	risk ratio	0.65	NS
Baker,P., 2012	Moderate Quality	Reoperation	none	6 months	BMI(15-24.9 versus 25-39.9)	12381	risk ratio	0.71	NS
Baker,P., 2012	Moderate Quality	Reoperation	none	6 months	BMI(15-24.9 versus 25-39.9)	12655	risk ratio	1.09	NS
Yeung,E. 2011	Moderate Quality	Revision (implant survival)	matched for age sex, side of surgery , surgeon, time to follow up	10 years	BMI<30, BMI>=30	100	odds ratio	.49(.042, 5.58)	NS
Napier,R.J., 2014	Moderate Quality	SF-12 Mental Component Score	matched by age	3 months	BMI over 40 versus BMI less than 30	100	Mean Difference	1.6 (-2.59, 5.79)	NS
Napier,R.J., 2014	Moderate Quality	SF-12 Mental Component Score	matched by age	1 year	BMI over 40 versus BMI less than 30	100	Mean Difference	-3.3 (-7.75, 1.15)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Napier,R.J., 2014	Moderate Quality	SF-12 Physical Component Score	matched by age	3 months	BMI over 40 versus BMI less than 30	100	Mean Difference	1.9 (-1.69, 5.49)	NS
Napier,R.J., 2014	Moderate Quality	SF-12 Physical Component Score	matched by age	1 year	BMI over 40 versus BMI less than 30	100	Mean Difference	-0.8 (-4.96, 3.36)	NS
Sharma,L.; Sinacore,J.; Daugherty,C.; Kuesis,D.T.; Stulberg,S.D.; Lewis,M.; Baumann,G.; Chang,R.W.	Moderate Quality	Sf-36 Physical Functioning-Function	social support, gender, age, education, role function-emotional score, social function, motivation, previous reconstruction, CIRS score, BMI, pain, physical function, quad strength	3 months	continuous predictor	57	Correlation	-0.04	NS
Napier,R.J., 2014	Moderate Quality	Signifcant pain	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	OR	1.532(0.245, 9.587)	NS
Napier,R.J., 2014	Moderate Quality	Significant pain	matched by age	1 year	BMI over 40 versus BMI less than 30	100	OR	0.235(0.025, 2.181)	NS
Napier,R.J., 2014	Moderate Quality	Superficial infection	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	risk difference	8 (0.48, 15.52)	risk is higher in morbidly obese patients with BMI of at least 40
Napier,R.J., 2014	Moderate Quality	Superficial infection	matched by age	1 year	BMI over 40 versus BMI less than 30	100	risk difference	0 (0, 0)	NS
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 25 and 29.9 versus less than 25	4701	None given	NR	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 30 and 34.99 versus less than 25	4701	None given	NR	NS
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 35 and 39.9 versus less than 25	4701	None given	NR	NS
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between at least 40 versus less than 25	4701	None given	NR	risk higher in patients with BMI of at least 40 than patients
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 25 and 29.9 versus less than 25	4211	None given	NR	NS
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 30 and 34.99 versus less than 25	4211	None given	NR	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 35 and 39.9 versus less than 25	4211	None given	NR	Higher risk in higher bmi group
Singh, J.A., 2010	Low Quality	Unlimited walking distance	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between at least 40 versus less than 25	4211	None given	NR	Higher risk in higher bmi group
Jarvenpaa,J., 2012	Moderate Quality	Up and Go-test (s)	none	mean 10.8	BMI>=30,BMI<30	52	mean difference	0.6	NS
Jarvenpaa,J., 2012	Moderate Quality	VTE	none	mean 10.8	BMI>=30,BMI<30	52	% risk difference	-7.41	NS
Nunez,M., 2011	Moderate Quality	WOMAC Pain (0-100)	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	mean difference	5.2	NS
Jones,C.A., 2012	Moderate Quality	WOMAC function	bmi, diabetes, cardiac disease, gender, age, diabetes*time interaction effect, gender*time interaction, time of measurement	measured at 6 months and 3 years	BMI 30 to 34.9 versus less than 30	0	regression coefficient	0.67 (- 3.15, 4.49)	NS
Jones,C.A., 2012	Moderate Quality	WOMAC function	bmi, diabetes, cardiac disease, gender, age, diabetes*time interaction effect, gender*time interaction, time of measurement	measured at 6 months and 3 years	BMI 35 or higher versus less than 30	0	regression coefficient	5.06 (0.79, 9.34)	function scores were significantly worse in patients with BMI of 35 or above than in those below 30
Perruccio,A.V., 2012	Moderate Quality	WOMAC function	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>25-<30	435	standardized regression coeficients(change in standard deviation units of outcome scale)	-0.17(-2.44, 2.1)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Perruccio,A.V., 2012	Moderate Quality	WOMAC function	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>=30	435	standardized regression coeficients(change in standard deviation units of outcome scale)	0.165(-2.108, 2.438)	NS
Nunez,M., 2011	Moderate Quality	WOMAC function (0-100)	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	mean difference	1.3	NS
Jones,C.A., 2012	Moderate Quality	WOMAC pain	bmi, diabetes, cardiac disease, gender, age, diabetes*time interaction effect, gender*time interaction, time of measurement	measured at 6 months and 3 years	BMI 30 to 34.9 versus less than 30	0	regression coefficient	0.42 (-3.30, 4.13)	NS
Jones,C.A., 2012	Moderate Quality	WOMAC pain	bmi, diabetes, cardiac disease, gender, age, diabetes*time interaction effect, gender*time interaction, time of measurement	measured at 6 months and 3 years	BMI 35 or higher versus less than 30	0	regression coefficient	4.01 (-0.15, 8.17)	NS
Perruccio,A.V., 2012	Moderate Quality	WOMAC pain	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>25-<30	435	standardized regression coeficients(change in standard deviation units of outcome scale)	-0.385(-1.15, 0.346)	NS
Perruccio,A.V., 2012	Moderate Quality	WOMAC pain	age, sex, level of education, obesity, comorbidity count	mean 12.5 months	BMI<=25,BMI>=30	435	standardized regression coeficients(change in standard deviation units of outcome scale)	-0.355(-1.083, 0.372)	NS
Jarvenpaa,J., 2012	Moderate Quality	WOMAC pain (VAS 0-100)	none	mean 10.8	BMI>=30,BMI<30	52	mean difference	9.1	NS
Jarvenpaa,J., 2012	Moderate Quality	WOMAC physical function	none	mean 10.8	BMI>=30,BMI<30	52	mean difference	12.1	worse with higher bmi
Jarvenpaa,J., 2012	Moderate Quality	WOMAC stiffness	none	mean 10.8	BMI>=30,BMI<30	52	mean difference	13.5	worse with higher bmi
Nunez,M., 2011	Moderate Quality	WOMAC stiffness (0-100)	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	mean difference	19	patients with diabetes had significantly higher revision rates up to 5 years

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Nunez,M., 2011	Moderate Quality	WOMAC total (0-100)	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	mean difference	3.5	NS
Jarvenpaa,J., 2012	Moderate Quality	Walking distance (m)	none	mean 10.8	BMI>=30,BMI<30	52	mean difference	-1041	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 25 and 29.9 versus less than 25	4701	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 30 and 34.99 versus less than 25	4701	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 35 and 39.9 versus less than 25	4701	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between at least 40 versus less than 25	4701	None given	NR	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 25 and 29.9 versus less than 25	4211	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 30 and 34.99 versus less than 25	4211	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 35 and 39.9 versus less than 25	4211	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to rise from chair with no arms	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between at least 40 versus less than 25	4211	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 25 and 29.9 versus less than 25	4701	None given	NR	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 30 and 34.99 versus less than 25	4701	None given	NR	Higher risk in higher bmi group
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between 35 and 39.9 versus less than 25	4701	None given	NR	Higher risk in higher bmi group
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	2 years	BMI between at least 40 versus less than 25	4701	None given	NR	Higher risk in higher bmi group
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 25 and 29.9 versus less than 25	4211	None given	NR	NS
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 30 and 34.99 versus less than 25	4211	None given	NR	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between 35 and 39.9 versus less than 25	4211	None given	NR	Higher risk in higher bmi group
Singh, J.A., 2010	Low Quality	ability to walk stairs without support	age, gender, BMI, comorbidity, income, distance frommedical center, ASA class, operative diagnosis and the type of implant	5 years	BMI between at least 40 versus less than 25	4211	None given	NR	Higher risk in higher bmi group
Bordini,B., 2009	High Quality	acute anemia		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	anesthetic complications		intraoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	bone fracture		intraoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	cardiac infarction		postoperative	BMI <= 25, 25 < BMI <= 30	6532	% risk difference	-0.001	lower risk in lower bmi group
Bordini,B., 2009	High Quality	cardiac infarction		postoperative	BMI <= 25, 30 < BMI <= 40	4871	% risk difference	0	NS
Bordini,B., 2009	High Quality	cardiac infarction		postoperative	BMI <= 25, BMI > 40	2012	% risk difference	-0.006	NS
Bordini,B., 2009	High Quality	cardiac infarction		postoperative	BMI <= 25, 30 < BMI <= 40	4871	% risk difference	0	NS
Bordini,B., 2009	High Quality	cardiac infarction		postoperative	25 < BMI <= 30, BMI > 40	4864	risk ratio	0.26	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Bordini,B., 2009	High Quality	cardiac infarction		postoperative	30 < BMI <= 40, BMI > 40	3203	risk ratio	0.06	NS
Napier,R.J., 2014	Moderate Quality	complications	matched by age	at 3 months	BMI over 40 versus BMI less than 30	100	Mean Difference	1.64 (0.86, 3.1)	NS
Napier,R.J., 2014	Moderate Quality	complications	matched by age	at 1 year	BMI over 40 versus BMI less than 30	100	OR	0.4 (0.08, 1.97)	NS
Amin,A.K., 2006	Moderate Quality	deep infection	none	5 years	BMI> 30, BMI <30	370	risk ratio	0.65625	NS
Nunez,M., 2011	Moderate Quality	deep infection	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	risk ratio	3	NS
Nunez,M., 2011	Moderate Quality	deep infection requiring surgical cleaning	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	-1.67	NS
Nunez,M., 2011	Moderate Quality	discomfort in the femoropatellar joint	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	-11.67	favors higher bmi
Nunez,M., 2011	Moderate Quality	distal woun dehiscence	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	1.67	NS
Bordini,B., 2009	High Quality	dvt		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Baker,P., 2012	Moderate Quality	eq-5d general health state VAS	BMI(40-60 versus 15-24.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(40-60 versus 15-24.9)	2310	Mean Difference	-0.19(-4.1, 0.4)	NS
Baker,P., 2012	Moderate Quality	eq-5d general health state VAS	BMI(40-60 versus 25-39.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(40-60 versus 25-39.9)	12381	Mean Difference	-1.3(-0.4, 3.1)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Baker,P., 2012	Moderate Quality	eq-5d general health state VAS	BMI(15-24.9 versus 25-39.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(15-24.9 versus 25-39.9)	12655	Mean Difference	-0.5(-2.1, 1)	NS
Baker,P., 2012	Moderate Quality	eq-5d index scores	BMI(40-60 versus 15-24.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(40-60 versus 15-24.9)	2310	Mean Difference	0.014(-0.021, 0.048)	NS
Baker,P., 2012	Moderate Quality	eq-5d index scores	BMI(40-60 versus 25-39.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(40-60 versus 25-39.9)	12381	Mean Difference	0.019(-0.008, 0.045)	NS
Baker,P., 2012	Moderate Quality	eq-5d index scores	BMI(15-24.9 versus 25-39.9)age, sex, ASA grade, number of comorbidities, general health rating	6 months	BMI(15-24.9 versus 25-39.9)	12655	Mean Difference	0.005(-0.021, 0.031)	NS
Bordini,B., 2009	High Quality	general post operative complications		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	hospital for special surgery-function	matched for age sex, side of surgery , surgeon, time to follow up	postoperative	BMI<30, BMI>=30	100	Mean Difference		non-obese group
Bordini,B., 2009	High Quality	hospital for special surgery-pain	matched for age sex, side of surgery , surgeon, time to follow up	post operative	BMI<30, BMI>=30	100	Mean Difference	0.5	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Bordini,B., 2009	High Quality	implant survival	matched for age sex, side of surgery , surgeon, time to follow up	10 years	BMI<30, BMI>=30	100	risk ratio	0.98	NS
Bordini,B., 2009	High Quality	intraoperative	None	intraoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Napier,R.J., 2014	Moderate Quality	length of hospital stay	matched by age	during hospital stay	BMI over 40 versus BMI less than 30	100	Mean Difference	0.9 (-0.15, 1.95)	NS
Bordini,B., 2009	High Quality	local post operative complications		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Nunez,M., 2011	Moderate Quality	loosening of tibial implant	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	3.33	NS
Bordini,B., 2009	High Quality	minor cardiac complications		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		NS
Bordini,B., 2009	High Quality	mortality		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Lizaur-Utrilla,A., 2015	High Quality	mortality	age, sex, Charlson index, post operative KSS function, use of walking aids, post operative womac pain, post op SF-12 physical, SF 12 mental	10 years	BMI over 30 versus under 30 in patients getting TKA	1768	Hazard Ratio	0.8 (0.6–1.3)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	2 years	BMI between 25 and 29.9 versus less than 25	4701	OR	1.1 (0.6,2.1)	NS
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	2 years	BMI between 30 and 34.99 versus less than 25	4701	OR	0.7 (0.4,1.5)	NS
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	2 years	BMI between 35 and 39.9 versus less than 25	4701	OR	1.7 (0.8,3.6)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	2 years	BMI between at least 40 versus less than 25	4701	OR	1.6 (0.7,3.6)	NS
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	5 years	BMI between 25 and 29.9 versus less than 25	4211	OR	0.9 (0.4,1.6)	NS
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	5 years	BMI between 30 and 34.99 versus less than 25	4211	OR	1.1 (0.5,2.1)	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	5 years	BMI between 35 and 39.9 versus less than 25	4211	OR	1.0 (0.5,2.3)	NS
Singh, J.A., 2010	Low Quality	need for walking aids	gender, age, Deyo-Charlson index, BMI, ASA score, distance from medical center, operative diagnosis, type of implant (cemented, uncemented, hybrid), incomecategory and pre-operative overall limitations	5 years	BMI between at least 40 versus less than 25	4211	OR	2.0 (0.8,4.7)	NS
Bordini,B., 2009	High Quality	nerve injury		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	other general postop complications		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	other local postoperative complications		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Jarvenpaa,J., 2012	Moderate Quality	prosthesis infection	none	mean 10.8	BMI>=30,BMI<30	52	risk ratio	2.16	NS
Baker,P., 2012	Moderate Quality	readmission	none	6 months	BMI(15-24.9 versus 25-39.9)	2310	risk ratio	1.01	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Baker,P., 2012	Moderate Quality	readmission	none	6 months	BMI(15-24.9 versus 25-39.9)	12381	risk ratio	1.04	NS
Baker,P., 2012	Moderate Quality	readmission	none	6 months	BMI(15-24.9 versus 25-39.9)	12655	risk ratio	1.03	NS
Nunez,M., 2011	Moderate Quality	reintervention due to arthrolysis due to stiffness	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	3.33	NS
Nunez,M., 2011	Moderate Quality	reintervention for patellar prosthesis	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	1.67	NS
van Jonbergen,H.P., 2010	High Quality	revision	Diagnostic group(isolated pattelofemoral, post traumatic, or patellofemmoral oa with a previous realignment procedure), sex, age>50/age<=50,	median 13.3 years	BMI >30 BMI <=30	157	Hazard Ratio	2.1(1.2, 4)	rate of revision is higher in obese patients
Nunez,M., 2011	Moderate Quality	revision	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	5	NS
Amin,A.K., 2006	High Quality	revision (BMI>40: deep infection needing revision (2); aseptic loosening needing revision (2), unexplained pain (1)) (BMI<30: unexplained pain (2)	matched for age, gender, diagnosis, type of prosthesis, laterality and preop knee society score	mean 38.5 months inobese group, 44 month in non-obese group	bmi>=40, BMI <30	74	risk ratio	4	NS
Bordini,B., 2009	High Quality	revision due to infection	gender, fixed versus mobil insert, age	mean follow up =3.1 years	BMI >25-30, BMI<=25	6532	Hazard Ratio	1.17	NS
Bordini,B., 2009	High Quality	revision due to infection	gender, fixed versus mobil insert, age	mean follow up =3.1 years	BMI >30-40, BMI<=25	4871	Hazard Ratio	0.89	NS

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Bordini,B., 2009	High Quality	revision due to infection	gender, fixed versus mobil insert, age	mean follow up =3.1 years	BMI >40, BMI<=25	2012	Hazard Ratio	0.94	NS
Bordini,B., 2009	High Quality	revision for any reason	gender, fixed versus mobil insert, age	mean follow up =3.1 years	BMI >25-30, BMI<=25	6532	Hazard Ratio	0.92	NS
Bordini,B., 2009	High Quality	revision for any reason	gender, fixed versus mobil insert, age	mean follow up =3.1 years	BMI >30-40, BMI<=25	4871	Hazard Ratio	0.91	NS
Bordini,B., 2009	High Quality	revision for any reason	gender, fixed versus mobil insert, age	mean follow up =3.1 years	BMI >40, BMI<=25	2012	Hazard Ratio	1.02	NS
Amin,A.K., 2006	Moderate Quality	superficial infection	none	5 years	BMI> 30, BMI <30	370	risk ratio	1.53125	NS
Nunez,M., 2011	Moderate Quality	superficial infection	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	% risk difference	1.67	NS
Bordini,B., 2009	High Quality	superficial infections		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Bordini,B., 2009	High Quality	tendon/ligament rupture		intraoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Nunez,M., 2011	Moderate Quality	total complications	matched by age, sex, baseline womac score	1 year	BMI>=35 versus BMI <35	120	risk ratio	1.25	NS
Bordini,B., 2009	High Quality	urinary		postoperative	BMI<=25, BMI 25 to 30, BMI 30> to <=40	9735	fisher's exact test		no significant difference between BMI groups
Jarvenpaa,J., 2012	Moderate Quality	use of ambulatory support	none	mean 10.8	BMI>=30,BMI<30	52	risk ratio	1.08	NS
Jarvenpaa,J., 2012	Moderate Quality	wound infection	none	mean 10.8	BMI>=30,BMI<30	52	% risk difference	4	NS
Baker,P., 2012	Moderate Quality	wound problems	none	6 months	BMI(40-60 versus 15-24.9)	2310	risk ratio	1.76	favors lower BMI

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Baker,P., 2012	Moderate Quality	wound problems	none	6 months	BMI(40-60 versus 25-39.9)	12381	risk ratio	1.39	favors lower BMI
Baker,P., 2012	Moderate Quality	wound problems	none	6 months	BMI(15-24.9 versus 25-39.9)	12655	risk ratio	0.79	favors lower BMI

TABLE 9: RISK STRATIFICATION: RENAL INSUFFICIENCY

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Duchman, K.R., 2014	Moderate Quality	Any complication after UKA	Not included in a multivariate analysis since bivariate association was not significant	30 day	On dialysis versus not	1588	None given	NR	NS
Singh, J.A., 2013	Low Quality	moderate to severe knee pain on Mayo Knee Questionnaire	age, gender, BMI, ASA class, distance from medical centre, operativediagnosis, implant fixation (cement status), six Deyo Charlson comorbidity categories, anxiety and depression, heart disease, renal disease, COPD, Diabetes (with or without organ damage, CTD	2 years	renal disease versus no renal disease in patients undergoing TKA	7139	OR	1.2 (0.8, 1.8)	NS
Singh, J.A., 2013	Low Quality	moderate to severe knee pain on Mayo Knee Questionnaire	age, gender, BMI, ASA class, distance from medical centre, operativediagnosis, implant fixation (cement status), six Deyo Charlson comorbidity categories, anxiety and depression, heart disease, renal disease, COPD, Diabetes (with or without organ damage, CTD	5 years	renal disease versus no renal disease in patients undergoing TKA	4234	OR	0.7 (0.3, 1.4)	NS

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome	Confounding Adjustment	Duration	Comparison	Study N	Statistic	Result	Significance
Singh, J.A., 2013	Low Quality	moderate to severe knee pain on Mayo Knee Questionnaire	age, gender, BMI, ASA class, distance from medical centre, operativediagnosis, implant fixation (cement status), six Deyo Charlson comorbidity categories, anxiety and depression, heart disease, renal disease, COPD, Diabetes (with or without organ damage, CTD	2 years	renal disease versus no renal disease in patients undergoing revision TKA	1533	OR	0.9 (0.4, 1.7)	NS
Singh, J.A., 2013	Low Quality	moderate to severe knee pain on Mayo Knee Questionnaire	age, gender, BMI, ASA class, distance from medical centre, operativediagnosis, implant fixation (cement status), six Deyo Charlson comorbidity categories, anxiety and depression, heart disease, renal disease, COPD, Diabetes (with or without organ damage, CTD	5 years	renal disease versus no renal disease in patients undergoing revision TKA	881	OR	1.4 (0.5, 4.5)	NS

PREOPERATIVE PHYSICAL THERAPY

Limited evidence supports that supervised exercise before total knee arthroplasty (TKA) might improve pain and physical function after surgery.

Strength of Recommendation: Limited Evidence ★★☆☆

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALE

Four high quality studies (Villadsen 2013, Gstoettner 2011, McKay 2012, D'Lima 1996) and four moderate quality studies (Rooks 2006, Topp 2009, Weidenhielm 1993, Brown 2012) compared pre-operative structured exercise program to groups receiving no-exercise, placebo exercise, or education.

One study of high quality (Villadsen 2013) and two studies of moderate quality (Topp 2009, Brown 2012) investigated the effects of exercise programs that combined primarily functional training, resistance training, and flexibility exercises compared to not receiving such exercise programs. Villadsen et al compared an exercise program of eight week duration (1 hour twice a week) supervised by physical therapists that combined warm-up, core stability, postural orientation, resistance training, and functional exercises, to a group who received education on exercise. They reported significantly improved physical function and pain six weeks after surgery, but the differences were no longer significant 3 months after total knee arthroplasty. Topp et al compared an experimental group who received supervised exercise program of four week duration (3 times per week) that combined flexibility exercises, resistance training, and step training, to a group who did not exercise. They reported conflicting results for physical function and pain. At 3 months after total knee arthroplasty the exercise group performed more sit-to-stand repetitions than the control group but the control group ascended stairs faster than the exercise group. The exercise group has less pain during stairs descend but more pain during sit-to-stand task as compared to the control group. Brown et al compared a 8-week (3 session per week) supervised exercise program comprised of warm up, resistance training at moderate intensity, flexibility exercises, and step training, to a control group who did not exercise. They reported better physical function in the exercise group.

Two studies of high quality (McKay 2012, D'Lima 1996) and one study of moderate quality (Weidenhielm 1993) evaluated the effects of resistance training primarily. McKay et al compared a group who performed 6 weeks of moderate-intensity strength training of the lower body to a group who did upper body resistance training (placebo). D'Lima designed a three-group study to compare strength training of lower and upper body, aerobic training, and routine care (no exercise). D'Lima was the only study on pre-rehabilitation that had an exercise group who did aerobic training only. Weidenhielm et al compared a 5-week exercise program of knee range of motion and lower body strength training to a group who did not exercise. These studies found no significant differences in outcome between groups. One study of moderate quality (Rooks 2006) et al compared a 6-week exercise program with cardiovascular, strength, and flexibility training to an attention-control group who received education on total knee arthroplasty. Amongst the outcomes evaluated at 8 and 26 weeks after total knee arthroplasty,

* *See Appendix XIII for details regarding support*

only bodily pain at 26-week was significantly less in the exercise group. One study of high quality (Gstoettner 2011) demonstrated that 6-week of stretching and balance training was not effective on physical function and pain.

POSSIBLE HARMS OF IMPLEMENTATION

There are no known harms associated with implementing this recommendation. Of note, this recommendation is specific to patients who have failed prior conservative intervention for knee osteoarthritis and are scheduled for a total knee arthroplasty. This does not replace prior recommendation from the AAOS Clinical Practice Guideline on treatment for knee osteoarthritis that strongly supports that patients with symptomatic osteoarthritis of the knee participate in self-management programs, strengthening, low-impact aerobic exercises, and neuromuscular education; and engage in physical activity consistent with national guidelines.

FUTURE RESEARCH

Further studies on rehabilitation pre-surgery should be aligned with exercise recommendations from national guidelines and use exercise programs sufficiently long to promote gradual progression and overload. Research could test the effect of pre surgical rehabilitation on cost and utilization of care after surgery. Future research could also test pre-operative rehabilitation on selected patient populations in whom TKA might be delayed due to co-existing morbidities such as obesity, diabetes, and musculoskeletal conditions associated to chronic pain.

RESULTS

SUMMARY OF FINDINGS TABLE 22: PRE-OPERATIVE STRUCTURED EXERCISE

Summary of Findings	High Quality				Moderate Quality					Low Quality
● Favors Pre-op Structured Exercise ● Favors No Pre-op Structured Exercise ○ Not Significant	McKay,C., 2012	Matassi,F., 2014	D'Lima,D.D., 1996	Villadsen,A., 2013	Gstoettner,M., 2011	Weidenhielm,L., 199	Rooks,D.S., 2006	Topp,R., 2009	Brown,K., 2012	Huang,S.W., 2012
Complications										
Fall in HB, g/dL										○
Manipulation Under Anesthesia- Other		○								
Composite										
Knee Society Score KSS					○					
Knee Society Score-Function- Function					○					
Hospital for Special Surgery Knee Rating			○							
Function										
Range of Motion		○				○				○
SF-36 Physical component summary									●	
Sf-36 Physical Functioning- Function							○			
Timed Functional Tests	○				○			●		
Womac-Function likert version (0-68)	○						○			
Koos-Function, Daily Living- Function				●						
Ambulation (walking)										○
Koos-Function, Sports And Recreational Activities- Function				○						
WOMAC function NRS (0-11)					○					
Length of Stay										
Days- Length Of Stay		●								
Length Of Recovery- Length Of Stay										●
Other										
SF-36 Emotional Role Functioning									○	
Sf-36 General Health Perceptions									○	
Sf-36 Social Role Functioning									○	
Sf-36 Vitality									○	
Sf-36 Mental Health									○	
Koos-Symptoms				○						
Medical cost (1000 NTD)										●
Pain										
Sf-36 Bodily Pain- Pain							●		○	
Vas Pain (10cm)- Pain						○				○
Womac-Pain	○				○		○			
Koos-Pain				○						
Pain								●		
Pain during 6-minute walk								●		
Pain when ascending stairs								●		
Pain when descending stairs								●		
Euroqol-5d(Eq-5d) Pain/Discomfort- Pain				●						
Quality of Life										
Euroqol-5d(Eq-5d) Total				○						
Koos-Quality Of Life- Quality Of Life				○						
Stiffness										
WOMAC stiffness NRS (0-11)					○					

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 12: PRE-OPERATIVE STRUCTURED EXERCISE PROGRAM

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Huang,S.W., 2012	○	●	●	●	●	●	Include	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Brown,K., 2012	◑	◑	○	○	●	●	Include	Moderate Quality
Brown,K., 2014	◑	●	○	●	●	●	Include	High Quality
D'Lima,D.D., 1996	●	◑	◑	◑	●	●	Include	High Quality
Evgeniadis,G., 2008	●	●	○	●	●	●	Include	High Quality
Gstoettner,M., 2011	●	◑	◑	●	●	●	Include	High Quality
Matassi,F., 2014	●	◑	○	●	●	●	Include	High Quality
McKay,C., 2012	●	◑	◑	◑	●	●	Include	High Quality
Mitchell,C., 2005	●	○	○	○	●	●	Include	Moderate Quality
Rooks,D.S., 2006	○	○	◑	●	●	●	Include	Moderate Quality
Topp,R., 2009	◑	●	○	●	●	○	Include	Moderate Quality
Villadsen,A., 2013	●	●	◑	●	●	●	Include	High Quality
Villadsen,A., 2014	●	●	○	●	●	●	Include	High Quality
Weidenhielm, L., 1993	●	○	○	◑	●	●	Include	Moderate Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 10: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
D'Lima,D.D., 1996	High Quality	Hospital for Special Surgery Knee Rating( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt ( )	10	69.33(15.05)	Pre-Op: No Structured Exercise program (control) ( )	10	66.69(13.12)	Mean Difference	2.64(-9.73,15.01)	Not Significant (P-value>.05)
D'Lima,D.D., 1996	High Quality	Hospital for Special Surgery Knee Rating( )	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	10	69.5(10.58)	Pre-Op: No Structured Exercise program (control) (Cardiovascular conditioning)	10	73.33(11.47)	Mean Difference	-3.83(-13.50,5.84)	Not Significant (P-value>.05)
D'Lima,D.D., 1996	High Quality	Hospital for Special Surgery Knee Rating( )	3 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	10	71.46(8.62)	Pre-Op: No Structured Exercise program (control) ( )	10	65.4(10.58)	Mean Difference	6.06(-2.40,14.52)	Not Significant (P-value>.05)
D'Lima,D.D., 1996	High Quality	Hospital for Special Surgery Knee Rating( )	2.8 months	Pre-Op: Structured Exercise Program Or Pt ( )	10	82.1(10.57)	Pre-Op: No Structured Exercise program (control) (Cardiovascular conditioning)	10	73(10.55)	Mean Difference	9.1(-0.16,18.36)	Not Significant (P-value>.05)
D'Lima,D.D., 1996	High Quality	Hospital for Special Surgery Knee Rating( )	5.5 months	Pre-Op: Structured Exercise Program Or Pt ( )	10	82.9(9.21)	Pre-Op: No Structured Exercise program (control) ( )	10	85.56(7.99)	Mean Difference	-2.66(-10.22,4.90)	Not Significant (P-value>.05)
D'Lima,D.D., 1996	High Quality	Hospital for Special Surgery Knee Rating( )	11 months	Pre-Op: Structured Exercise Program Or Pt ( )	10	88.6(7.40)	Pre-Op: No Structured Exercise program (control) (Cardiovascular conditioning)	10	87.77(7.80)	Mean Difference	0.83(-5.83,7.49)	Not Significant (P-value>.05)
Matassi,F., 2014	High Quality	Knee Society Score-Knee(All follow-ups)	1 years	Pre-Op: Structured Exercise Program Or Pt (Patients instructed on	61	. %	Pre-Op: No Structured Exercise program (control) (Regular activities until surgery)	61	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				exercises focused on muscle strength and flexibility; 5 days/week for 6 weeks at home)								

TABLE 11: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Brown,K., 2014	High Quality	Self-efficacy for Exercise (SEE) ( )	2 weeks	Pre-Op: Structured Exercise Program Or Pt (8 week prehabilitation exercise program with stength training, flexibility exercises and step exercises; 3 times a week (1 supervised and 2 at home))	16	. %	Pre-Op: No Structured Exercise program (control) (usual care before surgery)	15	. %	Author Reported	NA	Not Significant (P-value>.05)
Brown,K., 2014	High Quality	Outcome Expectations for Exercise (OEE) ( )	2 weeks	Pre-Op: Structured Exercise Program Or Pt (8 week prehabilitation exercise program with stength training, flexibility exercises and step exercises; 3 times a week (1 supervised and 2 at home))	.	. %	Pre-Op: No Structured Exercise program (control) (usual care before surgery)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion (flexion) – Function (Active flexion)	2 weeks	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	65.9(6.36)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program	20	70.25(11.30)	Mean Difference	-4.35(-10.11,1.41)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
							either pre-op or post-op.)					
Evgeniadis,G., 2008	High Quality	Range of Motion (flexion) – Function (Active flexion)	2.3 months	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	73.3(6.87)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	76.08(10.30)	Mean Difference	-2.78(-8.30,2.74)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion (flexion) – Function (Active flexion)	3.2 months	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	80.73(6.70)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	80.42(10.20)	Mean Difference	0.31(-5.13,5.75)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion (extension) – Function (Active extension. Hypoextension reported as negative values)	2 weeks	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	-5.45(3.80)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	-6.5(3.83)	Mean Difference	1.05(-1.38,3.48)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion (extension) – Function (Active extension.	2.3 months	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening	18	-7.45(5.56)	Pre-Op: No Structured Exercise program (control) (Did not	20	-7(3.95)	Mean Difference	-0.45(-3.55,2.65)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		Hypoextension reported as negative values)		exercise program)			receive additional exercise program either pre-op or post-op.)					
Evgeniadis,G., 2008	High Quality	Range of Motion (extension) – Function (Active extension. Hypoextension reported as negative values)	3.2 months	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	-5.7(4.27)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	-6.42(3.60)	Mean Difference	0.72(-1.81,3.25)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function (ILAS Total (0-50))	3 Days	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	29.5(2.90)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	28.9(3.30)	Mean Difference	0.6(-1.37,2.57)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function (ILAS Total (0-50))	2 weeks	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	19.7(2.45)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	20.3(1.97)	Mean Difference	-0.6(-2.02,0.82)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale	1.4 months	Pre-Op: Structured	18	9.82(0.98)	Pre-Op: No Structured	20	10.08(1.16)	Mean Difference	-0.26(-0.94,0.42)	Not Significant

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		(ILAS) - Function (ILAS Total (0-50))		Exercise Program Or Pt (3 week pre-op strengthening exercise program)			Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)					(P-value>.05)
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function (ILAS Total (0-50))	2.3 months	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	4.65(0.58)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	4.87(0.73)	Mean Difference	-0.22(-0.64,0.20)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function (ILAS Total (0-50))	3.2 months	Pre-Op: Structured Exercise Program Or Pt (3 week pre-op strengthening exercise program)	18	0.31(0.49)	Pre-Op: No Structured Exercise program (control) (Did not receive additional exercise program either pre-op or post-op.)	20	0.38(0.56)	Mean Difference	-0.07(-0.40,0.26)	Not Significant (P-value>.05)
Matassi,F., 2014	High Quality	Range of Motion (flexion) - Function (Active and passive at all follow-ups)	1 years	Pre-Op: Structured Exercise Program Or Pt (Patients instructed on exercises focused on muscle strength and flexibility; 5 days/week for	61	. %	Pre-Op: No Structured Exercise program (control) (Regular activities until surgery)	61	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				6 weeks at home)								
Matassi,F., 2014	High Quality	Range of Motion (extension) – Function (All follow-ups)	1 years	Pre-Op: Structured Exercise Program Or Pt (Patients instructed on exercises focused on muscle strength and flexibility; 5 days/week for 6 weeks at home)	61	. %	Pre-Op: No Structured Exercise program (control) (Regular activities until surgery)	61	. %	Author Reported	NA	Not Significant (P-value>.05)
Matassi,F., 2014	High Quality	Knee Society Score-Function-Function (All follow-ups)	1 years	Pre-Op: Structured Exercise Program Or Pt (Patients instructed on exercises focused on muscle strength and flexibility; 5 days/week for 6 weeks at home)	61	. %	Pre-Op: No Structured Exercise program (control) (Regular activities until surgery)	61	. %	Author Reported	NA	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function (50-foot walk test s)	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	11.38(5.95)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	12.63(3.51)	Mean Difference	-1.25(-5.44,2.94)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	14.23(7.55)	Pre-Op: No Structured Exercise program (control) (Upper-body	10	13.11(3.30)	Mean Difference	1.12(-4.22,6.46)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		Function (50-foot walk test s)					control program)					
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function (50-foot walk test s)	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	11.8(5.60)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	11.82(2.97)	Mean Difference	-0.02(-4.56,4.52)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	26.86(24.89)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	23.28(11.70)	Mean Difference	3.58(-13.21,20.37)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function ( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	30.53(24.85)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	26.72(30.53)	Mean Difference	3.81(-21.12,28.74)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function ( )	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	26.99(26.73)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	22.18(10.98)	Mean Difference	4.81(-16.13,25.75)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Function likert version (0-68) ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	28.5(12.57)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	30.5(13.68)	Mean Difference	-2(-12.98,8.98)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
McKay,C., 2012	High Quality	Womac-Function likert version (0-68) ( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	18.1(11.85)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	19.17(15.01)	Mean Difference	-1.07(-13.17,11.03)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Function likert version (0-68) ( )	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	13.1(11.56)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	14.33(15.42)	Mean Difference	-1.23(-14.06,11.60)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function (50-foot walk test s)	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	11.38(5.95)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	12.63(3.51)	Mean Difference	-1.25(-5.44,2.94)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function (50-foot walk test s)	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	14.23(7.55)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	13.11(3.30)	Mean Difference	1.12(-4.22,6.46)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function (50-foot walk test s)	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	11.8(5.60)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	11.82(2.97)	Mean Difference	-0.02(-4.56,4.52)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	26.86(24.89)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	23.28(11.70)	Mean Difference	3.58(-13.21,20.37)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function ( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	30.53(24.85)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	26.72(30.53)	Mean Difference	3.81(-21.12,28.74)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Time To Complete Functional Task (Time To Walk 10 Feet, Time To Climb Stairs, Other)-Function ( )	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	26.99(26.73)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	22.18(10.98)	Mean Difference	4.81(-16.13,25.75)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Function likert version (0-68) ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	28.5(12.57)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	30.5(13.68)	Mean Difference	-2(-12.98,8.98)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Function likert version (0-68) ( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	18.1(11.85)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	19.17(15.01)	Mean Difference	-1.07(-13.17,11.03)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Function likert	2.8 months	Pre-Op: Structured Exercise	7	13.1(11.56)	Pre-Op: No Structured Exercise	10	14.33(15.42)	Mean Difference	-1.23(-14.06,11.60)	Not Significant

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		version (0-68) ( )		Program Or Pt (Lower body experimental program)			program (control) (Upper-body control program)					(P-value>.05)
Villadsen,A., 2014	High Quality	Koos-Function, Daily Living-Function ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	2.6(1.90)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	-0.9(1.90)	Mean Difference	3.5(2.67,4.33)	Not Significant (P-value>.05)
Villadsen,A., 2014	High Quality	Koos-Function, Sports And Recreational Activities-Function ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	-1.7(2.10)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	0.5(1.80)	Mean Difference	-2.2(-3.05,-1.35)	Not Significant (P-value>.05)
Villadsen,A., 2014	High Quality	Timed Functional Test (lower scores better, units of time)- Function (Chairs stands (s))	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	-3(0.50)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	-1.1(0.50)	Mean Difference	-1.9(-2.12,-1.68)	Not Significant (P-value>.05)
Villadsen,A., 2014	High Quality	Timed Functional Test (lower scores better, units of time)- Function	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular	41	-1.3(0.40)	Pre-Op: No Structured Exercise program (control) (Basic	40	-0.9(0.50)	Mean Difference	-0.4(-0.60,-0.20)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		(20-m walk, self chosen pace (s))		exercise program)			instruction on procedure and exercises normally given)					
Villadsen,A., 2014	High Quality	Timed Functional Test (lower scores better, units of time)- Function (20-m walk, max pace (s))	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	-0.5(0.50)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	-0.4(0.50)	Mean Difference	-0.1(-0.32,0.12)	Not Significant (P-value>.05)
Villadsen,A., 2014	High Quality	Timed Functional Test (higher scores better, distance, distance/time)- Function (knee bands/30 sec)	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	2.2(1.10)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	-2(1.30)	Mean Difference	4.2(3.67,4.73)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Function likert version (0-68) ( )	Intra-Op	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	26.2(9.20)	Pre-Op: No Structured Exercise program (control) (Education group)	15	23.1(11.90)	Mean Difference	3.1(-4.61,10.81)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Function likert version (0-68) ( )	Intra-Op	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	27.7(11.60)	Pre-Op: No Structured Exercise program (control) (Education group)	15	25(11.90)	Mean Difference	2.7(-5.86,11.26)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Function likert	1.8 months	Pre-Op: Structured Exercise	14	16.3(7.10)	Pre-Op: No Structured Exercise	15	15.3(11.40)	Mean Difference	1(-5.86,7.86)	Not Significant

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		version (0-68) ( )		Program Or Pt (Exercise group)			program (control) (Education group)					(P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Function likert version (0-68) ( )	6 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	9.9(9.00)	Pre-Op: No Structured Exercise program (control) (Education group)	15	1.4(11.90)	Mean Difference	8.5(0.85,16.15)	Significant (P-value<.05)
Rooks,D.S., 2006	Moderate Quality	Sf-36 Physical Functioning-Function ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	45.5(18.60)	Pre-Op: No Structured Exercise program (control) (Education group)	15	43.7(18.80)	Mean Difference	1.8(-11.82,15.42)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Sf-36 Physical Functioning-Function ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	34(21.50)	Pre-Op: No Structured Exercise program (control) (Education group)	15	40.2(19.40)	Mean Difference	-6.2(-21.14,8.74)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Sf-36 Physical Functioning-Function ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	49.9(15.00)	Pre-Op: No Structured Exercise program (control) (Education group)	15	53.1(26.30)	Mean Difference	-3.2(-18.66,12.26)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Sf-36 Physical Functioning-Function ( )	6 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	68(19.80)	Pre-Op: No Structured Exercise program (control) (Education group)	15	66.1(26.60)	Mean Difference	1.9(-15.09,18.89)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Range Of Motion (overall) - Function ( )	Intra-Op	Pre-Op: Structured Exercise	19	119(12.00)	Pre-Op: No Structured Exercise	20	118(15.00)	Mean Difference	1(-7.50,9.50)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				Program Or Pt ( )			program (control) ( )					
Weidenhielm, L., 1993	Moderate Quality	Range Of Motion (overall) - Function ( )	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	19	113(12.00)	Pre-Op: No Structured Exercise program (control) ( )	20	108(18.00)	Mean Difference	5(-4.56,14.56)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Stability-Function ( )	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	19	73.68%	Pre-Op: No Structured Exercise program (control) ( )	20	70.00%	RR	.(.,.)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Stability-Function ( )	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	19	89.47%	Pre-Op: No Structured Exercise program (control) ( )	20	95.00%	RR	.(.,.)	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Ambulation (walking) ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	. %	Pre-Op: No Structured Exercise program (control) ( )	117	. %	Author Reported	NA	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Ambulation (walking) ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	. %	Pre-Op: No Structured Exercise program (control) ( )	117	. %	Author Reported	NA	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Ambulation (walking) ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	. %	Pre-Op: No Structured Exercise program (control) ( )	117	. %	Author Reported	NA	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Ambulation (walking) ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	. %	Pre-Op: No Structured Exercise program (control) ( )	117	. %	Author Reported	NA	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Range Of Motion (overall) - Function ( )	1 Days	Pre-Op: Structured Exercise	126	30(11.00)	Pre-Op: No Structured Exercise	117	30(12.00)	Mean Difference	0(-2.90,2.90)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				Program Or Pt ( )			program (control) ( )					
Huang,S.W., 2012	Low Quality	Range Of Motion (overall) - Function ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	76(22.00)	Pre-Op: No Structured Exercise program (control) ( )	117	74(20.00)	Mean Difference	2(-3.28,7.28)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Sit to stand, repetitions in 30 seconds)	Baseline	Pre-Op: Structured Exercise Program Or Pt ( )	26	10.39(0.72)	Pre-Op: No Structured Exercise program (control) ( )	28	9.79(0.69)	Mean Difference	0.6(0.22,0.98)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Sit to stand, repetitions in 30 seconds)	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	26	12.08(0.83)	Pre-Op: No Structured Exercise program (control) ( )	28	12.08(0.83)	Mean Difference	0(-0.44,0.44)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Sit to stand, repetitions in 30 seconds)	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	11.46(0.69)	Pre-Op: No Structured Exercise program (control) ( )	.	10.36(0.67)	Mean Difference	1.1(.,.)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Sit to stand, repetitions in 30 seconds)	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	12.87(0.82)	Pre-Op: No Structured Exercise program (control) ( )	28	11.25(0.79)	Mean Difference	1.62(1.19,2.05)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (6-minute walk (Distance))	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	26	1254(64.00)	Pre-Op: No Structured Exercise program (control) ( )	28	1237(62.00)	Mean Difference	17(-16.65,50.65)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (6-minute walk (Distance))	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	26	1282(59.00)	Pre-Op: No Structured Exercise program (control) ( )	28	1185.18(56.00)	Mean Difference	96.82(66.09,127.55)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (6-minute walk (Distance))	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1191(51.00)	Pre-Op: No Structured Exercise program (control) ( )	28	1166.71(49.00)	Mean Difference	24.29(-2.43,51.01)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (6-minute walk (Distance))	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1337(58.00)	Pre-Op: No Structured Exercise program (control) ( )	28	1365(56.00)	Mean Difference	-28(-58.45,2.45)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Ascend stairs)	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	26	11.22(1.06)	Pre-Op: No Structured Exercise program (control) ( )	28	9.78(1.02)	Mean Difference	1.44(0.88,2.00)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance,	1 weeks	Pre-Op: Structured Exercise	26	10.63(1.12)	Pre-Op: No Structured Exercise	28	10.36(1.08)	Mean Difference	0.27(-0.32,0.86)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		distance/time)-Function (Ascend stairs)		Program Or Pt ( )			program (control) ( )					
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Ascend stairs)	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	28	11.98(1.36)	Pre-Op: No Structured Exercise program (control) ( )	28	10.39(1.31)	Mean Difference	1.59(0.89,2.29)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Ascend stairs)	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	8.44(0.81)	Pre-Op: No Structured Exercise program (control) ( )	28	7.45(0.77)	Mean Difference	0.99(0.57,1.41)	**Treatment 1 Significant (P-value<.05)**

TABLE 12: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Matassi,F., 2014	High Quality	Days-Length Of Stay ( )	Intra-Op	Pre-Op: Structured Exercise Program Or Pt (Patients instructed on exercises focused on muscle strength and flexibility; 5 days/week for 6 weeks at home)	61	9.1(2.10)	Pre-Op: No Structured Exercise program (control) (Regular activities until surgery)	61	9.9(2.30)	Mean Difference	-0.8(-1.58,-0.02)	**Treatment 1 Significant (P-value<.05)**
Huang,S.W., 2012	Low Quality	Length Of Recovery-Length Of Stay ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	7(2.00)	Pre-Op: No Structured Exercise program (control) ( )	117	8(1.00)	Mean Difference	-1(-1.39,-0.61)	**Treatment 1 Significant (P-value<.05)**
Huang,S.W., 2012	Low Quality	Medical cost (1000 NTD) ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	123.7(5.20)	Pre-Op: No Structured Exercise program (control) ( )	117	125.8(4.40)	Mean Difference	-2.1(-3.31,-0.89)	**Treatment 1 Significant (P-value<.05)**

TABLE 13: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
McKay,C., 2012	High Quality	Womac-Pain Likert Version (0-20) ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	8.7(3.77)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	9(4.41)	Mean Difference	-0.3(-3.72,3.12)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Pain Likert Version (0-20) ( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	5.6(2.72)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	4.92(4.50)	Mean Difference	0.68(-2.63,3.99)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Pain Likert Version (0-20) ( )	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	4.4(3.20)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	3.58(4.40)	Mean Difference	0.82(-2.79,4.43)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Pain Likert Version (0-20) ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	10	8.7(3.77)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	12	9(4.41)	Mean Difference	-0.3(-3.72,3.12)	Not Significant (P-value>.05)
McKay,C., 2012	High Quality	Womac-Pain Likert Version (0-20) ( )	1.4 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	9	5.6(2.72)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	4.92(4.50)	Mean Difference	0.68(-2.63,3.99)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
McKay,C., 2012	High Quality	Womac-Pain Likert Version (0-20) ( )	2.8 months	Pre-Op: Structured Exercise Program Or Pt (Lower body experimental program)	7	4.4(3.20)	Pre-Op: No Structured Exercise program (control) (Upper-body control program)	10	3.58(4.40)	Mean Difference	0.82(-2.79,4.43)	Not Significant (P-value>.05)
Villadsen,A., 2014	High Quality	Koos-Pain-Pain ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	3(1.60)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	0.8(1.60)	Mean Difference	2.2(1.50,2.90)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Pain Likert Version (0-20) ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	7.4(2.30)	Pre-Op: No Structured Exercise program (control) (Education group)	15	6.8(4.00)	Mean Difference	0.6(-1.76,2.96)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Pain Likert Version (0-20) ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	7.3(0.70)	Pre-Op: No Structured Exercise program (control) (Education group)	15	7.5(5.00)	Mean Difference	-0.2(-2.76,2.36)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Pain Likert Version (0-20) ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	4.7(2.40)	Pre-Op: No Structured Exercise program (control) (Education group)	15	5(3.40)	Mean Difference	-0.3(-2.43,1.83)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Womac-Pain Likert Version (0-20) ( )	6 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	9.9(9.00)	Pre-Op: No Structured Exercise program (control) (Education group)	15	1.4(11.90)	Mean Difference	8.5(0.85,16.15)	Significant (P-value<.05)
Rooks,D.S., 2006	Moderate Quality	Sf-36 Bodily Pain- Pain ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt	14	47.5(17.80)	Pre-Op: No Structured Exercise program	15	55.9(22.10)	Mean Difference	-8.4(-22.96,6.16)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				(Exercise group)			(control) (Education group)					
Rooks,D.S., 2006	Moderate Quality	Sf-36 Bodily Pain- Pain ( )	Baseline	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	42.1(16.60)	Pre-Op: No Structured Exercise program (control) (Education group)	15	56.7(21.40)	Mean Difference	-14.6(-28.49,-0.71)	**Treatment 1 Significant (P-value<.05)**
Rooks,D.S., 2006	Moderate Quality	Sf-36 Bodily Pain- Pain ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	59.8(16.40)	Pre-Op: No Structured Exercise program (control) (Education group)	15	68.1(16.60)	Mean Difference	-8.3(-20.32,3.72)	Not Significant (P-value>.05)
Rooks,D.S., 2006	Moderate Quality	Sf-36 Bodily Pain- Pain ( )	6 months	Pre-Op: Structured Exercise Program Or Pt (Exercise group)	14	71.2(19.30)	Pre-Op: No Structured Exercise program (control) (Education group)	15	68.1(25.10)	Mean Difference	3.1(-13.13,19.33)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Vas Pain (10cm)- Pain (Pain at walking)	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	19	3.5(2.30)	Pre-Op: No Structured Exercise program (control) ( )	20	3.1(1.10)	Mean Difference	0.4(-0.74,1.54)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Vas Pain (10cm)- Pain (Pain at walking)	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	19	1.4(2.00)	Pre-Op: No Structured Exercise program (control) ( )	20	1.1(1.30)	Mean Difference	0.3(-0.76,1.36)	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Vas Pain (10cm)- Pain ( )	1 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	4.5(1.30)	Pre-Op: No Structured Exercise program (control) ( )	117	4.4(1.20)	Mean Difference	0.1(-0.21,0.41)	Not Significant (P-value>.05)
Huang,S.W., 2012	Low Quality	Vas Pain (10cm)- Pain ( )	5 Days	Pre-Op: Structured Exercise Program Or Pt ( )	126	2.4(0.70)	Pre-Op: No Structured Exercise program (control) ( )	117	2.5(0.60)	Mean Difference	-0.1(-0.26,0.06)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Topp,R., 2009	Very Low Quality	( )	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	26	3.96(0.45)	Pre-Op: No Structured Exercise program (control) ( )	28	4.13(0.44)	Mean Difference	-0.17(-0.41,0.07)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	( )	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	26	9.82(0.80)	Pre-Op: No Structured Exercise program (control) ( )	28	4.91(0.45)	Mean Difference	4.91(4.56,5.26)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	( )	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	2.2(0.39)	Pre-Op: No Structured Exercise program (control) ( )	28	2.2(0.39)	Mean Difference	0(-0.21,0.21)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	( )	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1.62(0.29)	Pre-Op: No Structured Exercise program (control) ( )	28	1.06(0.28)	Mean Difference	0.56(0.41,0.71)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain during 6-minute walk)	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	26	4.22(0.43)	Pre-Op: No Structured Exercise program (control) ( )	28	5.2(0.41)	Mean Difference	-0.98(-1.20,-0.76)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain during 6-minute walk)	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	26	4.77(0.45)	Pre-Op: No Structured Exercise program (control) ( )	28	6.8(0.43)	Mean Difference	-2.03(-2.27,-1.79)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain during 6-minute walk)	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	2.17(0.37)	Pre-Op: No Structured Exercise program (control) ( )	28	2.36(0.35)	Mean Difference	-0.19(-0.38,0.00)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	(Pain during 6-minute walk)	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1.53(0.34)	Pre-Op: No Structured Exercise program (control) ( )	28	1.38(0.33)	Mean Difference	0.15(-0.03,0.33)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Topp,R., 2009	Very Low Quality	(Pain when ascending stairs)	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	26	3.85(0.49)	Pre-Op: No Structured Exercise program (control) ( )	28	4.62(0.47)	Mean Difference	-0.77(-1.03,-0.51)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain when ascending stairs)	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	26	4.34(0.51)	Pre-Op: No Structured Exercise program (control) ( )	28	5.54(0.50)	Mean Difference	-1.2(-1.47,-0.93)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain when ascending stairs)	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	2.03(0.37)	Pre-Op: No Structured Exercise program (control) ( )	28	2.14(0.35)	Mean Difference	-0.11(-0.30,0.08)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	(Pain when ascending stairs)	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1.33(0.31)	Pre-Op: No Structured Exercise program (control) ( )	28	1.26(0.30)	Mean Difference	0.07(-0.09,0.23)	Not Significant (P-value>.05)
Topp,R., 2009	Very Low Quality	(Pain when descending stairs)	Intra-Op	Pre-Op: Structured Exercise Program Or Pt ( )	26	4.64(0.47)	Pre-Op: No Structured Exercise program (control) ( )	28	5.26(0.44)	Mean Difference	-0.62(-0.86,-0.38)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain when descending stairs)	1 weeks	Pre-Op: Structured Exercise Program Or Pt ( )	26	4.58(0.51)	Pre-Op: No Structured Exercise program (control) ( )	28	5.65(0.48)	Mean Difference	-1.07(-1.33,-0.81)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain when descending stairs)	1 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1.83(0.37)	Pre-Op: No Structured Exercise program (control) ( )	28	2.43(0.35)	Mean Difference	-0.6(-0.79,-0.41)	**Treatment 1 Significant (P-value<.05)**
Topp,R., 2009	Very Low Quality	(Pain when descending stairs)	3 months	Pre-Op: Structured Exercise Program Or Pt ( )	26	1.42(0.37)	Pre-Op: No Structured Exercise program (control) ( )	28	1.45(0.35)	Mean Difference	-0.03(-0.22,0.16)	Not Significant (P-value>.05)

TABLE 14: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Villadsen,A., 2014	High Quality	Koos-Quality Of Life-Quality Of Life( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	3.8(1.90)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	-2.5(1.90)	Mean Difference	6.3(5.47,7.13)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 15: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: STIFFNESS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Matassi,F., 2014	High Quality	Manipulation Under Anesthesia-Other ( )	Post-Op	Pre-Op: Structured Exercise Program Or Pt (Patients instructed on exercises focused on muscle strength and flexibility; 5 days/week for 6 weeks at home)	61	8.20%	Pre-Op: No Structured Exercise program (control) (Regular activities until surgery)	61	4.92%	RR	1.67(0.42,6.67)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 16: PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM VERSUS NO PRE-OPERATIVE STRUCTURE EXERCISE PROGRAM: OTHER

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Villadsen,A., 2014	High Quality	Koos-Symptoms - Other ( )	1.8 months	Pre-Op: Structured Exercise Program Or Pt (8 week neuromuscular exercise program)	41	4.9(1.90)	Pre-Op: No Structured Exercise program (control) (Basic instruction on procedure and exercises normally given)	40	0.5(1.80)	Mean Difference	4.4(3.59,5.21)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

DELAYED TOTAL KNEE ARTHROPLASTY

Moderate evidence supports that an eight month delay to total knee arthroplasty (TKA) does not worsen outcomes.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

There was one high quality study (Tuominen, U., 2010) that addressed the question of worsening of outcomes or an increase in complications on delayed cases of KA among adult patients with osteoarthritis, compared to cases without delay after having failed non-surgical management.

This study evaluated the effects of waiting time on health related quality of life, knee pain and physical function. The study also addressed the use and costs of medication of patients awaiting TKA. The mean waiting time was 94 days among those patients short waiting times versus 239 days (mean of 8 months) among those with non-fixed waiting times groups, respectively. Those in the short waiting time group had higher weekly costs of medication at admission, and reached better quality of life 3 months earlier than those in the other group, but the latter had better quality of life after operation.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

The study does not speak to the effects in outcomes in longer delays, nor does it subcategorize patients at higher risk of permanent disability or injury from delay.

FUTURE RESEARCH

Continued research addressing sex- specific issues, and subgroup analysis on the effects of risk modification may further clarify this matter in addition to addressing complications and functionality. The work group also supports future research examining the potential societal cost of delaying arthroplasty when the patient is otherwise ready to proceed with surgery (missed work, etc.) as well as the effect of surgical delay on the patient's pain and suffering during the delay period.

** See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 18: DELAYED TOTAL KNEE ARTHROPLASTY (EARLY FOLLOW-UP < 90 DAYS)

Summary of Findings	High Quality Tuominen,U., 2010
● Favors Delayed TKA ● Favors Early TKA ○ Not Significant	
Composite	
HRQoL 15D	○
Function	
Knee Society Score-Function- Function	○
Ambulation (walking)	
Stair climbing	
Pain	
Knee Society Score-Pain- Pain	○
Pain	

SUMMARY OF FINDINGS TABLE 19: DELAYED TOTAL KNEE ARTHROPLASTY (LATE FOLLOW-UP > 90 DAYS)

Summary of Findings	High Quality Tuominen,U., 2010
● Favors Delayed TKA ● Favors Early TKA ○ Not Significant	
Function	
Knee Society Score-Function- Function	○
Pain	
Knee Society Score-Pain- Pain	○

QUALITY EVALUATION TABLE 10: DELAYED TOTAL KNEE ARTHROPLASTY

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Tuominen,U., 2010	●	◑	●	●	●	●	Include	High Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 17: - DELAYED TOTAL KNEE ARTHROPLASTY VERSUS EARLY TOTAL KNEE ARTHROPLASTY: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Tuominen,U., 2010	High Quality	HRQoL 15D( )	3 months	Early Ka( )	119	0.813(0.12)	Delayed Ka( )	170	0.837(0.11)	Mean Difference	-0.024(-0.05,0.00)	Not Significant (P-value>.05)
Tuominen,U., 2010	High Quality	HRQoL 15D( )	1 years	Early Ka( )	119	0.813(0.14)	Delayed Ka( )	170	0.852(0.10)	Mean Difference	-0.039(-0.07,-0.01)	Significant (P-value<.05)

TABLE 18: DELAYED TOTAL KNEE ARTHROPLASTY VERSUS EARLY TOTAL KNEE ARTHROPLASTY: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Tuominen,U., 2010	High Quality	Knee Society Score-Function-Function ( )	3 months	Early Ka( )	119	62.78(25.58)	Delayed Ka( )	170	63.86(25.22)	Mean Difference	-1.08(-7.04,4.88)	Not Significant (P-value>.05)
Tuominen,U., 2010	High Quality	Knee Society Score-Function-Function ( )	1 years	Early Ka( )	119	73.5(23.32)	Delayed Ka( )	170	74.63(22.28)	Mean Difference	-1.13(-6.49,4.23)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 19: DELAYED TOTAL KNEE ARTHROPLASTY VERSUS EARLY TOTAL KNEE ARTHROPLASTY: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Tuominen,U., 2010	High Quality	Knee Society Score-Pain-Pain ( )	3 months	Early Ka( )	119	32.7(13.03)	Delayed Ka( )	170	34.07(13.49)	Mean Difference	-1.37(-4.47,1.73)	Not Significant (P-value>.05)
Tuominen,U., 2010	High Quality	Knee Society Score-Pain-Pain ( )	1 years	Early Ka( )	119	36.27(13.15)	Delayed Ka( )	170	36.95(12.83)	Mean Difference	-0.68(-3.73,2.37)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

PERIPHERAL NERVE BLOCKADE (PNB)

Strong evidence supports that peripheral nerve blockade for total knee arthroplasty (TKA) decreases postoperative pain and opioid requirements.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

There were seven high-quality (McNamee 2001, Good 2007, Kadic 2009, Xie 2012, Chan 2012, Moghtadaei 2014, Liu 2014) and three low-quality (Lau 1998, Beaupre 2012, Kim 2012) studies evaluating whether the use of peripheral nerve blockade reduces complications or improves outcomes in adult patients undergoing knee arthroplasty compared to no peripheral nerve block use.

Three high-quality studies (Chan 2012, Moghtadaei 2014, Liu 2014) demonstrated significantly lower VAS pain scores and opioid requirements during the postoperative period when peripheral nerve blockade was compared to parenteral opioids alone.

One high-quality study (Chan 2012) demonstrated improvement in overall range-of-motion and a reduction in opioid-related side effects with the use of peripheral nerve blockade when compared to no peripheral nerve block use. Another high-quality study (Liu 2014) demonstrated that peripheral nerve block use improved the Quality of Recovery (e.g., Emotive, Nociceptive and Cognitive domains) during the immediate postoperative period.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

The risks associated with peripheral nerve blockade may include bleeding, infection, and associated neural injury. Although rare, these potential risks need to be balanced with the documented benefits of peripheral nerve blockade. Depending upon clinical circumstances, peripheral nerve blockade may also be associated with postoperative motor weakness. Under these conditions, care must be taken to minimize the risk of patient falls or delayed mobilization during the hospitalization.

FUTURE RESEARCH

Additional prospective studies are needed to evaluate the long-term (>24-hour) analgesic benefits of peripheral nerve blockade; as well as their impact on functional outcomes. Future studies are also needed to compare peripheral nerve blockade to other modalities of perioperative analgesia (e.g., periarticular injection, neuraxial anesthesia).Future studies comparing the effectiveness of a single perioperative peripheral nerve block versus continuous infusion should be performed for standard outcomes. In addition, research should be done to evaluate effectiveness of combination sciatic and femoral nerve blocks compared to other peripheral block methods.

** See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 8: PERIPHERAL NERVE BLOCKADE PAIN AT FIRST DAY

Summary of Findings - Pain in First Day							
	High Quality					Low Quality	
● Favors PNB ● Favors No PNB ○ Not Significant	Chan,M.H., 2012	Good,R.P., 2007	Liu,J., 2014	Moghtadaei,M., 2014	Xie,Z., 2012	Kim,J.H., 2012	Lau,H.P., 1998
Pain							
Vas Pain (10cm)- Pain	●	○	●	●		○	○
Womac-Pain Likert Version (0-20)					○		
Postoperative Pain Control							
Morphine consumption (mg)	●			●			○

** See Appendix XIII for details regarding support*

SUMMARY OF FINDINGS TABLE 9: PERIPHERAL NERVE BLOCK

	High Quality							Low Quality		
● Favors PNB ● Favors No PNB ○ Not Significant	Chan,M.H., 2012	Good,R.P., 2007	Kadic,L., 2009	Liu,J., 2014	McNamee,D.A., 2001	Moghtadaei,M., 2014	Xie,Z., 2012	Beaupre,L.A., 2012	Kim,J.H., 2012	Lau,H.P., 1998
Complications										
Adverse Events		○								
Blood Loss										○
Dizziness									○	
Intra-Op Blood Pressure and Heart Rate				●						
Morphine Related Side-Effects	●									
Nausea and Vomitting							○		○	
Urinary Retension										○
Composite										
Knee Society Score			○							
Function										
Ambulation(walking distance)		○								
Knee Society Function			○							
Quality of Recovery(QoR-40)				○						
Range of Motion (Extension)		○								
Range of Motion (Flexion)		○	○					○		
Range of Motion (Overall)	●					○				
WOMAC Function VAS version (0-100)			○							
Length of Stay										
Length of Hospital Stay						○				
Other Outcomes										
Patient Satisfaction						○			○	
Quality of Recovery(QoR-40) Overall				●						
Quality of Recovery(QoR-40) Cognitive				●						
Quality of Recovery(QoR-40) Emotive-Anxiety				●						
Quality of Recovery(QoR-40) Emotive-Depression				●						
Quality of Recovery(QoR-40) Nociceptive-Pain				●						
Quality of Recovery(QoR-40) Nociceptive-Nausea				●						
Pain										
VAS Pain (10 cm)	●	○				●		○	○	
VAS Pain (100mm)					○					
WOMAC Pain Likert Version (0-20)							●			
Post-op Pain Control										
Morphine Consumption	●				●	●				○
Narcotic Consumption									○	
Sufentanil Consumption				●						
Stiffness										
WOMAC Stiffness VAS version (0-100)			○							

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 5: PERI-OPERATIVE PERIPHERAL NERVE BLOCK

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Beaupre,L.A., 2012	○	●	●	○	●	●	Include	Low Quality
Kim,J.H., 2012	○	●	●	◑	●	●	Include	Low Quality
Lau,H.P., 1998	○	●	●	◑	●	●	Include	Low Quality

QE – Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Albrecht,E., 2014	●	●	●	●	●	●	Include	High Quality
Chan,M.H., 2012	●	●	◑	●	●	●	Include	High Quality
Good,R.P., 2007	◑	◑	◑	●	●	●	Include	High Quality
Kadic,L., 2009	●	●	●	●	●	●	Include	High Quality
Liu,J., 2014	●	●	●	●	●	●	Include	High Quality
McMeniman,T.J., 2010	●	●	●	●	●	●	Include	High Quality
McNamee,D.A., 2001	●	●	●	●	●	●	Include	High Quality
Moghtadaei,M., 2014	●	●	●	●	●	●	Include	High Quality

** See Appendix XIII for details regarding support*

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Widmer,B.J., 2012	●	●	●	●	●	●	Include	High Quality
Xie,Z., 2012	●	●	●	◑	●	●	Include	High Quality

DETAILED DATA TABLES

TABLE 20: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Chan,M.H., 2012	High Quality	complications other(No morphine related side effect)	Discharge	Peripheral Nerve Block(Post-op PNB)	21	71.43%	No Peripheral Nerve Block(No Post-op PNB)	21	57.14%	RR	1.25(0.79,1.98)	Not Significant (P-value>.05)
Chan,M.H., 2012	High Quality	complications other(No morphine related side effect)	Discharge	Peripheral Nerve Block(Post-op PNB)	21	71.43%	No Peripheral Nerve Block(No Pre op PNB)	20	85.00%	RR	0.84(0.61,1.17)	Not Significant (P-value>.05)
Chan,M.H., 2012	High Quality	complications other(No morphine related side effect)	Discharge	Peripheral Nerve Block(Pre-op PNB)	20	95.00%	No Peripheral Nerve Block(No Post-op PNB)	21	57.14%	RR	1.66(1.13,2.44)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	complications other(No morphine related side effect)	Discharge	Peripheral Nerve Block(Pre-op PNB)	20	95.00%	No Peripheral Nerve Block(No Pre op PNB)	20	85.00%	RR	1.12(0.91,1.38)	Not Significant (P-value>.05)
Good,R.P., 2007	High Quality	complications other(Adverse Events)	3 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	54.55%	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	60.00%	RR	0.91(0.54,1.53)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	Postoperative nausea and vomiting( )	1 Days	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	10.00%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	10.00%	RR	1.00(0.27,3.72)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Postoperative nausea and vomiting( )	1 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	2.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	5.00%	RR	0.50(0.05,5.30)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Postoperative nausea and vomiting( )	12 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	7.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	7.50%	RR	1.00(0.21,4.66)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	Postoperative nausea and vomiting( )	2 Days	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	0.00%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Postoperative nausea and vomiting( )	2 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	12.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	15.00%	RR	0.83(0.28,2.51)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Postoperative nausea and vomiting( )	6 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	2.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	7.50%	RR	0.33(0.04,3.07)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	complications other(Dizziness)	1 Days	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	2.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	0.00%	RD	0.03(-0.02,0.07)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	complications other(Dizziness)	1 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	0.00%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	5.00%	RD	-0.05(-0.12,0.02)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	complications other(Dizziness)	12 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	2.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	5.00%	RR	0.50(0.05,5.30)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	complications other(Dizziness)	2 Days	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	2.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	2.50%	RR	1.00(0.06,15.44)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	complications other(Dizziness)	2 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	0.00%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	5.00%	RD	-0.05(-0.12,0.02)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	complications other(Dizziness)	6 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	12.50%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	15.00%	RR	0.83(0.28,2.51)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Lau,H.P., 1998	Low Quality	Blood Loss - Complications (ml)	Intra-Op	Peripheral Nerve Block(40ml 2% xylocaine and 10ml 0.5% marcaine)	20	530(.)	Neuraxial anesthesia or epidural/spinal (2.75-3.25ml 0.5% bupivacaine with propofol infustion 3.5mg/kg/hr)	20	550(.)	Author Reported	NA	Not Significant (P-value>.05)
Lau,H.P., 1998	Low Quality	complications other(Urinary retention (n))	Post-Op	Peripheral Nerve Block(40ml 2% xylocaine and 10ml 0.5% marcaine)	20	0(.)	Neuraxial anesthesia or epidural/spinal (2.75-3.25ml 0.5% bupivacaine with propofol infustion 3.5mg/kg/hr)	20	10(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	complications other(Intra-operative blood pressure and heart rate)	Intra-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Xie,Z., 2012	High Quality	Nausea and Vomiting(Nausea on a 6 point Likert scale (0-5) - Any)	1 Days	Peripheral Nerve Block(Pre-op 3-in-1 PNB with high-dose bupivicaine (30-mL 0.5% bupivacaine with 1:200 000 epinephrine))	34	61.76%	No Peripheral Nerve Block(Pre-op placebo nerve block (30ml normal saline))	32	43.75%	RR	1.41(0.88,2.27)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Xie,Z., 2012	High Quality	Nausea and Vomiting(Nausea on a 6 point Likert scale (0-5) - Any)	1 Days	Peripheral Nerve Block(Pre-op 3-in-1 PNB with low-dose bupivicaine (30-mL 0.25% bupivacaine with 1:200 000 epinephrine))	33	57.58%	No Peripheral Nerve Block(Pre-op placebo nerve block (30ml normal saline))	32	43.75%	RR	1.32(0.81,2.15)	Not Significant (P-value>.05)
Xie,Z., 2012	High Quality	Nausea and Vomiting(Nausea on a 6 point Likert scale (0-5) - Any)	Post-Op	Peripheral Nerve Block(Pre-op 3-in-1 PNB with high-dose bupivicaine (30-mL 0.5% bupivacaine with 1:200 000 epinephrine))	34	23.53%	No Peripheral Nerve Block(Pre-op placebo nerve block (30ml normal saline))	32	18.75%	RR	1.25(0.49,3.22)	Not Significant (P-value>.05)
Xie,Z., 2012	High Quality	Nausea and Vomiting(Nausea on a 6 point Likert scale (0-5) - Any)	Post-Op	Peripheral Nerve Block(Pre-op 3-in-1 PNB with low-dose bupivicaine (30-mL 0.25% bupivacaine with 1:200 000 epinephrine))	33	24.24%	No Peripheral Nerve Block(Pre-op placebo nerve block (30ml normal saline))	32	18.75%	RR	1.29(0.50,3.31)	Not Significant (P-value>.05)

TABLE 21: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kadic,L., 2009	High Quality	Knee Society Score-Knee( )	3 months	Peripheral Nerve Block( )	21	83.8(12.80)	No Peripheral Nerve Block( )	17	83.2(13.20)	Mean Difference	0.6(-7.73,8.93)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 22: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Beaupre,L.A., 2012	High Quality	Range of Motion(flexion) - Function( )	3 months	preemptive multimodeal analgesia with added femoral nerve block( )	19	110.9(9.60)	preemptive multimodeal analgesia withou added femoral nerve block( )	20	105(11.70)	Mean Difference	5.9 (-1.06, 12.86)	Not Significant (P-value>.05)
Beaupre,L.A., 2012	Low Quality	Range of Motion(flexion) - Function( )	6 weeks	preemptive multimodeal analgesia with added femoral nerve block( )	19	101.3(13.40)	preemptive multimodeal analgesia withou added femoral nerve block( )	20	97.4(13.20)	Mean Difference	3.9 (-4.73, 12.53)	Not Significant (P-value>.05)
Beaupre,L.A., 2012	Moderate Quality	Range of Motion(flexion) - Function( )	2 weeks	preemptive multimodeal analgesia with added femoral nerve block( )	19	84.7(10.40)	preemptive multimodeal analgesia withou added femoral nerve block( )	20	83.1(9.80)	Mean Difference	1.6 (-4.95, 8.15)	Not Significant (P-value>.05)
Chan,M.H., 2012	High Quality	Range Of Motion(overall) - Function(ROM)	1 Days	Peripheral Nerve Block(Pre-op PNB)	20	55.7(12.40)	No Peripheral Nerve Block(No Post-op PNB)	21	49.1(11.10)	Mean Difference	6.6(-0.62,13.82)	Not Significant (P-value>.05)
Chan,M.H., 2012	High Quality	Range Of Motion(overall) - Function(ROM)	1 Days	Peripheral Nerve Block(Pre-op PNB)	20	55.7(12.40)	No Peripheral Nerve Block(No Pre op PNB)	20	48(7.10)	Mean Difference	7.7(1.44,13.96)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	Range Of Motion(overall) - Function(ROM)	2 Days	Peripheral Nerve Block(Pre-op PNB)	20	68.5(11.90)	No Peripheral Nerve Block(No Post-op PNB)	21	65.5(12.70)	Mean Difference	3(-4.53,10.53)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Chan,M.H., 2012	High Quality	Range Of Motion(overall) - Function(ROM)	2 Days	Peripheral Nerve Block(Pre-op PNB)	20	68.5(11.90)	No Peripheral Nerve Block(No Pre op PNB)	20	65.8(11.80)	Mean Difference	2.7(-4.64,10.04)	Not Significant (P-value>.05)
Chan,M.H., 2012	High Quality	Range Of Motion(overall) - Function(ROM)	3 Days	Peripheral Nerve Block(Pre-op PNB)	20	86.0(8.2)	No Peripheral Nerve Block(No Pre op PNB)	20	83.5(9.90)	Author Reported	NA	Not Significant (P-value>.05)
Good,R.P., 2007	High Quality	Ambulation (walking)(Ambulation Distances Based on Graded Scale O (worst score) to 4 (best score))	1 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	1.8(1.00)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	1.7(1.00)	Mean Difference	0.1(-0.51,0.71)	Not Significant (P-value>.05)
Good,R.P., 2007	High Quality	Ambulation (walking)(Ambulation Distances Based on Graded Scale O (worst score) to 4 (best score))	2 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	3.3(0.70)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	3.1(0.90)	Mean Difference	0.2(-0.29,0.69)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Good,R.P., 2007	High Quality	Ambulation (walking)(Ambulation Distances Based on Graded Scale O (worst score) to 4 (best score))	3 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	3.5(0.70)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	3.5(0.70)	Mean Difference	0(-0.42,0.42)	Not Significant (P-value>.05)
Good,R.P., 2007	High Quality	Range of Motion(extension) - Function(Degrees)	2 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	-14(5.00)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	-15(4.00)	Mean Difference	1(-1.73,3.73)	Not Significant (P-value>.05)
Good,R.P., 2007	High Quality	Range of Motion(extension) - Function(Degrees)	3 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	19	-13(5.00)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	19	-14(3.00)	Mean Difference	1(-1.62,3.62)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Good,R.P., 2007	High Quality	Range of Motion(flexion) - Function(Degrees)	2 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	58(15.00)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	54(11.00)	Mean Difference	4(-3.91,11.91)	Not Significant (P-value>.05)
Good,R.P., 2007	High Quality	Range of Motion(flexion) - Function(Degrees)	3 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	19	67(16.00)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	19	62(10.00)	Mean Difference	5(-3.48,13.48)	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Knee Society Score-Function-Function( )	3 months	Peripheral Nerve Block( )	21	61.2(29.30)	No Peripheral Nerve Block( )	17	58.5(21.20)	Mean Difference	2.7(-13.38,18.78)	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	3 Days	Peripheral Nerve Block( )	16	. %	No Peripheral Nerve Block( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	3 Days	Peripheral Nerve Block( )	16	. %	No Peripheral Nerve Block( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	3 months	Peripheral Nerve Block( )	21	. %	No Peripheral Nerve Block( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	3 months	Peripheral Nerve Block( )	21	. %	No Peripheral Nerve Block( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	4 Days	Peripheral Nerve Block( )	16	. %	No Peripheral Nerve Block( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	5 Days	Peripheral Nerve Block( )	16	. %	No Peripheral Nerve Block( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Range of Motion(flexion) - Function( )	6 Days	Peripheral Nerve Block( )	16	. %	No Peripheral Nerve Block( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Kadic,L., 2009	High Quality	Womac-function averaged VAS Version (0-100)( )	3 months	Peripheral Nerve Block( )	21	80.4(10.50)	No Peripheral Nerve Block( )	17	71.8(19.50)	Mean Difference	8.6(-1.70,18.90)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS - Modified ADL domain**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 µg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 µg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Range Of Motion(overall) - Function(degrees)	3 months	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	112.2(14.40)	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	114.4(11.50)	Mean Difference	-2.2(-10.71,6.31)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Range Of Motion(overall) - Function(degrees)	Discharge	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	66.9(9.90)	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	69.5(8.90)	Mean Difference	-2.6(-8.75,3.55)	Not Significant (P-value>.05)

TABLE 23: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Days- Length Of Stay( )	Post-Op	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	. %	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 24: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	Patient satisfaction(Rate of satisfaction with postoperative analgesia (0-100))	Post-Op	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	67(.)	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	68(.)	Author Reported	NA	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Patient satisfaction(Rate of satisfaction with surgical anesthesia (0-100))	Post-Op	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	71(.)	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	65(.)	Author Reported	NA	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Patient satisfaction(Willingness to recommend the same surgical anesthesia to others)	Post-Op	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	90.00%	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	75.00%	RR	1.20(0.98,1.48)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS - Physiology domain**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Patient satisfaction(Satisfaction Level (1-4, 1=very good) after 48 hours)	2 Days	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	. %	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS - Physiology domain**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS – emotive-anxiety**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS – emotive-depression**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS – Nociceptive-Pain**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS – Nociceptive-Nausea**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS – Cognitive Domain**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Quality of Recovery (QoR)-40(**PQRS – Overall**)	Post-Op	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	. %	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

TABLE 25: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Beaupre,L.A., 2012	High Quality	Vas Pain (10cm)- Pain( )	3 months	preemptive multimodeal analgesia with added femoral nerve block( )	19	1.1(1.90)	preemptive multimodeal analgesia withou added femoral nerve block( )	20	2(2.20)	Mean Difference	-0.9 (-2.24, 0.44)	Not Significant (P-value>.05)
Beaupre,L.A., 2012	Low Quality	Vas Pain (10cm)- Pain( )	6 weeks	preemptive multimodeal analgesia with added femoral nerve block( )	19	2.8(2.20)	preemptive multimodeal analgesia withou added femoral nerve block( )	20	2.9(2.4)	Mean Difference	-0.1 (-1.6, 1.4)	Not Significant (P-value>.05)
Beaupre,L.A., 2012	Moderate Quality	Vas Pain (10cm)- Pain( )	2 weeks	preemptive multimodeal analgesia with added femoral nerve block( )	19	4(2.60)	preemptive multimodeal analgesia withou added femoral nerve block( )	20	4.4(2.40)	Mean Difference	-0.4 (-2.02, 1.22)	Not Significant (P-value>.05)
Chan,M.H., 2012	High Quality	Vas Pain (10cm)- Pain(Pain at rest)	1 Days	Peripheral Nerve Block(Post-op PNB)	21	1.6(1.30)	No Peripheral Nerve Block(No Post-op PNB)	21	3.8(1.30)	Mean Difference	-2.2(-2.99,-1.41)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	Vas Pain (10cm)- Pain(Pain at rest)	1 Days	Peripheral Nerve Block(Post-op PNB)	21	1.6(1.30)	No Peripheral Nerve Block(No Pre op PNB)	20	3.9(1.20)	Mean Difference	-2.3(-3.07,-1.53)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	Vas Pain (10cm)- Pain(Pain at rest)	1 Days	Peripheral Nerve Block(Pre-op PNB)	20	1.9(1.20)	No Peripheral Nerve Block(No Post-op PNB)	21	3.8(1.30)	Mean Difference	-1.9(-2.67,-1.13)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Chan,M.H., 2012	High Quality	Vas Pain (10cm)- Pain(Pain at rest)	1 Days	Peripheral Nerve Block(Pre-op PNB)	20	1.9(1.20)	No Peripheral Nerve Block(No Pre op PNB)	20	3.9(1.20)	Mean Difference	-2(-2.74,-1.26)	**Treatment 1 Significant (P-value<.05)**
Good,R.P., 2007	High Quality	Vas Pain (10cm)- Pain(ranging from O (no pain) to 10 (worst possible pain))	1 Days	Peripheral Nerve Block(40 mL of 0.50% bupivacaine hydrochloride with epinephrine 1:200,000 before surgery)	22	4.7(1.80)	No Peripheral Nerve Block(40-mL solution of 0.9% normal saline before surgery)	20	5.3(1.70)	Mean Difference	-0.6(-1.66,0.46)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Vas Pain (10cm)- Pain( )	1 Days	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	. %	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Vas Pain (10cm)- Pain( )	1 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	. %	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	Vas Pain (10cm)- Pain( )	12 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	. %	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Vas Pain (10cm)- Pain( )	2 Days	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	. %	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Vas Pain (10cm)- Pain( )	2 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	. %	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	Vas Pain (10cm)- Pain( )	6 hours	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	. %	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	. %	Author Reported	NA	Not Significant (P-value>.05)
McNamee,D.A., 2001	High Quality	Vas Pain (100mm)- Pain (VAS Pain Scores)	2 Days	Peripheral Nerve Block (2 mg· kg-1 of ropivacaine 7.5 mg· ml-1 divided equally between the femoral and sciatic nerves.)	25	. %	No Peripheral Nerve Block (No peripheral nerve blockade but the area was prepared and a dressing applied to the appropriate sites)	25	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Vas Pain (10cm)- Pain( )	1 Days	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	. %	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Vas Pain (10cm)- Pain( )	12 hours	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	. %	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Vas Pain (10cm)- Pain( )	6 hours	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	. %	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Xie,Z., 2012	High Quality	Womac-Pain Likert Version (0-20)(Pain measured on a 6-point Likert scale (0-5))	Post-Op	Peripheral Nerve Block(Pre-op 3-in-1 PNB with high-dose bupivicaine (30-mL 0.5% bupivacaine with 1:200 000 epinephrine))	.	. %	No Peripheral Nerve Block(Pre-op placebo nerve block (30ml normal saline))	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Xie,Z., 2012	High Quality	Womac-Pain Likert Version (0-20)(Pain measured on a 6-point Likert scale (0-5))	Post-Op	Peripheral Nerve Block(Pre-op 3-in-1 PNB with low-dose bupivicaine (30-mL 0.25% bupivacaine with 1:200 000 epinephrine))	.	. %	No Peripheral Nerve Block(Pre-op placebo nerve block (30ml normal saline))	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

TABLE 26: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: POST-OP PAIN CONTROL

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Chan,M.H., 2012	High Quality	Morphine consumption (mg)(Accumulative morphine consumption)	1 Days	Peripheral Nerve Block(Post-op PNB)	21	13.3(8.24)	No Peripheral Nerve Block(No Pre op PNB)	21	28.32(12.48)	Mean Difference	-15.02(-21.42,-8.62)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	Morphine consumption (mg)(Accumulative morphine consumption)	1 Days	Peripheral Nerve Block(Pre-op PNB)	20	18.24(12.68)	No Peripheral Nerve Block(No Pre op PNB)	21	28.32(12.48)	Mean Difference	-10.08(-17.79,-2.37)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	Morphine consumption (mg)(Accumulative morphine consumption)	6 hours	Peripheral Nerve Block(Post-op PNB)	21	4.08(3.76)	No Peripheral Nerve Block(No Pre op PNB)	20	13.28(8.40)	Mean Difference	-9.2(-13.22,-5.18)	**Treatment 1 Significant (P-value<.05)**
Chan,M.H., 2012	High Quality	Morphine consumption (mg)(Accumulative morphine consumption)	6 hours	Peripheral Nerve Block(Pre-op PNB)	20	8.9(10.00)	No Peripheral Nerve Block(No Pre op PNB)	20	13.28(8.40)	Mean Difference	-4.38(-10.10,1.34)	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Perioperative Use Of Narcotics-Pain(Complete resolution time of IV PCA (min))	Post-Op	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	264.5(.)	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	296.9(.)	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kim,J.H., 2012	Low Quality	Perioperative Use Of Narcotics-Pain(Duration of IV PCA use (min))	Post-Op	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	3596.8(.)	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	3007.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Kim,J.H., 2012	Low Quality	Perioperative Use Of Narcotics-Pain(Remaining amount of IV PCA (ml))	Post-Op	Peripheral Nerve Block(Femoral nerve block with 10ml of 1.5% mepivacaine, sciatic nerve block with 20ml of 1.5% mepivacaine)	40	1.4(.)	Neuraxial anesthesia or epidural/spinal (1.3ml of hyperbaric bupivacaine followed by 10ml 0.75% ropivacaine)	40	7.5(.)	Author Reported	NA	Not Significant (P-value>.05)
Lau,H.P., 1998	Low Quality	Perioperative Use Of Narcotics-Pain(Time until first dose of morphine (hrs))	Post-Op	Peripheral Nerve Block(40ml 2% xylocaine and 10ml 0.5% marcaine)	20	9.5(.)	Neuraxial anesthesia or epidural/spinal (2.75-3.25ml 0.5% bupivacaine with propofol infustion 3.5mg/kg/hr)	20	10(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Liu,J., 2014	High Quality	Additional Medication-Postoperative Pain Control(Sufentanil consumption, mg)	1 Days	Peripheral Nerve Block(Received midazolam (0.015–0.03 mg/kg) and fentanyl (0.8–2.0 μg/kg) titrated to provide conscious sedation before nerve block insertion; sciatic nerve block was performed in the same position after a twitch of hamstring, soleus, foot, or toes had been elicited using a similar current, and 15–25 mL of 0.35% ropivacaine was injected.)	105	37.5(8.50)	General anesthesia(General anesthesia was induced with midazolam (0.015–0.03 mg/kg), fentanyl (1.8–3.5 μg/kg), etomidate (0.2–0.3 mg/kg), and rocuronium (0.4–0.6 mg/kg))	108	63.5(10.50)	Mean Difference	-26(-28.56,-23.44)	**Treatment 1 Significant (P-value<.05)**
McNamee,D.A., 2001	High Quality	Morphine consumption (mg) (Consumption and Time to first morphine request)	2 Days	Peripheral Nerve Block (2 mg· kg-1 of ropivacaine 7.5 mg· ml-1 divided equally between the femoral and sciatic nerves.)	25	. %	No Peripheral Nerve Block (No peripheral nerve blockade but the area was prepared and a dressing applied to the appropriate sites)	25	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Moghtadaei,M., 2014	High Quality	Morphine consumption (mg)( )	1 Days	Peripheral Nerve Block(Post-op femoral nerve block with 20cc ropivacaine)	18	. %	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(300 mg ropivacaine, 30mg ketorolac, and 0.5mg ephedrine diluted to a volume of 150cc and locally injected intra- and peri-articularly intra-op)	18	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

TABLE 27: PERI-OPERATIVE PERIPHERAL NERVE BLOCK VERSUS NO PERI-OPERATIVE PERIPHERAL NERVE BLOCK: STIFFNESS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2 (SD2)	Effect Measure	Result (95% CI	Favored Treatment
Kadic,L., 2009	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	3 months	Peripheral Nerve Block( )	21	75.6(17.40)	No Peripheral Nerve Block( )	17	71.3(22.40)	Mean Difference	4.3(-8.69,17.29)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

PERI-ARTICULAR LOCAL ANESTHETIC INFILTRATION

Strong evidence supports that the use of peri-articular local anesthetic infiltration in total knee arthroplasty (TKA) decreases pain and opioid use compared to placebo.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Five high quality studies (Nakai 2013, Koh 2011, Klasen 1999, Busch 2006, Chen 2012) compared peri-articular infiltration (PAI) to placebo (normal saline or no infiltration) for total knee arthroplasty. Improved function (Chen 2012), lower opioid consumption Busch 2006, Chen 2012, improved patient satisfaction (Busch 2006), and lower visual analog scale (VAS) pain scores (Nakai 2013, Koh 2011, Busch 2006, Chen 2012) all favored peri-articular injection.

Twenty-seven high quality studies originally met the selection criteria. Comparisons between PAI and placebo, PAI and peripheral nerve blocks (femoral and/or sciatic nerve blocks), and PAI and epidural blocks were attempted. However, due to the heterogeneity of the studies, PAI could only be compared to placebo. The heterogeneity of the studies included differences in infiltration solution (long-acting local anesthetics, plus or minus ketorolac, plus or minus opioid, plus or minus corticosteroid), varying concentrations of infiltration solution and injections, single-injection or catheter peripheral nerve blocks, peripheral nerve blocks (femoral and/or sciatic), and epidural catheter infusions (local anesthetic, opioid, and rates).

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There is a risk of renal injury with ketorolac injection. There is a theoretical risk of increased infection rates injecting corticosteroids into a surgical field.

FUTURE RESEARCH

Standardization of peri-articular infiltration (PAI) solutions and peripheral nerve block (PNB) protocols are needed before comparisons of PAI and PNB can be truly compared with each other and to neuraxial anesthesia such as epidural infusions.. The impact of periarticular injection for pain relief on day of surgery mobilization should also be further explored.

** See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 33: PERI-ARTICULAR LOCAL ANESTHETIC INFILTRATION

Summary of Findings ● Favors Peri-Articular Infiltration ● Favors Saline ○ Not Significant	High Quality Nakai,T., 2013	Koh,I.J., 2011	Klasen,J.A., 1999	Busch,C.A., 2006	Chen,Y., 2012
Complications					
complications other			○		
Deep venous thrombosis					○
Nausea and Vomiting	○				○
Function					
Timed Functional Test (higher scores better, distance, distance/time)- Function					●
Other					
Morphine consumption (mg)		○		●	
Patient satisfaction				●	
Pain					
Vas Pain (100mm)- Pain					●
Vas Pain (10cm)- Pain	●	●	○	●	
Postoperative Pain Control					
Morphine consumption (mg)					●

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 22: PERI-ARTICULAR LOCAL INFILTRATION

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Busch,C.A., 2006	●	◑	◑	●	●	●	Include	High Quality
Chen,Y., 2012	●	●	●	●	●	●	Include	High Quality
Klasen,J.A., 1999	●	◑	◑	●	●	●	Include	High Quality
Koh,I.J., 2011	●	●	●	●	●	●	Include	High Quality
Nakai,T., 2013	●	◑	◑	●	●	●	Include	High Quality

DETAILED DATA TABLES

TABLE 28: PART 1- PERI-ARTICULAR LOCAL INFILTRATION VERSUS SALINE: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chen,Y., 2012	High Quality	Nausea and Vomiting( )	NR	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(Magnesium sulphate 50 mg/kg and ropivacain 190 mg)	40	30.00%	No Local Infiltration(Normal saline)	40	45.00%	RR	.(.,.)	Not Significant (P-value>.05)
Chen,Y., 2012	High Quality	Deep venous thrombosis( )	NR	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(Magnesium sulphate 50 mg/kg and ropivacain 190 mg)	40	0.00%	No Local Infiltration(Normal saline)	40	2.50%	RD	.(.,.)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Klasen,J.A., 1999	High Quality	complications other(All)	NR	Local Infiltration(Patients were anaesthetized via lumber subarachnoid block with a 26-6 needle)	.	. %	No Local Infiltration(Lumbar subarachnoid block was performed via the combined spinal-epidural anaesthesia technique with a 26-g needle)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Nakai,T., 2013	High Quality	Nausea and Vomiting(Postoperative nausea and vomiting (PONV))	Post-Op	Local Infiltration(Received intra-articular injection of a multimodal drug cocktail)	21	38.10%	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	20	10.00%	RR	3.81(0.92,15.81)	Not Significant (P-value>.05)
Nakai,T., 2013	High Quality	Nausea and Vomiting(Postoperative nausea and vomiting (PONV))	Post-Op	Local Infiltration(Received localperiarticular injection of a multimodal drug cocktail.)	19	15.79%	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	20	10.00%	RR	1.58(0.30,8.43)	Not Significant (P-value>.05)

TABLE 29: PART 1- PERI-ARTICULAR LOCAL INFILTRATION VERSUS SALINE: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chen,Y., 2012	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(Timed to perform a straight leg raise)	NR	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(Magnesium sulphate 50 mg/kg and ropivacain 190 mg)	40	22.2(2.77)	No Local Infiltration(Normal saline)	40	39.32(5.42)	Mean Difference	-17.12(-19.01,-15.23)	**Treatment 1 Significant (P-value<.05)**
Chen,Y., 2012	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(Time to reach a 90 knee flexion (days))	NR	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(Magnesium sulphate 50 mg/kg and ropivacain 190 mg)	40	11.05(3.14)	No Local Infiltration(Normal saline)	40	15.2(4.62)	Mean Difference	-4.15(-5.88,-2.42)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Nakai,T., 2013	High Quality	Range of Motion(flexion) - Function(Flexion angles at week 1)	1 weeks	Local Infiltration(Received intra-articular injection of a multimodal drug cocktail)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Nakai,T., 2013	High Quality	Ambulation (walking)(With walking cane)	Post-Op	Local Infiltration(Received intra-articular injection of a multimodal drug cocktail)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Nakai,T., 2013	High Quality	Range of Motion(flexion) - Function(Flexion angles at week 1)	1 weeks	Local Infiltration(Received localperiarticular injection of a multimodal drug cocktail.)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Nakai,T., 2013	High Quality	Ambulation (walking)(With walking cane)	Post-Op	Local Infiltration(Received localperiarticular injection of a multimodal drug cocktail.)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	.	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 30: PART 1- PERI-ARTICULAR LOCAL INFILTRATION VERSUS SALINE: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Busch,C.A., 2006	High Quality	Vas Pain (10cm)-Pain(Visual analog scores (VAS) for pain during activity)	4 hours	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Busch,C.A., 2006	High Quality	Vas Pain (10cm)-Pain(Visual analog scores (VAS) for pain during activity)	1 Days	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chen,Y., 2012	High Quality	Vas Pain (100mm)-Pain( )	1 Days	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(Magnesium sulphate 50 mg/kg and ropivacain 190 mg)	40	. %	No Local Infiltration(Normal saline)	40	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Klasen,J.A., 1999	High Quality	Vas Pain (10cm)-Pain(Pain intensity)	1 Days	Local Infiltration(Patients were anaesthetized via lumber subarachnoid block with a 26-6 needle)	.	. %	No Local Infiltration(Lumbar subarachnoid block was performed via the combined spinal-epidural anaesthesia technique with a 26-g needle)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Koh,I.J., 2011	High Quality	Vas Pain (10cm)-Pain(Pain at rest)	12 hours	Local Infiltration(Periarticular injections)	45	2.3(3.20)	No Local Infiltration( )	42	6.4(3.40)	Mean Difference	-4.1(-5.49,-2.71)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Koh,I.J., 2011	High Quality	Vas Pain (10cm)-Pain(Pain at rest)	1 Days	Local Infiltration(Periarticular injections)	45	4.5(2.90)	No Local Infiltration( )	42	5.7(2.60)	Mean Difference	-1.2(-2.36,-0.04)	**Treatment 1 Significant (P-value<.05)**
Nakai,T., 2013	High Quality	Vas Pain (10cm)-Pain(Mean VAS scores on the day of surgery)	NR	Local Infiltration(Received intra-articular injection of a multimodal drug cocktail)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	20	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Nakai,T., 2013	High Quality	Vas Pain (10cm)-Pain(Mean VAS scores on the day of surgery)	1 Days	Local Infiltration(Received intra-articular injection of a multimodal drug cocktail)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Nakai,T., 2013	High Quality	Vas Pain (10cm)-Pain(Mean VAS scores on the day of surgery)	1 Days	Local Infiltration(Received localperiarticular injection of a multimodal drug cocktail.)	.	. %	No Local Infiltration(Did not receive multimodal drug cocktailtherapy)	.	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 31: PART 1- PERI-ARTICULAR LOCAL INFILTRATION VERSUS SALINE: POST-OP PAIN CONTROL

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chen,Y., 2012	High Quality	Morphine consumption (mg)( )	2 Days	Peri-articular local infiltration (anesthetic and/ or anti-inflammatory and or/ analgesic)(Magnesium sulphate 50 mg/kg and ropivacain 190 mg)	40	. %	No Local Infiltration(Normal saline)	40	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 32: PART 1- PERI-ARTICULAR LOCAL INFILTRATION VERSUS SALINE: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Busch, C.A., 2006	High Quality	Morphine consumption (mg)(Consumption of patient-controlled analgesia (PCA) in milligrams)	6 hours	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Busch, C.A., 2006	High Quality	Morphine consumption (mg)(Consumption of patient-controlled analgesia (PCA) in milligrams)	12 hours	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

* *See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Grou p1 N	Mean1/P 1 (SD1)	Treatment 2 (Details)	Grou p2 N	Mean2/P 2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Busch, C.A., 2006	High Quality	Morphine consumption (mg)(Consumption of patient-controlled analgesia (PCA) in milligrams)	1 Days	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Busch, C.A., 2006	High Quality	Morphine consumption (mg)(Consumption of patient-controlled analgesia (PCA) in milligrams)	1.4 months	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Grou p1 N	Mean1/P 1 (SD1)	Treatment 2 (Details)	Grou p2 N	Mean2/P 2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Busch, C.A., 2006	High Quality	Patient satisfaction(Visual analog scores (VAS) for patient satisfaction)	4 hours	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Busch, C.A., 2006	High Quality	Patient satisfaction(Visual analog scores (VAS) for patient satisfaction)	1 Days	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Busch, C.A., 2006	High Quality	Patient satisfaction(Visual analog scores (VAS) for patient satisfaction)	1.4 months	Local Infiltration(400 mg of ropivacaine, 30 mg of Toradol (ketorolac), 5 mg of epimorphine, and 0.6 mL of epinephrine (1:1000).)	.	. %	Control (Peri-articular local infiltration)(Saline)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Koh,I.J., 2011	High Quality	Morphine consumption (mg)(Fentanyl consumption via IV-PCA pump (?g))	1 Days	Local Infiltration(Peri articular injections)	45	169.4(273.90)	No Local Infiltration( )	42	262.3(200.20)	Mean Difference	-92.9(-193.25, 7.45)	Not Significant (P-value>.05)

NEURAXIAL ANESTHESIA

Moderate evidence supports that neuraxial anesthesia could be used in total knee arthroplasty (TKA) to improve select perioperative outcomes and complication rates compared to general anesthesia.

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

There were six high-quality (Nielson PT 1990, Nielson WR 1990, Mitchell 1991, Jorgensen 1991, Williams-Russo P 1995, Williams-Russo P 1996) and three low-quality (Sharrock 1991, Stundner 2012, Memtsoudis 2013) studies evaluating whether neuraxial anesthesia ("spinal or epidural") reduces complications or improves outcomes in adult patients undergoing knee arthroplasty compared to general anesthesia.

Two high-quality studies (Nielson PT 1990, Jorgensen 1991) and one low-quality (Sharrock 1991) study demonstrated significantly lower rates of deep venous thrombosis (DVT) compared to general anesthesia. Of note, the two high-quality studies did not utilize any form of perioperative prophylactic anticoagulation; and the low-quality study utilized postoperative aspirin therapy only. Neither study used warfarin or low-molecular weight heparin as part of their postoperative DVT prophylactic regimen. Four additional low- (Stundner 2012, Memtsoudis 2013) quality studies demonstrated significant reductions in overall postoperative complications with neuraxial anesthesia; including reductions in blood transfusion rates, pulmonary compromise, pulmonary embolism, pneumonia, mechanical ventilation rates, acute renal failure and composite infectious complications.

Two high-quality studies demonstrated improved short-term functional outcomes after neuraxial anesthesia. Specifically, Williams-Russo (1996) demonstrated improved short-term range-of-motion (flexion) and short-term ambulation (days until unassisted stair climbing) compared to general anesthesia. Nielson WR (1990) demonstrated improved short-term cognitive function (Wechsler Memory Scale; Controlled Oral Word Association) compared to general anesthesia.

One low-quality study (Memtsoudis) demonstrated a significant reduction in 30-day mortality in patients undergoing neuraxial anesthesia compared to general anesthesia.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Neuraxial anesthesia should not be performed in patients with known contraindications to the technique.

FUTURE RESEARCH

Additional comparative multicenter (high-quality) prospective studies evaluating the impact of intraoperative anesthetic technique on perioperative complications and outcomes are needed to further clarify if unique patient cohorts (e.g., patients with cardiopulmonary disease, obstructive sleep apnea, obesity) may benefit from neuraxial anesthesia.Future studies comparing the

* *See Appendix XIII for details regarding support*

effectiveness of neuraxial anesthesia with periarticular injections and/or peripheral nerve blockade should be performed.

RESULTS

SUMMARY OF FINDINGS TABLE 7: NEURAXIAL ANESTHESIA

Summary of Findings	High Quality						Low Quality			
	Williams-Russo,P., 1996	Williams-Russo,P., 1995	Nielson,W.R., 1990	Nielsen,P.T., 1990	Mitchell,D., 1991	Jorgensen,L.N., 1991	Stundner,O., 2012	Sharrock,N.E., 1991	Memtsoudis,S.G., 2013	Meta-Analysis
● Favors Neuraxial anesthesia										
● Favors General anasthesia										
○ Not Significant										
Complications										
Complications other							●		●	
Deep venous thrombosis	○			●	○	●		●		NA
Need Transfusion- Complications					○	○				
Wound Complications							○			
Blood Loss					○					
Blood transfusion %										
Drainage- Complications				○		○				
Pulmonary embolism						○	○		●	NA
Cerebrovascular Event- Complications									○	
Function										
Range of Motion(flexion) - Function	●									
Ambulation (walking)	●									
Cognitive function		○	●							
Length of Stay										
Days- Length Of Stay	○	○			○					NA
Length Of Recovery- Length Of Stay							○			
Length of Surgery										
Length Of Surgery- Length Of Surgery		○			○					
Mortality										
Mortality- Mortality		○					○		●	

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 4: NEURAXIAL ANESTHIA

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Is there a large magnitude of effect?	Influence of All Plausible Residual Confounding	Dose-Response Gradient	Inclusion	Strength
Jorgensen,L.N., 1991	●	◑	◑	●	●	●	●	●	●	Include	High Quality
Mitchell,D., 1991	●	◑	◑	●	●	●	●	●	●	Include	High Quality
Nielsen,P.T., 1990	◑	◑	◑	●	●	●	●	●	●	Include	High Quality
Nielson,W.R., 1990	◑	◑	◑	●	●	●	●	●	●	Include	High Quality
Williams-Russo, P., 1995	●	◑	◑	●	●	●	●	●	●	Include	High Quality
Williams-Russo, P., 1996	●	◑	◑	●	●	●	●	●	●	Include	High Quality

QE - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Beaupre,L.A., 2012	○	●	●	○	●	●	Include	Low Quality
Memtsoudis,S.G., 2013	○	●	●	●	●	●	Include	Low Quality
Sharrock,N.E., 1991	○	●	◑	○	●	●	Include	Low Quality
Stundner,O., 2012	○	●	●	◑	●	●	Include	Low Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 33: NEURAXIAL ANESTHESIA VERSUS GENERAL ANESTHESIA: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Jorgensen,L.N., 1991	High Quality	Deep venous thrombosis (Total)	1.4 weeks	Neuraxial anesthesia or epidural/spinal (2% mepivicaine 8-15ml through lumbar extradural catheter)	17	17.65%	General anesthesia (Thiopentone 3-5mg/kg, fentanyl 5ug/kg, pancuronium 0.1mg/kg, diazepam 0.2mg/kg, and nitrous oxide/oxygen)	22	59.09%	RR	0.30(0.10,0.88)	**Treatment 1 Significant (P-value<.05)**
Jorgensen,L.N., 1991	High Quality	pulmonary embolism( )	Post-Op	Neuraxial anesthesia or epidural/spinal (2% mepivicaine 8-15ml through lumbar extradural catheter)	17	0.00%	General anesthesia (Thiopentone 3-5mg/kg, fentanyl 5ug/kg, pancuronium 0.1mg/kg, diazepam 0.2mg/kg, and nitrous oxide/oxygen)	22	4.55%	RD	-0.05(-0.13,0.04)	Not Significant (P-value>.05)
Mitchell,D., 1991	High Quality	Deep venous thrombosis (DVT/PE)	Post-Op	Neuraxial anesthesia or epidural/spinal (Local anesthetic via epidural catheter)	34	35.29%	General anesthesia (Tubocurarine, sodium thiopental, succinylcholine, and nitrous oxide in oxygen)	38	26.32%	RR	1.34(0.67,2.70)	Not Significant (P-value>.05)
Nielsen,P.T., 1990	High Quality	Deep venous thrombosis( )	1.4 weeks	Neuraxial anesthesia or epidural/spinal (2% mepivacain via lumbar epidural catheter)	13	15.38%	General anesthesia (Thiopental/diazepam/fentanyl, nitrous oxide/oxygen)	16	62.50%	RR	0.25(0.07,0.93)	**Treatment 1 Significant (P-value<.05)**
Nielson,W.R., 1990	High Quality	Cognitive function (Controlled Oral Word Association, number of words)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	45(12.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	36(11.00)	Mean Difference	9(3.17,14.83)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Nielson,W.R., 1990	High Quality	Cognitive function (Sickness Impact Profile (SIP), Physical Dimension Score)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	15(11.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	16(7.00)	Mean Difference	-1(-5.84,3.84)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Sickness Impact Profile (SIP), Physical Dimension Score)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	10(11.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	12(7.00)	Mean Difference	-2(-6.84,2.84)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Sickness Impact Profile (SIP), Psychological Dimension Score)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	6(8.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	8(10.00)	Mean Difference	-2(-6.44,2.44)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Sickness Impact Profile (SIP), Psychological Dimension Score)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	4(7.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	3(4.00)	Mean Difference	1(-2.02,4.02)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Adult Intelligence Scale - Revised, Visual IQ Score (WAIS-R VIQ))	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	101(16.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	94(13.00)	Mean Difference	7(-0.48,14.48)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Adult Intelligence Scale - Revised, Visual IQ Score (WAIS-R VIQ))	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	103(15.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	96(14.00)	Mean Difference	7(-0.34,14.34)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Adult Intelligence Scale - Revised, Performance IQ Score (WAIS-R PIQ))	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	98(13.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	93(15.00)	Mean Difference	5(-1.94,11.94)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Adult Intelligence Scale - Revised, Performance IQ Score (WAIS-R PIQ))	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	102(10.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	95(15.00)	Mean Difference	7(0.87,13.13)	**Treatment 1 Significant (P-value<.05)**
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Verbal Index Score)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	100.88(16.27)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	95.74(13.86)	Mean Difference	5.14(-2.58,12.86)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Verbal Index Score)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	105.8(16.52)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	100.28(14.62)	Mean Difference	5.52(-2.42,13.46)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Visual Index Score)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	95.28(16.78)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	90.23(14.19)	Mean Difference	5.05(-2.89,12.99)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Visual Index Score)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	101.8(17.14)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	91.51(15.14)	Mean Difference	10.29(2.06, 18.52)	**Treatment 1 Significant (P-value<.05)**
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Attention/Concentration Index Score)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	98.08(14.66)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	92.1(16.05)	Mean Difference	5.98(-1.66,13.62)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Attention/Concentration Index Score)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	101.8(14.64)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	93.08(16.13)	Mean Difference	8.72(1.07,16.37)	**Treatment 1 Significant (P-value<.05)**
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Delayed Index Score)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	97.92(13.90)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	91.26(11.53)	Mean Difference	6.66(0.12,13.20)	**Treatment 1 Significant (P-value<.05)**
Nielson,W.R., 1990	High Quality	Cognitive function (Wechsler Memory Scale - Revised, Delayed Index Score)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	104.64(18.76)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	96.77(13.90)	Mean Difference	7.87(-0.68,16.42)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Nielson,W.R., 1990	High Quality	Cognitive function (Hand Preference Questionnaire, number of apraxic errors)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	0.32(0.40)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	0.5(1.01)	Mean Difference	-0.18(-0.53,0.17)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Hand Preference Questionnaire, number of apraxic errors)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	0.36(0.70)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	0.34(0.67)	Mean Difference	0.02(-0.33,0.37)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail A Time)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	38.04(12.83)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	46.97(22.96)	Mean Difference	-8.93(-17.72,-0.14)	**Treatment 1 Significant (P-value<.05)**
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail A Time)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	36.8(9.22)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	42.68(16.72)	Mean Difference	-5.88(-12.25,0.49)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail A Errors)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	0.32(0.63)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	0.24(0.49)	Mean Difference	0.08(-0.21,0.37)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail A Errors)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	0.32(0.63)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	0.18(0.39)	Mean Difference	0.14(-0.14,0.42)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail B Time)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	125(80.48)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	148.3(77.65)	Mean Difference	-23.3(-63.16,16.56)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail B Time)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	105.76(33.32)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	132.46(77.56)	Mean Difference	-26.7(-54.33,0.93)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail B Errors)	Peri-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	1.12(1.42)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	1.08(1.26)	Mean Difference	0.04(-0.64,0.72)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Trail-making Test, Trail B Errors)	3 months	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	0.64(0.91)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	0.76(1.30)	Mean Difference	-0.12(-0.66,0.42)	Not Significant (P-value>.05)
Nielson,W.R., 1990	High Quality	Cognitive function (Controlled Oral Word Association, number of words)	Post-Op	Neuraxial anesthesia or epidural/spinal (Tetracaine or bupivicaine)	25	44(12.00)	General anesthesia (Thiopental, succinylcholine; N2O in oxygen, isoflurane, and fentanyl)	39	37(9.00)	Mean Difference	7(1.51,12.49)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1995	High Quality	Cognitive function (Boston Naming Test, Controlled Word Association, Wechsler Adult Intelligence Scale Revised - Digit Symbol, Trail Making Tests, Digit Span, Benton Visual Retention, Benton Visual Recognition, and Mattis-Kovner Verbal Recall and Verbal Recognition)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	134	.(4.50)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O)	128	.(4.40)	Mean Difference	.(.,.)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1995	High Quality	Cognitive function (Boston Naming Test, Controlled Word Association, Wechsler Adult Intelligence Scale Revised - Digit Symbol, Trail Making Tests, Digit Span, Benton Visual Retention, Benton Visual Recognition, and Mattis-Kovner Verbal Recall and Verbal Recognition)	1 weeks	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	134	. %	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O)	128	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1995	High Quality	Cognitive function (Boston Naming Test, Controlled Word Association, Wechsler Adult Intelligence Scale Revised - Digit Symbol, Trail Making Tests, Digit Span, Benton Visual Retention, Benton Visual Recognition, and Mattis-Kovner Verbal Recall and Verbal Recognition)	5.9 months	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	114	. %	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O)	117	. %	Author Reported	NA	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Deep venous thrombosis(Incidence of DVT)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	39.85%	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	48.33%	RR	0.82(0.62,1.09)	Not Significant (P-value>.05)
Memtsoudis,S.G., 2013	Low Quality	Cerebrovascular Event-Complications (Cerebrovascular event)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.07%	General anesthesia (General anesthesia)	194682	0.11%	RR	0.68(0.43,1.06)	Not Significant (P-value>.05)
Memtsoudis,S.G., 2013	Low Quality	complications other(Pulmonary compromise)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.39%	General anesthesia (General anesthesia)	194682	0.71%	RR	0.55(0.45,0.67)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Memtsoudis,S.G., 2013	Low Quality	complications other(Cardiac (nonmyocardial infarction))	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	6.43%	General anesthesia (General anesthesia)	194682	6.27%	RR	1.03(0.98,1.08)	Not Significant (P-value>.05)
Memtsoudis,S.G., 2013	Low Quality	pulmonary embolism(Pulmonary embolism)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.39%	General anesthesia (General anesthesia)	194682	0.55%	RR	0.71(0.58,0.86)	**Treatment 1 Significant (P-value<.05)**
Memtsoudis,S.G., 2013	Low Quality	complications other(Blood product transfusion)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	14.59%	General anesthesia (General anesthesia)	194682	16.62%	RR	0.88(0.85,0.90)	**Treatment 1 Significant (P-value<.05)**
Memtsoudis,S.G., 2013	Low Quality	Mortality-Mortality(30-day mortality)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.08%	General anesthesia (General anesthesia)	194682	0.13%	RR	0.66(0.43,1.00)	**Treatment 1 Significant (P-value<.05)**
Memtsoudis,S.G., 2013	Low Quality	complications other(Pneumonia)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.74%	General anesthesia (General anesthesia)	194682	0.84%	RR	0.88(0.76,1.01)	Not Significant (P-value>.05)
Memtsoudis,S.G., 2013	Low Quality	complications other(Acute renal failure)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	1.13%	General anesthesia (General anesthesia)	194682	1.55%	RR	0.73(0.65,0.82)	**Treatment 1 Significant (P-value<.05)**
Memtsoudis,S.G., 2013	Low Quality	complications other(Gastrointestinal complications)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.66%	General anesthesia (General anesthesia)	194682	0.67%	RR	0.99(0.85,1.15)	Not Significant (P-value>.05)
Memtsoudis,S.G., 2013	Low Quality	complications other(Acute myocardial infarction)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.23%	General anesthesia (General anesthesia)	194682	0.25%	RR	0.93(0.72,1.21)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Memtsoudis,S.G., 2013	Low Quality	complications other(Mechanical ventilation)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	0.46%	General anesthesia (General anesthesia)	194682	0.67%	RR	0.68(0.57,0.82)	**Treatment 1 Significant (P-value<.05)**
Memtsoudis,S.G., 2013	Low Quality	complications other(All infections)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	28426	3.09%	General anesthesia (General anesthesia)	194682	3.86%	RR	0.80(0.75,0.86)	**Treatment 1 Significant (P-value<.05)**
Sharrock,N.E., 1991	Low Quality	Deep venous thrombosis(DVT unilateral arthroplasty)	NA	Neuraxial anesthesia or epidural/spinal (Epidural anesthesia was performed with fifteen to twenty five ml of 0.75 percent bupivacaine or 2 percent lidocaine with epinephrine)	206	56.31%	General anesthesia (General anesthesia)	171	42.11%	RR	1.34(1.08,1.65)	**Treatment 1 Significant (P-value<.05)**
Sharrock,N.E., 1991	Low Quality	Deep venous thrombosis(DVT bilateral arthroplasty)	NA	Neuraxial anesthesia or epidural/spinal (Epidural anesthesia was performed with fifteen to twenty five ml of 0.75 percent bupivacaine or 2 percent lidocaine with epinephrine)	71	78.87%	General anesthesia (General anesthesia)	93	64.52%	RR	1.22(1.01,1.48)	**Treatment 1 Significant (P-value<.05)**
Stundner,O., 2012	Low Quality	Wound Complications (Wound infection)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	0.09%	General anesthesia (General anesthesia)	12567	0.10%	RR	0.91(0.12,6.93)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Stundner,O., 2012	Low Quality	pulmonary embolism(Pulmonary embolism)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	1.50%	General anesthesia (General anesthesia)	12567	0.90%	RR	1.67(0.99,2.81)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	complications other(Cardiac (non-myocardial infection))	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	5.16%	General anesthesia (General anesthesia)	12567	5.90%	RR	0.88(0.67,1.14)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	complications other(Pneumonia)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	0.66%	General anesthesia (General anesthesia)	12567	0.90%	RR	0.73(0.34,1.56)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	complications other(All infections)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	3.19%	General anesthesia (General anesthesia)	12567	4.50%	RR	0.71(0.50,1.00)	**Treatment 1 Significant (P-value<.05)**
Stundner,O., 2012	Low Quality	complications other(Mechanical ventilation)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	0.47%	General anesthesia (General anesthesia)	12567	0.90%	RR	0.52(0.21,1.27)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	complications other(Acute renal failure)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	1.88%	General anesthesia (General anesthesia)	125667	2.70%	RR	0.69(0.45,1.07)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	complications other(Gastrointestinal complication)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	1.13%	General anesthesia (General anesthesia)	12567	1.30%	RR	0.87(0.48,1.55)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	complications other(Acute myocardial infaction)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	0.19%	General anesthesia (General anesthesia)	12567	0.40%	RR	0.47(0.11,1.94)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Stundner,O., 2012	Low Quality	complications other(Blood transfusion)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	28.52%	General anesthesia (General anesthesia)	12567	44.70%	RR	0.64(0.58,0.70)	**Treatment 1 Significant (P-value<.05)**

TABLE 34: NEURAXIAL ANESTHESIA VERSUS GENERAL ANESTHESIA: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until assisted transfer in and out of bed)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	2.5(0.80)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	2.6(1.00)	Mean Difference	-0.1(-0.32,0.12)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until unassisted transfer in and out of bed)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	6.6(2.90)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	6.9(3.40)	Mean Difference	-0.3(-1.08,0.48)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until walking with walker, assisted)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	2.7(1.00)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	2.7(1.10)	Mean Difference	0(-0.26,0.26)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until walking with walker, unassisted)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	5.8(2.70)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	6.1(3.00)	Mean Difference	-0.3(-1.01,0.41)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until walking with cane, assisted)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	7.2(3.10)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	7.4(2.90)	Mean Difference	-0.2(-0.94,0.54)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until walking with cane, unassisted)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	10.4(4.70)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	11.1(4.60)	Mean Difference	-0.7(-1.85,0.45)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until walking up stairs, assisted)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	7.9(3.10)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	9.5(4.90)	Mean Difference	-1.6(-2.62,-0.58)	**Treatment 1 Significant (P-value<.05)**
Williams-Russo, P., 1996	High Quality	Ambulation (walking) (Days until walking up stairs, unassisted)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	10.9(4.80)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	11.8(4.70)	Mean Difference	-0.9(-2.07,0.27)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Range of Motion (flexion) - Function (Days until 90 degree flexion)	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	6.9(2.10)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	7.8(3.20)	Mean Difference	-0.9(-1.57,-0.23)	**Treatment 1 Significant (P-value<.05)**

TABLE 35: NEURAXIAL ANESTHESIA VERSUS GENERAL ANESTHESIA: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P 1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P 2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Mitchell,D., 1991	High Quality	Days- Length Of Stay (Hospital Days)	Post-Op	Neuraxial anesthesia or epidural/spinal (Local anesthetic via epidural catheter)	34	10.4(.)	General anesthesia (Tubocurarine, sodium thiopental, succinylcholine, and nitrous oxide in oxygen)	38	11(.)	Author Reported	NA	
Williams-Russo, P., 1995	High Quality	Days- Length Of Stay ( )	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	134	12.7(5.30)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O)	128	12.7(4.30)	Mean Difference	0(-1.17,1.17)	Not Significant (P-value>.05)
Williams-Russo, P., 1996	High Quality	Days- Length Of Stay ( )	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	133	12.1(4.50)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O and isoflurane)	120	12.7(4.30)	Mean Difference	-0.6(-1.68,0.48)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	Length Of Recovery- Length Of Stay (Length of stay, median (IQR))	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	. %	General anesthesia (General anesthesia)	12567	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 36: NEURAXIAL ANESTHESIA VERSUS GENERAL ANESTHESIA: LENGTH OF SURGERY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1995	High Quality	Length Of Surgery- Length Of Surgery (Time in min.)	Intra-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	134	85(33.00)	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O)	128	88(32.00)	Mean Difference	-3(-10.87,4.87)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 37: NEURAXIAL ANESTHESIA VERSUS GENERAL ANESTHESIA: MORTALITY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Williams-Russo, P., 1995	High Quality	Mortality-Mortality( )	Post-Op	Neuraxial anesthesia or epidural/spinal (Lidocaine 2% or Bupivicaine 0.75% via epidural catheter)	134	0.75%	General anesthesia (Thiopental, fentanyl, and vecuronium; inhaled N2O)	128	0.78%	RR	0.96(0.06,15.11)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	Mortality-Mortality(In-hospital mortality)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	0.09%	General anesthesia (General anesthesia)	12567	0.10%	RR	0.91(0.12,6.93)	Not Significant (P-value>.05)
Stundner,O., 2012	Low Quality	Mortality-Mortality(30-day Mortality)	NA	Neuraxial anesthesia or epidural/spinal (Neuraxial anesthesia)	1066	0.09%	General anesthesia (General anesthesia)	12567	0.10%	RR	0.91(0.12,6.93)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TOURNIQUETS

A. TOURNIQUET: BLOOD LOSS REDUCTION

Moderate evidence supports that the use of a tourniquet in total knee arthroplasty (TKA) decreases intraoperative blood loss.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

B. TOURNIQUET: POSTOPERATIVE PAIN REDUCTION

Strong evidence supports that tourniquet use in total knee arthroplasty (TKA) increases short term post-operative pain.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

C. TOURNIQUET: POSTOPERATIVE FUNCTION

Limited evidence supports that tourniquet use in total knee arthroplasty (TKA) decreases short term post-operative function.

Strength of Recommendation: Limited Evidence 

Description: Evidence from two or more "Low" strength studies with consistent findings ***or*** *evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALE

With regard to pain, two high quality studies (Liu 2014 and Ledin 2012) and another moderate quality study (Ejaz 2014) showed decreased pain in the no tourniquet group in the very early postoperative period that was not significant after four days (Ledin 2012 and Liu 2014) and eight weeks (Ejaz 2014) respectively.

One high quality study (Ledin 2012) and one moderate quality (Aglietti 2000) found increased intraoperative blood loss in the no tourniquet patients. However, Ledin 2012 found no increased total bleeding when hemoglobin dilution was measured and Aglietti 2000 found no difference when overall total blood loss was tabulated.

One high quality study (Liu 2014) showed better quadriceps function in the no tourniquet group but equivalent Oxford Knee Scores and range of motion. One moderate quality (Ejaz 2014) study demonstrated better Knee Injury and Osteoarthritis Outcomes (KOOS) subscores and early range of motion to week eight postoperatively in the no tourniquet group, where differences then became statistically insignificant.

** See Appendix XIII for details regarding support*

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There is increased risk of acute intraoperative blood loss without a tourniquet. The possibility of poor fixation at the cement-bone interface exists.

FUTURE RESEARCH

Continued prospective multicenter randomized studies with and without use of a tourniquet may show difference if more detailed patient reported outcomes instruments are utilized. Studies that included gradation of use of tourniquet or select times during the operation when utilized may demonstrate when tourniquet may be most beneficial. The work group also supports more high quality studies that take into consideration tourniquet use in the context of modern blood conservation protocols such as the addition of tranexamic acid.

RESULTS

SUMMARY OF FINDINGS TABLE 23: TOURNIQUETS VERSUS NO TOURNIQUET

Summary of Findings	High Quality		Moderate Quality	
● Favors Tourniquet ● Favors No Tourniquet ○ Not Significant	Liu,D., 2014	Ledin,H., 2012	Ejaz,A., 2014	Aglietti,P., 2000
Complications				
Deep venous thrombosis			○	
Manipulation Under Anesthesia- Other		○	○	
Need Transfusion- Complications	●			
Blood Loss		●	●	●
Function				
Koos-Function, Daily Living- Function			●	
Koos-Function, Sports And Recreational Activities- Function			●	
Other				
Koos-Symptoms- Other			●	
Pain				
Knee Society Score-Pain- Pain			●	
Vas Pain (100mm)- Pain		●		
Vas Pain (10cm)- Pain	●		●	
Quality of Life				
Koos-Quality Of Life- Quality Of Life			●	
Reoperation				
Reoperation- Reoperation		○		

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 13: TOURNIQUETS

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Aglietti,P., 2000	◑	◑	●	●	●	○	Include	Moderate Quality
Ejaz,A., 2014	●	◑	○	●	○	●	Include	Moderate Quality
Ledin,H., 2012	◑	◑	●	●	●	●	Include	High Quality
Liu,D., 2014	●	●	●	●	●	●	Include	High Quality
Steffin,B., 2009	●	●	●	●	○	●	Include	High Quality

DETAILED DATA TABLES

TABLE 38: TOURNIQUET VERSUS NO TOURNIQUET: BLOOD LOSS AND NEED FOR TRANSFUSION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Aglietti,P., 2000	Moderate Quality	Blood Loss - Complications (ml during post operative period only)	During 1st Post-op hour	Tourniquet(tourniquet routinely was deflated intraoperatively after the components were cemented in place so that hemostasis could be obtained)	10	290(54)	No Tourniquet( )	10	145(50.00)	Mean Difference	145 (96.11, 193.89)	Treatment 2 Significant (P-value<.05)
Aglietti,P., 2000	Moderate Quality	Blood Loss - Complications (ml)	Intra-Op	Tourniquet(tourniquet routinely was deflated intraoperatively after the components were cemented in place so that hemostasis could be obtained)	10	350(12.00)	No Tourniquet( )	10	482(97.40)	Mean Difference	-132(-192.83,-71.17)	Treatment 1 Significant (P-value<.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ejaz,A., 2014	Moderate Quality	Blood Loss - Complications (ml)	Intra-Op	Tourniquet( )	33	140(32.70)	No Tourniquet( )	31	280(52.00)	Mean Difference	-140(-161.44,-118.56)	Treatment 1 Significant (P-value<.05)
Ledin,H., 2012	High Quality	Blood Loss - Complications (overt bleeding)	Peroperative	Tourniquet(110 mm wide, which was inflated to 275 mmHg during the entire operation)	25	317(.)	No Tourniquet( )	23	615(.)	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Aglietti,P., 2000	Moderate Quality	Blood Loss - Complications (total blood loss intraoperative + post operative)	1 hours	Tourniquet(tourniquet routinely was deflated intraoperatively after the components were cemented in place so that hemostasis could be obtained)	10	640(120.00)	No Tourniquet( )	10	627(142.00)	Mean Difference	13(-102.23,128.23)	Not Significant (P-value>.05)
Ledin,H., 2012	High Quality	Blood Loss - Complications (total blood loss measured by hemoglobin dilution method)	NR	Tourniquet(110 mm wide, which was inflated to 275 mmHg during the entire operation)	25	1184(346.00)	No Tourniquet( )	23	1236(349.00)	Mean Difference	-52(-248.82,144.82)	Not Significant (P-value>.05)
Liu,D., 2014	High Quality	Drainage-Complications ( )	Post-Op	Tourniquet( )	10	%	No Tourniquet( )	10	%	Author Reported	NA	Not Significant (P-value>.05)
Ledin,H., 2012	High Quality	Need Transfusion-Complications ( )	Post-Op	Tourniquet(110 mm wide, which was inflated to 275 mmHg during the entire operation)	25	16.00%	No Tourniquet( )	23	13.04%	RR	1.23 (0.31, 4.9)	Not Significant (P-value>.05)
Liu,D., 2014	High Quality	Need Transfusion-Complications ( )	Post-Op	Tourniquet( )	10	30.00%	No Tourniquet( )	10	0.00%	RD	0.30(0.02,0.58)	Treatment 2 Significant (P-value<.05)

TABLE 39: TOURNIQUET VERSUS NO TOURNIQUET: OTHER COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ejaz,A., 2014	Moderate Quality	Manipulation Under Anesthesia-Other (need for MUA)	2 months	Tourniquet( )	33	6.06%	No Tourniquet( )	31	0.00%	RD	0.06(-0.02,0.14)	Not Significant (P-value>.05)
Ledin,H., 2012	High Quality	Manipulation Under Anesthesia-Other (need for)	4 Days	Tourniquet(110 mm wide, which was inflated to 275 mmHg during the entire operation)	25	4.00%	No Tourniquet( )	23	0.00%	RD	0.04(-0.04,0.12)	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Deep venous thrombosis( )	Post-Op	Tourniquet( )	33	6.06%	No Tourniquet( )	31	3.23%	RR	1.88(0.18,19.70)	Not Significant (P-value>.05)

TABLE 40: TOURNIQUET VERSUS NO TOURNIQUET: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ejaz,A., 2014	Moderate Quality	Koos-Function, Daily Living-Function ( )	2 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Ejaz,A., 2014	Moderate Quality	Koos-Function, Daily Living-Function ( )	6 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Koos-Function, Daily Living-Function ( )	1 year	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Koos-Function, Sports And Recreational Activities-Function ( )	2 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Ejaz,A., 2014	Moderate Quality	Koos-Function, Sports And Recreational Activities-Function ( )	6 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ejaz,A., 2014	Moderate Quality	Koos-Function, Sports And Recreational Activities-Function ( )	1 year	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 41: TOURNIQUET VERSUS NO TOURNIQUET: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ledin,H., 2012	High Quality	Vas Pain (100mm)- Pain ( )	4 Days	Tourniquet(110 mm wide, which was inflated to 275 mmHg during the entire operation)	25	. %	No Tourniquet( )	23	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Liu,D., 2014	High Quality	Vas Pain (10cm)- Pain ( )	1 Days	Tourniquet( )	10	. %	No Tourniquet( )	10	. %	Author Reported	NA	Not Significant (P-value>.05)
Liu,D., 2014	High Quality	Vas Pain (10cm)- Pain ( )	2 Days	Tourniquet( )	10	. %	No Tourniquet( )	10	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Liu,D., 2014	High Quality	Vas Pain (10cm)- Pain ( )	3 Days	Tourniquet( )	10	. %	No Tourniquet( )	10	. %	Author Reported	NA	Not Significant (P-value>.05)
Liu,D., 2014	High Quality	Vas Pain (10cm)- Pain ( )	4 Days	Tourniquet( )	10	. %	No Tourniquet( )	10	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Liu,D., 2014	High Quality	Vas Pain (10cm)- Pain ( )	5 Days	Tourniquet( )	10	. %	No Tourniquet( )	10	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Vas Pain (10cm)- Pain ( )	Post-Op	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Vas Pain (10cm)- Pain ( )	Discharge	Tourniquet( )	33	5.5(1.60)	No Tourniquet( )	31	4.6(1.40)	Mean Difference	0.9(0.16,1.64)	Treatment 2 Significant (P-value<.05)
Ejaz,A., 2014	Moderate Quality	Vas Pain (10cm)- Pain ( )	2 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Knee Society Score-Pain-Pain ( )	2 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Ejaz,A., 2014	Moderate Quality	Knee Society Score-Pain-Pain ( )	6 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Knee Society Score-Pain-Pain ( )	1 year	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 42: TOURNIQUET VERSUS NO TOURNIQUET: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ejaz,A., 2014	Moderate Quality	Koos-Quality Of Life- Quality Of Life( )	2 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Ejaz,A., 2014	Moderate Quality	Koos-Quality Of Life- Quality Of Life( )	6 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Koos-Quality Of Life- Quality Of Life( )	1 year	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 43: TOURNIQUET VERSUS NO TOURNIQUET: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ledin,H., 2012	High Quality	Reoperation-Reoperation (revision due to loosening)	2 years	Tourniquet(110 mm wide, which was inflated to 275 mmHg during the entire operation)	25	4.00%	No Tourniquet( )	23	4.35%	RR	0.92(0.06,13.87)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 44: TOURNIQUET VERSUS NO TOURNIQUET: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ejaz,A., 2014	Moderate Quality	Koos-Symptoms-Other ( )	2 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Ejaz,A., 2014	Moderate Quality	Koos-Symptoms-Other ( )	6 months	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)
Ejaz,A., 2014	Moderate Quality	Koos-Symptoms-Other ( )	1 year	Tourniquet( )	33	. %	No Tourniquet( )	31	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TRANEXAMIC ACID

Strong evidence supports that, in patients with no known contraindications, treatment with tranexamic acid decreases postoperative blood loss and reduces the necessity of postoperative transfusions following total knee arthroplasty (TKA).

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Eight high quality studies (Antinolfi, 2013, Charoencholvanich, 2011, Gautam, 2011, Good, 2003,Ishida, 2011,Roy, 2012, Sa-Ngasoongsong, 2013, Sarzaeem, 2014, Pachauri, 2014) were reviewed to assess the impact of tranexamic acid administration on blood loss and transfusion rates post total knee arthroplasty. There was significant variability in dosing, route of administration, and timing of administration; when assessed collectively, however, the use of tranexamic acid did show improvement in blood loss related outcomes.

Using six of the high quality studies a meta-analysis was performed on rate of blood transfusions which demonstrated a 52% reduction in patients receiving tranexamic acid (Figure 1). Three high quality studies demonstrated an improvement in Hgb. One high quality study (Ishida 2011) demonstrated a reduction in swelling and one high quality (Sa-Ngasoongsong 2013) study found an improvement in WOMAC function scores out to 1 year.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Care must be taken when utilizing tranexamic acid in patients at high risk for complications such as thromboembolic disease, and color blindness as this has not been adequately studied. This is not an FDA approved use of this agent. The studies used to make this recommendation almost all have significant exclusion criteria, especially regarding patients with a history of VTE or at high risk for the same. There are also specific contraindications in the PDR for the FDA approved uses that include color blindness. The surgeon should be aware of the several common exclusion criteria in the literature, specific contraindications, the experience with this agent in other specialties, and the evolving case report literature before using this agent indiscriminately.

FUTURE RESEARCH

The studies used to make this recommendation almost all have significant exclusion criteria, and this must be considered by the practitioner implementing the recommendation. The most common exclusion criteria were thromboembolic disorders, cerebrovascular conditions, and cardiovascular disorders. As tranexamic acid is renally excreted, its use must be modified or reconsidered in patients with poor renal function. Use of tranexamic acid in joint replacement surgery should be considered "off-label" as it is not explicitly FDA approved for this usage. FDA contraindications for its approved usages include: patients with acquired defective color vision, patients with subarachnoid hemorrhage, patients with active intravascular clotting, and in patients with hypersensitivity to tranexamic acid (accessdata.fda.gov).

* *See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 10: TRANEXAMIC ACID VERSUS PLACEBO

Summary of Findings

● **Favors Tranexamic Acid**

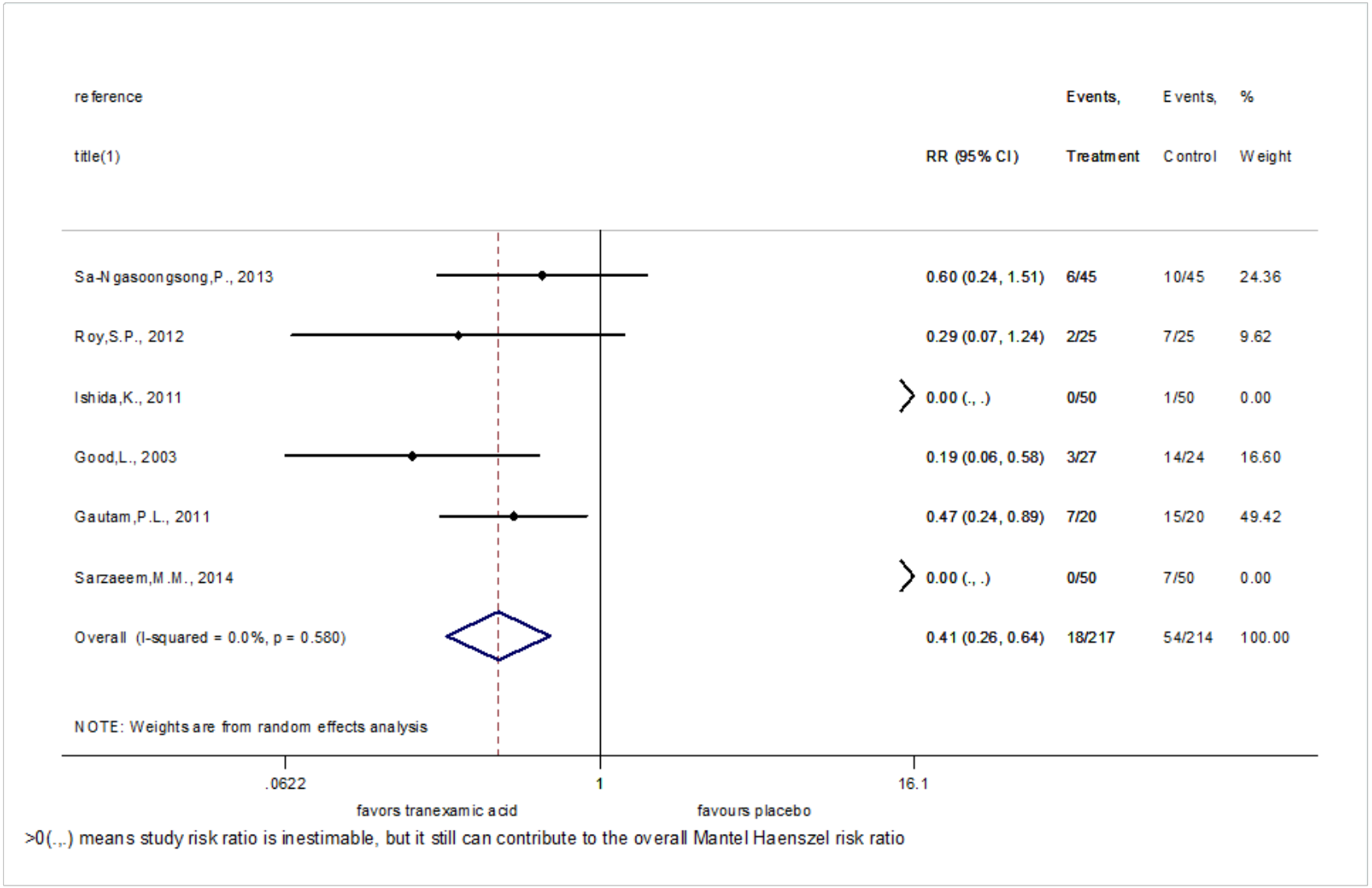
● **Favors Placebo**

○ **Not Significant**

	High Quality							
	Sarzaeem,M.M., 2014	Sa-Ngasoongsong,P., 2013	Roy,S.P., 2012	Ishida,K., 2011	Good,L., 2003	Gautam,P.L., 2011	Antinolfi,P., 2013	Meta-Analysis
Complications								
Complications other		●						
Deep venous thrombosis					○		○	
Fall in HB, g/dL	○	○	●	○		○	●	
Infection- Complications					○			
VTE- Complications	○	○	○					
Blood transfusion %		○	○	○	●	●		●
Need Transfusion- Complications	●							
Wound Complications							○	
Blood Loss	●	●			○	●	●	
Drainage- Complications			●	○				
Pulmonary embolism							○	
Hematocrit			●				●	
Composite								
Fall in HB, g/dL	●							
Womac-overall- Composite Likert (0-96)		●						
Function								
Range Of Motion(overall) - Function								
Other								
Swelling - Other				●				

** See Appendix XIII for details regarding support*

FIGURE 1 TRANEXAMIC ACID VERSUS PLACEBO – BLOOD TRANSFUSION %



** See Appendix XIII for details regarding support*

TRANEXAMIC ACID

QUALITY EVALUATION TABLE 6: TRANEXAMIC ACID

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Antinolfi,P., 2013	●	◑	●	●	●	●	Include	High Quality
Charoencholvanich,K., 2011	◑	●	●	●	●	●	Include	High Quality
Gautam,P.L., 2011	●	◑	●	●	●	○	Include	High Quality
Good,L., 2003	●	●	●	●	●	●	Include	High Quality
Ishida,K., 2011	◑	◑	●	●	●	●	Include	High Quality
Roy,S.P., 2012	●	●	●	●	●	●	Include	High Quality
Sa-Ngasoongsong, P., 2013	●	◑	●	●	●	●	Include	High Quality
Sarzaeem, M.M., 2014	●	◑	●	●	●	●	Include	High Quality
Pachauri,A., 2014	◑	◑	●	●	○	●	Not best available evidence	Moderate Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 45: TRANEXAMIC ACID VERSUS PLACEBO: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Antinolfi,P., 2013	High Quality	Blood Loss - Complications (cc's, .75 indicates evening)	0 days (morning)	Tranexamic Acid (500 mg)	20	245(155.50)	No Tranexamic Acid (placebo)	20	313(105.50)	Mean Difference	-68(-150.36,14.36)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Blood Loss - Complications (cc's, .75 indicates evening)	0 days (evening)	Tranexamic Acid (500 mg)	20	428(223.90)	No Tranexamic Acid (placebo)	20	559.9(153.30)	Mean Difference	-131.9(-250.83,-12.97)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Blood Loss - Complications (cc's, .75 indicates evening)	1 Days (in morning)	Tranexamic Acid (500 mg)	20	536(234.70)	No Tranexamic Acid (placebo)	20	819(161.90)	Mean Difference	-283(-407.96,-158.04)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Blood Loss - Complications (cc's, .75 indicates evening)	1 Days (in evening)	Tranexamic Acid (500 mg)	20	617.5(222.90)	No Tranexamic Acid (placebo)	20	1011.5(180.30)	Mean Difference	-394(-519.65,-268.35)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Blood Loss - Complications (cc's, .75 indicates evening)	2 Days	Tranexamic Acid (500 mg)	20	658.5(211.40)	No Tranexamic Acid (placebo)	20	1093(183.90)	Mean Difference	-434.5(-561.30,-307.66)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Fall in HB, g/dL(raw scores, not change scores)	0 days	Tranexamic Acid (500 mg)	20	11.9(1.10)	No Tranexamic Acid (placebo)	20	10.6(1.10)	Mean Difference	1.3(0.62,1.98)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Fall in HB, g/dL(raw scores, not change scores)	2 Days	Tranexamic Acid (500 mg)	20	10.2(1.00)	No Tranexamic Acid (placebo)	20	9.3(1.10)	Mean Difference	10.9(10.25,11.55)	Treatment 1 Significant (P-value<.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Antinolfi,P., 2013	High Quality	Fall in HB, g/dL(raw scores, not change scores)	3 Days	Tranexamic Acid (500 mg)	20	10.1(1.20)	No Tranexamic Acid (placebo)	20	9.7(0.90)	Mean Difference	0.4(-0.26,1.06)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Fall in HB, g/dL(raw scores, not change scores)	4 Days	Tranexamic Acid (500 mg)	20	9.7(0.80)	No Tranexamic Acid (placebo)	20	9.9(1.00)	Mean Difference	-0.2(-0.76,0.36)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Fall in HB, g/dL(raw scores, not change scores)	5 Days	Tranexamic Acid (500 mg)	20	9.8(0.90)	No Tranexamic Acid (placebo)	20	10.2(0.90)	Mean Difference	-0.4(-0.96,0.16)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Fall in HB, g/dL (raw scores, not change scores)	1 Days	Tranexamic Acid (500 mg)	20	10.9(1.40)	No Tranexamic Acid (placebo)	20	9.5(1.00)	Mean Difference	1.4(0.65,2.15)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Hematocrit (raw scores, not change scores)	0 days	Tranexamic Acid (500 mg)	20	36.1(3.50)	No Tranexamic Acid (placebo)	20	32.3(3.60)	Mean Difference	3.8(1.60,6.00)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Hematocrit (raw scores, not change scores)	1 Days	Tranexamic Acid (500 mg)	20	32.2(4.20)	No Tranexamic Acid (placebo)	20	29.3(3.10)	Mean Difference	2.9(0.61,5.19)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Hematocrit (raw scores, not change scores)	2 Days	Tranexamic Acid (500 mg)	20	30.1(3.00)	No Tranexamic Acid (placebo)	20	28(3.10)	Mean Difference	2.1(0.21,3.99)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Hematocrit (raw scores, not change scores)	3 Days	Tranexamic Acid (500 mg)	29.5	29.5(3.60)	No Tranexamic Acid (placebo)	20	29.4(2.20)	Mean Difference	.1(--1.81,-2.01)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Hematocrit (raw scores, not change scores)	4 Days	Tranexamic Acid (500 mg)	20	28.8(2.80)	No Tranexamic Acid (placebo)	20	30(2.80)	Mean Difference	-1.2(-2.94,0.54)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Hematocrit (raw scores, not change scores)	5 Days	Tranexamic Acid (500 mg)	20	29.3(3.00)	No Tranexamic Acid (placebo)	20	31(2.50)	Mean Difference	-1.7(-3.41,0.01)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Antinolfi,P., 2013	High Quality	Blood transfusion % (units transfused)	5 Days	Tranexamic Acid (500 mg)	20	0.8(0.80)	No Tranexamic Acid (placebo)	20	2.2(1.00)	Mean Difference	-1.4(-1.98, -.82)	Treatment 1 Significant (P-value<.05)
Antinolfi,P., 2013	High Quality	Wound Complications (wound healing complications)	3 months	Tranexamic Acid (500 mg)	20	0.00%	No Tranexamic Acid (placebo)	20	10.00%	RD	-0.10(-0.23,0.03)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Deep venous thrombosis (symptomatic dvt)	3 months	Tranexamic Acid (500 mg)	20	0.00%	No Tranexamic Acid (placebo)	20	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	pulmonary embolism (symptomatic PE)	3 months	Tranexamic Acid (500 mg)	20	0.00%	No Tranexamic Acid (placebo)	20	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Gautam,P.L., 2011	High Quality	Blood Loss - Complications (postoperative)	Post-Op	Tranexamic Acid (received tranexamic acid 10 mg/kg IV, approximately half an hour before deflation of tourniquet and 3 hours after the first dose)	20	272.5(122.51)	No Tranexamic Acid (placebo)	20	685(118.21)	Mean Difference	-412.5(-487.11,-337.89)	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Gautam,P.L., 2011	High Quality	Blood Loss - Complications (total blood loss)	5 Days	Tranexamic Acid (received tranexamic acid 10 mg/kg IV, approximately half an hour before deflation of tourniquet and 3 hours after the first dose)	20	443(134.38)	No Tranexamic Acid (placebo)	20	985.25(220.40)	Mean Difference	-542.25(-655.38,-429.12)	Treatment 1 Significant (P-value<.05)
Gautam,P.L., 2011	High Quality	Fall in HB, g/dL( )	Post-Op	Tranexamic Acid (received tranexamic acid 10 mg/kg IV, approximately half an hour before deflation of tourniquet and 3 hours after the first dose)	20	11.11(1.56)	No Tranexamic Acid (placebo)	20	10.42(1.42)	Mean Difference	0.69(-0.23,1.61)	Not Significant (P-value>.05)
Gautam,P.L., 2011	High Quality	Blood transfusion % ( )	5 Days	Tranexamic Acid (received tranexamic acid 10 mg/kg IV, approximately half an hour before deflation of tourniquet and 3 hours after the first dose)	.	. %	No Tranexamic Acid (placebo)	.	. %	RR	0.47(0.24,0.89)	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Gautam,P.L., 2011	High Quality	Blood transfusion % (multiple transfusions required)	5 Days	Tranexamic Acid (received tranexamic acid 10 mg/kg IV, approximately half an hour before deflation of tourniquet and 3 hours after the first dose)	20	0.00%	No Tranexamic Acid (placebo)	20	10.00%	RD	-0.10(-0.23,0.03)	Not Significant (P-value>.05)
Good,L., 2003	High Quality	Drainage-Complications ( )	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Good,L., 2003	High Quality	Blood Loss - Complications (ml)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Good,L., 2003	High Quality	Blood Loss - Complications (hidden blood loss)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Not Significant (P-value>.05)
Good,L., 2003	High Quality	Blood transfusion % (red blood cells transfused)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Good,L., 2003	High Quality	Blood transfusion % (number transfused)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	11.11%	No Tranexamic Acid (placebo)	.	. %	RR	0.19(0.06,0.58)	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Good,L., 2003	High Quality	Deep venous thrombosis (clinical symptoms of dvt)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	7.41%	No Tranexamic Acid (placebo)	24	8.33%	RR	0.89(0.14,5.83)	Not Significant (P-value>.05)
Good,L., 2003	High Quality	Infection-Complications (wound infection)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	.	. %	No Tranexamic Acid (placebo)	24	0.00%	RD	0.04(-0.03,0.11)	Not Significant (P-value>.05)
Good,L., 2003	High Quality	Fall in HB, g/dL (raw post op hb)	1 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Good,L., 2003	High Quality	Fall in HB, g/dL (raw post op hb)	3 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Good,L., 2003	High Quality	Fall in HB, g/dL (raw post op hb)	5 Days	Tranexamic Acid (tranexamic acid 10 mg kg-1)	27	. %	No Tranexamic Acid (placebo)	24	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Drainage-Complications ( )	3 hours	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Drainage-Complications ( )	6 hours	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Drainage-Complications ( )	1 hours	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Fall in HB, g/dL( )	1 Days	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Fall in HB, g/dL( )	1 weeks	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ishida,K., 2011	High Quality	Fall in HB, g/dL( )	2 weeks	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Fall in HB, g/dL( )	Post-Op	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Drainage-Complications ( )	12 hours	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Drainage-Complications ( )	1 Days	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Drainage-Complications ( )	2 Days	Tranexamic Acid ( )	50	. %	No Tranexamic Acid ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Blood transfusion % (allogenic blood transfusions)	2 weeks	Tranexamic Acid ( )	50	0.00%	No Tranexamic Acid ( )	.	. %	RD	-0.02(-0.06,0.02)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (supratellar girth cm)	1 weeks	Tranexamic Acid ( )	50	1.6(1.20)	No Tranexamic Acid ( )	50	2.5(1.20)	Mean Difference	-0.9(-1.37,-0.43)	Treatment 1 Significant (P-value<.05)
Ishida,K., 2011	High Quality	Swelling - Other (supratellar girth cm)	2 weeks	Tranexamic Acid ( )	50	0.7(2.10)	No Tranexamic Acid ( )	50	1.1(1.10)	Mean Difference	-0.4(-1.06,0.26)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (supratellar girth cm)	4 weeks	Tranexamic Acid ( )	50	0.1(1.10)	No Tranexamic Acid ( )	50	-0.1(1.30)	Mean Difference	0.2(-0.27,0.67)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (calf girth cm)	1 weeks	Tranexamic Acid ( )	50	0.5(1.60)	No Tranexamic Acid ( )	50	0.9(2.00)	Mean Difference	-0.4(-1.11,0.31)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (calf girth cm)	2 weeks	Tranexamic Acid ( )	50	-1.1(1.40)	No Tranexamic Acid ( )	50	-0.3(1.60)	Mean Difference	-0.8(-1.39,-.20)	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ishida,K., 2011	High Quality	Swelling - Other (calf girth cm)	4 weeks	Tranexamic Acid ( )	50	-1.2(1.30)	No Tranexamic Acid ( )	50	-1(1.10)	Mean Difference	-0.2(-0.67,0.27)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (change from preoperative thigh girth cm)	1 weeks	Tranexamic Acid ( )	50	1.1(2.00)	No Tranexamic Acid ( )	50	1.4(1.70)	Mean Difference	-0.3(-1.03,0.43)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (change from preoperative thigh girth cm)	2 weeks	Tranexamic Acid ( )	50	-0.7(2.10)	No Tranexamic Acid ( )	50	-0.6(1.90)	Mean Difference	-0.1(-0.88,0.68)	Not Significant (P-value>.05)
Ishida,K., 2011	High Quality	Swelling - Other (change from preoperative thigh girth cm)	4 weeks	Tranexamic Acid ( )	50	-1.8(2.10)	No Tranexamic Acid ( )	50	-1.6(2.20)	Mean Difference	-0.2(-1.04,0.64)	Not Significant (P-value>.05)
Roy,S.P., 2012	High Quality	Drainage-Complications (measured between 0-6,6-48 hours. and total in 5 days)	6 hours	Tranexamic Acid (500 mg/5 ml)	25	268.4(111.08)	No Tranexamic Acid (placebo)	25	470(114.56)	Mean Difference	-201.6(-264.15,-139.05)	Treatment 1 Significant (P-value<.05)
Roy,S.P., 2012	High Quality	Drainage-Complications (measured between 0-6,6-48 hours. and total in 5 days)	2 Days	Tranexamic Acid (500 mg/5 ml)	25	151.6(82.10)	No Tranexamic Acid (placebo)	25	400(180.27)	Mean Difference	-248.4(-326.05,-170.75)	Treatment 1 Significant (P-value<.05)
Roy,S.P., 2012	High Quality	Drainage-Complications (measured between 0-6,6-48 hours. and total in 5 days)	5 Days	Tranexamic Acid (500 mg/5 ml)	25	401(82.44)	No Tranexamic Acid (placebo)	25	870(201.04)	Mean Difference	-469(-554.18,-383.82)	Treatment 1 Significant (P-value<.05)
Roy,S.P., 2012	High Quality	Fall in HB, g/dL (day5-day0)	5 Days	Tranexamic Acid (500 mg/5 ml)	25	1.94(0.98)	No Tranexamic Acid (placebo)	25	3.04(1.33)	Mean Difference	-1.1(-1.75,-0.45)	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Roy,S.P., 2012	High Quality	Hematocrit (day5-day0)	5 Days	Tranexamic Acid (500 mg/5 ml)	25	30.37(3.08)	No Tranexamic Acid (placebo)	25	28.01(3.22)	Mean Difference	2.36(0.61,4.11)	Treatment 1 Significant (P-value<.05)
Roy,S.P., 2012	High Quality	Blood transfusion % (number of patients transfused)	5 Days	Tranexamic Acid (500 mg/5 ml)	25	8.00%	No Tranexamic Acid (placebo)	25	28.00%	RR	0.29(0.07,1.24)	Not Significant (P-value>.05)
Roy,S.P., 2012	High Quality	VTE-Complications (throboembolic events)	5 Days	Tranexamic Acid (500 mg/5 ml)	25	0.00%	No Tranexamic Acid (placebo)	25	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Roy,S.P., 2012	High Quality	Blood Loss - Complications ( )	Intra-Op	Tranexamic Acid (500 mg/5 ml)	25	109.6(71.54)	No Tranexamic Acid (placebo)	25	194(79.66)	Mean Difference	-84.4(-127.46,-41.34)	Treatment 1 Significant (P-value<.05)
Sa-Ngasoongsong, P., 2013	High Quality	complications other (re-clamp)	Post-Op	Tranexamic Acid (500mg)	45	0.00%	No Tranexamic Acid ( )	45	13.33%	RD	-0.13(-0.23,-0.03)	Treatment 1 Significant (P-value<.05)
Sa-Ngasoongsong, P., 2013	High Quality	complications other (re-dressing)	Post-Op	Tranexamic Acid (500mg)	45	0.00%	No Tranexamic Acid ( )	45	6.67%	RD	-0.07(-0.14,0.01)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	VTE-Complications ( )	Peri-Op	Tranexamic Acid (500mg)	45	4.44%	No Tranexamic Acid ( )	45	8.89%	RR	0.50(0.10,2.59)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	complications other (congestive heart failure)	Post-Op	Tranexamic Acid (500mg)	45	0.00%	No Tranexamic Acid ( )	45	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Blood Loss - Complications (Drainage blood loss)	Peri-Op	Tranexamic Acid (250 mg)	45	475(254.40)	No Tranexamic Acid ( )	45	546.9(273.00)	Mean Difference	-71.9(-180.93,37.13)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Fall in HB, g/dL( )	Peri-Op	Tranexamic Acid (500mg)	45	2.2(0.70)	No Tranexamic Acid ( )	45	2.9(119.40)	Mean Difference	-0.7(-35.59,34.19)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Sa-Ngasoongsong, P., 2013	High Quality	Blood Loss - Complications (calculated total blood loss)	Peri-Op	Tranexamic Acid (500mg)	45	217.20(86.3)	No Tranexamic Acid ( )	45	329.2(119.40)	Mean Difference	-112(-155.61,-68.39)	Treatment 1 Significant (P-value<.05)
Sa-Ngasoongsong, P., 2013	High Quality	Fall in HB, g/dL( )	Peri-Op	Tranexamic Acid (250 mg)	45	2.2(0.70)	No Tranexamic Acid ( )	45	2.9(119.40)	Mean Difference	-0.7(-35.59,34.19)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Blood Loss - Complications (calculated total blood loss)	Peri-Op	Tranexamic Acid (250 mg)	45	239.7(83.70)	No Tranexamic Acid ( )	45	329.2(119.40)	Mean Difference	-89.5(-132.10,-46.90)	Treatment 1 Significant (P-value<.05)
Sa-Ngasoongsong, P., 2013	High Quality	Blood Loss - Complications (Drainage blood loss)	Post-Op	Tranexamic Acid (500mg)	45	430.2(224.00)	No Tranexamic Acid ( )	45	546.9(273.00)	Mean Difference	-116.7(-219.88,-13.52)	Treatment 1 Significant (P-value<.05)
Sa-Ngasoongsong, P., 2013	High Quality	Blood transfusion % ( )	Peri-Op	Tranexamic Acid (250 mg)	45	13.33%	No Tranexamic Acid ( )	45	22.22%	RR	0.60(0.24,1.51)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	complications other (re-clamp)	Post-Op	Tranexamic Acid (250 mg)	45	2.22%	No Tranexamic Acid ( )	45	13.33%	RR	0.17(0.02,1.33)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	complications other (re-dressing)	Post-Op	Tranexamic Acid (250 mg)	45	0.00%	No Tranexamic Acid ( )	45	6.67%	RD	-0.07(-0.14,0.01)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	VTE-Complications ( )	Post-Op	Tranexamic Acid (250 mg)	45	2.22%	No Tranexamic Acid ( )	45	8.89%	RR	0.25(0.03,2.15)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	complications other (congestive heart failure)	Post-Op	Tranexamic Acid (250 mg)	45	2.22%	No Tranexamic Acid ( )	45	0.00%	RD	0.02(-0.02,0.07)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Sarzaeem, M.M., 2014	High Quality	Blood Loss - Complications ( )	Post-Op	Tranexamic Acid (topical: the knee joint cavity irrigatedwith 3 g of TXA in 100 cc of saline just before suturing for 5 min)	50	743.2(116.50)	No Tranexamic Acid ( )	50	860.5(152.20)	Mean Difference	-117.3(-170.43,-64.17)	Treatment 1 Significant (P-value<.05)
Sarzaeem, M.M., 2014	High Quality	Fall in HB, g/dL(drop in HB (higher=greater drop))	Post-Op	Tranexamic Acid (topical: the knee joint cavity irrigatedwith 3 g of TXA in 100 cc of saline just before suturing for 5 min)	50	4.2(1.00)	No Tranexamic Acid ( )	50	4.5(1.00)	Mean Difference	-0.3(-0.69,0.09)	Not Significant (P-value>.05)
Sarzaeem, M.M., 2014	High Quality	Need Transfusion-Complications (need for transfusion)	Post-Op	Tranexamic Acid (topical: the knee joint cavity irrigatedwith 3 g of TXA in 100 cc of saline just before suturing for 5 min)	50	14.00%	No Tranexamic Acid ( )	50	14.00%	RR	1.00(0.38,2.64)	Not Significant (P-value>.05)
Sarzaeem, M.M., 2014	High Quality	VTE-Complications (any throboembolic event)	Post-Op	Tranexamic Acid (topical: the knee joint cavity irrigatedwith 3 g of TXA in 100 cc of saline just before suturing for 5 min)	50	0.00%	No Tranexamic Acid ( )	50	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Sarzaeem, M.M., 2014	High Quality	Blood Loss - Complications ( )	Post-Op	Tranexamic Acid (500 mg of TXA in 100 cc of saline)	50	476.8(114.80)	No Tranexamic Acid ( )	50	860.5(152.20)	Mean Difference	-383.7(-436.54,-330.86)	Treatment 1 Significant (P-value<.05)
Sarzaeem, M.M., 2014	High Quality	Need Transfusion-Complications (need for transfusion)	Post-Op	Tranexamic Acid (500 mg of TXA in 100 cc of saline)	50	0.00%	No Tranexamic Acid ( )	50	14.00%	RD	-0.14(-0.24,-0.04)	Treatment 1 Significant (P-value<.05)
Sarzaeem, M.M., 2014	High Quality	VTE-Complications (any throboembolic event)	Post-Op	Tranexamic Acid (500 mg of TXA in 100 cc of saline)	50	0.00%	No Tranexamic Acid ( )	50	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Sarzaeem, M.M., 2014	High Quality	Fall in HB, g/dL(drop in HB (higher=greater drop))	Post-Op	Tranexamic Acid (500 mg of TXA in 100 cc of saline)	50	2.6(0.90)	No Tranexamic Acid ( )	50	4.5(1.00)	Mean Difference	-1.9(-2.27,-1.53)	Treatment 1 Significant (P-value<.05)

TABLE 46: TRANEXAMIC ACID VERSUS PLACEBO: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Sa-Ngasoongsong, P., 2013	High Quality	Womac-overall-Composite Likert (0-96) (unclear if likert or vas)	3 months	Tranexamic Acid (250 mg)	45	35.8(7.6)	No Tranexamic Acid ( )	15.5	36.7(8.2)	Mean Difference	-0.9 (-4.21, 2.41)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Womac-overall-Composite Likert (0-96) (unclear if likert or vas)	6 months	Tranexamic Acid (250 mg)	45	23.1(6.5)	No Tranexamic Acid ( )	45	25.4(6)	Mean Difference	-2.3 (-4.92, 0.32)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Womac-overall-Composite Likert (0-96) (unclear if likert or vas)	1 years	Tranexamic Acid (250 mg)	45	15.1(6.2)	No Tranexamic Acid ( )	45	15.5(6.6)	Mean Difference	-0.4 (-3.08, 2.28)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Womac-overall-Composite Likert (0-96) (unclear if likert or vas)	3 months	Tranexamic Acid (500 mg)	45	35.5(7.2)	No Tranexamic Acid ( )	15.5	36.7(8.2)	Mean Difference	-1.2 (-4.43, 2.03)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Womac-overall-Composite Likert (0-96) (unclear if likert or vas)	6 months	Tranexamic Acid (500 mg)	45	23.5(6.6)	No Tranexamic Acid ( )	45	25.4(6)	Mean Difference	-1.9 (-4.54, 0.74)	Not Significant (P-value>.05)
Sa-Ngasoongsong, P., 2013	High Quality	Womac-overall-Composite Likert (0-96) (unclear if likert or vas)	1 years	Tranexamic Acid (500 mg)	45	14.5(7.1)	No Tranexamic Acid ( )	45	15.5(6.6)	Mean Difference	-1 (-3.87, 1.87)	Not Significant (P-value>.05)

TABLE 47: TRANEXAMIC ACID VERSUS PLACEBO: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Antinolfi,P., 2013	High Quality	Range Of Motion (overall) - Function (recovery of during hospital stay)	During Hospital Stay	Tranexamic Acid (500 mg)	20	. %	No Tranexamic Acid (placebo)	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Antinolfi,P., 2013	High Quality	Range Of Motion (overall) - Function ( )	3 months	Tranexamic Acid (500 mg)	20	. %	No Tranexamic Acid (placebo)	20	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 48: TRANEXAMIC ACID VERSUS PLACEBO: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ishida,K., 2011	High Quality	Reoperation-Reoperation (at average of 21.5 month follow up)	1.7 years	Tranexamic Acid ( )	50	0.00 %	No Tranexamic Acid ( )	50	0.00%	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

ANTIBIOTIC BONE CEMENT

Limited evidence does not support the routine use of antibiotics in the cement for primary total knee arthroplasty (TKA).

Strength of Recommendation: Limited Evidence ★★☆☆

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALE

Two moderate quality studies and one low quality registry review were considered. One moderate quality randomized study demonstrated a reduction in total knee arthroplasty infection in diabetic patients from 13.5 % to 0% when cefuroxime was added to the cement. This study was performed in operating rooms without modern features (Chiu 2001). One moderate quality, randomized, prospective study demonstrated a reduction in revision total knee arthroplasty infection rates when vancomycin was added to the cement (Chiu 2009). A large Canadian registry study reviewing more than 36000 patients found no difference in revision rates for infection between those patients treated with or without antibiotics in the cement. Given two moderate quality studies that are not widely applicable to patients with osteoarthritis undergoing primary total knee arthroplasty and one low quality, although large, registry review demonstrating no benefit from routinely adding antibiotics to cement for primary total knee arthroplasty, it is the conclusion of the work group that limited evidence does not support the routine use of antibiotics in the cement for primary total knee arthroplasty. One study did provide some suggestion that antibiotics added to the cement may be of benefit in diabetic patients. (Chiu 2001).

Of note, the FDA approved indications for antibiotic loaded cement in total knee arthroplasty are limited to revision scenarios and do not include primary applications (http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpcd/classification.cfm?id=mbb).

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Possible harms of adding antibiotics to the cement include a reaction to the antibiotics, development of antibiotic-resistant infections and increased costs. Antibiotics could potentially impact the mechanical properties of the cement. Because the evidence is limited, it is possible that with additional evidence it will become apparent that routinely omitting antibiotics misses an opportunity to reduce infection rates.

FUTURE RESEARCH

This is an ideal topic for a large, prospective, multi-centered randomized clinical trial. If appropriately risk adjusted, data from large registries could also be of value. These studies should focus on both routine use of antibiotics in the cement and use in high-risk patients.

** See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 2: ANTIBIOTIC BONE CEMENT

Summary of Findings	Moderate Quality		Low Quality
● Favors Antibiotic Bone Cement ● Favors Conventional Bone Cement ○ Not Significant	Chiu,F.Y., 2001	Chiu,F.Y., 2009	Bohm,E., 2013
Complications			
Infection- Complications	●	●	
Loosening- Complications		○	
Length of Stay			
Length Of Recovery- Length Of Stay		○	
Reoperation			
Reoperation- Reoperation			○

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 2: - ANITBIOTIC BONE CEMENT

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Bohm,E., 2013	○	●	●	●	●	◑	Include	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Chiu,F.Y., 2001	○	◑	○	●	●	●	Include	Moderate Quality
Chiu,F.Y., 2009	◑	◑	○	●	●	●	Include	Moderate Quality

DETAILED DATA TABLES

TABLE 49: - ANTIBIOTIC CEMENT VERSUS NO ANTIBIOTIC CEMENT: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chiu,F.Y., 2001	Moderate Quality	Infection-Complications (deep wound infection)	Post-Op	Antibiotic Bone Cement (2 g of cefuroxime in 40 g of Simplex P cement)	41	0.00%	Conventional Bone Cement (Without Antibiotics) (Simplex P cement)	37	13.51%	RD	-0.14(-0.25,-0.02)	Treatment 1 Significant (P-value<.05)
Chiu,F.Y., 2009	Moderate Quality	Infection-Complications (deep infection)	2 years	Antibiotic Bone Cement (1 g of vancomycin in 40 g of Simplex-P cement)	93	0.00%	Conventional Bone Cement (Without Antibiotics) (Simplex-P cement)	90	6.67%	RD	-.07(-.12,-.02)	Treatment 1 Significant (P-value<.05)
Chiu,F.Y., 2009	Moderate Quality	Infection-Complications (superficial)	2 years	Antibiotic Bone Cement (1 g of vancomycin in 40 g of Simplex-P cement)	93	0.00%	Conventional Bone Cement (Without Antibiotics) (Simplex-P cement)	90	1.11%	RD	-0.01(-0.03,0.01)	Not Significant (P-value>.05)
Chiu,F.Y., 2009	Moderate Quality	Infection-Complications (total wound infections)	2 years	Antibiotic Bone Cement (1 g of vancomycin in 40 g of Simplex-P cement)	93	0.00%	Conventional Bone Cement (Without Antibiotics) (Simplex-P cement)	90	7.78%	RD	-0.08(-0.13,-0.02)	Treatment 1 Significant (P-value<.05)
Chiu,F.Y., 2009	Moderate Quality	Loosening-Complications (component loosening)	NR	Antibiotic Bone Cement (1 g of vancomycin in 40 g of Simplex-P cement)	93	0.00%	Conventional Bone Cement (Without Antibiotics) (Simplex-P cement)	.	. %	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)

TABLE 50: ANTIBIOTIC CEMENT VERSUS NO ANTIBIOTIC CEMENT: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chiu,F.Y., 2009	Moderate Quality	Length Of Recovery-Length Of Stay (days)	NA	Antibiotic Bone Cement (1 g of vancomycin in 40 g of Simplex-P cement)	93	13(1.70)	Conventional Bone Cement (Without Antibiotics) (Simplex-P cement)	90	13(1.80)	Mean Difference	0(-0.51,0.51)	Not Significant (P-value>.05)

TABLE 51: ANTIBIOTIC CEMENT VERSUS NO ANTIBIOTIC CEMENT: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chiu,F.Y., 2009	Moderate Quality	Length Of Recovery-Length Of Stay (days)	NA	Antibiotic Bone Cement (1 g of vancomycin in 40 g of Simplex-P cement)	93	13(1.70)	Conventional Bone Cement (Without Antibiotics) (Simplex-P cement)	90	13(1.80)	Mean Difference	0(-0.51,0.51)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 52: ANTIBIOTIC CEMENT VERSUS NO ANTIBIOTIC CEMENT: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Bohm,E., 2013	Low Quality	Reoperation-Reoperation (revision)	2 years	Antibiotic Bone Cement (The most commonly used cement was Simplex1 (Stryker Orthopaedics, Mahwah, NJ, USA) (79%), followed by Palacos1 (Heraeus Medical, Hanau, Germany) (12%), CMW1 (DePuy Orthopaedics, Inc, Warsaw, IN, USA) (6%), and a mixture of others (3%))	.	. %	Conventional Bone Cement (Without Antibiotics) ( )	.	. %	Author Reported Hazard ratio	1.07(.90,1.27)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

CRUCIATE RETAINING ARTHROPLASTY

Strong evidence supports no difference in outcomes or complications between posterior stabilized and posterior cruciate retaining arthroplasty designs.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Meta-analysis of included literature was unable to show a difference between the cruciate retaining and posterior stabilized designs with regard to complications, pain, function or patient reported outcomes.

There is one high quality prospective comparative study (Maruyama 2004) evaluating outcomes and ROM in consecutive patients having bilateral total knee arthroplasty who had one posterior stabilized (PS) implant and one posterior cruciate retaining (CR) implant. They found equivalent Knee Society Scores, but statistically improved ROM in the PS group. Another high quality study (Roh 2013) failed to show improved kinematics or improved clinical outcome with PCL retention in highly conforming mobile bearing total knee arthroplasty. A third high quality study (Cankaya 2014) investigated blood loss with CR and PS designs in a prospective randomized study of 100 patients. They found no difference in either perioperative blood loss or postoperative transfusion rates between the two types of designs.

A moderate quality study (Clark 2001) in patients without extreme pre-operative deformities showed no notable differences between PS and CR designs with regard to knee scores, ROM or patient reported outcomes instruments SF-12 and WOMAC. Likewise, four other moderate quality studies (Tanzer 2002, Catani 2004, Molt 2014, Ishii 2011) showed no differences between the CR and PS designs. Tanzer 2002 controlled for surgical technique by having a single surgeon perform a similar surgical technique for each design. Catani 2004 and Molt 2014 showed no statistical difference between designs with regard to tibial migration. Ishii 2011 found no difference between designs in range of motion.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no known harms associated with implementing this recommendation.

FUTURE RESEARCH

Continued comparative multicenter prospective studies between PCR and PS simultaneous or staged total knee arthroplasty may further clarify the cohort of patients (e.g. subgroups with high deformities) for whom PCR or PS designs would be more beneficial.

* *See Appendix XIII for details regarding support*

SUMMARY OF FINDINGS TABLE 29: CRUCIATE RETAINING ARTHROPLASTY

** See Appendix XIII for details regarding support*

Summary of Findings

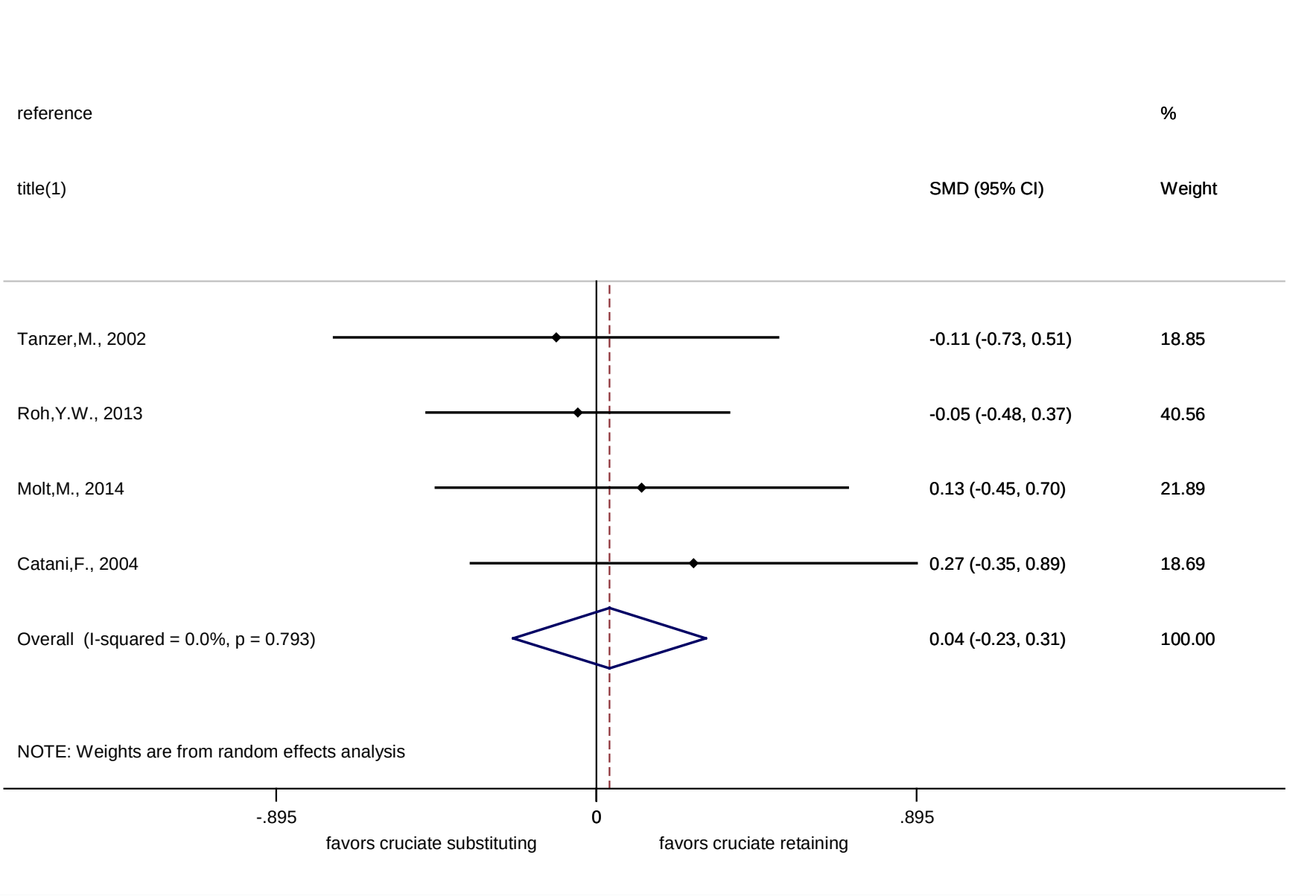
● **Favors Cruciate Retaining Arthroplasty**

● **Favors Posterior Stabalized Arthroplasty**

○ **Not Significant**

	High Quality		Moderate Quality					
	Roh,Y.W., 2013	Maruyama,S., 2004	Tanzer,M., 2002	Molt,M., 2014	Ishii,Y., 2011	Clark,C.R., 2001	Catani,F., 2004	Meta-Analysis
Complications								
Complications other	○							
Infection- Complications		○		○				
Manipulation Under Anesthesia- Other							○	
Womac-overall- Composite averaged VAS version (0-100)						○		
pulmonary embolism				○				
Composite								
Womac-overall- Composite averaged VAS version (0-100	○							
Function								○
Knee Society Score-Function- Function	○	○	○					
Range of Motion(extension) - Function		○	○					
Range of Motion(flexion) - Function	○	●	○					
Range Of Motion(overall) - Function	○	●	○		○		●	
Koos-Function, Daily Living- Function				○				
Koos-Function, Sports And Recreational Activities- Function				○				
Ambulation (walking)			○					
Other								
Koos-Symptoms- Other				○				
Pain								
Knee Society Score-Pain- Pain				○				
Quality of Life								
Koos-Quality Of Life- Quality Of Life				○				
Reoperation								
Reoperation- Reoperation	○						○	

FIGURE 2 NO CRUCIATE RETAINING ARTHROPLASTY VERSUS CRUCIATE RETAINING ARTHROPLASTY-FUNCTION AT 2 YEARS



QUALITY EVALUATION TABLE 19: CRUCIATE RETAINING ARTHROPLASTY

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Udomkiat,P., 2000	○	◑	●	●	●	●	Not best available evidence	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Cankaya,D., 2014	●	◑	○	●	●	●	Include	High Quality
Catani,F., 2004	◑	◑	◑	●	●	○	Include	Moderate Quality
Clark,C.R., 2001	◑	◑	◑	○	○	●	Include	Moderate Quality
Ishii,Y., 2011	○	○	◑	◑	●	●	Include	Moderate Quality
Maruyama,S., 2004	◑	◑	◑	●	●	●	Include	High Quality
Molt,M., 2014	●	◑	◑	○	●	●	Include	Moderate Quality
Roh,Y.W., 2013	●	◑	◑	●	●	●	Include	High Quality
Tanzer,M., 2002	◑	◑	●	●	○	●	Include	Moderate Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 53: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Maruyama,S., 2004	High Quality	Infection-Complications (superficial wound infection)	2 years	Cruciate Retaining Tka Design ( )	20	0.00%	Posterior Stabilized Tka Design ( )	20	5.00%	RD	-0.05(-0.15,0.05)	Not Significant (P-value>.05)
Roh,Y.W., 2013	High Quality	complications other (total complications)	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	7.14%	Posterior Stabilized Tka Design (PCL substituting)	44	0.00%	RD	0.07(-0.01,0.15)	Not Significant (P-value>.05)
Catani,F., 2004	Moderate Quality	Manipulation Under Anesthesia- Other (underwent MUA due to severe lack of knee range of motion)	2 years	Cruciate Retaining Tka Design ( )	20	5.00%	Posterior Stabilized Tka Design ( )	20	0.00%	RD	0.05(-0.05,0.15)	Not Significant (P-value>.05)
Clark,C.R., 2001	Moderate Quality	Womac-overall-Composite averaged VAS version (0-100) (unclear if likert or vas version used. cannot meta analyze)	2 years	Cruciate Retaining Tka Design ( )	51	18.5(32.90)	Posterior Stabilized Tka Design ( )	57	22.8(35.40)	Mean Difference	-4.3(-17.18,8.58)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Infection-Complications (superficial)	Post-Op	Cruciate Retaining Tka Design ( )	21	4.76%	Posterior Stabilized Tka Design ( )	26	3.85%	RR	1.24(0.08,18.64)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	pulmonary embolism( )	Post-Op	Cruciate Retaining Tka Design ( )	21	4.76%	Posterior Stabilized Tka Design ( )	26	0.00%	RD	0.05(-0.04,0.14)	Not Significant (P-value>.05)
Cankaya,D., 2014	High Quality	Need for transfusion	5 days	Cruciate Retaining Tka Design ( )	50	. %	Posterior Stabilized Tka Design ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 54: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Roh,Y.W., 2013	High Quality	Womac-overall-Composite averaged VAS version (0-100) ( )	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	15.9()	Posterior Stabilized Tka Design (PCL substituting)	44	17(10.7)	Mean Difference	-1.1(-5.27,3.07)	Not Significant (P-value>.05)

TABLE 55: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Maruyama,S., 2004	High Quality	Knee Society Score-Function-Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Maruyama,S., 2004	High Quality	Range Of Motion (overall) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	**Treatment 2 Significant (P-value<.05)**
Maruyama,S., 2004	High Quality	Range Of Motion (flexion) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	**Treatment 2 Significant (P-value<.05)**
Maruyama,S., 2004	High Quality	Range Of Motion (extension) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Roh,Y.W., 2013	High Quality	Knee Society Score-Function-Function ( )	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	83.1(16.6)	Posterior Stabilized Tka Design (PCL substituting)	44	84.6(13.6)	Mean Difference	-0.80 (-7.23, .63)	Not Significant (P-value>.05)
Roh,Y.W., 2013	High Quality	Range Of Motion (overall) - Function ( )	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	124.3(9.1)	Posterior Stabilized Tka Design (PCL substituting)	44	124(11.9)	Mean Difference	0.3 (-4.26, 4.86)	Not Significant (P-value>.05)
Roh,Y.W., 2013	High Quality	Range Of Motion (maximum flexion) - Function ( )	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	126.7(7.1)	Posterior Stabilized Tka Design (PCL substituting)	44	125.5(10.2)	Mean Difference	1.2 (-2.59, 4.99)	Not Significant (P-value>.05)
Catani,F., 2004	Moderate Quality	International Knee Society Score-Function- Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	81(17)	Posterior Stabilized Tka Design ( )	20	76(19(	Mean Difference	4.7(-2.76,12.16)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Catani,F., 2004	Moderate Quality	Range Of Motion (overall) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	97(15)	Posterior Stabilized Tka Design ( )	20	114(21.00)	Mean Difference	5(-6.54,16.54)	**Treatment 2 Significant (P-value<.05)**
Ishii,Y., 2011	Moderate Quality	Range Of Motion (overall) - Function ( )	2 years	Cruciate Retaining Tka Design (posterior cruciate retaining tka)	57	120(.)	Posterior Stabilized Tka Design (PCL sacrificing)	51	115(.)	Author Reported	NA	Not Significant (P-value>.05)
Ishii,Y., 2011	Moderate Quality	Range Of Motion (overall) - Function ( )	1 years	Cruciate Retaining Tka Design (posterior cruciate retaining tka)	57	120(.)	Posterior Stabilized Tka Design (PCL sacrificing)	51	120(.)	Author Reported	NA	Not Significant (P-value>.05)
Ishii,Y., 2011	Moderate Quality	Range Of Motion (overall) - Function ( )	6 months	Cruciate Retaining Tka Design (posterior cruciate retaining tka)	57	120(.)	Posterior Stabilized Tka Design (PCL sacrificing)	51	120(.)	Author Reported	NA	Not Significant (P-value>.05)
Ishii,Y., 2011	Moderate Quality	Range Of Motion (overall) - Function ( )	3 months	Cruciate Retaining Tka Design (posterior cruciate retaining tka)	57	105(.)	Posterior Stabilized Tka Design (PCL sacrificing)	51	105(.)	Author Reported	NA	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Function, Daily Living-Function ( )	3 months	Cruciate Retaining Tka Design ( )	21	74(14.00)	Posterior Stabilized Tka Design ( )	26	72(19.00)	Mean Difference	2(-7.44,11.44)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Function, Daily Living-Function ( )	1 years	Cruciate Retaining Tka Design ( )	21	86(15.00)	Posterior Stabilized Tka Design ( )	26	79(20.00)	Mean Difference	7(-3.01,17.01)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Function, Daily Living-Function ( )	2 years	Cruciate Retaining Tka Design ( )	21	86(15.00)	Posterior Stabilized Tka Design ( )	26	84(16.00)	Mean Difference	2(-6.89,10.89)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Function, Sports And Recreational	3 months	Cruciate Retaining Tka Design ( )	21	31(22.00)	Posterior Stabilized Tka Design ( )	26	29(14.00)	Mean Difference	2(-8.84,12.84)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		Activities-Function ( )										
Molt,M., 2014	Moderate Quality	Koos-Function, Sports And Recreational Activities-Function ( )	1 years	Cruciate Retaining Tka Design ( )	21	39(22.00)	Posterior Stabilized Tka Design ( )	26	38(24.00)	Mean Difference	1(-12.18,14.18)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Function, Sports And Recreational Activities-Function ( )	2 years	Cruciate Retaining Tka Design ( )	21	40(27.00)	Posterior Stabilized Tka Design ( )	26	46(22.00)	Mean Difference	-6(-20.31,8.31)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	73(24.00)	Posterior Stabilized Tka Design ( )	20	76(28.00)	Mean Difference	-3(-19.16,13.16)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range of Motion (flexion) - Function ( )	1.4 months	Cruciate Retaining Tka Design ( )	20	96(15.00)	Posterior Stabilized Tka Design ( )	20	99(8.00)	Mean Difference	-3(-10.45,4.45)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range of Motion (flexion) - Function ( )	3 months	Cruciate Retaining Tka Design ( )	20	108(12.00)	Posterior Stabilized Tka Design ( )	20	109(12.00)	Mean Difference	-1(-8.44,6.44)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range of Motion (flexion) - Function ( )	5.9 months	Cruciate Retaining Tka Design ( )	20	109(13.00)	Posterior Stabilized Tka Design ( )	20	111(15.00)	Mean Difference	-2(-10.70,6.70)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range of Motion (flexion) - Function ( )	1 years	Cruciate Retaining Tka Design ( )	20	110(11.00)	Posterior Stabilized Tka Design ( )	20	110(14.00)	Mean Difference	0(-7.80,7.80)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range of Motion (flexion) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	112(13.00)	Posterior Stabilized Tka Design ( )	20	111(17.00)	Mean Difference	1(-8.38,10.38)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range of Motion (extension) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Tanzer,M., 2002	Moderate Quality	Range Of Motion (overall) - Function ( )	1.4 months	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range Of Motion (overall) - Function ( )	3 months	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range Of Motion (overall) - Function ( )	5.9 months	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range Of Motion (overall) - Function ( )	1 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Range Of Motion (overall) - Function ( )	2 years	Cruciate Retaining Tka Design ( )	20	. %	Posterior Stabilized Tka Design ( )	20	. %	Author Reported	NA	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Ambulation (walking) (unlimited walking distance)	2 years	Cruciate Retaining Tka Design ( )	20	50.00%	Posterior Stabilized Tka Design ( )	20	55.00%	RR	0.91 (0.5, 1.64)	Not Significant (P-value>.05)
Tanzer,M., 2002	Moderate Quality	Ambulation (walking) (walk stairs without support)	2 years	Cruciate Retaining Tka Design ( )	20	50.00%	Posterior Stabilized Tka Design ( )	20	45.00%	RR	1.11(0.58,2.14)	Not Significant (P-value>.05)

TABLE 56: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Molt,M., 2014	Moderate Quality	Knee Society Score-Pain- Pain ( )	3 hours	Cruciate Retaining Tka Design ( )	21	72(20.00)	Posterior Stabilized Tka Design ( )	26	71(20.00)	Mean Difference	1(-10.50,12.50)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Knee Society Score-Pain- Pain ( )	1 years	Cruciate Retaining Tka Design ( )	21	86(14.00)	Posterior Stabilized Tka Design ( )	26	80(19.00)	Mean Difference	6(-3.44,15.44)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Knee Society Score-Pain- Pain ( )	2 years	Cruciate Retaining Tka Design ( )	21	87(18.00)	Posterior Stabilized Tka Design ( )	26	87(14.00)	Mean Difference	0(-9.39,9.39)	Not Significant (P-value>.05)

TABLE 57: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Molt,M., 2014	Moderate Quality	Koos-Quality Of Life- Quality Of Life( )	3 months	Cruciate Retaining Tka Design ( )	21	56(19.00)	Posterior Stabilized Tka Design ( )	26	58(22.00)	Mean Difference	-2(-13.73,9.73)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Quality Of Life- Quality Of Life( )	1 years	Cruciate Retaining Tka Design ( )	21	68(18.00)	Posterior Stabilized Tka Design ( )	26	68(25.00)	Mean Difference	0(-12.31,12.31)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Quality Of Life- Quality Of Life( )	2 years	Cruciate Retaining Tka Design ( )	21	78(22.00)	Posterior Stabilized Tka Design ( )	26	79(20.00)	Mean Difference	-1(-13.15,11.15)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 58: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Roh,Y.W., 2013	High Quality	Reoperation- Reoperation (instablity following falls leading to replacement of polyethylene insert with thicker insert)	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	4.76%	Posterior Stabilized Tka Design (PCL substituting)	44	0.00%	RD	0.05(-0.02,0.11)	Not Significant (P-value>.05)
Roh,Y.W., 2013	High Quality	Reoperation- Reoperation (sublaxation leading to resection of the PCL and insertion of thicker polythylene insert)	2 years	Cruciate Retaining Tka Design (PCL retaining)	42	2.38%	Posterior Stabilized Tka Design (PCL substituting)	44	0.00%	RD	0.02(-0.02,0.07)	Not Significant (P-value>.05)
Catani,F., 2004	Moderate Quality	Reoperation- Reoperation (lateral release with resurfacing of the patellar in patients with anterior knee pain with a lateral sublaxation of the patella)	2 years	Cruciate Retaining Tka Design ( )	20	5.00%	Posterior Stabilized Tka Design ( )	20	10.00%	RR	0.50(0.05,5.08)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 59: CRUCIATE RETAINING ARTHROPLASTY VERSUS POSTERIOR STABILIZE ARTHROPLASTY: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Molt,M., 2014	Moderate Quality	Koos-Symptoms-Other ( )	3 months	Cruciate Retaining Tka Design ( )	21	67(18.00)	Posterior Stabilized Tka Design ( )	26	66(18.00)	Mean Difference	1(-9.35,11.35)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Symptoms-Other ( )	1 years	Cruciate Retaining Tka Design ( )	21	76(19.00)	Posterior Stabilized Tka Design ( )	26	76(15.00)	Mean Difference	0(-9.96,9.96)	Not Significant (P-value>.05)
Molt,M., 2014	Moderate Quality	Koos-Symptoms-Other ( )	2 years	Cruciate Retaining Tka Design ( )	21	82(18.00)	Posterior Stabilized Tka Design ( )	26	83(15.00)	Mean Difference	-1(-10.62,8.62)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

POLYETHYLENE TIBIAL COMPONENTS

Strong evidence supports use of either all-polyethylene or modular tibial components in knee arthroplasty (KA) because of no difference in outcomes.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Three high (Kalisvaart 2012, Murray 2014, Hyldahl 2001) and five moderate quality (Adalberth 2001, Gioe 2000, Muller 2006, Norgren 2004, Adalberth 2000) studies evaluated the use of all-polyethylene versus modular (metal baseplate and polyethylene insert) tibial components in knee arthroplasty.

One high quality randomized controlled trial (Kalisvaart 2012) of cemented posterior-stabilized total knee arthroplasty demonstrated no differences in range of motion, functional outcomes, stair climbing, or revisions across three tibial designs (all-polyethylene fixed-bearing, modular metal-backed fixed-bearing, rotating-platform) at two and five years post-operatively.

In a high quality multicenter trial (Knee Arthroplasty Trial; Murray 2014) randomizing the use of all-polyethylene and modular metal-backed tibia components in the United Kingdom, 89% of patients received the allocated procedure. There were no differences in Oxford Knee Scores or rates of complications, reoperations, and revisions at ten years post-operatively. There was a trend towards the metal-backed group having better EQ-5D and Short Form-12 scores based on marginal estimates over the entire ten-year follow up period.

A third high quality randomized trial (Hyldahl 2001) in unicompartmental knee arthroplasty, with a focus on radiostereometric analysis (RSA) of component fixation, found no differences with respect to clinical results (Hospital for Special Surgery score) or migration of the comparative tibial components over a two-year follow-up period.

Five moderate quality (Adalberth 2001, Gioe 2000, Muller 2006, Norgren 2004, Adalberth 2000) randomized controlled trials with minimum two years of follow up demonstrated no differences with respect to clinical results (all studies used the Knee Society Score, except for Short Form-12 and Oxford Knee Score used in the study by Muller 2006) and range of motion between all-polyethylene and modular tibial components in total knee arthroplasty. Likewise, complications and reoperations were similar between groups in all studies, and equivalent component migration was measured in four studies utilizing RSA techniques (Adalberth 2001, Muller 2006, Norgren 2004, Adalberth 2000).

The practitioner must be aware that results in the literature may be implant specific, and that surgical technique and surgeon experience with particular methods are important factors in achieving durable results. The decision to use modularity versus a monolithic tibial design may be influenced by particular patient situations, such as metal hypersensitivity and severe bone loss. The practitioner should be aware of the advantages and disadvantages of the two treatments methods.

* *See Appendix XIII for details regarding support*

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no known harms associated with implementing this recommendation

FUTURE RESEARCH

Continued comparative studies between modern all-polyethylene and modular metal-backed devices in knee arthroplasty will help to further define the utility of these component types, including evolving component designs (e.g. modular and monolithic) and newer materials (e.g. highly cross-linked and stabilized polyethylenes and porous metals). Future study should include larger patient numbers across specific patient subgroups that may help to identify patient-specific factors that may inform the decision to utilize a particular fixation technique, or to avoid complications associated with particular fixation strategies. Registry data and long-term studies (greater than ten years clinical follow up) should inform durability of particular components and may serve to analyze implant-specific complications and revision risk. Given some variability in the reported patient-reported outcome measures between treatment groups in particular high-quality studies, more clinical data may discern subtle differences in clinical outcomes based on the use of implant modularity. Issues of cost and cost-effectiveness should be incorporated into future clinical studies.

RESULTS

SUMMARY OF FINDINGS TABLE 34: ALL POLYETHYLENE TIBIAL COMPONENTS

Summary of Findings ● Favors Polythylene Tibial Components ● Favors Metal Tibial Components ○ Not Significant	High Quality			Moderate Quality				
	Kalisvaart,M.M., 2012	Murray,D.W., 2014	Hyldahl, H.C.,2001	Adalberth,G., 2001	Gioe,T.J., 2000	Muller,S.D., 2006	Norgren,B., 2004	Adalberth,G., 2000
Complications								
Complications other	○	○						
Deep venous thrombosis				○				○
Infection- Complications	○	○					○	○
Loosening- Complications	○							
Manipulation Under Anesthesia- Other				○				○
Pulmonary embolism								○
Composite								
Knee Society Score-Pain- Pain	○							
SF-12 overall score						○		
Oxford Knee Score		○						
Function								
Knee Society Score-Function- Function	○				○		○	○
Knee society score-stair climbing	○							
Mortality								
Mortality		○						
Pain								
Knee Society Score-Pain- Pain	○							
knee society score-stair climbing	○							
Quality of Life								
EQ-5d		●						
SF-12 Physical Component Score		●						
SF-12 Mental Component Score		○						
Reoperation								
Infection- Complications	○							
Reoperation- Reoperation	○	○	○	○	○			

STUDY QUALITY TABLE

QUALITY EVALUATION TABLE 23: ALL POLYETHYLENE TIBIAL COMPONENTS

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention – Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Adalberth,G., 2000	●	◑	◑	●	●	○	Include	Moderate Quality
Adalberth,G., 2001	●	◑	◑	●	○	●	Include	Moderate Quality
Gioe,T.J., 2000	◑	◑	◑	◑	●	●	Include	Moderate Quality
Hyldahl,H.C., 2001	◑	◑	◑	●	●	●	Include	High Quality
Kalisvaart,M.M., 2012	●	●	●	●	●	●	Include	High Quality
Muller,S.D., 2006	●	◑	◑	○	○	●	Include	Moderate Quality
Murray,D.W., 2014	●	●	○	●	●	●	Include	High Quality
Norgren,B., 2004	●	◑	◑	●	○	○	Include	Moderate Quality

DETAILED DATA TABLES

TABLE 60: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: COMPLICATIONS

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalisvaart,M.M., 2012	High Quality	complications other (patellar crepitus)	5 years	All Polyethylene Tibial Component( )	75	1.33%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	0.00%	RD	0.01(-0.01,0.04)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	complications other (knee stiffness)	5 years	All Polyethylene Tibial Component( )	75	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	2.63%	RD	-0.03(-0.06,0.01)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	Infection- Complications ( )	5 years	All Polyethylene Tibial Component( )	75	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	Loosening-Complications (aseptic loosening)	5 years	All Polyethylene Tibial Component( )	75	1.33%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	2.63%	RR	0.51(0.05,5.47)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	Infection- Complications ( )	5 years	All Polyethylene Tibial Component( )	75	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	complications other (patellar crepitus)	5 years	All Polyethylene Tibial Component( )	75	1.33%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	0.00%	RD	0.01(-0.01,0.04)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	complications other (knee stiffness)	5 years	All Polyethylene Tibial Component( )	75	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	2.63%	RD	-0.03(-0.06,0.01)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalisvaart,M.M., 2012	High Quality	complications other (need for other surgeries besides artroplast (debridement or manipulation))	5 years	All Polyethylene Tibial Component( )	75	1.33%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	2.63%	RR	0.50(0.05,5.40)	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Stability- Function (stability of tibial component measured by maximum migration)	4 months	All Polyethylene Tibial Component( )	17	. %	metal backed tibial components( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Stability- Function (stability of tibial component measured by maximum migration)	1 years	All Polyethylene Tibial Component( )	17	. %	metal backed tibial components( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Stability- Function (stability of tibial component measured by maximum migration)	2 years	All Polyethylene Tibial Component( )	17	. %	metal backed tibial components( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Infection- Complications (deep wound infection)	NR	All Polyethylene Tibial Component( )	.	. %	metal backed tibial components( )	.	. %	RR	-0.06(-0.17,0.05)	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Manipulation Under Anesthesia- Other (mobization under anesthesia)	NR	All Polyethylene Tibial Component( )	17	5.88%	metal backed tibial components( )	17	0.00%	RD	0.06(-0.05,0.17)	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Deep venous thrombosis( )	Post-Op	All Polyethylene Tibial Component( )	17	5.88%	metal backed tibial components( )	17	0.00%	RD	0.06(-0.05,0.17)	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	pulmonary embolism( )	Post-Op	All Polyethylene Tibial Component( )	17	5.88%	metal backed tibial components( )	17	0.00%	RD	0.06(-0.05,0.17)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Adalberth,G., 2001	Moderate Quality	complications other (maximum migration mm)	4 months	All Polyethylene Tibial Component( )	20	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2001	Moderate Quality	complications other (maximum migration mm)	1 years	All Polyethylene Tibial Component( )	20	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2001	Moderate Quality	complications other (maximum migration mm)	2 years	All Polyethylene Tibial Component( )	.	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2001	Moderate Quality	Deep venous thrombosis( )	Post-Op	All Polyethylene Tibial Component( )	20	5.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	5.56%	RR	0.90(0.06,13.36)	Not Significant (P-value>.05)
Adalberth,G., 2001	Moderate Quality	Manipulation Under Anesthesia- Other (required MUA)	1 months	All Polyethylene Tibial Component( )	20	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	5.56%	RD	-0.06(-0.16,0.05)	Not Significant (P-value>.05)
Norgren,B., 2004	Moderate Quality	Infection- Complications (deep infection)	2 years	All Polyethylene Tibial Component( )	12	8.33%	metal backed tibial components( )	11	0.00%	RD	0.08(-0.07,0.24)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	Loosening-Complications (aseptic loosening)	5 years	All Polyethylene Tibial Component( )	75	1.33%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	2.63%	RR	0.51(0.05,5.47)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	complications other (Knee dislocation)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.00%	metal backed tibial components( )	197	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Septicaemia)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.00%	metal backed tibial components( )	197	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Con?rmed cerebrovascular accident)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.00%	metal backed tibial components( )	197	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Surgical complications)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.00%	metal backed tibial components( )	197	1.52%	RD	-1.52(-3.23,0.19)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Fall)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.00%	metal backed tibial components( )	197	0.51%	RD	-0.51(-1.50,0.48)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Infection- Complications (Con?rmed infection)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.00%	metal backed tibial components( )	197	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Manipulation under anaesthetic)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	1.00%	metal backed tibial components( )	196	0.00%	RD	1.00(-0.37,2.37)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Wound problem)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.00%	metal backed tibial components( )	196	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	complications other (Musculoskeletal ligamentous (including imbalance))	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.00%	metal backed tibial components( )	196	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Patella complication)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.00%	metal backed tibial components( )	196	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Con?rmed infection)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.00%	metal backed tibial components( )	196	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Dislocation)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.00%	metal backed tibial components( )	196	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Prosthetic complication)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.00%	metal backed tibial components( )	196	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Any postoperative complications)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	17.33%	metal backed tibial components( )	197	15.23%	RR	1.14(0.73,1.78)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Proven wound infection)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.50%	metal backed tibial components( )	197	0.51%	RR	0.98(0.06,15.48)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Treated DVT or PE)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	2.48%	metal backed tibial components( )	197	1.52%	RR	1.63(0.39,6.71)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	complications other (Con?rmed myocardial infarction)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.50%	metal backed tibial components( )	197	0.51%	RR	0.98(0.06,15.48)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Other serious complication)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	13.86%	metal backed tibial components( )	197	13.71%	RR	1.01(0.62,1.65)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Medical complications)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	6.93%	metal backed tibial components( )	197	8.12%	RR	0.85(0.43,1.70)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Suspicion of infection)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	3.96%	metal backed tibial components( )	197	2.03%	RR	1.95(0.60,6.37)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Skin complications)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.99%	metal backed tibial components( )	197	1.02%	RR	0.98(0.14,6.86)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Stiffness)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	0.99%	metal backed tibial components( )	197	0.51%	RR	1.95(0.18,21.34)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Suspected thrombolytic complications)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	1.49%	metal backed tibial components( )	197	1.02%	RR	1.46(0.25,8.66)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	complications other (Urinary complications)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	202	1.49%	metal backed tibial components( )	197	1.02%	RR	1.46(0.25,8.66)	Not Significant (P-value>.05)

TABLE 61: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	3 months	All Polyethylene Tibial Component( )	165	29.3(9.40)	metal backed tibial components( )	162	31(9.90)	Mean Difference	-1.7(-3.80,0.40)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	1 years	All Polyethylene Tibial Component( )	154	32.7(9.80)	metal backed tibial components( )	157	34.7(10.20)	Mean Difference	-2(-4.23,0.23)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	2 years	All Polyethylene Tibial Component( )	150	33.3(10.50)	metal backed tibial components( )	142	35.4(10.70)	Mean Difference	-2.1(-4.54,0.34)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	3 years	All Polyethylene Tibial Component( )	150	33.8(10.00)	metal backed tibial components( )	150	34.7(10.40)	Mean Difference	-0.9(-3.22,1.42)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	4 years	All Polyethylene Tibial Component( )	153	33.5(10.30)	metal backed tibial components( )	149	34.7(10.30)	Mean Difference	-1.2(-3.53,1.13)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	5 years	All Polyethylene Tibial Component( )	139	33.7(10.70)	metal backed tibial components( )	145	34.5(9.80)	Mean Difference	-0.8(-3.20,1.60)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	6 years	All Polyethylene Tibial Component( )	136	33.6(10.50)	metal backed tibial components( )	135	34(10.20)	Mean Difference	-0.4(-2.88,2.08)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	7 years	All Polyethylene Tibial Component( )	131	33.6(10.70)	metal backed tibial components( )	131	33.9(9.70)	Mean Difference	-0.3(-2.78,2.18)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	8 years	All Polyethylene Tibial Component( )	114	32.9(10.40)	metal backed tibial components( )	122	33.5(9.90)	Mean Difference	-0.6(-3.20,2.00)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	9 years	All Polyethylene Tibial Component( )	104	32(11.70)	metal backed tibial components( )	110	33(9.40)	Mean Difference	-1(-3.85,1.85)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	10 years	All Polyethylene Tibial Component( )	79	32.1(10.30)	metal backed tibial components( )	81	32.5(10.10)	Mean Difference	-0.4(-3.59,2.79)	Not Significant (P-value>.05)
Muller,S.D., 2006	Moderate Quality	SF-12 overall score( )	6 months	All Polyethylene Tibial Component( )	21	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	19	. %	Author Reported	NA	Not Significant (P-value>.05)
Muller,S.D., 2006	Moderate Quality	SF-12 overall score( )	1 years	All Polyethylene Tibial Component( )	21	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	19	. %	Author Reported	NA	Not Significant (P-value>.05)
Muller,S.D., 2006	Moderate Quality	SF-12 overall score( )	2 years	All Polyethylene Tibial Component( )	21	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	19	. %	Author Reported	NA	Not Significant (P-value>.05)
Muller,S.D., 2006	Moderate Quality	Oxford Knee Score( )	6 months	All Polyethylene Tibial Component( )	21	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	19	. %	Author Reported	NA	Not Significant (P-value>.05)
Muller,S.D., 2006	Moderate Quality	Oxford Knee Score( )	1 years	All Polyethylene Tibial Component( )	21	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	19	. %	Author Reported	NA	Not Significant (P-value>.05)
Muller,S.D., 2006	Moderate Quality	Oxford Knee Score( )	2 years	All Polyethylene Tibial Component( )	21	. %	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	19	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 62: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalisvaart,M.M., 2012	High Quality	Knee Society Score-Function-Function ( )	5 years	All Polyethylene Tibial Component( )	75	69.7(26.09)	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	77.4(23.44)	Mean Difference	-7.7(-15.61,0.21)	Not Significant (P-value>.05)
Kalisvaart,M.M., 2012	High Quality	knee society score-stair climbing( )	5 years	All Polyethylene Tibial Component( )	75	37.3(11.55)	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	39.9(10.00)	Mean Difference	-2.6(-6.05,0.85)	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Knee Society Score-Function-Function ( )	3.9 months	All Polyethylene Tibial Component( )	17	. %	metal backed tibial components ( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Knee Society Score-Function-Function ( )	1 years	All Polyethylene Tibial Component( )	17	. %	metal backed tibial components ( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Adalberth,G., 2000	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	All Polyethylene Tibial Component( )	17	. %	metal backed tibial components ( )	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Gioe,T.J., 2000	Moderate Quality	Knee Society Score-Function-Function ( )	4 years	All Polyethylene Tibial Component( )	103	74.4(19.60)	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	97	72.1(22.10)	Mean Difference	2.3(-3.50,8.10)	Not Significant (P-value>.05)
Norgren,B., 2004	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	All Polyethylene Tibial Component( )	12	. %	metal backed tibial components ( )	11	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 63: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: MORTALITY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	Mortality(mortality during hospital stay)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	0.50%	metal backed tibial components( )	196	0.00%	RD	0.50(-0.47,1.47)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 64: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalisvaart,M.M., 2012	High Quality	Knee Society Score-Pain-Pain ( )	5 years	All Polyethylene Tibial Component ( )	75	88.3(1158.00)	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	88.7(9.93)	Mean Difference	-0.4(-262.49,261.69)	Not Significant (P-value>.05)

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TABLE 65: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	EQ-5d( )	3 months	All Polyethylene Tibial Component( )	179	0.644(0.24)	metal backed tibial components( )	182	0.682(0.25)	Mean Difference	-0.04(-0.09,0.01)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	1 years	All Polyethylene Tibial Component( )	178	0.69(0.24)	metal backed tibial components( )	176	0.72(0.27)	Mean Difference	-0.03(-0.08,0.02)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	2 years	All Polyethylene Tibial Component( )	174	0.69(0.27)	metal backed tibial components( )	163	0.719(0.26)	Mean Difference	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	3 years	All Polyethylene Tibial Component( )	163	0.675(0.26)	metal backed tibial components( )	165	0.73(0.25)	Mean Difference	-0.05(-0.10,0.00)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	4 years	All Polyethylene Tibial Component( )	159	0.673(0.26)	metal backed tibial components( )	163	0.738(0.24)	Mean Difference	-0.06(-0.11,-0.01)	Treatment 2 Significant (P-value<.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	5 years	All Polyethylene Tibial Component( )	153	0.638(0.30)	metal backed tibial components( )	149	0.717(0.24)	Mean Difference	-0.08(-0.14,-0.02)	Treatment 2 Significant (P-value<.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	6 years	All Polyethylene Tibial Component( )	146	0.648(0.28)	metal backed tibial components( )	145	0.68(0.28)	Mean Difference	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	7 years	All Polyethylene Tibial Component( )	139	0.65(0.30)	metal backed tibial components( )	135	0.697(0.25)	Mean Difference	-0.05(-0.12,0.02)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	8 years	All Polyethylene Tibial Component( )	122	0.622(0.30)	metal backed tibial components( )	130	0.678(0.25)	Mean Difference	-0.06(-0.13,0.01)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	9 years	All Polyethylene Tibial Component( )	113	0.593(0.31)	metal backed tibial components( )	116	0.692(0.23)	Mean Difference	-0.1(-0.17,-0.03)	Treatment 2 Significant (P-value<.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	10 years	All Polyethylene Tibial Component( )	83	0.625(0.30)	metal backed tibial components( )	88	0.65(0.24)	Mean Difference	-0.03(-0.11,0.05)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	3 months	All Polyethylene Tibial Component( )	180	37.8(9.20)	metal backed tibial components( )	178	38.9(10.10)	Mean Difference	-1.1(-3.11,0.91)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	1 years	All Polyethylene Tibial Component( )	172	38(10.00)	metal backed tibial components( )	176	40.4(11.00)	Mean Difference	-2.4(-4.62,-0.18)	Treatment 2 Significant (P-value<.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	2 years	All Polyethylene Tibial Component( )	167	38.1(10.70)	metal backed tibial components( )	156	40.3(10.90)	Mean Difference	-2.2(-4.57,0.17)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	3 years	All Polyethylene Tibial Component( )	165	37.3(10.60)	metal backed tibial components( )	157	40.2(10.80)	Mean Difference	-2.9(-5.25,-0.55)	Treatment 2 Significant (P-value<.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	4 years	All Polyethylene Tibial Component( )	157	37.2(10.90)	metal backed tibial components( )	158	39.4(10.30)	Mean Difference	-2.2(-4.55,0.15)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	5 years	All Polyethylene Tibial Component( )	149	36.7(11.10)	metal backed tibial components( )	148	39.1(10.80)	Mean Difference	-2.4(-4.90,0.10)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	6 years	All Polyethylene Tibial Component( )	141	36.8(10.60)	metal backed tibial components( )	143	37.5(11.00)	Mean Difference	-0.7(-3.22,1.82)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	7 years	All Polyethylene Tibial Component( )	136	35.8(11.70)	metal backed tibial components( )	134	37.8(10.80)	Mean Difference	-2(-4.70,0.70)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	8 years	All Polyethylene Tibial Component( )	121	35.8(11.00)	metal backed tibial components( )	130	36.6(10.50)	Mean Difference	-0.8(-3.47,1.87)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	9 years	All Polyethylene Tibial Component( )	114	34.4(11.30)	metal backed tibial components( )	114	37.6(10.90)	Mean Difference	-3.2(-6.10,-0.30)	Treatment 2 Significant (P-value<.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	10 years	All Polyethylene Tibial Component( )	83	33.9(11.10)	metal backed tibial components( )	86	35.9(10.40)	Mean Difference	-2(-5.27,1.27)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	3 months	All Polyethylene Tibial Component( )	180	50(11.70)	metal backed tibial components( )	178	50.7(11.20)	Mean Difference	-0.7(-3.08,1.68)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	1 years	All Polyethylene Tibial Component( )	172	51.4(10.50)	metal backed tibial components( )	176	51.2(11.60)	Mean Difference	0.2(-2.13,2.53)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	2 years	All Polyethylene Tibial Component( )	167	51(10.20)	metal backed tibial components( )	156	51.4(10.20)	Mean Difference	-0.4(-2.63,1.83)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	3 years	All Polyethylene Tibial Component( )	165	50.4(10.20)	metal backed tibial components( )	157	50.1(10.30)	Mean Difference	0.3(-1.95,2.55)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	4 years	All Polyethylene Tibial Component( )	157	50.8(11.30)	metal backed tibial components( )	158	49.7(11.30)	Mean Difference	1.1(-1.41,3.61)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	5 years	All Polyethylene Tibial Component( )	149	49.1(11.40)	metal backed tibial components( )	148	49.4(11.90)	Mean Difference	-0.3(-2.96,2.36)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	6 years	All Polyethylene Tibial Component( )	141	49.2(11.70)	metal backed tibial components( )	143	50.4(10.80)	Mean Difference	-1.2(-3.83,1.43)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	7 years	All Polyethylene Tibial Component( )	136	50.5(11.50)	metal backed tibial components( )	134	49.7(11.00)	Mean Difference	0.8(-1.90,3.50)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	8 years	All Polyethylene Tibial Component( )	121	47.8(11.70)	metal backed tibial components( )	130	48.9(11.30)	Mean Difference	-1.1(-3.96,1.76)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	9 years	All Polyethylene Tibial Component( )	114	50.3(10.90)	metal backed tibial components( )	114	47.5(11.20)	Mean Difference	2.8(-0.08,5.68)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	10 years	All Polyethylene Tibial Component( )	83	49.9(12.00)	metal backed tibial components( )	86	48.1(10.70)	Mean Difference	1.8(-1.65,5.25)	Not Significant (P-value>.05)

TABLE 66: ALL POLYETHYLENE TIBIAL COMPONENTS VERSUS METAL TIBIAL COMPONENTS: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalisvaart,M. M., 2012	High Quality	Reoperation- Reoperation ( )	5 years	All Polyethylene Tibial Component( )	75	1.33%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	76	2.63%	RR	0.51(0.05,5.47)	Not Significant (P-value>.05)
Murray,D.W. , 2014	High Quality	Reoperation- Reoperation (Any further knee surgery before hospital discharge)	During Hospital Stay/short term	All Polyethylene Tibial Component( )	201	1.99%	metal backed tibial components( )	196	0.51%	RR	3.90(0.44,34.59)	Not Significant (P-value>.05)
Murray,D.W. , 2014	High Quality	Reoperation- Reoperation (Participants requiring any further operation)	10 years	All Polyethylene Tibial Component( )	203	10.34%	metal backed tibial components( )	203	8%	RR	1.29 (0.69, 2.39)	Not Significant (P-value>.05)
Murray,D.W. , 2014	High Quality	Reoperation- Reoperation (Participants requiring At least one minor operation)	10 years	All Polyethylene Tibial Component( )	203	6.90%	metal backed tibial components( )	203	8%	RR	0.86(0.43,1.71)	Not Significant (P-value>.05)
Murray,D.W. , 2014	High Quality	Reoperation- Reoperation (Participants requiring Debridement/exploration/washout)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0.5%	RR	0.98(0.06,15.57)	Not Significant (P-value>.05)
Murray,D.W. , 2014	High Quality	Reoperation- Reoperation (Participants requiring MUA)	10 years	All Polyethylene Tibial Component( )	203	2.46%	metal backed tibial components( )	203	4%	RR	0.61(0.2,1.84)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Arthroscopy EUA/biopsy)	10 years	All Polyethylene Tibial Component( )	203	2.96%	metal backed tibial components( )	203	3.5%	RR	0.84(0.29,2.46)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Drain abscess)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0%	RD	.005(-.005,.015)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Exchange poly)	10 years	All Polyethylene Tibial Component( )	203	0.99%	metal backed tibial components( )	203	0.5%	RR	1.96(0.18,21.45)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Removal of patella button)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0%	RD	.005(-.005,.015)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Late patellar resurfacing)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0%	RD	.005(-.005,.015)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Patella revision)	10 years	All Polyethylene Tibial Component( )	203	0.00%	metal backed tibial components( )	203	0.5%	RD	-.005(-.015,.005)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring at least one major operation)	10 years	All Polyethylene Tibial Component( )	203	3.45%	metal backed tibial components( )	203	1.5%	RR	2.29(0.6,8.72)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Above-knee amputation)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0.5%	RR	0.98(0.06,15.57)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Revision for aseptic loosening)	10 years	All Polyethylene Tibial Component( )	203	0.99%	metal backed tibial components( )	203	1%	RR	0.98(0.14,6.89)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Revision for instability)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0%	RD	.005(-.005,.015)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Revision for pain)	10 years	All Polyethylene Tibial Component( )	203	0.99%	metal backed tibial components( )	203	0%	RD	.01(-.004,.023)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (Participants requiring Revision for malalignment)	10 years	All Polyethylene Tibial Component( )	203	0.49%	metal backed tibial components( )	203	0%	RD	.005(-.005,.015)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation- Reoperation (revision)	10 years	All Polyethylene Tibial Component( )	203	2.96%	metal backed tibial components( )	203	1%	RR	2.94(0.6,14.4)	Not Significant (P-value>.05)
Adalberth,G., 2001	Moderate Quality	Reoperation- Reoperation (femoral neck fracture)	3.9 months	All Polyethylene Tibial Component( )	20	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	5.56%	RD	-0.06(-0.16,0.05)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Adalberth,G., 2001	Moderate Quality	Reoperation- Reoperation (operation for a severe ipsilateral patellar fracture after car accident)	3 months	All Polyethylene Tibial Component( )	20	0.00%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	18	5.56%	RD	-0.06(-0.16,0.05)	Not Significant (P-value>.05)
Hyldahl, H.C.,2001	High Quality	Reoperation- Reoperation()	2 years	All Polyethylene Tibial Component( )	23	4.3%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	22	4.5%	RR	1.045(.070,15.70)	Not Significant (P-value>.05)
Gioe,T.J., 2000	Moderate Quality	Reoperation- Reoperation (revision)	5 years	All Polyethylene Tibial Component( )	103	7.77%	Modular (Metal Or Polyethylene) Tibial Component (metal backed)	97	5.15%	RR	1.51(0.51,4.45)	Not Significant (P-value>.05)

PATELLAR RESURFACING

A. PATELLAR RESURFACING: PAIN AND FUNCTION

Strong evidence supports no difference in pain or function with or without patellar resurfacing in total knee arthroplasty.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

B. PATELLAR RESURFACING: REOPERATIONS

Moderate evidence supports that patellar resurfacing in total knee arthroplasty (TKA) could decrease cumulative reoperations after 5 years when compared to no patellar resurfacing in total knee arthroplasty (TKA).

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

Strong evidence from high quality studies show very similar outcomes and complications with both patella resurfacing and no resurfacing. Unresurfaced categories often included a variety of limited debridements or releases such as circumferential patella osteophyte debridement or electrocautery. A meta-analysis showed that only reoperation rate (all reoperations, although a significant number were patella-related) was statistically increased in knees without patella resurfacing. This was only significant when enough reoperation data was aggregated to include reoperation after five years.

The high quality KAT trial (Breeman 2011 and Murray 2014) favors resurfacing for reasons of decreased reoperation. Four moderate quality studies also favored resurfacing for different reasons. Waters 2003 demonstrated higher anterior knee pain following total knee arthroplasty without resurfacing. Wood 2002 showed higher incidence of anterior knee pain in the knees that had not been resurfaced. One moderate quality study (Barrack 2001) showed anterior knee pain was same for overall KSS, and pain and function subscores, but reoperation significantly more common without resurfacing. Schroeder-Boersch 1998 showed better task knee function scores with resurfacing. Newman 2000 showed increased need for secondary surgery in the unresurfaced group. Partio 1995 showed decreased anterior knee pain in the resurfaced knees.

On the other hand, two high quality study (Bourne 1995) showed improved total Knee Society Scores (KSS) and KSS function scores in patients without patellar resurfacing. Liu 2012 chose to reshape the patella (osteophyte debridement) and found no difference in total KSS and in pain and function subgroups, arguing to keep patella bone stock. Campbell 2006 was unable to recommend resurfacing because of no significant differences in outcomes or complications. The

** See Appendix XIII for details regarding support*

KAT trial (Breeman 2011 and Murray 2014) found no statistically significant differences in EQ-5D score, SF-12 physical component scores and SF12 mental component scores.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Patellar arthroplasty in total knee arthroplasty has been associated with patella fracture or complications from patella insufficiency and the data suggests that this may increase over time. Not resurfacing the patella in the setting of total knee arthroplasty is associated with patella-related reoperations and all reoperations including infection and revision for which the association is not clearly understood.

FUTURE RESEARCH

Continued comparative large multicenter prospective studies between resurfaced and non-resurfaced patellae may elucidate superiority in more patient reported outcomes instruments. Also, future research should attempt to delineate which patients, with careful attention to age at total knee arthroplasty, may benefit from non-resurfacing of the patella.

RESULTS

SUMMARY OF FINDINGS TABLE 27: PATELLAR RESURFACING (EARLY FOLLOW-UP < 90 DAYS)

Summary of Findings ● Favors Patellar Resurfacing ● Favors No Patellar Resurfacing ○ Not Significant	High Quality Murray,D.W., 2014
Composite	
Oxford Knee Score	○
Quality of Life	
EQ-5d	○
SF-12 Physical Component Score	○
SF-12 Mental Component Score	○

SUMMARY OF FINDINGS TABLE 28: PATELLAR RESURFACING (LATE FOLLOW-UP > 90 DAYS)

Summary of Findings	High Quality				Moderate Quality																
● Favors Patellar Resurfacing ● Favors No Patellar Resurfacing ○ Not Significant	Wood,D.J., 2002	Liu,Z.T., 2012	Breeman,S., 2011	Bourne,R.B., 1995	Murray,D.W., 2014	Waters,T.S., 2003	Sun,Y.Q., 2012	Smith,A.J., 2008	Schroeder,Boersch H., 1998	Partio,E., 1995	Newman,John H., 2000	Gildone,A., 2005	Campbell,D.G., 2006	Burnett,R.S., 2007	Burnett,R.S., 2004	Barrack,R.L., 2001	Barrack,R.L., 1997	Breeman,S., 2011	Meta-Analysis
Complications																			
Manipulation Under Anesthesia- Other																		○	
Composite																			
Knee Society Score KSS	○			●				○											
Knee Society Score-Knee	○								○	○					○				
Oxford Knee Score					○														
Hospital for Special Surgery Knee Rating							○												
Function																			
Knee Society Score-Function- Function	○	○		●				○		○			○		○				
Range of Motion(extension) - Function				●															
Range of Motion(flexion) - Function				●															
Range Of Motion(overall) - Function							○			○					○				
Functional Task								○	●										
Sf-12 Physical Component- Function																		○	
Sf-12 Mental Component- Function																		○	
Length of Stay																			
Readmission- Length Of Stay																		○	
Other																			
Womac-stiffness averaged VAS Version (0-100)													○						
Satisfaction									○	○					○				
Pain																			
Knee Society Score-Pain- Pain		●							○						○				
Womac-Pain averaged VAS Version (0-100)													○						
Anterior Knee Pain- Pain										●									
Global pain, %																			
Knee pain scale								○											
Functional Task										●									
Quality of Life																			
Patient satisfaction									○	○					○				
EQ-5d					○														
SF-12 Physical Component Score					○														
SF-12 Mental Component Score					○														
Euroqol-5d(Eq-5d) overall																		○	
Reoperation																			
Reoperation- Reoperation	○		●		●		●		○		○	●	○	○	○	●	●	○	●
Reoperation due to anterior knee pain				○															

** See Appendix XIII for details regarding support*

FIGURE 3 PATELLAR RESURFACING - REOPERATION STRATIFIED BY FOLLOW UP

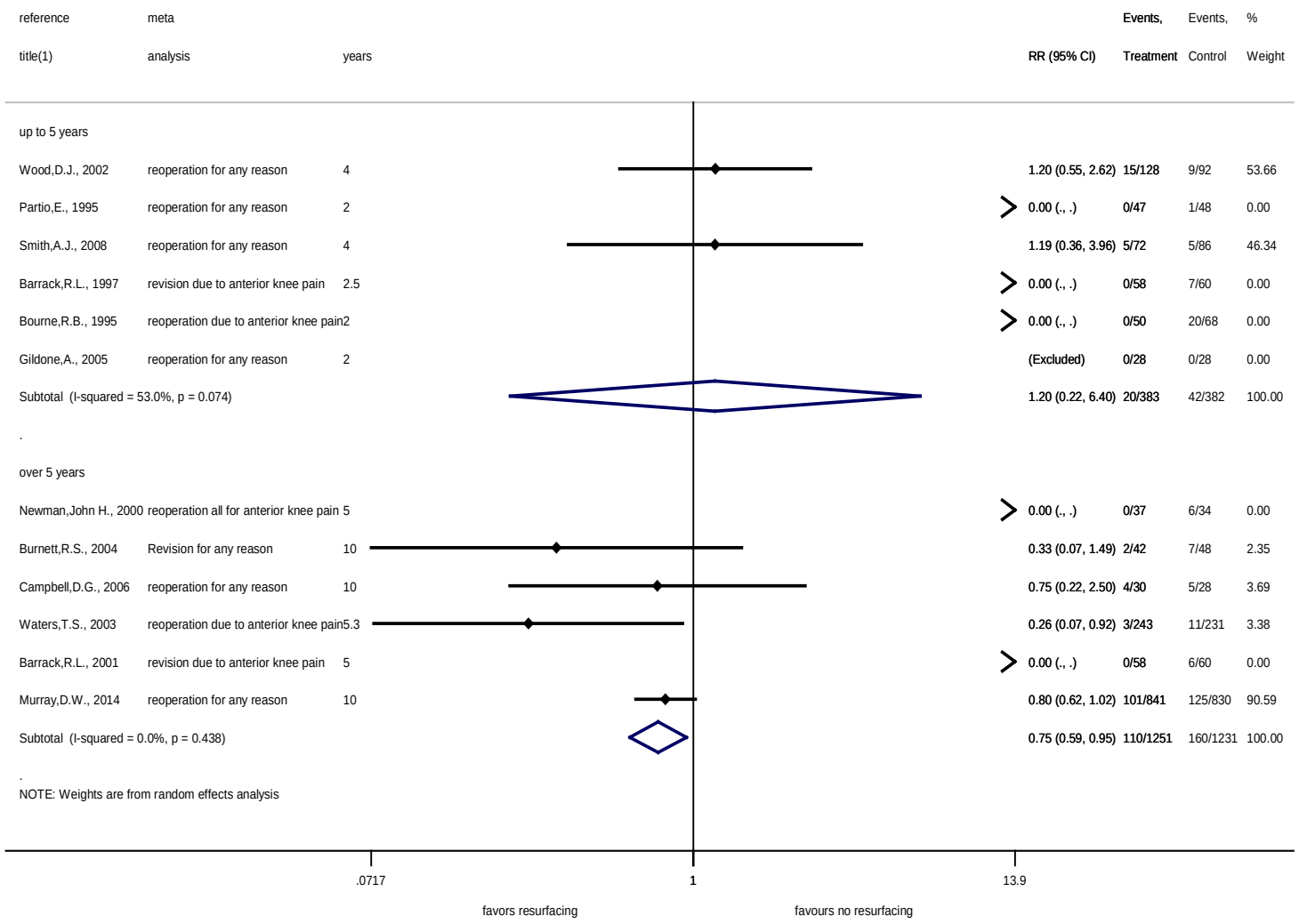
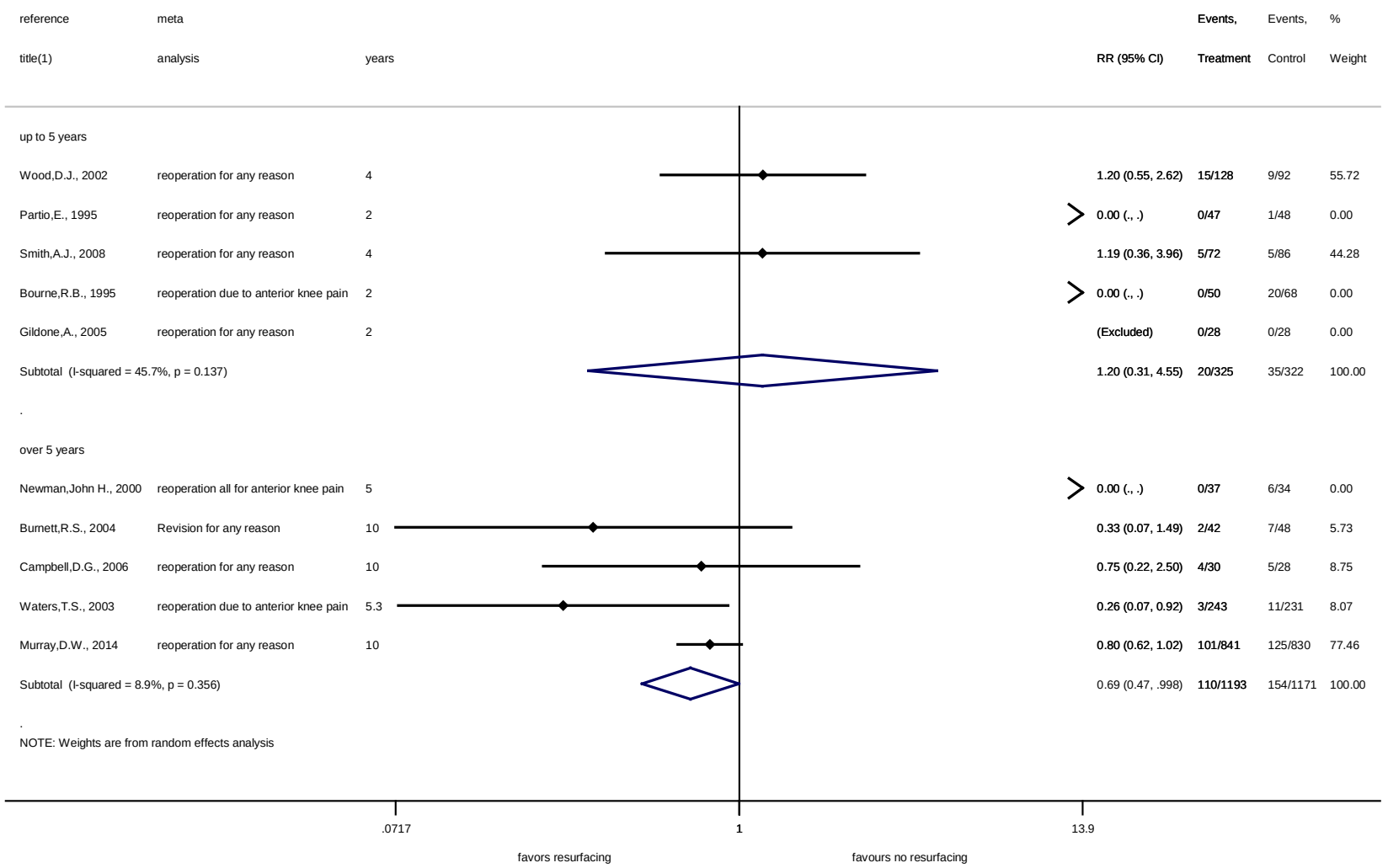


FIGURE 4 PATELLAR RESURFACING (SENSITIVITY ANALYSIS) - REOPERATION WITH BARRACK 1997 AND 2001 REMOVED SINCE REOPERATIONS FOR REASONS OTHER THAN ANTERIOR KNEE PAIN WERE EXCLUDED FROM THAT ANALYSIS.



QUALITY EVALUATION TABLE 18: PATELLAR RESURFACING

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Khatod,M., 2013	○	◑	●	●	●	○	Include	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Barrack,R.L., 1997	●	●	●	●	○	○	Include	Moderate Quality
Barrack,R.L., 2001	●	◑	●	◑	●	○	Include	Moderate Quality
Bourne,R.B., 1995	●	●	●	●	●	●	Include	High Quality
Burnett,R.S., 2004	●	●	●	○	○	●	Include	Moderate Quality
Burnett,R.S., 2007	◑	●	●	●	○	○	Include	Moderate Quality
Campbell,D.G., 2006	●	◑	●	○	○	◑	Include	Moderate Quality
Gildone,A., 2005	◑	◑	◑	●	○	●	Include	Moderate Quality
Liu,Z.T., 2012	●	●	●	●	○	●	Include	High Quality
Mayman,D., 2003	◑	◑	●	●	●	●	Include	High Quality
Murray,D.W., 2014	●	●	○	●	●	●	Include	High Quality
Newman,John H., 2000	●	◑	◑	●	○	●	Include	Moderate Quality
Partio,E., 1995	◑	◑	◑	●	◑	●	Include	Moderate Quality
Schroeder,Boersch H., 1998	◑	◑	○	●	●	●	Include	Moderate Quality
Smith,A.J., 2008	●	◑	◑	○	○	●	Include	Moderate Quality
Sun,Y.Q., 2012	●	◑	◑	●	○	●	Include	Moderate Quality
Waters,T.S., 2003	●	◑	◑	●	○	◑	Include	Moderate Quality
Wood,D.J., 2002	●	◑	●	●	●	●	Include	High Quality

DETAILED DATA TABLES

TABLE 67: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Breeman,S., 2011	High Quality	Manipulation Under Anesthesia- Other (need MUA)	5 years	Resurfacing( )	861	2.09%	No Resurfacing (Control) ( )	854	2.69%	RR	0.78(0.42,1.43)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 68: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	3 months	Resurfacing( )	661	31.2(9.60)	( )	679	30.5(9.40)	Mean Difference	0.7(-0.32,1.72)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	1 years	Resurfacing( )	635	34.7(9.40)	( )	645	34.5(10.20)	Mean Difference	0.2(-0.88,1.28)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	2 years	Resurfacing( )	556	35.6(9.80)	( )	589	35.2(10.20)	Mean Difference	0.4(-0.76,1.56)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	3 years	Resurfacing( )	609	35.5(10.10)	( )	602	34.7(10.40)	Mean Difference	0.8(-0.36,1.96)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	4 years	Resurfacing( )	610	34.9(10.70)	( )	616	34.3(10.60)	Mean Difference	0.6(-0.59,1.79)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	5 years	Resurfacing( )	594	35(10.60)	( )	570	34.6(10.20)	Mean Difference	0.4(-0.80,1.60)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	6 years	Resurfacing( )	550	35.1(10.50)	( )	534	34.9(10.30)	Mean Difference	0.2(-1.04,1.44)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	7 years	Resurfacing( )	530	34.6(11.00)	( )	504	34.2(10.50)	Mean Difference	0.4(-0.91,1.71)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	8 years	Resurfacing( )	495	34(11.00)	( )	487	34(10.50)	Mean Difference	0(-1.35,1.35)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	9 years	Resurfacing( )	461	34.2(10.90)	( )	431	33.8(10.40)	Mean Difference	0.4(-1.00,1.80)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Oxford Knee Score( )	10 years	Resurfacing( )	418	33.6(11.30)	( )	380	33.5(10.80)	Mean Difference	0.1(-1.44,1.64)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 69: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Breeman,S., 2011	High Quality	Sf-12 Physical Component-Function ( )	5 years	Resurfacing( )	861	. %	No Resurfacing (Control) ( )	854	. %	Author Reported	NA	Not Significant (P-value>.05)
Breeman,S., 2011	High Quality	Sf-12 Mental Component-Function ( )	5 years	Resurfacing( )	861	. %	No Resurfacing (Control) ( )	854	. %	Author Reported	NA	Not Significant (P-value>.05)
Bourne,R.B., 1995	High Quality	Knee Society Score-Function-Function ( )	5.9 months	Resurfacing( )	50	65(18.00)	No Resurfacing (Control) ( )	50	63(23.00)	Mean Difference	2(-6.10,10.10)	Not Significant (P-value>.05)
Bourne,R.B., 1995	High Quality	Knee Society Score-Function-Function ( )	1 years	Resurfacing( )	50	70(21.00)	No Resurfacing (Control) ( )	50	71(20.00)	Mean Difference	-1(-9.04,7.04)	Not Significant (P-value>.05)
Bourne,R.B., 1995	High Quality	Knee Society Score-Function-Function ( )	2 years	Resurfacing( )	50	67(26.00)	No Resurfacing (Control) ( )	50	76(19.00)	Mean Difference	-9(-17.93,-0.07)	**Treatment 2 Significant (P-value<.05)**
Bourne,R.B., 1995	High Quality	Range Of Motion (flexion) - Function (Knee flexion torque)	5.9 months	Resurfacing( )	50	34(15.00)	No Resurfacing (Control) ( )	50	35(15.00)	Mean Difference	-1(-6.88,4.88)	Not Significant (P-value>.05)
Bourne,R.B., 1995	High Quality	Range Of Motion (flexion) - Function (Knee flexion torque)	1 years	Resurfacing( )	50	38(14.00)	No Resurfacing (Control) ( )	50	42.(18.00)	Mean Difference	-4 (-10.4, 2.4)	Not Significant (P-value>.05)
Bourne,R.B., 1995	High Quality	Range Of Motion (flexion) - Function (Knee flexion torque)	2 years	Resurfacing( )	50	41(12.00)	No Resurfacing (Control) ( )	50	49(17.00)	Mean Difference	-8(-13.77,-2.23)	**Treatment 2 Significant (P-value<.05)**
Bourne,R.B., 1995	High Quality	Range Of Motion (extension) - Function (Knee extension torque)	5.9 months	Resurfacing( )	50	56(18.00)	No Resurfacing (Control) ( )	50	63(28.00)	Mean Difference	-7(-16.23,2.23)	Not Significant (P-value>.05)
Bourne,R.B., 1995	High Quality	Range Of Motion (extension) - Function (Knee extension torque)	1 years	Resurfacing( )	50	65(18.00)	No Resurfacing (Control) ( )	50	76(29.00)	Mean Difference	-11(-20.46,-1.54)	**Treatment 2 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Bourne,R.B., 1995	High Quality	Range Of Motion (extension) - Function (Knee extension torque)	2 years	Resurfacing( )	50	70(21.00)	No Resurfacing (Control) ( )	50	74(23.00)	Mean Difference	-4 (-12.74, 4.74)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	3 years	Resurfacing( )	68	74.6(17.60)	No Resurfacing (Control) (Reshaping)	64	72.4(19.10)	Mean Difference	2.2(-4.08,8.48)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	1 years	Resurfacing( )	68	47.9(17.50)	No Resurfacing (Control) (Reshaping)	64	43.8(16.20)	Mean Difference	4.1(-1.65,9.85)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	2 years	Resurfacing( )	68	64.7(16.20)	No Resurfacing (Control) (Reshaping)	64	67.5(16.90)	Mean Difference	-2.8 (-8.5, 2.9)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	4 years	Resurfacing( )	68	75.8(17.60)	No Resurfacing (Control) (Reshaping)	64	77.6(18.50)	Mean Difference	-1.8(-7.97,4.37)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	5 years	Resurfacing( )	68	80(19.90)	No Resurfacing (Control) (Reshaping)	64	76.5(17.60)	Mean Difference	3.5(-2.90,9.90)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	6 years	Resurfacing( )	68	79.6(18.30)	No Resurfacing (Control) (Reshaping)	64	81.3(20.00)	Mean Difference	-1.7(-8.25,4.85)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Function-Function ( )	7 years	Resurfacing( )	68	83.8(16.30)	No Resurfacing (Control) (Reshaping)	64	80.2(18.10)	Mean Difference	3.6(-2.29,9.49)	Not Significant (P-value>.05)
Wood,D.J., 2002	High Quality	Knee Society Score-Function-Function ( )	4 years	Resurfacing( )	91	65(28.50)	No Resurfacing (Control) ( )	127	70(32.50)	Mean Difference	-5(-13.14,3.14)	Not Significant (P-value>.05)
Barrack,R.L., 1997	Moderate Quality	Range Of Motion (overall) - Function ( )	2.5 years	Resurfacing( )	58	110(.)	No Resurfacing (Control) ( )	60	113(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Barrack,R.L., 1997	Moderate Quality	Functional Task (Difficulty exiting from an automobile)	2.5 years	Resurfacing( )	58	7.9(.)	No Resurfacing (Control) ( )	60	8.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 1997	Moderate Quality	Functional Task (Difficulty rising from a chair)	2.5 years	Resurfacing( )	58	8.9(.)	No Resurfacing (Control) ( )	60	8.7(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 1997	Moderate Quality	Functional Task (Difficulty in stair climbing)	2.5 years	Resurfacing( )	58	7.7(.)	No Resurfacing (Control) ( )	60	7.9(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 2001	Moderate Quality	Knee Society Score-Function-Function ( )	5 years	Resurfacing( )	44	73.5(.)	No Resurfacing (Control) ( )	44	80.7(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 2001	Moderate Quality	Functional Task (Exiting an automobile)	5 years	Resurfacing( )	44	7.5(.)	No Resurfacing (Control) ( )	44	8.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 2001	Moderate Quality	Functional Task (Rising for a chair)	5 years	Resurfacing( )	44	8.1(.)	No Resurfacing (Control) ( )	44	8.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 2001	Moderate Quality	Functional Task (Stair-climbing)	5 years	Resurfacing( )	44	7.9(.)	No Resurfacing (Control) ( )	44	7.9(.)	Author Reported	NA	Not Significant (P-value>.05)
Barrack,R.L., 2001	Moderate Quality	Reoperation-Reoperation (reoperation due to anterior knee pain)	5 years	Resurfacing( )	58	0.00%	No Resurfacing (Control) ( )	60	10.00%	RD	-0.10(-0.20,-0.03)	Significant (P-value<.05)
Burnett,R.S., 2004	Moderate Quality	Range Of Motion (overall) - Function ( )	10 years	Resurfacing( )	38	108.6(12.60)	No Resurfacing (Control) ( )	41	108.5(15.80)	Mean Difference	0.1(-6.18,6.38)	Not Significant (P-value>.05)
Burnett,R.S., 2004	Moderate Quality	Knee Society Score-Function-Function ( )	10 years	Resurfacing( )	38	58.7(24.70)	No Resurfacing (Control) ( )	41	59.5(25.30)	Mean Difference	-0.8(-11.83,10.23)	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Knee Society Score-Function-Function ( )	1 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Campbell,D.G., 2006	Moderate Quality	Knee Society Score-Function-Function ( )	4 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Knee Society Score-Function-Function ( )	8 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Knee Society Score-Function-Function ( )	10 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting out of a car)	1 months	Resurfacing( )	28	3.1(.)	No Resurfacing (Control) ( )	28	3.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting out of a car)	3 months	Resurfacing( )	28	4.4(.)	No Resurfacing (Control) ( )	28	4.5(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting out of a car)	6 months	Resurfacing( )	28	6(.)	No Resurfacing (Control) ( )	28	6.2	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting out of a car)	1 years	Resurfacing( )	28	7.7(.)	No Resurfacing (Control) ( )	28	7.9(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting out of a car)	2 years	Resurfacing( )	28	7.9(.)	No Resurfacing (Control) ( )	28	8(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting into a chair)	1 months	Resurfacing( )	28	3.3(.)	No Resurfacing (Control) ( )	28	3.6(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting into a chair)	3 months	Resurfacing( )	28	4.7(.)	No Resurfacing (Control) ( )	28	4.7(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting into a chair)	6 months	Resurfacing( )	28	6.2(.)	No Resurfacing (Control) ( )	28	6.7(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting into a chair)	1 years	Resurfacing( )	28	7(.)	No Resurfacing (Control) ( )	28	7.4(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting into a chair)	2 years	Resurfacing( )	28	8.2(.)	No Resurfacing (Control) ( )	28	8.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting up/down stairs)	1 months	Resurfacing( )	28	3.9(.)	No Resurfacing (Control) ( )	28	3.8(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting up/down stairs)	3 months	Resurfacing( )	28	4.9(.)	No Resurfacing (Control) ( )	28	5.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting up/down stairs)	5.9 months	Resurfacing( )	28	7.4(.)	No Resurfacing (Control) ( )	28	7.6(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting up/down stairs)	1 years	Resurfacing( )	28	7.8(.)	No Resurfacing (Control) ( )	28	8.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Functional Task (VAS: percieved difficulty getting up/down stairs)	2 years	Resurfacing( )	28	8.4(.)	No Resurfacing (Control) ( )	28	.(8.40)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Knee Society Score-Function-Function ( )	1 months	Resurfacing( )	28	54.1(.)	No Resurfacing (Control) ( )	28	56.3(.)	Author Reported	NA	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Knee Society Score-Function-Function ( )	3 months	Resurfacing( )	28	80.4(.)	No Resurfacing (Control) ( )	28	78.6(.)	Author Reported	NA	Not Significant (P-value>.05)
Partio,E., 1995	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	Resurfacing( )	47	77.1(.)	No Resurfacing (Control) ( )	48	78.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Partio,E., 1995	Moderate Quality	Range Of Motion (overall) - Function ( )	2 years	Resurfacing( )	47	112(.)	No Resurfacing (Control) ( )	48	108(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Schroeder,Boersch H., 1998	Moderate Quality	Knee Society Score-Function-Function ( )	1 year	Resurfacing( )	20	76.5(.)	No Resurfacing (Control) ( )	19	68.3(.)	Author Reported	NA	Not Significant (P-value>.05)
Schroeder,Boersch H., 1998	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	Resurfacing( )	20	80(.)	No Resurfacing (Control) ( )	19	69.5(.)	Author Reported	NA	Significant (P-value<.05)
Schroeder,Boersch H., 1998	Moderate Quality	Functional Task (Climbing stairs)	1 year	Resurfacing( )	20	36.5(.)	No Resurfacing (Control) ( )	19	30(.)	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Schroeder,Boersch H., 1998	Moderate Quality	Functional Task (Climbing stairs)	2 years	Resurfacing( )	20	39.5(.)	No Resurfacing (Control) ( )	19	32.1(.)	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Smith,A.J., 2008	Moderate Quality	Knee Society Score-Function-Function ( )	4 years	Resurfacing( )	73	14.4(19.30)	No Resurfacing (Control) ( )	86	18.6(19.50)	Mean Difference	-4.2(-10.25,1.85)	Not Significant (P-value>.05)
Smith,A.J., 2008	Moderate Quality	Functional Task (Able to rise with ease without use of arms)	4 years	Resurfacing( )	72	56.94%	No Resurfacing (Control) ( )	86	62.79%	RR	.(,,)	Not Significant (P-value>.05)
Smith,A.J., 2008	Moderate Quality	Functional Task (Ascent stair using no rail or rail for balance only)	4 years	Resurfacing( )	72	56.94%	No Resurfacing (Control) ( )	86	66.28%	RR	.(,,)	Not Significant (P-value>.05)
Smith,A.J., 2008	Moderate Quality	Functional Task (Ascent leads with operated leg or in reciprocal manner)	4 years	Resurfacing( )	72	84.72%	No Resurfacing (Control) ( )	86	83.72%	RR	.(,,)	Not Significant (P-value>.05)
Smith,A.J., 2008	Moderate Quality	Functional Task (Descent rail using no rail or rail for balance only)	4 years	Resurfacing( )	72	50.00%	No Resurfacing (Control) ( )	86	60.47%	RR	.(,,)	Not Significant (P-value>.05)
Smith,A.J., 2008	Moderate Quality	Functional Task (Stair decent leads with non operated leg or in reciprocal manner)	4 years	Resurfacing( )	72	69.44%	No Resurfacing (Control) ( )	86	76.74%	RR	.(,,)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Sun,Y.Q., 2012	Moderate Quality	Knee Society Score-Function-Function ( )	4.5 years	Resurfacing(Patelloplasty)	68	73.6(13.10)	No Resurfacing (Control) (Traditional)	64	61.9(16.50)	Mean Difference	11.7(6.60,16.80)	**Treatment 1 Significant (P-value<.05)**
Sun,Y.Q., 2012	Moderate Quality	Range Of Motion (overall) - Function ( )	4.5 years	Resurfacing(Patelloplasty)	68	123.2(9.80)	No Resurfacing (Control) (Traditional)	64	119.7(12.80)	Mean Difference	3.5(-0.41,7.41)	Not Significant (P-value>.05)

TABLE 70: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Breeman,S., 2011	High Quality	Readmission- Length Of Stay ( )	5 years	Resurfacing ( )	861	12.08%	No Resurfacing (Control) ( )	854	13.11%	RR	0.92(0.72,1.18)	Not Significant (P-value>.05)

TABLE 71: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	1 years	Resurfacing( )	68	31.2(8.40)	No Resurfacing (Control) (Reshaping)	64	34.6(10.00)	Mean Difference	-3.4(-6.56,-0.24)	**Treatment 2 Significant (P-value<.05)**
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	2 years	Resurfacing( )	68	37.5(9.10)	No Resurfacing (Control) (Reshaping)	64	35.7(8.50)	Mean Difference	1.8(-1.20,4.80)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	3 years	Resurfacing( )	68	40.5(8.20)	No Resurfacing (Control) (Reshaping)	64	43.9(9.30)	Mean Difference	-3.4(-6.40,-0.40)	**Treatment 2 Significant (P-value<.05)**
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	4 years	Resurfacing( )	68	43.6(7.50)	No Resurfacing (Control) (Reshaping)	64	44.1(6.70)	Mean Difference	-0.5(-2.92,1.92)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	5 years	Resurfacing( )	68	44.2(8.00)	No Resurfacing (Control) (Reshaping)	64	44.8(7.50)	Mean Difference	-0.6(-3.24,2.04)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	6 years	Resurfacing( )	68	45.8(7.90)	No Resurfacing (Control) (Reshaping)	64	46.2(8.80)	Mean Difference	-0.4(-3.26,2.46)	Not Significant (P-value>.05)
Liu,Z.T., 2012	High Quality	Knee Society Score-Pain-Pain ( )	7 years	Resurfacing( )	68	46.7(7.40)	No Resurfacing (Control) (Reshaping)	64	46(8.60)	Mean Difference	0.7(-2.04,3.44)	Not Significant (P-value>.05)
Barrack,R.L., 2001	Moderate Quality	Knee Society Score-Pain-Pain ( )	5 years	Resurfacing( )	44	88.3(.)	No Resurfacing (Control) ( )	44	88.5(.)	Author Reported	NA	Not Significant (P-value>.05)
Burnett,R.S., 2004	Moderate Quality	Knee Society Score-Pain-Pain ( )	10 years	Resurfacing( )	38	45.3(7.50)	No Resurfacing (Control) ( )	41	43.7(8.70)	Mean Difference	1.6(-1.97,5.17)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Campbell,D.G., 2006	Moderate Quality	Womac-Pain averaged VAS Version (0-100) ( )	8 years	Resurfacing( )	NR	. %	No Resurfacing (Control) ( )	NR	. %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Womac-Pain averaged VAS Version (0-100) ( )	10 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Anterior Knee Pain-Pain ( )	4 years	Resurfacing( )	41	35.00 %	No Resurfacing (Control) ( )	42	28.00 %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Anterior Knee Pain-Pain ( )	8 years	Resurfacing( )	NR	29.00 %	No Resurfacing (Control) ( )	NR	33.00 %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Anterior Knee Pain-Pain ( )	10 years	Resurfacing( )	28	47.00 %	No Resurfacing (Control) ( )	30	43.00 %	Author Reported	NA	Not Significant (P-value>.05)
Partio,E., 1995	Moderate Quality	Anterior Knee Pain-Pain (No patellar pain)	2 years	Resurfacing( )	47	97.87%	No Resurfacing (Control) ( )	48	77.08%	RR	1.27(1.08,1.49)	**Treatment 1 Significant (P-value<.05)**
Partio,E., 1995	Moderate Quality	Functional Task (no compression pain)	2 years	Resurfacing( )	47	91.49%	No Resurfacing (Control) ( )	48	54.17%	RR	1.69(1.28,2.22)	**Treatment 1 Significant (P-value<.05)**
Schroeder,Boersch H., 1998	Moderate Quality	Knee Society Score-Pain-Pain ( )	11.8 months	Resurfacing( )	20	45.3(.)	No Resurfacing (Control) ( )	19	42.5(.)	Author Reported	NA	Not Significant (P-value>.05)
Schroeder,Boersch H., 1998	Moderate Quality	Knee Society Score-Pain-Pain ( )	2 years	Resurfacing( )	20	45(.)	No Resurfacing (Control) ( )	19	40(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Smith,A.J., 2008	Moderate Quality	Knee pain scale( )	4 years	Resurfacing( )	73	47.7(25.00)	No Resurfacing (Control) ( )	86	48.7(23.20)	Mean Difference	-1(-8.55,6.55)	Not Significant (P-value>.05)
Sun,Y.Q., 2012	Moderate Quality	Global pain, %( )	4.5 years	Resurfacing(Patelloplasty)	68	. %	No Resurfacing (Control) (Traditional)	64	. %	Author Reported	NA	Not Significant (P-value>.05)
Sun,Y.Q., 2012	Moderate Quality	Anterior Knee Pain-Pain (VAS)	4.5 years	Resurfacing(Patelloplasty)	68	1.3(.)	No Resurfacing (Control) (Traditional)	64	1.4(.)	Author Reported	NA	Not Significant (P-value>.05)
Waters,T.S., 2003	Moderate Quality	Anterior Knee Pain-Pain ( )	5.3 years	Resurfacing( )	243	5.35%	No Resurfacing (Control) ( )	231	25.11%	RR	0.21(0.12,0.38)	**Treatment 1 Significant (P-value<.05)**

TABLE 72: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Breeman,S., 2011	High quality	Euroqol-5d(Eq-5d) overall( )	5 years	Resurfacing( )	861	. %	No Resurfacing (Control) ( )	854	. %	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	3 months	Resurfacing( )	737	0.703(0.23)	( )	739	0.687(0.24)	Mean Difference	0.02(0.00,0.04)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	1 years	Resurfacing( )	734	0.744(0.23)	( )	725	0.732(0.25)	Mean Difference	0.01(-0.01,0.03)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	2 years	Resurfacing( )	693	0.743(0.24)	( )	689	0.724(0.27)	Mean Difference	0.02(-0.01,0.05)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	3 years	Resurfacing( )	679	0.733(0.25)	( )	667	0.706(0.28)	Mean Difference	0.03(0.00,0.06)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	4 years	Resurfacing( )	661	0.717(0.27)	( )	647	0.688(0.29)	Mean Difference	0.03(0.00,0.06)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	5 years	Resurfacing( )	641	0.718(0.26)	( )	611	0.701(0.27)	Mean Difference	0.02(-0.01,0.05)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	6 years	Resurfacing( )	589	0.705(0.27)	( )	572	0.686(0.28)	Mean Difference	0.02(-0.01,0.05)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	7 years	Resurfacing( )	573	0.695(0.28)	( )	550	0.677(0.29)	Mean Difference	0.02(-0.01,0.05)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	EQ-5d( )	8 years	Resurfacing( )	532	0.669(0.29)	( )	512	0.672(0.29)	Mean Difference	0(-0.04,0.04)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	9 years	Resurfacing( )	490	0.667(0.30)	( )	475	0.659(0.28)	Mean Difference	0.01(-0.03,0.05)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	EQ-5d( )	10 years	Resurfacing( )	443	0.665(0.29)	( )	424	0.647(0.30)	Mean Difference	0.02(-0.02,0.06)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	3 months	Resurfacing( )	719	39.4(9.40)	( )	708	38.7(9.10)	Mean Difference	0.7(-0.26,1.66)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	1 years	Resurfacing( )	725	40.8(10.50)	( )	708	40.7(10.40)	Mean Difference	0.1(-0.98,1.18)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	2 years	Resurfacing( )	694	40.7(11.00)	( )	675	40.8(10.40)	Mean Difference	-0.1(-1.24,1.04)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	3 years	Resurfacing( )	659	40.8(11.10)	( )	651	39.8(10.90)	Mean Difference	1(-0.19,2.19)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	4 years	Resurfacing( )	652	39.7(11.40)	( )	641	39.2(10.90)	Mean Difference	0.5(-0.72,1.72)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	5 years	Resurfacing( )	622	39.6(11.00)	( )	612	39.4(11.50)	Mean Difference	0.2(-1.06,1.46)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	6 years	Resurfacing( )	578	39.1(11.10)	( )	554	38.7(11.40)	Mean Difference	0.4(-0.91,1.71)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	7 years	Resurfacing( )	559	38.6(11.60)	( )	532	38.5(11.50)	Mean Difference	0.1(-1.27,1.47)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	8 years	Resurfacing( )	518	37.6(11.20)	( )	501	38.1(11.60)	Mean Difference	-0.5(-1.90,0.90)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	9 years	Resurfacing( )	478	37.6(11.30)	( )	459	37.9(11.40)	Mean Difference	-0.3(-1.76,1.16)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Physical Component Score( )	10 years	Resurfacing( )	440	37.5(11.50)	( )	416	37.3(11.10)	Mean Difference	0.2(-1.32,1.72)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	3 months	Resurfacing( )	719	39.4(9.40)	( )	708	38.7(9.10)	Mean Difference	0.7(-0.26,1.66)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	1 years	Resurfacing( )	725	40.8(10.50)	( )	708	40.7(10.40)	Mean Difference	0.1(-0.98,1.18)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	2 years	Resurfacing( )	694	40.7(11.00)	( )	675	40.8(10.40)	Mean Difference	-0.1(-1.24,1.04)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	3 years	Resurfacing( )	659	40.8(11.10)	( )	651	39.8(10.90)	Mean Difference	1(-0.19,2.19)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	4 years	Resurfacing( )	652	39.7(11.40)	( )	641	39.2(10.90)	Mean Difference	0.5(-0.72,1.72)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	5 years	Resurfacing( )	622	39.6(11.00)	( )	612	39.4(11.50)	Mean Difference	0.2(-1.06,1.46)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	6 years	Resurfacing( )	578	39.1(11.10)	( )	554	38.7(11.40)	Mean Difference	0.4(-0.91,1.71)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	7 years	Resurfacing( )	559	38.6(11.60)	( )	532	38.5(11.50)	Mean Difference	0.1(-1.27,1.47)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	8 years	Resurfacing( )	518	37.6(11.20)	( )	501	38.1(11.60)	Mean Difference	-0.5(-1.90,0.90)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	9 years	Resurfacing( )	478	37.6(11.30)	( )	459	37.9(11.40)	Mean Difference	-0.3(-1.76,1.16)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	SF-12 Mental Component Score( )	10 years	Resurfacing( )	440	37.5(11.50)	( )	416	37.3(11.10)	Mean Difference	0.2(-1.32,1.72)	Not Significant (P-value>.05)
Burnett,R.S., 2004	Moderate Quality	Patient satisfaction (Extremely satisfied or very satisfied)	10 years	Resurfacing( )	40	85.00%	No Resurfacing (Control) ( )	41	92.68%	RR	0.92(0.78,1.07)	Not Significant (P-value>.05)
Partio,E., 1995	Moderate Quality	Patient satisfaction (Enthusiastic)	2 years	Resurfacing( )	47	53.19%	No Resurfacing (Control) ( )	48	41.67%	RR	1.28(0.83,1.96)	Not Significant (P-value>.05)
Schroeder,Boersch H., 1998	Moderate Quality	Patient satisfaction (Excellent)	2 years	Resurfacing( )	20	60.00%	No Resurfacing (Control) ( )	19	52.63%	RR	1.14(0.65,1.99)	Not Significant (P-value>.05)

TABLE 73: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Breeman,S., 2011	High Quality	Reoperation-Reoperation (reoperation for patellar fracture)	5 years	Resurfacing( )	861	0.23%	No Resurfacing (Control) ( )	854	0.00%	RD	0.00(-0.00,0.01)	Not Significant (P-value>.05)
Breeman,S., 2011	High Quality	Reoperation-Reoperation (late patellar resurfacing)	5 years	Resurfacing( )	861	0.81%	No Resurfacing (Control) ( )	854	1.87%	RR	0.43(0.18,1.05)	Not Significant (P-value>.05)
Breeman,S., 2011	High Quality	Reoperation-Reoperation (at least one major operation (one or two stage revision, or above the knee amputation))	5 years	Resurfacing( )	862	1.62%	No Resurfacing (Control) ( )	854	2.93%	RR	0.55(0.29,1.06)	Not Significant (P-value>.05)
Breeman,S., 2011	High Quality	Reoperation-Reoperation (above knee amputation)	5 years	Resurfacing( )	861	0.00%	No Resurfacing (Control) ( )	854	0.23%	RD	-0.00(-0.01,0.00)	Not Significant (P-value>.05)
Breeman,S., 2011	High Quality	Reoperation-Reoperation (at least one minor reoperation (wound closure, debridement/ washout, MUA, arthrolysis and quadricepsplasty, arthroscopy under anesthesia, exchange of cement spacer, polyethylene exchange, bone removal))	5 years	Resurfacing( )	861	4.41%	No Resurfacing (Control) ( )	854	5.85%	RR	0.75(0.50,1.14)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Bourne,R.B., 1995	High Quality	reoperation due to anterior knee pain (reoperation due to anterior knee pain)	2 years	Resurfacing(Reoperation-Reoperation)	50	0.00%	No Resurfacing (Control) ( )	50	40.00%	RD	-4.00(-9.43,1.43)	Not Significant (P-value>.05)
Breeman,S., 2011	High Quality	Reoperation-Reoperation (reoperation for any reason)	5 years	Resurfacing( )	861	7.20%	No Resurfacing (Control) ( )	854	10.66%	RR	0.68(0.50,0.92)	**Treatment 1 Significant (P-value<.05)**
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (at least one revision)	10 years	Resurfacing( )	841	3.09%	( )	830	4.46%	RR	0.69(0.42,1.13)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (any patella related reoperation)	10 years	Resurfacing( )	841	1.78%	( )	830	1.81%	RR	0.99 (0.49, 2.01)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (late patellar resurfacing required)	10 years	Resurfacing( )	841	1.07%	( )	830	1.93%	RR	0.56(0.25,1.25)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (reoperation due to patella fracture)	10 years	Resurfacing( )	841	0.24%	( )	830	0.00%	RD	.002(-.001,.006)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (patella revision required)	10 years	Resurfacing( )	841	0.24%	( )	830	0.00%	RD	.002(-.001,.006)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (patella realignment required)	10 years	Resurfacing( )	841	0.12%	( )	830	0.00%	RD	.001(-.001,.004)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (removal of	10 years	Resurfacing( )	841	0.12%	( )	830	0.00%	RD	.001(-.001,.004)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		patalla button required)										
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (required above knee amputation)	10 years	Resurfacing( )	841	0.00%	( )	830	0.24%		-0.002(-0.006,0.001)	Not Significant (P-value>.05)
Murray,D.W., 2014	High Quality	Reoperation-Reoperation (reoperation for any reason)	10 years	Resurfacing( )	841	12.01%	( )	830	15.06%	RR	0.80(0.62,1.02)	Not Significant (P-value>.05)
Wood,D.J., 2002	High Quality	Reoperation-Reoperation (Revisions and other reoperations)	4 years	Resurfacing( )	128	11.72%	No Resurfacing (Control) ( )	92	9.78%	RR	.(.,.)	Not Significant (P-value>.05)
Barrack,R.L., 1997	Moderate Quality	Reoperation-Reoperation (revision due to anterior knee pain)	2.5 years	Resurfacing( )	58	0.00%	No Resurfacing (Control) ( )	60	11.67%	RD	-0.12(-0.20,-0.04)	**Treatment 1 Significant (P-value<.05)**
Barrack,R.L., 2001	Moderate Quality	Reoperation-Reoperation (revision due to anterior knee pain)	5 years	Resurfacing( )	58	0.00%	No Resurfacing (Control) ( )	60	10.00%	RD	-0.10(-0.18,-0.02)	**Treatment 1 Significant (P-value<.05)**
Burnett,R.S., 2004	Moderate Quality	Reoperation-Reoperation ( )	10 years	Resurfacing( )	42	4.76%	No Resurfacing (Control) ( )	48	14.58 %	RR	0.33(0.07,1.49)	Not Significant (P-value>.05)
Burnett,R.S., 2007	Moderate Quality	Reoperation-Reoperation (knees randomized)	10 years	Resurfacing(knees randomized)	32	10.5%	No Resurfacing (Control) ( )	32	7.00 %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Reoperation-Reoperation (reoperation for any reason)	10 years	Resurfacing( )	30	13.33%	No Resurfacing (Control) ( )	28	17.86%	RR	0.75(0.22,2.50)	Not Significant (P-value>.05)
Gildone,A., 2005	Moderate Quality	Reoperation-Reoperation	2 years	Resurfacing( )	28	0.00%	No Resurfacing (Control) ( )	28	0.00%	RD	0.00(0.00,0.00)	Not Significant

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		(reoperation for any reason)										(P-value>.05)
Newman,John H., 2000	Moderate Quality	Reoperation-Reoperation (revision: subsequent patellar resurfacing)	5 years	Resurfacing( )	37	0.00%	No Resurfacing (Control) ( )	34	17.65%	RD	-0.18(-0.30,-0.05)	**Treatment 1 Significant (P-value<.05)**
Partio,E., 1995	Moderate Quality	Reoperation-Reoperation (reoperation for any reason)	2 years	Resurfacing( )	47	0.00%	No Resurfacing (Control) ( )	48	2.08%	RD	-0.02(-0.06,0.02)	Not Significant (P-value>.05)
Smith,A.J., 2008	Moderate Quality	Reoperation-Reoperation (reoperation for any reason)	4 years	Resurfacing( )	72	6.94%	No Resurfacing (Control) ( )	86	5.81%	RR	1.18(0.35,3.91)	Not Significant (P-value>.05)
Waters,T.S., 2003	Moderate Quality	Reoperation-Reoperation (reoperation due to anterior knee pain)	5.3 years	Resurfacing( )	243	1.23%	No Resurfacing (Control) ( )	231	4.76%	RR	0.26(0.07,0.92)	**Treatment 1 Significant (P-value<.05)**

TABLE 74: PATELLAR RESURFACING VERSUS NO PATELLAR RESURFACING: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Campbell,D.G., 2006	Moderate Quality	Womac-stiffness averaged VAS Version (0-100) ( )	8 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Campbell,D.G., 2006	Moderate Quality	Womac-stiffness averaged VAS Version (0-100) ( )	10 years	Resurfacing( )	.	. %	No Resurfacing (Control) ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

BONE CEMENT

Overall recommendation language: A range of evidence (Strong, Moderate, and Limited Quality, based on component) examining component fixation supports the use of cemented or cementless fixation in knee arthroplasty due to similar functional outcomes and rates of complications and reoperations.

CEMENTED TIBIAL COMPONENTS VERSUS CEMENTLESS TIBIAL COMPONENTS

Strong evidence supports the use of tibial component fixation that is cemented or cementless in total knee arthroplasty due to similar functional outcomes and rates of complications and reoperations.

Strength of Recommendation: Strong Evidence 

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

CEMENTED FEMORAL & TIBIAL COMPONENTS VERSUS CEMENTLESS FEMORAL & TIBIAL COMPONENTS

Moderate evidence supports the use of either cemented femoral and tibial components or cementless femoral and tibial components in knee arthroplasty due to similar rates of complications and reoperations.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

ALL CEMENTED COMPONENTS VERSUS HYBRID FIXATION (CEMENTLESS FEMORAL COMPONENT)

Moderate evidence supports the use of either cementing all components or hybrid fixation (cementless femur) in total knee arthroplasty due to similar functional outcomes and rates of complications and reoperations.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

ALL CEMENTLESS COMPONENTS VERSUS HYBRID FIXATION (CEMENTLESS FEMORAL COMPONENT)

Limited evidence supports the use of either all cementless components or hybrid fixation (cementless femur) in total knee arthroplasty due to similar rates of complications and reoperations.

Strength of Recommendation: Limited Evidence 

* *See Appendix XIII for details regarding support*

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALE

There were five high (Lizaur-Utrilla 2014, Kim 2014, Beaupre 2007, Demey 2011, Fernandez-Fairen 2013) and seven moderate quality (Park 2011, Khaw 2002, Carlsson 2005, Baker 2007, Pandit 2013, Parker 2001, Pulido 2015) studies evaluating the use of various combinations of cemented versus cementless component (tibia, femur, patella) fixation in knee arthroplasty.

The overall body of evidence was notable for heterogeneity in study design and comparative study groups (including cementless, hybrid, and cemented fixation). Nevertheless, across comparative groups, no major differences existed between cemented and cementless fixation with respect to rates of complications and re-operations, including studies with longer follow up (Khaw 2002, Baker 2007, Kim 2014).

Only small differences were seen with respect to outcome measures, depending on the particular study comparative groups, length of follow up, and scoring instruments. Lizaur-Utrilla found no significant differences in WOMAC scores at follow-up time points of two years or less when comparing cemented and cementless tibial fixation (with cementless femoral fixation and selective patellar resurfacing in both arms). WOMAC scores were significantly better in the uncemented (porous) tibial group (-5[-9.49,-0.51]) at final follow up (average 7 years), but this difference was not clinically significant. Knee Society function scores were significantly better in the uncemented tibial group only at the 2 year follow up (-4[-7.62,-0.38]). Knee Society pain scores were significantly better at 2 years (-3 [-5.58, -0.42]) and at final follow up (-3 [-5.68, -0.32]), but not at 6 months or one year. In a study comparing cemented and cementless tibial fixation (with cementless femoral fixation and selective patellar resurfacing in both arms), Beaupré reported that WOMAC pain and RAND SF-36 bodily pain scores were significantly worse in the group with cementless hydroxyapatite-coated tibial components (9.1[2.79,15.41] versus 18.1[9.66,26.54] for cemented fixation)at 6 months. The differences in pain did not remain statistically significant at 1 or 5 years post-operatively. Fernandez-Fairen found that WOMAC scores were worse in the cemented tibial fixation group compared to scores in the cementless tibial fixation group (cementless femoral fixation and no patellar resurfacing in both arms), with a difference of 4 points (CI 0.13, 7.87) that was not clinically significant. When comparing non-modular cemented tibial components with non-modular cementless porous tibial components, Pulido demonstrated more improvement in Knee Society pain scores (5 [0.08, 9.92]) in the cemented tibial group, but this difference was not clinically significant. In a study of unicompartmental knee arthroplasty patients implanted with either cemented or cementless femoral/tibial fixation, Pandit reported significantly worse Knee Society function scores at 5 years (-12.2[-20.26,-4.14]), but not at 1 or 2 years, for the cemented group. Tegner Activity Scores in the cemented group were significantly worse at 2 years (-0.6[-1.10,-0.10]), but not at 1 or 5 years.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no known harms associated with implementing this recommendation. The decision to use cementless versus cementless fixation may be influenced by particular patient situations. The practitioner should be aware of the advantages and disadvantages of particular treatments

methods. For example, intra-operative fracture during component insertion or failure of ingrowth may be of concern with certain cementless designs in patients with poor bone quality.

FUTURE RESEARCH

Continued comparative studies between modern cemented and cementless component fixation options in knee arthroplasty will help to further define the utility of these component types, durability of fixation, and effect of evolving component designs (e.g. modular and monolithic) on patient-reported outcomes. Certainly, newer fixation materials (e.g. porous metals) should be evaluated in long-term follow-up. Identifying patient-specific factors that may inform the decision to utilize a particular fixation technique, or to avoid complications associated with particular fixation strategies, is important. Registry data and long-term studies (greater than ten years clinical follow up) should inform durability of particular components and may serve to analyze implant-specific complications and revision risk. Given some variability in the reported patient-reported outcome measures between treatment groups in particular high-quality studies, more clinical data may discern subtle differences in clinical outcomes based on the use of cemented or cementless component fixation. Issues of cost and cost-effectiveness should be incorporated into future clinical studies.

RESULTS

** See Appendix XIII for details regarding support*

SUMMARY OF FINDINGS TABLE 11: PART 1 TIBIAL COMPONENT CEMENTING

	High Quality			Moderate Quality	
• Favors Cemented Tibial Component • Favors Cementless Tibial Component	Beaupré,L.A., 2007	Fernandez-Fairen,M., 2013	Lizaur-Utrilla,A., 2014	Carlsson,A., 2005	Pulido,L, 2014
Complications					
Blood Loss		○			
Transfusion		○			
total complications		○			○
DVT		○			○
post-op stiffness		○			
Infections		○			○
Post-op patellar pain		○			
post-op femoral loosening					○
post-op tibial loosening					○
post-op instability					○
Wound drainage or delayed healing					○
Arthrofibrosis					○
Patellar crepitus and Clunk syndrome					○
Contained hematoma					○
Deep periprosthetic joint infection					○
Femoral aseptic loosening					○
Femoral periprosthetic fracture					○
Patella periprosthetic fracture					○
pulmonary embolism					○
myocardial infarction					○
atrial fibrillation					○
GI bleed					○
progressive loosening	○				
post-op complications	○				
post-op femoral fracture					○
Composite					
WOMAC-overall		●	●		
RAND short form 36(all other subscales besides pain and function)	○				
Function					
Knee Society Score-Function			●	○	○
WOMAC-function	○				
RAND short form 36-physical function	○				
length of stay					
length of stay		○			
Pain					
Knee Society Score-Pain			●		◉
WOMAC-Pain	◉				
RAND short form 36-bodily pain	◉				
Reoperation					
reoperation		○	○		

SUMMARY OF FINDINGS TABLE 12: PART 2 CEMENTED FEMORAL AND TIBIAL COMPONENTS

Summary of Findings	High Quality	Moderate Quality			
● Favors Cemented Femoral and Tibial Components ● Favors Cementless Femoral and Tibial Components ○ Not Significant	Kim,Y.H., 2014	Baker,P.N., 2007	Khaw,F.M., 2002	Park,J.W., 2011	Pandit,H., 2013 (UKA study)
Complications					
Deep Infection	○				
Composite					
WOMAC-overall	○			○	
Function					
Knee Society Score-Function				○	●
Tenger Activity Scale					●
Mortality					
Mortality					○
Reoperation					
reoperation	○	○	○	○	

SUMMARY OF FINDINGS TABLE 13: PART 3 ALL COMPONENT CEMENTED VERSUS HYBRID (CEMENTLESS FEMORAL)

	High Quality	Low Quality	
● **Favors Cementing Every Component** ● **Favors Hybrid Fixation (Cementelss Femoral Component)** ○ **Not Significant**	**Demey,G., 2011**	**Iosifidis,M., 2014**	**Khatod,M., 2013**
Complications			
aseptic loosening	○		
ligamentous laxity	○		
pain due to intra-articular cement fragment	○		
vascular ischemia secondary to popliteal thrombosis	○		
Deep Infection	○		
Composite			
KOOS-Total Score		○	
Function			
KOOS-Function		○	
International Knee Society-Function	○		
Mortality			
		○	
Pain			
KOOS Pain		○	
quality of life			
KOOS-Quality Of Life		○	
Reoperation			
reoperation		○	○
Symptoms			
symptoms		○	

SUMMARY OF FINDINGS TABLE 14: PART 4-HYBRID (CEMENTLESS FEMORAL) VERSUS ALL CEMENTLESS COMPONENTS

	Moderate Quality
	Parker, D.A., 2001
● **Favors Hybrid Fixation (Cementelss Femoral Component)**	
● **Favors All Cementless Components**	
○ **Not Significant**	
Complications	
Infection causing revision	○
Reoperation	
Reoperation	○

QUALITY EVALUATION TABLE 7: BONE CEMENT

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Khatod,M., 2013	○	◑	●	●	●	○	Include	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Baker,P.N., 2007	○	○	◑	●	●	●	Include	Moderate Quality
Beaupré,L.A., 2007	●	●	●	●	●	●	Include	High Quality
Carlsson,A., 2005	◑	◑	○	●	●	○	Include	Moderate Quality
Demey,G., 2011	●	●	○	●	●	●	Include	High Quality
Fernandez-Fairen,M., 2013	●	●	●	●	●	●	Include	High Quality
Iosifidis,M., 2014	○	○	◑	◑	◑	◑	Include	Low Quality
Khaw,F.M., 2002	○	○	◑	●	●	○	Include	Moderate Quality
Kim,Y.H., 2014	●	●	◑	●	◑	●	Include	High Quality
Lizaur-Utrilla,A., 2014	●	●	●	●	●	●	Include	High Quality
Pandit,H., 2013	○	●	●	●	●	○	Include	Moderate Quality
Park,J.W., 2011	●	◑	◑	●	○	●	Include	Moderate Quality
Parker, D.A., 2001	◑	◑	◑	○	○	●	Include	Moderate Quality

DETAILED DATA TABLES

TABLE 75 PART 1 TIBIAL COMPONENTS CEMENTED VERSUS TIBIAL COMPONENTS UNCEMENTED

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2 (SD2)	Effect Measure	Result (95%CI)	Statistical Significance
Carlsson,A., 2005	Moderate Quality	Knee Society Score-Function-Function ( )	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial component)	53	. %	Uncemented Arthroplasty (TKA with uncemented porous or hydroxyapatite-coated tibial comonent)	57	. %	Author Reported	NA	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	Womac-overall-Composite averaged VAS version (0-100)()	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	63	63(19.1)	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	69	69(15.1)	Mean Difference	4(0.13,7.87)	Treatment 2 Significant (P-value<.05)
Fernandez-Fairen,M., 2013	High Quality	Blood Loss - Complications (cc)	post op	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	63	71(889)	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	73	73(908)	Mean Difference	-19(-63.76,25.76)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Fernandez-Fairen,M., 2013	High Quality	Blood transfusion %()	post op	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	71	85%	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	73	78%	RR	1.08(0.92,1.27)	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	Length Of Recovery-Length Of Stay(days)	during hospital stay	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	71	71(3.2)	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	73	73(3.2)	Mean Difference	0(-0.2,0.2)	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	complications other(total complications)	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	64	17%	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	71	13%	RR	.74(.60,3.06)	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	Deep venous thrombosis()	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with	64	3%	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	71	3%	RR	1.11(0.16,7.65)	Not Significant (P-value>.05)

				no resurfacing)								
Fernandez-Fairen,M., 2013	High Quality	complications other(post op stiffness)	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	64	11%	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	71	8%	RR	1.29(0.46,3.65)	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	Infection-Complications()	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	64	2%	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	71	0%	RD	0.02(-0.01,0.05)	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	complications other(patellar pain)	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and cemented tibial with no resurfacing)	64	2%	Uncemented Arthroplasty(porous. all components uncemented with no resurfacing)	71	1%	RR	1.11(0.07,17.37)	Not Significant (P-value>.05)
Fernandez-Fairen,M., 2013	High Quality	Reoperation(for patellar pain,infection, or postop stiffness)	5 years	Hybrid(Partially) Cemented Arthroplasty(uncemented femoral and	64	14%	Uncemented Arthroplasty(porous. all components uncemented	71	10%	RR	1.43(0.56,3.61)	Not Significant (P-value>.05)

				cemented tibial with no resurfacing)			with no resurfacing)					
Pulido,L,. 2014	Moderate Quality	Change in Knee Society Pain	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	41(19)	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	36(18)	Mean Difference	5 (0.08, 9.92)	Favors Group 1
Pulido,L,. 2014	Moderate Quality	Change in Knee Society Function	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	19(23)	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	18(23)	Mean Difference	1 (-5.1, 7.1)	NS
Pulido,L,. 2014	Moderate Quality	Complications(femoral fracture)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0%	rd	0 (0, 0)	NS
Pulido,L,. 2014	Moderate Quality	Complications(femoral loosening)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0%	rd	0 (0, 0)	NS

Pulido,L,. 2014	Moderate Quality	Complications(tibial loosening)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0%	rd	0 (0, 0)	NS
Pulido,L,. 2014	Moderate Quality	Complications(instability)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	3.48%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rr	3.69 (0.42, 32.47)	NS
Pulido,L,. 2014	Moderate Quality	Complications(infection)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	1.74%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	1.89%	rr	0.92 (0.13, 6.43)	NS
Pulido,L,. 2014	Moderate Quality	Complications(total complications)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	3.48%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	2.83%	rr	1.23 (0.28, 5.36)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Wound drainage or delayed healing)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all	115	6.96%	Conventional Bone Cement (Without Antibiotics) (all but	106	4.72%	rr	1.47 (0.5, 4.37)	NS

				components cemented)			tibial components cemented)					
Pulido,L,. 2014	Moderate Quality	Complications(Arthrofibrosis)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	4.35%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	4.72%	rr	0.92 (0.27, 3.09)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Patellar crepitus and Clunk syndrome)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rd	-0.011 (-0.03, 0.01)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Contained hematoma)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	2.61%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	1.89%	rr	1.38 (0.24, 8.11)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Deep periprosthetic joint infection)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	1.74%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	1.89%	rr	0.92 (0.13, 6.43)	NS

Pulido,L,. 2014	Moderate Quality	Complications(Femoral aseptic loosening)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0%	rd	0 (0, 0)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Tibial loosening)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0%	rd	0 (0, 0)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Instability)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	3.48%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rr	3.69 (0.42, 32.47)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Femoral periprosthetic fracture)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0.87%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0%	rd	0.011 (-0.01, 0.03)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Patella periprosthetic fracture)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all	115	0%	Conventional Bone Cement (Without Antibiotics) (all but	106	0%	rd	0 (0, 0)	NS

				components cemented)			tibial components cemented)					
Pulido,L,. 2014	Moderate Quality	Complications(Deep vein thrombosis)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	6.96%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	4.72%	rr	1.47 (0.5, 4.37)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Pulmonary embolism)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	2.61%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rr	2.77 (0.29, 26.18)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Myocardial infarction)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rd	-0.011 (-0.03, 0.01)	NS
Pulido,L,. 2014	Moderate Quality	Complications(Atrial fibrillation)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0.87%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rr	0.92 (0.06, 14.55)	NS

Pulido,L,. 2014	Moderate Quality	Complications(Gastrointestinal bleeding)	Minimum of 2 year follow up	Conventional Bone Cement (Without Antibiotics) (all components cemented)	115	0%	Conventional Bone Cement (Without Antibiotics) (all but tibial components cemented)	106	0.94%	rd	-0.011 (-0.03, 0.01)	NS
Beaupré,L.A., 2007	High Quality	Loosening-Complications (progressive loosening)	5 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	7.32%	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	2.56%	RR	2.85(0.31,26.28)	Not Significant (P-value>.05)
Beaupré,L.A., 2007	High Quality	complications other (postoperative or after discharge)	Post-Op	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	0.00%	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)

Beaupré,L.A., 2007	High Quality	RAND short form 36(all other subscales besides pain and function)	5 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	.	. %	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Womac-overall-Composite averaged VAS version (0-100) ( )	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar compoents when resurfacing was deemed necessary)	48	78(16.40)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	80(17.10)	Mean Difference	-2(-8.82,4.82)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Womac-overall-Composite averaged VAS version (0-100) ( )	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components	48	76(23.80)	Uncemented Arthroplasty (TKA with uncemented porous tibial components	45	82(20.20)	Mean Difference	-6(-14.95,2.95)	Not Significant (P-value>.05)

				and cemented patellar compoents when resurfacing was deemed necessary)			and cemented patellar compoents when resurfacing was deemed necessary)					
Lizaur-Utrilla,A., 2014	High Quality	Womac-overall-Composite averaged VAS version (0-100) ( )	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar compoents when resurfacing was deemed necessary)	48	82(13.10)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	86(12.10)	Mean Difference	-4(-9.12,1.12)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Womac-overall-Composite averaged VAS version (0-100) ( )	7 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar compoents when resurfacing was deemed necessary)	48	83(11.40)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	88(10.70)	Mean Difference	-5(-9.49,-0.51)	Treatment 2 Significant (P-value<.05)

Beaupré,L.A., 2007	High Quality	Womac-function averaged VAS Version (0-100) (raw scores)	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	73.4(13.20)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	71.3(13.00)	Mean Difference	2.1(-3.64,7.84)	Not Significant (P-value>.05)
Beaupré,L.A., 2007	High Quality	Womac-function averaged VAS Version (0-100) (raw scores)	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	71.7(19.60)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	74.7(18.90)	Mean Difference	-3(-11.44,5.44)	Not Significant (P-value>.05)
Beaupré,L.A., 2007	High Quality	Womac-function averaged VAS Version (0-100) (raw scores)	5 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and	41	76(18.00)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component	39	74.6(22.80)	Mean Difference	1.4(-7.63,10.43)	Not Significant (P-value>.05)

				cemented patellar component when resurfacing was deemed necessary.)			and cemented pattellar component when resurfacing was deemed necessary)					
Beaupré,L.A., 2007	High Quality	RAND short form 36-physical function (raw score)	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	50.4(19.50)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	41.8(26.50)	Mean Difference	8.6(-1.64,18.84)	Not Significant (P-value>.05)
Beaupré,L.A., 2007	High Quality	RAND short form 36-physical function (raw score)	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	58(25.60)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	48.6(24.10)	Mean Difference	9.4(-1.49,20.29)	Not Significant (P-value>.05)

Beaupré,L.A., 2007	High Quality	RAND short form 36-physical function (raw score)	5 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	53.04(25.70)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	56.5(27.90)	Mean Difference	-3.46(-15.23,8.31)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score-Function( )	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar components when resurfacing was deemed necessary)	48	87(10.40)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	89(10.20)	Mean Difference	-2(-6.19,2.19)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score-Function( )	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components	48	86(11.20)	Uncemented Arthroplasty (TKA with uncemented porous tibial components	45	89(9.80)	Mean Difference	-3(-7.27,1.27)	Not Significant (P-value>.05)

				and cemented patellar components when resurfacing was deemed necessary)			and cemented patellar compoents when resurfacing was deemed necessary)					
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score-Function( )	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar components when resurfacing was deemed necessary)	48	87(9.60)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	91(8.20)	Mean Difference	-4(-7.62,-0.38)	Treatment 2 Significant (P-value<.05)
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score-Function( )	7 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar components when resurfacing was deemed necessary)	48	86(10.70)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	89(9.90)	Mean Difference	-3(-7.19,1.19)	Not Significant (P-value>.05)

Beaupré,L.A., 2007	High Quality	Womac-Pain averaged VAS Version (0-100) ( )	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	81.3(14.50)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	72.2(14.30)	Mean Difference	9.1(2.79,15.41)	Treatment 1 Significant (P-value<.05)
Beaupré,L.A., 2007	High Quality	Womac-Pain averaged VAS Version (0-100) ( )	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	79.7(21.90)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	81.5(15.50)	Mean Difference	-1.8(-10.09,6.49)	Not Significant (P-value>.05)
Beaupré,L.A., 2007	High Quality	Womac-Pain averaged VAS Version (0-100) ( )	5 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and	41	80.6(17.50)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component	39	79(21.70)	Mean Difference	1.6(-7.06,10.26)	Not Significant (P-value>.05)

				cemented patellar component when resurfacing was deemed necessary.)			and cemented pattellar component when resurfacing was deemed necessary)					
BeauprÃ,L.A., 2007	High Quality	RAND short form 36-bodily pain (raw scores)	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	63(19.40)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	44.9(19.10)	Mean Difference	18.1(9.66,26.54)	Treatment 1 Significant (P-value<.05)
BeauprÃ,L.A., 2007	High Quality	RAND short form 36-bodily pain (raw scores)	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	64.1(26.50)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	58.7(22.40)	Mean Difference	5.4(-5.33,16.13)	Not Significant (P-value>.05)

BeauprÃ,L.A., 2007	High Quality	RAND short form 36-bodily pain (raw scores)	5 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial fixation and cemented patellar component when resurfacing was deemed necessary.)	41	56.1(29.70)	Uncemented Arthroplasty (TKA with hydroxyapatite-coated tibial component and cemented pattellar component when resurfacing was deemed necessary)	39	59.5(27.90)	Mean Difference	-3.4(-16.02,9.22)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score- Pain ( )	6 months	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar components when resurfacing was deemed necessary)	48	45(5.80)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	45(5.3)	Mean Difference	0 (-2.29, 2.29)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score- Pain ( )	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components	48	45(6.10)	Uncemented Arthroplasty (TKA with uncemented porous tibial components	45	47(5.6)	Mean Difference	-2 (-4.42, 0.42)	Not Significant (P-value>.05)

				and cemented patellar components when resurfacing was deemed necessary)			and cemented patellar compoents when resurfacing was deemed necessary)					
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score- Pain ( )	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar components when resurfacing was deemed necessary)	48	45(6.90)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	48(5.5)	Mean Difference	-3 (-5.58, -0.42)	Treatment 2 Significant (P-value<.05)
Lizaur-Utrilla,A., 2014	High Quality	Knee Society Score- Pain ( )	7 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar compoents when resurfacing was deemed necessary)	48	44(8.10)	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	47(4.2)	Mean Difference	-3 (-5.68, -0.32)	Treatment 2 Significant (P-value<.05)

Lizaur-Utrilla,A., 2014	High Quality	Reoperation-Reoperation (revision)	9 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar compoents when resurfacing was deemed necessary)	48	10.42%	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	2.22%	RR	4.69(0.57,38.59)	Not Significant (P-value>.05)
Lizaur-Utrilla,A., 2014	High Quality	Reoperation-Reoperation (reoperation for any reason)	9 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial components and cemented patellar compoents when resurfacing was deemed necessary)	48	12.50%	Uncemented Arthroplasty (TKA with uncemented porous tibial components and cemented patellar compoents when resurfacing was deemed necessary)	45	4.44%	RR	2.81(0.60,13.22)	Not Significant (P-value>.05)

TABLE 76 PART 2 FEMORAL AND TIBIAL COMPONENTS CEMENTED VERSUS FEMORAL AND TIBIAL COMPONENTS UNCEMENTED

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2 (SD2)	Effect Measure	Result (95%CI)	Statistical Significance
Pandit,H., 2013	Moderate Quality	Knee Society Score-Function( )	1 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	31	87.5(16.00)	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	27	90.5(11.70)	Mean Difference	-3(-10.16,4.16)	Not Significant (P-value>.05)
Pandit,H., 2013	Moderate Quality	Knee Society Score-Function( )	2 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	31	86.6(14.50)	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	27	91.5(12.90)	Mean Difference	-4.9(-11.95,2.15)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Pandit,H., 2013	Moderate Quality	Knee Society Score-Function( )	5 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	31	79.8(18.40)	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	27	92(12.70)	Mean Difference	-12.2(-20.26,-4.14)	Treatment 2 Significant (P-value<.05)
Pandit,H., 2013	Moderate Quality	Tenger Activity Scale( )	1 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	31	2.9(0.90)	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	27	3.1(1.10)	Mean Difference	-0.2(-0.72,0.32)	Not Significant (P-value>.05)
Pandit,H., 2013	Moderate Quality	Tenger Activity Scale( )	2 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with	31	2.5(0.80)	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial	27	3.1(1.10)	Mean Difference	-0.6(-1.10,-0.10)	Treatment 2 Significant (P-value<.05)

				cemented tibial and femoral components)			components (both filled with porous titanium and coated with hydroxyapatite))					
Pandit,H., 2013	Moderate Quality	Tenger Activity Scale( )	5 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	31	2.6(0.80)	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	27	2.9(0.60)	Mean Difference	-0.3(-0.66,0.06)	Not Significant (P-value>.05)
Pandit,H., 2013	Moderate Quality	Mortality( )	6 months	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	33	3.03%	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	30	0.00%	RD	0.03(-0.03,0.09)	Not Significant (P-value>.05)

Pandit,H., 2013	Moderate Quality	Mortality( )	5 years	Conventional Bone Cement (Without Antibiotics) (unicompartmental arthroplasty with cemented tibial and femoral components)	33	6.06%	Uncemented Arthroplasty (unicompartmental uncemented femoral and tibial components (both filled with porous titanium and coated with hydroxyapatite))	33	6.06%	RR	1.00(0.15,6.68)	Not Significant (P-value>.05)
Baker,P.N., 2007	Moderate Quality	Reoperation - Reoperation (revision)	15 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral and tibial components)	277	8.66%	Uncemented Arthroplasty (TKA with uncemented porous coated)	224	8.93%	Author Reported	0.97 (0.55, 1.71)	Not Significant (P-value>.05)
Baker,P.N., 2007	Moderate Quality	Reoperation - Reoperation (reoperation for any reason)	15 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral and tibial components)	277	9.75%	Uncemented Arthroplasty (TKA with uncemented porous coated)	224	12.05%	Author Reported	0.81(0.49,1.34)	Not Significant (P-value>.05)
Khaw,F.M., 2002	Moderate Quality	Reoperation -	10 years	Conventional Bone Cement	277	. %	Uncemented Arthroplast	224	. %	Author Reported Hazard Ratio	.97(.36,2.6)	Not Significant (P-value>.05)

		Reoperation (revision)		(Without Antibiotics) (TKA with cemented femoral and tibial components)			y (TKA with uncemented porous coated)					
Park,J.W., 2011	Moderate Quality	Knee Society Score-Function-Function ()	13.6 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral tibial and patellar components)	50	. %	Uncemented Arthroplasty (TKA with cemented patellar components only uncemented tibial and patellar components)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Park,J.W., 2011	Moderate Quality	Womac-overall-Composite averaged VAS version (0-100) ( )	13.6 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral tibial and patellar components)	50	. %	Uncemented Arthroplasty (TKA with cemented patellar components only uncemented tibial and patellar components)	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Park,J.W., 2011	Moderate Quality	Reoperation - Reoperation (revision)	1 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented	50	0.00%	Uncemented Arthroplasty (TKA with cemented patellar	50	2.00%	RR/RD	-0.02(-0.06,0.02)	Not Significant (P-value>.05)

				femoral tibial and patellar components)			components only uncemented tibial and patellar components)					
Kim,Y.H., 2014	High Quality	Womac-overall-Composite Likert (0-96) ( )	16 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial, femoral and patellar component)	80	. %	Uncemented Arthroplasty (TKA with cemented patellar component only and uncemented tibial and femoral)	80	. %	Author Reported	NA	Not Significant (P-value>.05)
Kim,Y.H., 2014	High Quality	Infection-Complications (deep)	Post-Op	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial, femoral and patellar component)	80	1.25%	Uncemented Arthroplasty (TKA with cemented patellar component only and uncemented tibial and femoral)	80	1.25%	RR/RD	1.00(0.06,15.71)	Not Significant (P-value>.05)
Kim,Y.H., 2014	High Quality	Reoperation - Reoperation (revision)	17 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial, femoral and patellar component)	80	0.00%	Uncemented Arthroplasty (TKA with cemented patellar component only and uncemented	80	1.25%	RR/RD	-0.01(-0.04,0.01)	Not Significant (P-value>.05)

							tibial and femoral)					

TABLE 77 PART 3 ALL REPLACED COMPONENTS VERSUS ALL BUT FEMORAL COMPONENTS REPLACED (HYBRID)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2 (SD2)	Effect Measure	Result (95%CI)	Statistical Significance
Demey,G., 2011	High Quality	Loosening-Complications (aseptic loosening)	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral, tibial and patellar components)	61	1.64%	Hybrid(Partially) Cemented Arthroplasty (TKA with Hydroxyapatite (HA)-coated femoral and patellar component and cemented tibial component)	60	0.00%	RD	0.02(-0.02,0.05)	Not Significant (P-value>.05)
Demey,G., 2011	High Quality	complications other (ligamentous laxity)	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral, tibial and	61	1.64%	Hybrid(Partially) Cemented Arthroplasty (TKA with Hydroxyapatite (HA)-coated	60	0.00%	RD	0.02(-0.02,0.05)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

				patellar components)			femoral and patellar component and cemented tibial component)					
Demey,G., 2011	High Quality	complications other (pain due to intra-articular cement fragment)	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral, tibial and patellar components)	61	1.64%	Hybrid(Partially) Cemented Arthroplasty (TKA with Hydroxyapatite (HA)-coated femoral and patellar component and cemented tibial component)	60	0.00%	RD	0.02(-0.02,0.05)	Not Significant (P-value>.05)
Demey,G., 2011	High Quality	complications other (vascular ischemia secondary to popliteal	Post-Op	Conventional Bone Cement (Without Antibiotics) (TKA with cemented	61	0.00%	Hybrid(Partially) Cemented Arthroplasty (TKA with Hydroxyapatite	60	1.67%	RD	-0.02(-0.05,0.02)	Not Significant (P-value>.05)

		thrombosis)		femoral, tibial and patellar components)			(HA)-coated femoral and patellar component and cemented tibial component)					
Demey,G., 2011	High Quality	Infection-Complications (deep infection)	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral, tibial and patellar components)	61	0.00%	Hybrid(Partially) Cemented Arthroplasty (TKA with Hydroxyapatite (HA)-coated femoral and patellar component and cemented tibial component)	60	1.67%	RD	-0.02(-0.05,0.02)	Not Significant (P-value>.05)
Iosifidis,M., 2014	Low Quality	KOOS-Total Score-Composite( )	10 years	Conventional Bone Cement (Without Antibiotics) (TKA	45	77.8(17.50)	Hybrid(Partially) Cemented Arthroplasty (TKA with	37	77.2(20.40)	Mean Difference	0.6(-7.73,8.93)	Not Significant (P-value>.05)

				with cemented tibial and femoral components)			cemented tibial component and uncemented femoral components)					
Demey,G., 2011	High Quality	Knee Society Score-Function-Function (international knee society)	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral, tibial and patellar components)	61	93(16.00)	Hybrid (Partially) Cemented Arthroplasty (TKA with Hydroxyapatite (HA)-coated femoral and patellar component and cemented tibial component)	60	92(16.00)	Mean Difference	1(-4.70,6.70)	Not Significant (P-value>.05)
Iosifidis,M., 2014	Low Quality	Mortality-Mortality( )	10 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented	51	9.80%	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial	41	4.88%	RR	2.01(0.41,9.83)	Not Significant (P-value>.05)

				tibial and femoral components)			component and uncemented femoral components)					
Iosifidis,M., 2014	Low Quality	KOOS Pain- Pain ( )	10 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial and femoral components)	45	81.5(21.10)	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial component and uncemented femoral components)	37	82.3(20.40)	Mean Difference	-0.8(-9.81,8.21)	Not Significant (P-value>.05)
Iosifidis,M., 2014	Low Quality	KOOS-Quality Of Life-Quality Of Life( )	10 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial and femoral components)	45	70(28.90)	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial component and uncemented femoral	37	68.3(29.30)	Mean Difference	1.7(-10.97,14.37)	Not Significant (P-value>.05)

							components)					
Iosifidis,M., 2014	Low Quality	Reoperation-Reoperation (revision)	10 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial and femoral components)	51	1.96%	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial component and uncemented femoral components)	41	4.88%	RR	0.40(0.04,4.28)	Not Significant (P-value>.05)
Khatod,M., 2013	Low Quality	Reoperation-Reoperation (revision)	2 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented femoral and tibial components)	32387	. %	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial component and uncemented femoral components)	2213	. %	Author Reported Hazard Ratio	1.02(.68,1.53)	Not Significant (P-value>.05)
Iosifidis,M., 2014	Low Quality	KOOS-Symptom	10 years	Conventional Bone Cement	45	88.1(15.10)	Hybrid(Partially) Cemented	37	86.1(16.40)	Mean Difference	2(-4.88,8.88)	Not Significant

		s- Other ( )		(Without Antibiotics) (TKA with cemented tibial and femoral components)			Arthroplasty (TKA with cemented tibial component and uncemented femoral components)					(P-value>.05)
Iosifidis,M., 2014	Low Quality	KOOS-Function in daily living ( )	10 years	Conventional Bone Cement (Without Antibiotics) (TKA with cemented tibial and femoral components)	45	71.6(17.5)	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial component and uncemented femoral components)	37	72(22.2)	Mean Difference	-.4(-9.12,8.32)	Not Significant (P-value>.05)

TABLE 78 PART 4 ALL BUT FEMORAL COMPONENTS CEMENTED (HYBRID) VERSUS ALL COMPONENTS UNCEMENTED

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2 (SD2)	Effect Measure	Result (95%CI)	Statistical Significance
Parker, D.A., 2001	Moderate Quality	Reoperation - Reoperation (revision)	14 years	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial and patelar fixation)	48	33.33%	Uncemented Arthroplasty (TKA with uncemented porous fixation)	52	44.23%	RR	0.75(0.46,1.25)	Not Significant (P-value>.05)
Parker, D.A., 2001	Moderate Quality	Infection-Complications (revision due to infection)	14 years	Hybrid(Partially) Cemented Arthroplasty (TKA with cemented tibial and patelar fixation)	48	4.17%	Uncemented Arthroplasty (TKA with uncemented porous fixation)	52	3.85%	RR	1.08(0.16,7.39)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

BILATERAL TKA

Limited evidence supports simultaneous bilateral total knee arthroplasty for patients aged 70 or younger or ASA status 1-2, because there are no increased complications.

Strength of Recommendation: Limited Evidence ★★☆☆

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALE

There is one low quality retrospective comparative study (Yoon 2010) evaluating systemic complications in consecutive patients who had bilateral simultaneous total knee arthroplasty that met criteria for inclusion. They found equivalent complications among patients who were not elderly (defined as less than 71 years old) or not high risk (defined as ASA 1 and 2). Analysis showed patients aged 71 and older or ASA 3-4 were at higher risk of having systemic complications.

More data was not available for inclusion because many of the relevant studies included a mixture of patients with osteoarthritis and rheumatoid arthritis and the outcomes data was not split out.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Given the potential for serious perioperative mortality, further discussion is included here. Retrospective reviews of the Swedish Knee Arthoplasty Register (Stefansdottir 2008) revealed higher 30-day mortality if bilateral knee arthoplasties were done at the same time versus staged within a year. Multiple retrospective reviews (Meehan 2011, Memtsoudis 2011, and Health Quality Ontario 2013) showed adverse cardiovascular outcomes in patients with simultaneous bilateral knee arthroplasties. Memtsoudis 2011 helped define the higher risk patient by showing that patients who suffered a major complication had a higher prevalence of comorbidities including, specifically, chronic lung diseases, congestive heart failure and pulmonary hypertension.

FUTURE RESEARCH

Continued comparative multicenter prospective studies between simultaneous bilateral or staged bilateral total knee arthroplasty may further clarify the cohort of patients for whom simultaneous bilateral total knee arthroplasty is high-risk. It is also recommended that future research focus on osteoarthritis versus inflammatory arthropathies, and if mixed patient populations are utilized, the results are segregated in the literature.

The ASA physical status classification system was devised by the American Society of Anesthesiologists (ASA) to assess a patient's physical status prior to surgical intervention. In addition to ASA status, future research may include a more robust risk stratification to identify high-risk patients.

** See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 15: SIMULTANEOUS BI-LATERAL KNEE ARTHROPLASTY VERSUS STAGED KNEE ARTHROPLASTY

Summary of Findings	Low Quality Yoon,H.S., 2010
Complications	
VTE- Complications	○
Complications - overall	○
Systemic complications (ASA grade 3 or 4)	●
Systemic complications (ASA grade 1 or 2)	○
Systemic complications - overall	○
Mortality	
Mortality- Mortality	○

QUALITY EVALUATION TABLE 8: SIMULTANEOUS BI-LATERAL KNEE ARTHROPLASTY

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Yoon,H.S., 2010	○	●	●	●	●	○	Include	Low Quality

DETAILED DATA TABLES

TABLE 79: SIMULTANEOUS BI-LATERAL KNEE ARTHROPLASTY VERSUS STAGED KNEE ARTHROPLASTY: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Yoon,H.S., 2010	Low Quality	complications other (hypovolemic shock)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	0.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	119	0.84%	RD	-0.01(-0.02,0.01)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	complications other (pnemonia)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	0.84%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	119	0.00%	RD	0.01(-0.01,0.02)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	complications other (confusion)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	1.68%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	119	0.00%	RD	0.02(-0.01,0.04)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	complications other (acute renal failure)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	.84%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	119	0.00%	RD	0.008(-.015,.031)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	complications other (uremic encephalitis)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	50	2.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee	119	0.00%	RD	0.02(-0.02,0.06)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
							Within 6 Months( )					
Yoon,H.S., 2010	Low Quality	complications other (ICU care)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	0.84%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	119	0.00%	RD	0.01(-0.01,0.02)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	complications other (systemic complications among patients with ASA grade of 3 or 4)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	30	20.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	35	0.00%	RD	0.20(0.06,0.34)	**Treatment 2 Significant (P-value<.05)**
Yoon,H.S., 2010	Low Quality	complications other (systemic complications among patients with ASA grade of 1 or 2)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	89	0.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	84	1.19%	RD	-0.01(-0.04,0.01)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	complications other (systemic complications overall)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	89	5.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	84	.84%	RR	6(.73, 49.08)	Not Significant (P-value>.05)
Yoon,H.S., 2010	Low Quality	VTE- Complications (Thromboembolitic disease)	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	0.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	119	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)

TABLE 80: SIMULTANEOUS BI-LATERAL KNEE ARTHROPLASTY VERSUS STAGED KNEE ARTHROPLASTY: MORTALITY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Yoon,H.S., 2010	Low Quality	Mortality - Mortality ( )	Peri-Op	Simultaneous Bilateral Total Knee Arthroplasty (Tka) ( )	119	0.00%	Staged (Not Simultaneous) Total Knee Arthroplasties (Tka) On Each Knee Within 6 Months( )	199	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

UNICOMPARTMENTAL KNEE ARTHROPLASTY (UKA)

A. UKA: REVISIONS

Moderate evidence supports that total knee arthroplasty (TKA) could be used to decrease revision surgery risk compared to unicompartmental knee arthroplasty (UKA) for medial compartment osteoarthritis.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

B. UKA: DVT & MANIPULATION UNDER ANESTHESIA

Limited evidence supports that unicompartmental knee arthroplasty might be used to decrease the risk of deep vein thrombosis (DVT) and manipulation under anesthesia compared to total knee arthroplasty (TKA) for medial compartment osteoarthritis.

Strength of Recommendation: Limited Evidence 

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

C. UKA VERSUS OSTEOTOMY

Moderate evidence supports no difference between unicompartmental knee arthroplasty (UKA) or valgus-producing proximal tibial osteotomy in outcomes and complications in patients with medial compartment knee osteoarthritis.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

One moderate quality study (Sun 2012) and our meta-analysis of two moderate quality (Sun 2012, Newman 1998) and one low quality (Cameron 1988) studies demonstrated that the rate of revision surgery was significantly higher for those patients with medial compartment OA of the knee treated with unicompartmental arthroplasty, when compared to total knee arthroplasty.

Comparing the data of two moderate quality studies (Newman 1998, Murray 2014) and one low quality study (Cameron 1988) for early complications there were fewer thromboembolic events and manipulations in the unicompartmental when compared to total knee arthroplasty.

One high quality (Stukenborg-Colsman 2001) and two moderate studies (Weidenhielm 1993 and Borjesson 2005) compared the outcomes of UKA and HTO in patients with predominantly medial compartment osteoarthritis. There were no statistically significant differences in complications or outcomes.

There was no data comparing tibial tubercle osteotomy to patellofemoral arthroplasty or total knee arthroplasty.

** See Appendix XIII for details regarding support*

Likewise, there was no data comparing distal femoral osteotomy to lateral compartment unicompartmental arthroplasty or total knee arthroplasty.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no known harms associated with implementing these recommendations.

FUTURE RESEARCH

A larger prospective randomized trial comparing a modern unicompartmental knee arthroplasty to total knee arthroplasty stressing functional outcomes, early complications and morbidity, and survivorship are warranted. Randomized controlled trials of unicompartmental knee arthroplasty versus high tibial osteotomy in a younger population (ages 40 to 60) would be of value to assess the functional outcomes and survivorship of either of these procedures in that younger population. Careful analysis of registry data comparing unicompartmental knee arthroplasty to total knee arthroplasty is warranted.

RESULTS

SUMMARY OF FINDINGS TABLE 3: PART 1 UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE ARTHROPLASTY (EARLY FOLLOW-UP< 90 DAYS)

Summary of Findings	Moderate Quality			Low Quality	
● Favors UKA ● Favors TKA ○ Not Significant	Sun, P.F., 2012	Newman,J.H., 1998	Murray,D.W., 2014	Cameron,H.U., 1988	Hunt,L.P., 2014
Complications					
Complications other				○	
Deep venous thrombosis	●	○		○	
Manipulation Under Anesthesia		●			
Wound Complications		○			
Pulmonary embolism				○	
Composite					
Oxford Knee Score			○		
Length of Stay					
Length Of Recovery- Length Of Stay		●			
Mortality					
Mortality					●
Quality of Life					
EQ-5d			○		
SF-12 Physical Component Score			○		
SF-12 Mental Component Score			○		
Reoperation					
Reoperation				○	

** See Appendix XIII for details regarding support*

SUMMARY OF FINDINGS TABLE 4: PART 1 UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE ARTHROPLASTY (LATE FOLLOW-UP > 90 DAYS)

Summary of Findings	Moderate Quality		Low Quality		
● Favors UKA ● Favors TKA ○ Not Significant	Sun.P.F., 2012	Newman.J.H., 1998	Murrav.D.W., 2014	Cameron,H.U., 1988	Meta-Analysis
Composite					
Oxford Knee Score			○		
Pain					
Bristol knee score pain		○			
Quality of Life					
EQ-5d			○		
SF-12 Physical Component Score			○		
SF-12 Mental Component Score			○		
Reoperation					
Reoperation	●	○		○	●

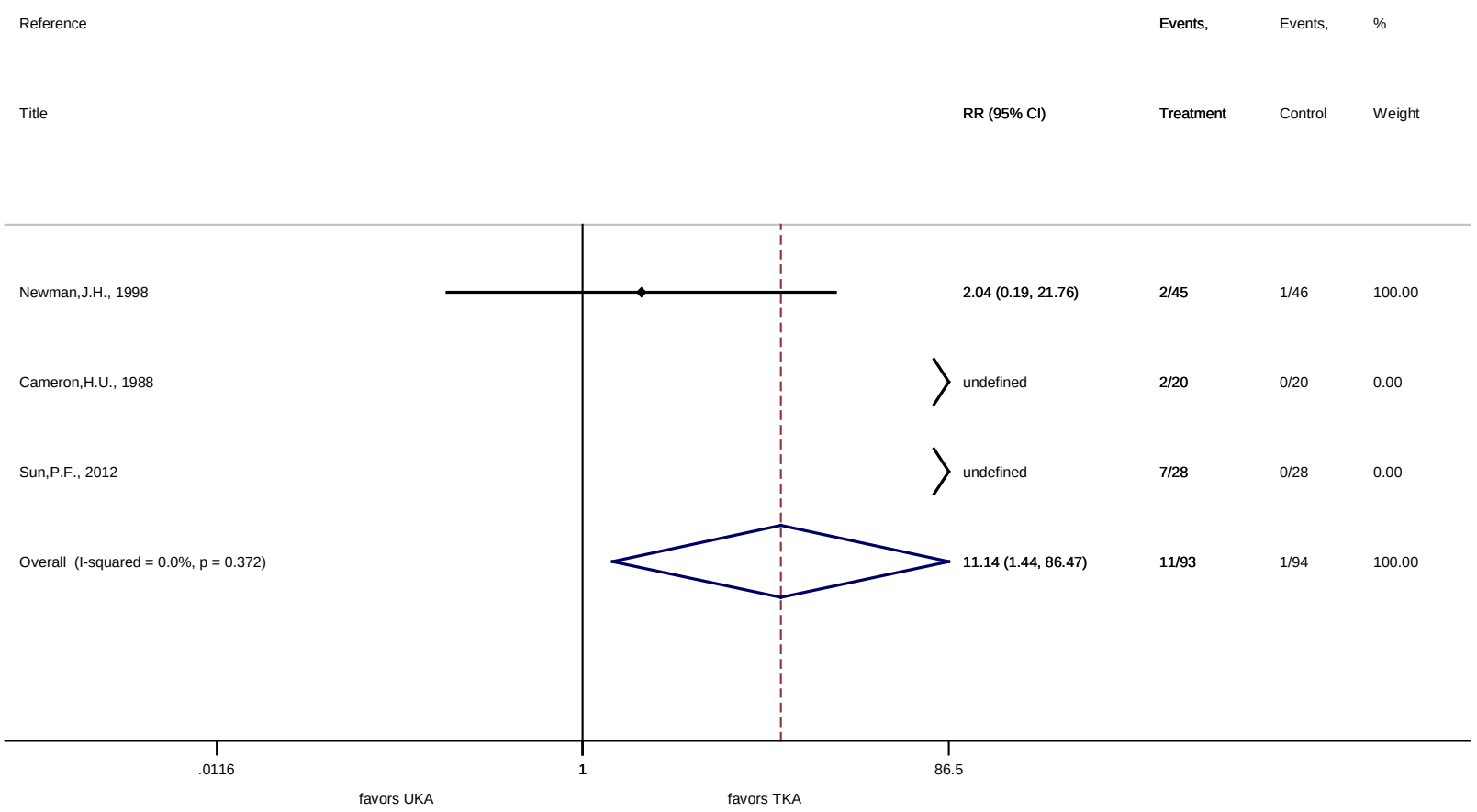
SUMMARY OF FINDINGS TABLE 5: PART 2 UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS OSTEOTOMY (EARLY FOLLOW-UP < 90 DAYS)

Summary of Findings	High Quality	Moderate Quality
● Favors UKA ● Favors Osteotomy ○ Not Significant	Stukenborg-Colsman,C., 2001	BÃrjesson,M., 2005
Complications		
Complications other	○	
Deep venous thrombosis	○	
Infection- Complications	○	
Fractures- Complications	○	
Function		
Knee Society Score-Function- Function	○	
Timed Functional Test (higher scores better, distance, distance/time)- Function		●
Pain		
Borg scale-Pain on walking		○

SUMMARY OF FINDINGS TABLE 6: PART 2 UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS OSTEOTOMY(LATE FOLLOW-UP > 90 DAYS)

Summary of Findings ● Favors UKA ● Favors Osteotomy ○ Not Significant	High Quality	Moderate Quality	
	Stukenborg-Colsman,C., 2001	Weidenhielm,L., 1993	BÃrjesson,M., 2005
Complications			
Infection- Complications		○	
Function			
Knee Society Score-Function- Function	○		
Timed Functional Test (higher scores better, distance, distance/time)- Function			●
physical activity scale (1-6)			○
Pain			
Berg scale-Pain on walking		○	
Borg scale-Pain on walking			○
Reoperation			
Implant Survival- Reoperation	○		

FIGURE 5 UKA VERSUS TKA: REOPERATION RISK RATIO FAVORS TKA GROUP



Undefined means the trial effects were unable to be calculated due to zero events in one trial arm. The Mantel Haenszel RR still allows these trials to contribute to the pooled risk ratio

QUALITY EVALUATION TABLE 3: UNICOMPARTMENTAL KNEE ARTHROPLASTY

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Cameron, H.U., 1988	○	●	●	◑	●	◑	Include	Low Quality
Hunt,L.P., 2014	○	◑	●	◑	●	◑	Include	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Barjesson,M., 2005	●	◑	◑	●	○	●	Include	Moderate Quality
Murray,D.W., 2014	●	●	○	○	●	●	Include	Moderate Quality
Newman,J.H., 1998	●	◑	◑	●	●	○	Include	Moderate Quality
Stukenborg-Colsman,C., 2001	●	◑	◑	●	●	●	Include	High Quality
Sun,P.F., 2012	●	●	●	●	○	○	Include	Moderate Quality
Weidenhielm, L., 1993	○	◑	◑	●	●	○	Include	Moderate Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

PART 1 UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT

TABLE 81: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Newman,J.H., 1998	Moderate Quality	Deep venous thrombosis (clinical signs)	Post-Op	Unicompartmental Arthroplasty (st george sled)	45	2.22%	Total Knee Arthroplasty (Tka) (posterior cruciate retaining)	46	10.87%	RR	0.20(0.02,1.68)	Not Significant (P-value>.05)
Newman,J.H., 1998	Moderate Quality	Manipulation Under Anesthesia- Other ( )	Post-Op	Unicompartmental Arthroplasty (st george sled)	45	0.00%	Total Knee Arthroplasty (Tka) (posterior cruciate retaining)	46	8.70%	RD	-0.09(-0.17,-0.01)	Treatment 1 Significant (P-value<.05)
Newman,J.H., 1998	Moderate Quality	Wound Complications (delayed healing)	Post-Op	Unicompartmental Arthroplasty (st george sled)	45	0.00%	Total Knee Arthroplasty (Tka) (posterior cruciate retaining)	46	2.17%	RD	-0.02(-0.06,0.02)	Not Significant (P-value>.05)
Sun,P.F., 2012	Moderate Quality	Deep venous thrombosis( )	Post-Op	Unicompartmental Arthroplasty ( )	28	. %	Total Knee Arthroplasty (Tka) ( )	28	. %	Author Reported	NA	Significant (P-value<.05)
Cameron, H.U., 1988	Low Quality	Deep venous thrombosis( )	Intra-Op	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	RR	1.00(0.07,14.90)	Not Significant (P-value>.05)
Cameron, H.U., 1988	Low Quality	pulmonary embolism( )	Intra-Op	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	0.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	RD	-0.05(-0.15,0.05)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Cameron, H.U., 1988	Low Quality	complications other (one tibial eminence avulsion)	Intra-Op	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	20	0.00%	RD	0.05(-0.05,0.15)	Not Significant (P-value>.05)
Cameron, H.U., 1988	Low Quality	complications other (drop foot)	Intra-Op	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	0.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	RD	-0.05(-0.14,0.04)	Not Significant (P-value>.05)
Cameron, H.U., 1988	Low Quality	complications other (neuroma of the infrapatellar branch of the saphenous nerve with significant dysesthesia.)	Intra-Op	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	10.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	20	0.00%	RD	0.10(-0.03,0.23)	Not Significant (P-value>.05)
Cameron, H.U., 1988	Low Quality	Manipulation Under Anesthesia- Other ( )	Post-Op	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	28	0.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	28	25.00%	RD	-0.25(-0.41,-0.09)	Treatment 1 Significant (P-value<.05)

TABLE 82: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	3 months	Unicompartmental Arthroplasty ( )	13	. %	Total Knee Arthroplasty (Tka) ( )	.	12(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	1 years	Unicompartmental Arthroplasty ( )	13	. %	Total Knee Arthroplasty (Tka) ( )	.	13(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	2 years	Unicompartmental Arthroplasty ( )	12	. %	Total Knee Arthroplasty (Tka) ( )	.	13(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	3 years	Unicompartmental Arthroplasty ( )	17	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	4 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	5 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	6 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	7 years	Unicompartmental Arthroplasty ( )	13	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	8 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	12(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	9 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	11(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	Oxford Knee Score( )	10 years	Unicompartmental Arthroplasty ( )	13	. %	Total Knee Arthroplasty (Tka) ( )	.	10(.)	Author Reported	NA	Not Significant (P-value>.05)

TABLE 83: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Newman,J.H., 1998	Moderate Quality	Length Of Recovery-Length Of Stay (>= 20 days)	NA	Unicompartmental Arthroplasty (st george sled)	45	6.67%	Total Knee Arthroplasty (Tka) (posterior cruciate retaining)	46	23.91%	RR	0.28(0.08,0.93)	Significant (P-value<.05)

TABLE 84: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: MORTALITY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Hunt,L.P., 2014	Low Quality	Mortality- Mortality (Hazard Ratio)	1.5 months	Unicompartmental Arthroplasty ( )	38608	. %	Total Knee Arthroplasty (Tka) ( )	40428	. %	Author Reported Hazard Ratio	.32(.19,.54)	Treatment 1 Significant (P-value<.05)

** See Appendix XIII for details regarding support*

TABLE 85: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Newman,J.H., 1998	Moderate Quality	bristol knee score pain (Excellent: score 35 to 40)	5 years	Unicompartmental Arthroplasty (st george sled)	45	88.89%	Total Knee Arthroplasty (Tka) (posterior cruciate retaining)	46	82.61%	RR	1.08(0.91,1.27)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 86: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	3 months	Unicompartmental Arthroplasty ( )	16	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	1 years	Unicompartmental Arthroplasty ( )	16	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	2 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	16(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	3 years	Unicompartmental Arthroplasty ( )	17	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	4 years	Unicompartmental Arthroplasty ( )	16	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	5 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	6 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	7 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	8 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	9 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	11(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	EQ-5d( )	10 years	Unicompartmental Arthroplasty ( )	13	. %	Total Knee Arthroplasty (Tka) ( )	.	10(.)	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	3 months	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	1 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	2 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	3 years	Unicompartmental Arthroplasty ( )	17	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	4 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	5 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	6 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	7 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	8 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	13(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	9 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	11(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Physical Component Score( )	10 years	Unicompartmental Arthroplasty ( )	12	. %	Total Knee Arthroplasty (Tka) ( )	.	10(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	3 months	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	1 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	2 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	3 years	Unicompartmental Arthroplasty ( )	17	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	4 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	5 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	6 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	14(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	7 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	15(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	8 years	Unicompartmental Arthroplasty ( )	14	. %	Total Knee Arthroplasty (Tka) ( )	.	13(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	9 years	Unicompartmental Arthroplasty ( )	15	. %	Total Knee Arthroplasty (Tka) ( )	.	11(.)	Author Reported	NA	Not Significant (P-value>.05)
Murray,D.W., 2014	Moderate Quality	SF-12 Mental Component Score( )	10 years	Unicompartmental Arthroplasty ( )	12	. %	Total Knee Arthroplasty (Tka) ( )	.	10(.)	Author Reported	NA	Not Significant (P-value>.05)

TABLE 87: PART 1- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS TOTAL KNEE REPLACEMENT: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Newman,J.H., 1998	Moderate Quality	Reoperation-Reoperation ( )	5 years	Unicompartmental Arthroplasty (st george sled)	45	4.44%	Total Knee Arthroplasty (Tka) (posterior cruciate retaining)	46	2.17%	RR	2.04(0.19,21.76)	Not Significant (P-value>.05)
Sun,P.F., 2012	Moderate Quality	Reoperation-Reoperation ( )	2 years	Unicompartmental Arthroplasty ( )	28	25.00%	( )	28	0.00%	RD	0.25(0.09,0.41)	Treatment 2 Significant (P-value<.05)
Cameron, H.U., 1988	Low Quality	Reoperation-Reoperation (revision due to plastic wearing through)	3 years	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	.	. %	RR	0.05(-0.05,0.15)	Not Significant (P-value>.05)
Cameron, H.U., 1988	Low Quality	Reoperation-Reoperation (reoperation due to inadequate pain relief)	Low Quality	Unicompartmental Arthroplasty (patients with bilateral OA. one knee got uka, the other tka)	20	5.00%	Total Knee Arthroplasty (Tka) (patients with bilateral OA. one knee got uka, the other tka)	20	0.00%	RD	0.05(-0.05,0.15)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

PART 2 UNICOMPARTMENTALKNEE ARTHROPLASTY VERSUS OSTEOTOMY

TABLE 88: PART 2- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS OSTEOTOMY: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Stukenborg-Colsman,C., 2001	High Quality	complications other (pseudoarthritis)	Post-Op	Unicompartmental Arthroplasty ( )	28	0.00%	High/Proximal Tibial Osteotomy( )	32	3.13%	RD	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Fractures-Complications ( )	Post-Op	Unicompartmental Arthroplasty ( )	28	0.00%	High/Proximal Tibial Osteotomy( )	32	6.25%	RD	-0.06(-0.15,0.02)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	complications other (arthrolysis)	Post-Op	Unicompartmental Arthroplasty ( )	28	3.57%	High/Proximal Tibial Osteotomy( )	32	0.00%	RD	0.04(-0.03,0.10)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	complications other (mobilisation)	Post-Op	Unicompartmental Arthroplasty ( )	.	. %	High/Proximal Tibial Osteotomy( )	32	0.00%	RD	0.04(-0.03,0.10)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Deep venous thrombosis( )	Post-Op	Unicompartmental Arthroplasty ( )	28	0.00%	High/Proximal Tibial Osteotomy( )	32	9.38%	RD	-0.09(-0.19,0.01)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Infection-Complications ( )	Post-Op	Unicompartmental Arthroplasty ( )	28	0.00%	High/Proximal Tibial Osteotomy( )	32	6.25%	RD	-0.06(-0.15,0.02)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	complications other (pseudoarthritis)	Post-Op	Unicompartmental Arthroplasty ( )	28	0.00%	High/Proximal Tibial Osteotomy( )	32	3.13%	RD	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Infection-Complications ( )	1 years	Unicompartmental Arthroplasty ( )	36	0.00%	High/Proximal Tibial Osteotomy(HTO)	23	4.35%	RD	-0.04(-0.12,0.04)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	complications other (pnemonia)	1 years	Unicompartmental Arthroplasty ( )	36	2.78%	High/Proximal Tibial Osteotomy(HTO)	23	0.00%	RD	0.03(-0.03,0.08)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Weidenhielm, L., 1993	Moderate Quality	Deep venous thrombosis( )	Post-Op	Unicompartmental Arthroplasty ( )	36	2.78%	High/Proximal Tibial Osteotomy (HTO)	23	0.00%	RD	0.03(-0.03,0.08)	Not Significant (P-value>.05)

TABLE 89: PART 2- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS OSTEOTOMY: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Stukenborg-Colsman,C., 2001	High Quality	Knee Society Score-Function-Function (follow ups are 14 days, 2-5 years, 4-7 years, and 7-10 years)	2 weeks	Unicompartmental Arthroplasty ( )	28	. %	High/Proximal Tibial Osteotomy( )	32	. %	Author Reported	NA	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Knee Society Score-Function-Function (follow ups are 14 days, 2-5 years, 4-7 years, and 7-10 years)	5 years	Unicompartmental Arthroplasty ( )	28	. %	High/Proximal Tibial Osteotomy( )	32	. %	Author Reported	NA	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Knee Society Score-Function-Function (follow ups are 14 days, 2-5 years, 4-7 years, and 7-10 years)	7 years	Unicompartmental Arthroplasty ( )	28	. %	High/Proximal Tibial Osteotomy( )	32	. %	Author Reported	NA	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Knee Society Score-Function-Function (follow ups are 14 days, 2-5 years, 4-7 years, and 7-10 years)	10 years	Unicompartmental Arthroplasty ( )	28	59(.)	High/Proximal Tibial Osteotomy( )	32	71(.)	Author Reported	NA	Not Significant (P-value>.05)
Börjesson,M., 2005	Moderate Quality	physical activity scale (1-6) ( )	5 years	Unicompartmental Arthroplasty ( )	.	. %	High/Proximal Tibial Osteotomy (HTO)	.	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Börjesson,M., 2005	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (free walk spee m/s)	3 months	Unicompartmental Arthroplasty ( )	22	1.16(0.16)	High/Proximal Tibial Osteotomy (HTO)	18	0.94(0.18)	Mean Difference	0.22(0.11,0.33)	Treatment 1 Significant (P-value<.05)
Börjesson,M., 2005	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (free walk spee m/s)	1 years	Unicompartmental Arthroplasty ( )	22	1.24(0.21)	High/Proximal Tibial Osteotomy (HTO)	18	1.12(0.16)	Mean Difference	0.12(0.01,0.23)	Treatment 1 Significant (P-value<.05)
Börjesson,M., 2005	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (free walk spee m/s)	5 years	Unicompartmental Arthroplasty ( )	22	1.19(0.15)	High/Proximal Tibial Osteotomy (HTO)	18	1.13(0.14)	Mean Difference	0.06(-0.03,0.15)	Not Significant (P-value>.05)
Börjesson,M., 2005	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (step frequency (steps/s))	3 months	Unicompartmental Arthroplasty ( )	22	1.75(0.15)	High/Proximal Tibial Osteotomy (HTO)	18	1.6(0.18)	Mean Difference	0.15(0.04,0.26)	Treatment 1 Significant (P-value<.05)
Börjesson,M., 2005	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (step frequency (steps/s))	1 years	Unicompartmental Arthroplasty ( )	22	1.77(0.15)	High/Proximal Tibial Osteotomy (HTO)	18	1.74(0.14)	Mean Difference	0.03(-0.06,0.12)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Börjesson,M., 2005	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (step frequency (steps/s))	5 years	Unicompartmental Arthroplasty ( )	22	1.8(0.11)	High/Proximal Tibial Osteotomy (HTO)	18	1.75(0.15)	Mean Difference	0.04(-0.04,0.12)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (walk speed m/s)	1 years	Unicompartmental Arthroplasty ( )	36	1.19(.19)	High/Proximal Tibial Osteotomy (HTO)	23	1.09(.15)	Mean Difference	.1(.006,.19)	Treatment 1 Significant (P-value<.05)
Weidenhielm, L., 1993	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (step frequency (steps/s))	1 years	Unicompartmental Arthroplasty ( )	36	1.78(.13)	High/Proximal Tibial Osteotomy (HTO)	23	1.75(.14)	Mean Difference	.03(-.04, .10)	Not Significant (P-value>.05)

TABLE 90: PART 2- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS OSTEOTOMY: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Börjesson,M., 2005	Moderate Quality	Borg scale-Pain on walking( )	3 months	Unicompartmental Arthroplasty ( )	22	. %	High/Proximal Tibial Osteotomy (HTO)	18	. %	Author Reported	NA	Not Significant (P-value>.05)
Börjesson,M., 2005	Moderate Quality	Borg scale-Pain on walking (measured at 1 and 5 years with same scores at both follow ups)	5 years	Unicompartmental Arthroplasty ( )	22	. %	High/Proximal Tibial Osteotomy (HTO)	18	. %	Author Reported	NA	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Berg scale-Pain on walking( )	1 years	Unicompartmental Arthroplasty ( )	36	0.5(0.90)	High/Proximal Tibial Osteotomy (HTO)	23	1(1.40)	Mean Difference	-0.5(-1.14,0.14)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 91: PART 2- UNICOMPARTMENTAL KNEE ARTHROPLASTY VERSUS OSTEOTOMY: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Stukenborg-Colsman,C., 2001	High Quality	Implant Survival-Reoperation (implant survival)	5 years	Unicompartmental Arthroplasty ( )	30	83.33%	High/Proximal Tibial Osteotomy( )	32	78.13%	RR	1.07(0.84,1.36)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Implant Survival-Reoperation (implant survival)	10 years	Unicompartmental Arthroplasty ( )	30	76.67%	High/Proximal Tibial Osteotomy( )	32	59.38%	RR	1.29(0.91,1.83)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Implant Survival-Reoperation (implant survival)	5 years	Unicompartmental Arthroplasty ( )	30	83.33%	High/Proximal Tibial Osteotomy( )	32	78.13%	RR	1.07(0.84,1.36)	Not Significant (P-value>.05)
Stukenborg-Colsman,C., 2001	High Quality	Implant Survival-Reoperation (implant survival)	10 years	Unicompartmental Arthroplasty ( )	30	76.67%	High/Proximal Tibial Osteotomy( )	32	59.38%	RR	1.29(0.91,1.83)	Not Significant (P-value>.05)
Weidenhielm, L., 1993	Moderate Quality	Reoperation - Reoperation (aseptic loosening of tibial plateau leading to reoperation)	5.9 months	Unicompartmental Arthroplasty ( )	36	2.78%	High/Proximal Tibial Osteotomy (HTO)	23	0.00%	RD	0.03(-0.03,0.08)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

SURGICAL NAVIGATION

Strong evidence supports not using intraoperative navigation in total knee arthroplasty (TKA) because there is no difference in outcomes or complications.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Three high quality studies (Thiengwittayaporn 2013, Seon 2009, Kiss 2012) and two moderate quality studies (Lutzner 2010, Dutton 2008) compared surgical navigation to conventional instrumentation for total knee arthroplasty. At follow-up greater than 90 days, there were no differences in patient reported quality of life outcomes (EQ-5D, SF-36 Mental Component Summary), patient reported knee function (Oxford Knee Score, Knee Society Score, and WOMAC), and pain (WOMAC).

Four high quality studies (Lutzner 2008, Church 2007, Chin 2005, Blakeney 2011) and one moderate quality study (Kalairajah 2005) were all consistent in their findings that length of surgery favored no surgical navigation. A meta-analysis on infection found no difference in infection risk comparing surgical navigation to conventional instrumentation for total knee arthroplasty.

The work group recognizes that there are scenarios where computer navigation theoretically could be considered, such as malunions, intramedullary implants, or in training scenarios, but the evidence is insufficient to make a recommendation.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no known harms associated with implementing this recommendation.

FUTURE RESEARCH

The theoretical benefit of surgical navigation is to improve knee function and long-term implant survival by improving the accuracy of alignment. No consensus on optimal knee alignment in total knee arthroplasty has been reached. However, coupling of surgical navigation data with registry implant longevity data has the potential to determine if surgical navigation improves implant longevity through alignment. The strong evidence indicates that no further research is needed on reviewed current surgical navigation methods. New surgical navigation methods will need randomized controlled trials to determine their effectiveness

* *See Appendix XIII for details regarding support*

SUMMARY OF FINDINGS TABLE 16: SURGICAL NAVIGATION (EARLY FOLLOW-UP < 90 DAYS)

** See Appendix XIII for details regarding support*

Summary of Findings

● **Favors Surgical Navigation**

● **Favors No Surgical Navigation**

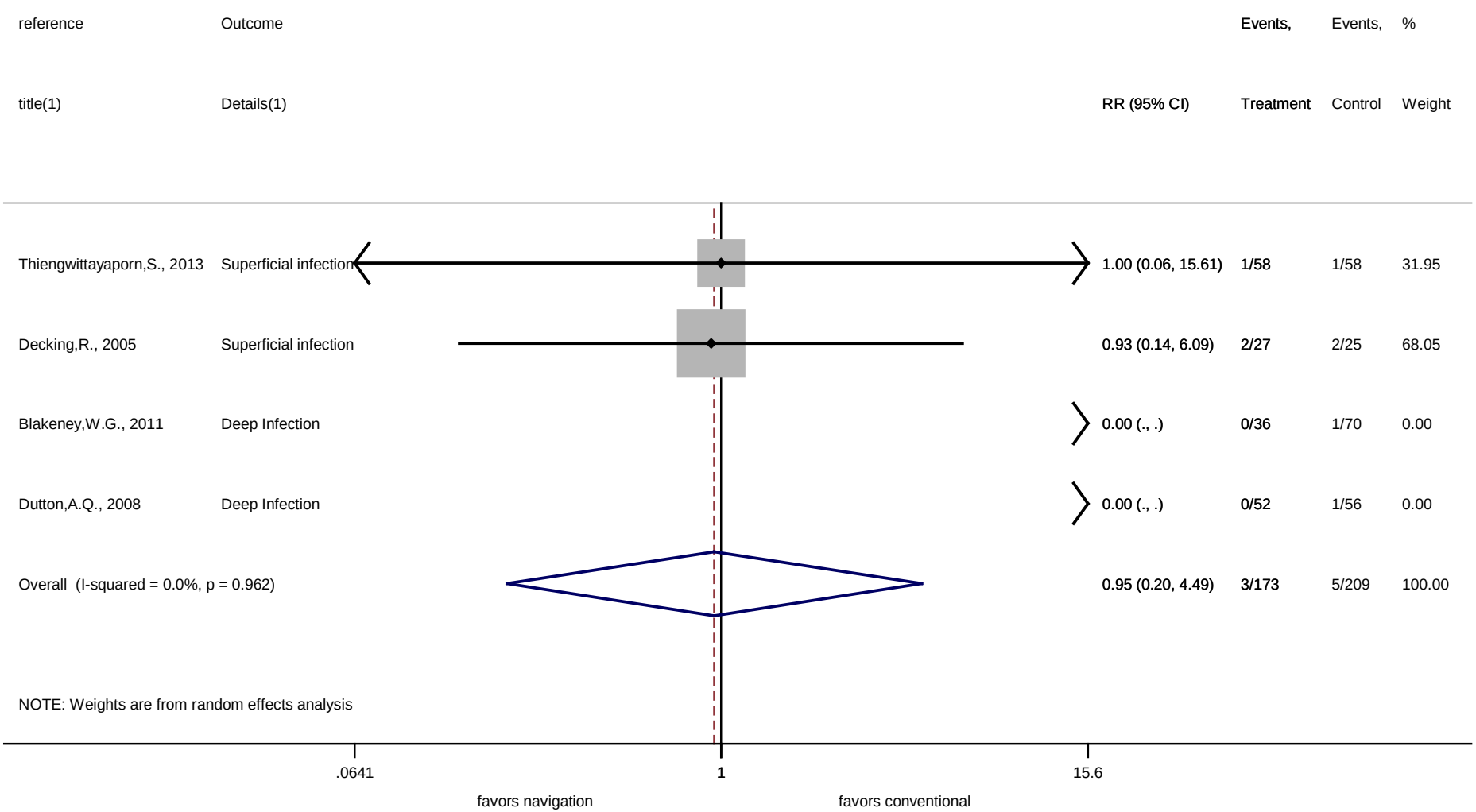
○ **Not Significant**

	High Quality			Moderate Quality									
	Thiengwittayaporn,S., 2013	Lutzner,J., 2008	Kim,Y.H., 2008	Decking,R., 2005	Church,J.S., 2007	Chin,P.L., 2005	Blakeney,W.G., 2011	Kim,Y.-H., 2007	Dutton,A.Q., 2008	Mizu-uchi,H., 2008	Kalairajah,Y., 2005	Meta-Analysis
Complications												
Complications other			○									
Fall in HB, g/dL						○					●	
Infection- Complications	○			○			○					○
Manipulation Under Anesthesia- Other	○						○					
Blood Loss	○							○			●	
Drainage- Complications	○					●						
Composite												
Knee Society Score KSS				○								
Function												
Knee Society Score-Function- Function	●									○		
Timed Functional Test (higher scores better, distance, distance/time)- Function									●			
Womac-function averaged VAS Version (0-100)				○								
Length of Surgery												
Length Of Surgery- Length Of Surgery		●			●	●	●				●	
Pain												
Womac-Pain averaged VAS Version (0-100)				○								
Reoperation												
Reoperation- Reoperation	○											
Reoperation polyethylene exchange	○											
Stiffness												
Womac-stiffness averaged VAS Version (0-100)				○								

SUMMARY OF FINDINGS TABLE 17: SURGICAL NAVIGATION (LATE FOLLOW-UP > 90 DAYS)

Summary of Findings	High Quality			Moderate Quality	
	Thiengwittayaporn,S., 2013	Seon,J.K., 2009	Kiss,R.M., 2012	Lutzner,J., 2010	Dutton,A.Q., 2008
● Favors Surgical Navigation					
● Favors No Surgical Navigation					
○ Not Significant					
Composite					
Euroqol-5d(Eq-5d) Total- Composite				○	
Oxford Knee Score (Oks)- Composite					○
SF-36 Mental Component summary					○
Womac-overall- Composite Likert (0-96)		○			
Function					
Knee Society Score-Function- Function	○				
Muscle Strength- Function					○
Timed Functional Test (higher scores better, distance, distance/time)- Function			○		○
Range Of Motion(overall) - Function		○			
Pain					
Womac-Pain Likert Version (0-20)		○			
Hospital for Special Surgery Knee Rating		○			

FIGURE 6 SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION – INFECTION



>0(.,.) means study risk ratio is inestimable due to zero events in one arm, but it still can contribute to the overall pooled Mantel Haenszel risk ratio

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 9: SURGICAL NAVIGATION

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Mohanlal,P.K., 2013	○	●	●	●	●	○	Not best available evidence	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Blakeney,W.G., 2011	●	●	●	●	●	●	Include	High Quality
Chin,P.L., 2005	●	●	◑	●	○	●	Include	High Quality
Church,J.S., 2007	●	◑	●	●	●	●	Include	High Quality
Decking,R., 2005	●	●	◑	●	●	●	Include	High Quality
Dutton,A.Q., 2008	●	◑	●	◑	●	○	Include	Moderate Quality
Hoffart,H.E., 2012	○	○	○	◑	○	○	Include	Low Quality
Kalairajah,Y., 2005	◑	●	●	●	○	●	Include	High Quality
Kim,Y.-H., 2007	◑	◑	◑	●	○	●	Include	Moderate Quality
Kim,Y.H., 2008	●	◑	◑	●	●	●	Include	High Quality
Kiss,R.M., 2012	◑	◑	◑	●	●	●	Include	High Quality
Lutzner,J., 2008	●	◑	◑	●	●	●	Include	High Quality
Lutzner,J., 2010	●	◑	◑	●	●	○	Include	Moderate Quality
Seon,J.K., 2009	●	◑	◑	●	●	●	Include	High Quality
Thiengwittayaporn,S., 2013	◑	◑	◑	●	●	●	Include	High Quality

** See Appendix XIII for details regarding support*

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Keene,G., 2006	◑	●	◑	●	○	●	Not best available evidence	Moderate Quality
Weng,Y.J., 2009	○	○	●	●	●	●	Not best available evidence	Moderate Quality

Detailed Data Tables

TABLE 92: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalairajah,Y., 2005	High Quality	Blood Loss - Complications (ml)	Intra-Op	Surgical Navigation ( )	30	1351(466.68)	No Surgical Navigation ( )	30	1747(461.09)	Mean Difference	-396(-630.76,-161.24)	Treatment 1 Significant (P-value<.05)
Kalairajah,Y., 2005	High Quality	Fall in HB, g/dL (Calculated Hb loss in g/dl)	Post-Op	Surgical Navigation ( )	30	36.5(9.22)	No Surgical Navigation ( )	30	52.6(17.05)	Mean Difference	-16.1(-23.04,-9.16)	Treatment 1 Significant (P-value<.05)
Blakeney,W.G., 2011	High Quality	Manipulation Under Anesthesia-Other ( )	Post-Op	Surgical Navigation ( )	36	0.00%	No Surgical Navigation (Extramedullary Guide)	34	2.94%	RD	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Blakeney,W.G., 2011	High Quality	Infection-Complications ( )	Post-Op	Surgical Navigation ( )	36	0.00%	No Surgical Navigation (Extramedullary Guide)	34	2.94%	RD	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Blakeney,W.G., 2011	High Quality	Manipulation Under Anesthesia-Other ( )	Post-Op	Surgical Navigation ( )	36	0.00%	No Surgical Navigation (Intramedullary Guide)	36	2.78%	RD	-0.03(-0.08,0.03)	Not Significant (P-value>.05)
Blakeney,W.G., 2011	High Quality	Infection-Complications ( )	Post-Op	Surgical Navigation ( )	36	0.00%	No Surgical Navigation (Intramedullary Guide)	36	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Chin,P.L., 2005	High Quality	Drainage-Complications (ml)	Intra-Op	Surgical Navigation ( )	30	290.3(.)	No Surgical Navigation (Intramedullary Guide)	30	396.3(.)	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Chin,P.L., 2005	High Quality	Fall in HB, g/dL ( )	Intra-Op	Surgical Navigation ( )	30	2.56(.)	No Surgical Navigation (Intramedullary Guide)	30	3.14(.)	Author Reported	NA	Not Significant (P-value>.05)
Chin,P.L., 2005	High Quality	Drainage-Complications (ml)	Intra-Op	Surgical Navigation ( )	30	290.3(.)	No Surgical Navigation (Extramedullary Guide)	30	400.5(.)	Author Reported	NA	Treatment 1 Significant (P-value<.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chin,P.L., 2005	High Quality	Fall in HB, g/dL ( )	Intra-Op	Surgical Navigation ( )	30	2.56(.)	No Surgical Navigation (Extramedullary Guide)	30	2.94(.)	Author Reported	NA	Not Significant (P-value>.05)
Decking,R., 2005	High Quality	Infection-Complications ( )	Post-Op	Surgical Navigation (Computer Assisted Navigation)	27	7.41%	No Surgical Navigation (Manually Implanted TKAs)	25	8.00%	RR	0.93(0.14,6.09)	Not Significant (P-value>.05)
Kim,Y.H., 2008	High Quality	complications other (fat embolism measured as at leats 1 fat globule found)	Post-Op	Surgical Navigation ( )	210	48.57%	No Surgical Navigation ( )	210	51.90%	RR	0.94(0.77,1.13)	Not Significant (P-value>.05)
Kim,Y.H., 2008	High Quality	complications other (at least 1 bone marrow cell embolization)	Post-Op	Surgical Navigation ( )	210	17.14%	No Surgical Navigation ( )	210	14.76%	RR	1.16(0.75,1.80)	Not Significant (P-value>.05)
Thiengwittayaporn,S., 2013	High Quality	Blood Loss - Complications (ml)	Peri-Op	Surgical Navigation ( )	58	423(227.95)	No Surgical Navigation ( )	58	449(238.75)	Mean Difference	-26(-110.95,58.95)	Not Significant (P-value>.05)
Thiengwittayaporn,S., 2013	High Quality	Infection-Complications (Superficial infection)	Post-Op	Surgical Navigation ( )	58	1.72%	No Surgical Navigation ( )	58	1.72%	RR	1.00(0.06,15.61)	Not Significant (P-value>.05)
Thiengwittayaporn,S., 2013	High Quality	Manipulation Under Anesthesia-Other (Need for Manipulation)	Post-Op	Surgical Navigation ( )	58	1.72%	No Surgical Navigation ( )	58	0.00%	RD	0.02(-0.02,0.05)	Not Significant (P-value>.05)
Thiengwittayaporn,S., 2013	High Quality	Drainage-Complications (Prolonged wound drainage)	Post-Op	Surgical Navigation ( )	58	1.72%	No Surgical Navigation ( )	58	0.00%	RD	0.02(-0.02,0.05)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Dutton,A.Q., 2008	Moderate Quality	Infection-Complications (Infection requiring readmission)	Post-Op	Surgical Navigation ( )	52	0.00%	No Surgical Navigation ( )	56	1.79%	RD	-0.02(-0.05,0.02)	Not Significant (P-value>.05)
Kim,Y.-H., 2007	Moderate Quality	Blood Loss - Complications (ml)	Intra-Op	Surgical Navigation ( )	100	277(.)	No Surgical Navigation ( )	100	264.7(.)	Author Reported	NA	Not Significant (P-value>.05)
Kim,Y.-H., 2007	Moderate Quality	Overall Complications - Complications ( )	Post-Op	Surgical Navigation ( )	100	7.00%	No Surgical Navigation ( )	100	1.00%	RR	7.00(0.88,55.86)	Not Significant (P-value>.05)
Kim,Y.-H., 2007	Moderate Quality	Drainage-Complications (ml)	Post-Op	Surgical Navigation ( )	100	783.3(.)	No Surgical Navigation ( )	100	750(.)	Author Reported	NA	Not Significant (P-value>.05)
Hoffart,H.E., 2012	Low Quality	Overall Complications - Complications ([ctrl: Short term complications: pulmonary embolus (1), deep venous thrombosis (3), cerebrovascular accident with hemiparesis (1), anaemia (1) and delayed wound healing (1).] [navig short term complications: Short term complications: deep infection])	5 years	Surgical Navigation ( )	98	6.12%	No Surgical Navigation ( )	97	7.22%	RR	0.85(0.30,2.43)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Hoffart,H.E., 2012	Low Quality	Overall Complications - Complications ([ctrl: Late complications: revision (1), femoral osteolysis(2) [navig.:distal femoral calcification (1), synovial hypertrophy(1) , adhesions(1)])	5 years	Surgical Navigation ( )	98	3.06%	No Surgical Navigation ( )	97	3.09%	RR	0.99(0.20,4.78)	Not Significant (P-value>.05)

TABLE 93: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Seon,J.K., 2009	High Quality	Womac-overall-Composite Likert (0-96) ( )	2 years	Surgical Navigation ( )	43	32.3(.)	No Surgical Navigation ( )	42	32.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Dutton,A.Q., 2008	Moderate Quality	SF-36 Mental Component summary( )	5.9 months	Surgical Navigation ( )	52	57(.)	No Surgical Navigation ( )	56	58(.)	Author Reported	NA	Not Significant (P-value>.05)
Dutton,A.Q., 2008	Moderate Quality	Oxford Knee Score (Oks)-Composite( )	5.9 months	Surgical Navigation ( )	52	20(.)	No Surgical Navigation ( )	56	22(.)	Author Reported	NA	Not Significant (P-value>.05)
Lutzner,J., 2010	Moderate Quality	Euroqol-5d (Eq-5d) Total-Composite( )	1.6 years	Surgical Navigation ( )	38	. %	No Surgical Navigation ( )	35	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 94: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Mizu-uchi,H., 2008	Moderate Quality	Knee Society Score-Function-Function ( )	6 months	Surgical Navigation ( )	37	78.1(.)	No Surgical Navigation ( )	39	78.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Decking,R., 2005	High Quality	Womac-function averaged VAS Version (0-100) (Scale unclear. Reported on 10cm scale. Extracted on 100mm scale.)	3 months	Surgical Navigation (Computer Assisted Navigation)	27	20(16.00)	No Surgical Navigation (Manually Implanted TKAs)	25	23(15.00)	Mean Difference	-3(-11.43,5.43)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kiss,R.M., 2012	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Walking speed (m/s))	5.9 months	Surgical Navigation ( )	15	0.8(0.20)	No Surgical Navigation ( )	15	0.8(0.30)	Mean Difference	0(-0.18,0.18)	Not Significant (P-value>.05)
Kiss,R.M., 2012	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Walking speed (m/s))	11.8 months	Surgical Navigation ( )	15	1(0.20)	No Surgical Navigation ( )	15	1(0.20)	Mean Difference	0(-0.14,0.14)	Not Significant (P-value>.05)
Seon,J.K., 2009	High Quality	Range Of Motion (overall) - Function ( )	2 years	Surgical Navigation ( )	43	129(.)	No Surgical Navigation ( )	42	129.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Thiengwittayaporn,S., 2013	High Quality	Knee Society Score-Function-Function ( )	1.4 months	Surgical Navigation ( )	58	65(2.31)	No Surgical Navigation ( )	58	64(2.72)	Mean Difference	1(0.08,1.92)	Treatment 1 Significant (P-value<.05)
Thiengwittayaporn,S., 2013	High Quality	Knee Society Score-Function-Function ( )	6 years	Surgical Navigation ( )	58	67.3(4.64)	No Surgical Navigation ( )	58	66.7(2.77)	Mean Difference	0.6(-0.79,1.99)	Not Significant (P-value>.05)
Dutton,A.Q., 2008	Moderate Quality	Muscle Strength-Function (Manual muscle testing (kg))	5.9 months	Surgical Navigation ( )	52	14(.)	No Surgical Navigation ( )	56	15(.)	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Dutton,A.Q., 2008	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Walking ability: number of patients able to walk independently for more than 30 min)	1 months	Surgical Navigation ( )	52	. %	No Surgical Navigation ( )	56	. %	Author Reported	NA	Treatment 1 Significant (P-value<.05)
Decking,R., 2005	High Quality	Knee Society Score KSS(Scale unclear. KSS generally on 0-100 scale?)	3 months	Surgical Navigation (Computer Assisted Navigation)	27	167.7(24.80)	No Surgical Navigation (Manually Implanted TKAs)	25	160.6(22.20)	Mean Difference	7.1(-5.68,19.88)	Not Significant (P-value>.05)
Latzner,J., 2010	High Quality	Knee Society Score-Function-Function (Improvement in score)	1 months	Surgical Navigation ( )	38	. %	No Surgical Navigation ( )	35	. %	Author Reported	NA	Not Significant (P-value>.05)
Dutton,A.Q., 2008	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function (Walking ability: number of patients able to walk independently for more than 30 min)	5.9 months	Surgical Navigation ( )	52	. %	No Surgical Navigation ( )	56	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 95: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: LENGTH OF SURGERY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kalairajah,Y., 2005	High Quality	Length Of Surgery-Length Of Surgery ( )	Intra-Op	Surgical Navigation ( )	30	89(13.97)	No Surgical Navigation ( )	30	74(22.36)	Mean Difference	15(5.57,24.43)	Treatment 2 Significant (P-value<.05)
Blakeney,W.G., 2011	High Quality	Length Of Surgery-Length Of Surgery (Minutes)	NA	Surgical Navigation ( )	36	107(.)	No Surgical Navigation (Extramedullary Guide)	34	83(.)	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Blakeney,W.G., 2011	High Quality	Length Of Surgery-Length Of Surgery (Minutes)	NA	Surgical Navigation ( )	36	107(.)	No Surgical Navigation (Intramedullary Guide)	36	88(.)	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Chin,P.L., 2005	High Quality	Length Of Surgery-Length Of Surgery (Minutes)	Intra-Op	Surgical Navigation ( )	30	118.2(.)	No Surgical Navigation (Intramedullary Guide)	30	83.5(.)	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Chin,P.L., 2005	High Quality	Length Of Surgery-Length Of Surgery (Minutes)	Intra-Op	Surgical Navigation ( )	30	118.2(.)	No Surgical Navigation (Extramedullary Guide)	30	90.3(.)	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Church,J.S., 2007	High Quality	Length Of Surgery-Length Of Surgery ( )	Intra-Op	Surgical Navigation ( )	14	74.1(.)	No Surgical Navigation ( )	12	56.8(.)	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Lutzner,J., 2008	High Quality	Length Of Surgery-Length Of Surgery (Minutes)	Intra-Op	Surgical Navigation ( )	40	. %	No Surgical Navigation ( )	40	. %	Author Reported	NA	Treatment 2 Significant (P-value<.05)
Thiengwittayaporn,S., 2013	High Quality	Length Of Surgery-Length Of Surgery (min)	Intra-Op	Surgical Navigation ( )	58	159(28.2)	No Surgical Navigation ( )	58	117(21.77)	Mean Difference	42 (32.73, 51.27)	Treatment 2 Significant (P-value<.05)

TABLE 96: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Decking,R., 2005	High Quality	Womac-Pain averaged VAS Version (0-100) (Scale unclear. Reported on 10cm scale. Extracted on 100mm scale.)	3 months	Surgical Navigation (Computer Assisted Navigation)	27	19(20.00)	No Surgical Navigation (Manually Implanted TKAs)	25	19(17.00)	Mean Difference	0(-10.07,10.07)	Not Significant (P-value>.05)
Seon,J.K., 2009	High Quality	Hospital for Special Surgery Knee Rating(Pain subscale)	2 years	Surgical Navigation ( )	43	28.7(.)	No Surgical Navigation ( )	42	29.2(.)	Author Reported	NA	Not Significant (P-value>.05)
Seon,J.K., 2009	High Quality	Womac-Pain Likert Version (0-20) ( )	2 years	Surgical Navigation ( )	43	6.1(.)	No Surgical Navigation ( )	42	6.3(.)	Author Reported	NA	Not Significant (P-value>.05)

TABLE 97: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: REOPERATION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Thiengwittayaporn,S., 2013	High Quality	Reoperation-Reoperation (Open reduction surgery for fracture (in non-navigation group: for patellar fracture; for navigation group: for supracondylar fracture))	Post-Op	Surgical Navigation ( )	58	1.72%	No Surgical Navigation ( )	58	1.72%	RR	1.00(0.06,15.61)	Not Significant (P-value>.05)
Thiengwittayaporn,S., 2013	High Quality	Outcomes Of Conversions-Reoperation (Poly ethylene exchange for postoperative recurvatum)	Post-Op	Surgical Navigation ( )	58	0.00%	No Surgical Navigation ( )	58	1.72%	RD	-0.02(-0.05,0.02)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 98: SURGICAL NAVIGATION VERSUS NO SURGICAL NAVIGATION: STIFFNESS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Decking,R., 2005	High Quality	Womac-stiffness averaged VAS Version (0-100) (Scale unclear. Reported on 10cm scale. Extracted on 100mm scale.)	3 months	Surgical Navigation (Computer Assisted Navigation)	27	23(18.00)	No Surgical Navigation (Manually Implanted TKAs)	25	28(19.00)	Mean Difference	-5(-15.08,5.08)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

PATIENT SPECIFIC TECHNOLOGY

A. PATIENT SPECIFIC INSTRUMENTATION: PAIN AND FUNCTION

Strong evidence supports not using patient specific instrumentation compared to conventional instrumentation for total knee arthroplasty (TKA) because there is no difference in pain or functional outcomes.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

B. PATIENT SPECIFIC INSTRUMENTATION: TRANSFUSIONS AND COMPLICATIONS

Moderate evidence supports not using patient specific instrumentation compared to conventional instrumentation for total knee arthroplasty (TKA) because there is no difference in transfusions or complications.

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

Two high quality studies (Pfitzner 2014 and Pietsch 2013) demonstrated no difference in knee society and visual analog pain scores between patient specific cutting guides and conventional instrumentation. Both studies also found no difference in knee society function score and one study (Pfitzner 2014) additionally found no difference in the overall WOMAC score. There was heterogeneity in outcomes regarding perioperative blood loss with Pietsch 2013 demonstrating a clinically significant difference in perioperative blood loss, however, no impact in the drop in hgb and need for transfusion. This indicates that while there is some improvement in blood loss in patients who receive patient specific instrumentation there was no significant clinical impact when compared to conventional instrumentation. Three moderate quality studies and one low quality study found similar results with no significant difference between both treatment groups.

There was no evidence to demonstrate a clinically relevant difference in surgical time or shorter length of stay when comparing both groups. One moderate quality study (Boonen 2013) found no difference in hospital length of stay between both groups.

The work group recognizes that there are scenarios where patient specific instrumentation theoretically could be considered but the evidence is insufficient to make a recommendation.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no risks or Harms with implementation

** See Appendix XIII for details regarding support*

FUTURE RESEARCH

Further study into the impact of patient specific cutting guides on blood loss and potential transfusion rates would be appropriate.

RESULTS

SUMMARY OF FINDINGS TABLE 30: PATIENT SPECIFIC TECHNOLOGY

Summary of Findings ● Favors Patient Specific Technology ● Favors Traditional Instrumentation ○ Not Significant	High Quality		Moderate Quality				Low Quality
	Pietsch,M., 2013	Pfitzner,T., 2014	Roh,Y.W., 2013	Hamilton,W.G., 2013	Chareancholvanich,K., 2013	Boonen,B., 2013	Chen,J.Y., 2014
Complications							
Complications other							○
Fall in HB, g/dL	●					○	
Blood transfusion %					○		
Need Transfusion- Complications	○						
Blood Loss	●		○				
Composite							
Womac-overall- Composite Likert (0-96)		○					
Function							
Knee Society Score-Function- Function	○	○					
Length of Stay							
Length Of Recovery- Length Of Stay						○	
Length of Surgery							
Length Of Surgery- Length Of Surgery		●	●	●		●	
Pain							
Knee Society Score-Pain- Pain		○					
Vas Pain (10cm)- Pain	○						

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 20: PATIENT SPECIFIC TECHNOLOGY

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Chen,J.Y., 2014	○	●	●	●	●	●	Include	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Boonen,B., 2013	○	◑	●	●	○	○	Include	Moderate Quality
Chareancholvanich,K., 2013	◑	◑	○	●	●	●	Include	Moderate Quality
Hamilton,W.G., 2013	◑	◑	●	○	●	◑	Include	Moderate Quality
Pfitzner,T., 2014	●	●	○	●	●	●	Include	High Quality
Pietsch,M., 2013	◑	◑	◑	●	●	●	Include	High Quality
Roh,Y.W., 2013	●	●	○	●	○	●	Include	Moderate Quality

DETAILED DATA TABLES

TABLE 99: PATIENT SPECIFIC TECHNOLOGY VERSUS CONVENTIONAL INSTRUMENTATION: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Pietsch,M., 2013	High Quality	Blood Loss - Complications (ml)	Post-Op	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	391(186.00)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	603(239.00)	Mean Difference	-212(-305.85,-118.15)	**Treatment 1 Significant (P-value<.05)**
Pietsch,M., 2013	High Quality	Need Transfusion-Complications ( )	Post-Op	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	7.50%	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	10.00%	RR	0.75(0.18,3.14)	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Fall in HB, g/dL(HB loss)	Post-Op	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	3.6(1.00)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	4.1(1.20)	Mean Difference	-0.5(-0.98,-0.02)	**Treatment 1 Significant (P-value<.05)**
Boonen,B., 2013	Moderate Quality	Fall in HB, g/dL(raw hb levels mmol/L)	1 Days	Use Of Patient Specific Technology(MRI ptient specific guides)	45	7.5(0.70)	No Use Of Patient Specific Technology( )	45	7.4(1.10)	Mean Difference	0.1(-0.28,0.48)	Not Significant (P-value>.05)
Boonen,B., 2013	Moderate Quality	Fall in HB, g/dL(raw hb levels mmol/L)	3 Days	Use Of Patient Specific Technology(MRI ptient specific guides)	45	6.9(0.80)	No Use Of Patient Specific Technology( )	45	6.7(1.30)	Mean Difference	0.2(-0.25,0.65)	Not Significant (P-value>.05)
Boonen,B., 2013	Moderate Quality	Blood Loss - Complications (ml)	Peri-Op	Use Of Patient Specific Technology(MRI ptient specific guides)	.	. %	No Use Of Patient Specific Technology( )	.	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Chareancholvanich,K., 2013	Moderate Quality	Blood Loss - Complications (ml)	Intra-Op	Use Of Patient Specific Technology(patient specific cutting guides)	40	614.8(.)	No Use Of Patient Specific Technology( )	40	581.8(.)	Author Reported	NA	Not Significant (P-value>.05)
Chareancholvanich,K., 2013	Moderate Quality	Blood transfusion %( )	Intra-Op	Use Of Patient Specific Technology(patient specific cutting guides)	40	20.00%	No Use Of Patient Specific Technology( )	40	25.00%	RR	0.80(0.35,1.82)	Not Significant (P-value>.05)
Roh,Y.W., 2013	Moderate Quality	Blood Loss - Complications (ml)	Post-Op	Use Of Patient Specific Technology( )	42	783.7(.)	No Use Of Patient Specific Technology( )	48	843.8(.)	Author Reported	NA	Not Significant (P-value>.05)
Chen,J.Y., 2014	Low Quality	complications other (Non-ST Elevation Myocardial Infarction (NSTEMI))	Post-Op	Use Of Patient Specific Technology(patient specific instrumentation with MRI scan)	29	3.45%	No Use Of Patient Specific Technology( )	30	0.00%	RD	0.03(-0.03,0.10)	Not Significant (P-value>.05)

TABLE 100: PATIENT SPECIFIC TECHNOLOGY VERSUS CONVENTIONAL INSTRUMENTATION: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Pfitzner,T., 2014	High Quality	Womac-overall-Composite Likert (0-96) ( )	3 months	Use Of Patient Specific Technology(MRI patient specific cutting blocks)	.	. %	No Use Of Patient Specific Technology( )	30	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 101: PATIENT SPECIFIC TECHNOLOGY VERSUS CONVENTIONAL INSTRUMENTATION: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Pfitzner,T., 2014	High Quality	Knee Society Score-Function-Function ( )	3 months	Use Of Patient Specific Technology(MRI patient specific cutting blocks)	.	. %	No Use Of Patient Specific Technology( )	30	. %	Author Reported	NA	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Knee Society Score-Function-Function ( )	2 weeks	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	57(11.00)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	56(13.00)	Mean Difference	1(-4.28,6.28)	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Knee Society Score-Function-Function ( )	1.4 months	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	79(14.00)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	79(15.00)	Mean Difference	0(-6.36,6.36)	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Knee Society Score-Function-Function ( )	2.8 months	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	86(12.00)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	86(13.00)	Mean Difference	0(-5.48,5.48)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 102: PATIENT SPECIFIC TECHNOLOGY VERSUS CONVENTIONAL INSTRUMENTATION: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Boonen,B., 2013	Moderate Quality	Length Of Recovery-Length Of Stay (days)	Peri-Op	Use Of Patient Specific Technology(MRI ptient specific guides)	90	3.6(1.50)	No Use Of Patient Specific Technology( )	90	3.7(1.40)	Mean Difference	-0.1(-0.52,0.32)	Not Significant (P-value>.05)
Chareancholvanich,K., 2013	Moderate Quality	Length Of Recovery-Length Of Stay (days)	During Hospital Stay	Use Of Patient Specific Technology(patient specific cutting guides)	.	. %	No Use Of Patient Specific Technology( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 103: PATIENT SPECIFIC TECHNOLOGY VERSUS CONVENTIONAL INSTRUMENTATION: LENGTH OF SURGERY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Roh,Y.W., 2013	Moderate Quality	Length Of Surgery-Length Of Surgery (minutes)	Intra-Op	Use Of Patient Specific Technology( )	42	59.4(.)	No Use Of Patient Specific Technology( )	48	46.6(.)	Author Reported	NA	**Treatment 2 Significant (P-value<.05)**
Pfitzner,T., 2014	High Quality	Length Of Surgery-Length Of Surgery ( )	Intra-Op	Use Of Patient Specific Technology(MRI patient specific cutting blocks)	.	. %	No Use Of Patient Specific Technology( )	30	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Boonen,B., 2013	Moderate Quality	Length Of Surgery-Length Of Surgery (in minutes)	Intra-Op	Use Of Patient Specific Technology(MRI ptient specific guides)	90	44.7(6.50)	No Use Of Patient Specific Technology( )	90	50(10.60)	Mean Difference	-5.3(-7.87,-2.73)	**Treatment 1 Significant (P-value<.05)**
Hamilton,W.G., 2013	Moderate Quality	Length Of Surgery-Length Of Surgery (in seconds)	Intra-Op	Use Of Patient Specific Technology(patient specific instrumentation with CT scan)	26	3447(298.00)	No Use Of Patient Specific Technology( )	26	3707(348.00)	Mean Difference	-260(-436.11,-83.89)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 104: PATIENT SPECIFIC TECHNOLOGY VERSUS CONVENTIONAL INSTRUMENTATION: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Pfitzner,T., 2014	High Quality	Knee Society Score-Pain-Pain ( )	3 months	Use Of Patient Specific Technology(MRI patient specific cutting blocks)	30	. %	No Use Of Patient Specific Technology( )	30	. %	Author Reported	NA	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Vas Pain (10cm)-Pain ( )	1 Days	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	2.6(0.70)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	2.9(0.80)	Mean Difference	-0.3(-0.63,0.03)	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Vas Pain (10cm)-Pain ( )	3 Days	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	2.6(0.60)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	2.6(0.70)	Mean Difference	0(-0.29,0.29)	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Vas Pain (10cm)-Pain ( )	1.4 weeks	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	2(0.70)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	2.1(0.70)	Mean Difference	-0.1(-0.41,0.21)	Not Significant (P-value>.05)
Pietsch,M., 2013	High Quality	Vas Pain (10cm)-Pain ( )	1.4 months	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	1.1(9.00)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	1.3(1.00)	Mean Difference	-0.2(-3.01,2.61)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Pietsch,M., 2013	High Quality	Vas Pain (10cm)-Pain ( )	2.8 months	Use Of Patient Specific Technology(custom fit MRI=based pin guide with minimally invasive surgery)	40	0.8(0.80)	No Use Of Patient Specific Technology(minimally invasive conventional surgery)	40	0.9(0.70)	Mean Difference	-0.1(-0.43,0.23)	Not Significant (P-value>.05)

DRAINS

Strong evidence supports not using a drain with total knee arthroplasty (TKA) because there is no difference in complications or outcomes.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Four high-quality studies and three moderate-quality studies were reviewed. These studies showed no difference in multiple measures including VTE, infection, swelling, blood transfusions, hematoma formation, range of motion, length of stay, pain or reoperation between the treatment groups. One high quality study demonstrated a significantly greater need for manipulation (8 % vs. 0 %, P-value<0.05) in patients who did not receive a drain (Esler, 2003). Two high-quality studies reported significantly higher transfusion rates in patients who received a drain (Esler, 2003 and Li 2011). Two high-quality studies found no difference in transfusion rates in the presence or absence of a drain (Ritter 1994 and Jenny 2001). Meta-analysis of the included studies did not show significant differences in infection or flexion range of motion in the presence or absence of a drain. One study (Niskanen 2000) suggested that there may be more wound drainage in patients without a drain. All studies were relatively small ranging from 20 – 50 patients per treatment group with the exception of one high-quality study with 138 patients per treatment group (Ritter 1994).

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Potential harms include increased incidence of knee stiffness requiring manipulation with resultant poor range of motion, and increased wound drainage.

FUTURE RESEARCH

This is an ideal topic for a large, prospective, multi-centered randomized clinical trial. If appropriately risk adjusted, data from large registries could also be of value. Particular focus could be given to evaluation of patient-reported outcomes, infection, and long-term functional outcomes including range of motion.

* *See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 1: DRAINS VERSUS NO DRAINS

Summary of Findings	High Quality					Moderate Quality		
● Favors Drains ● Favors No Drains ○ Not Significant	Ritter,M.A., 1994	Niskanen,R.O., 2000	Li,C., 2011	Esler,C.N.A., 2003	Jenny,J.Y., 2001	Omonbude,D., 2010	Fan,Y., 2013	Meta-Analysis
Complications								
Complications other	○	○		○				
Deep venous thrombosis			○	○				
Fall in HB, g/dL	○							
Infection- Complications	○	○	○					○
Manipulation Under Anesthesia- Other				●				
Swelling - Other	○				○			
VTE- Complications	○							
Blood transfusion %	○			●	○			
Effusion						○		
Hematoma				○		○		
Need Transfusion- Complications		○						
Wound Complications							○	
Blood Loss								
Drainage- Complications								
Function								
Range of Motion(flexion) - Function	○				○			○
Range Of Motion(overall) - Function			○	○			○	
Length of Stay								
Length Of Recovery- Length Of Stay				○				
Pain								
Vas Pain (10cm)- Pain				○	○		●	
Reoperation								
Reoperation- Reoperation					○			

** See Appendix XIII for details regarding support*

FIGURE 7 DRAINS VERSUS NO DRAINS: INFECTION PETO ODDS RATIO

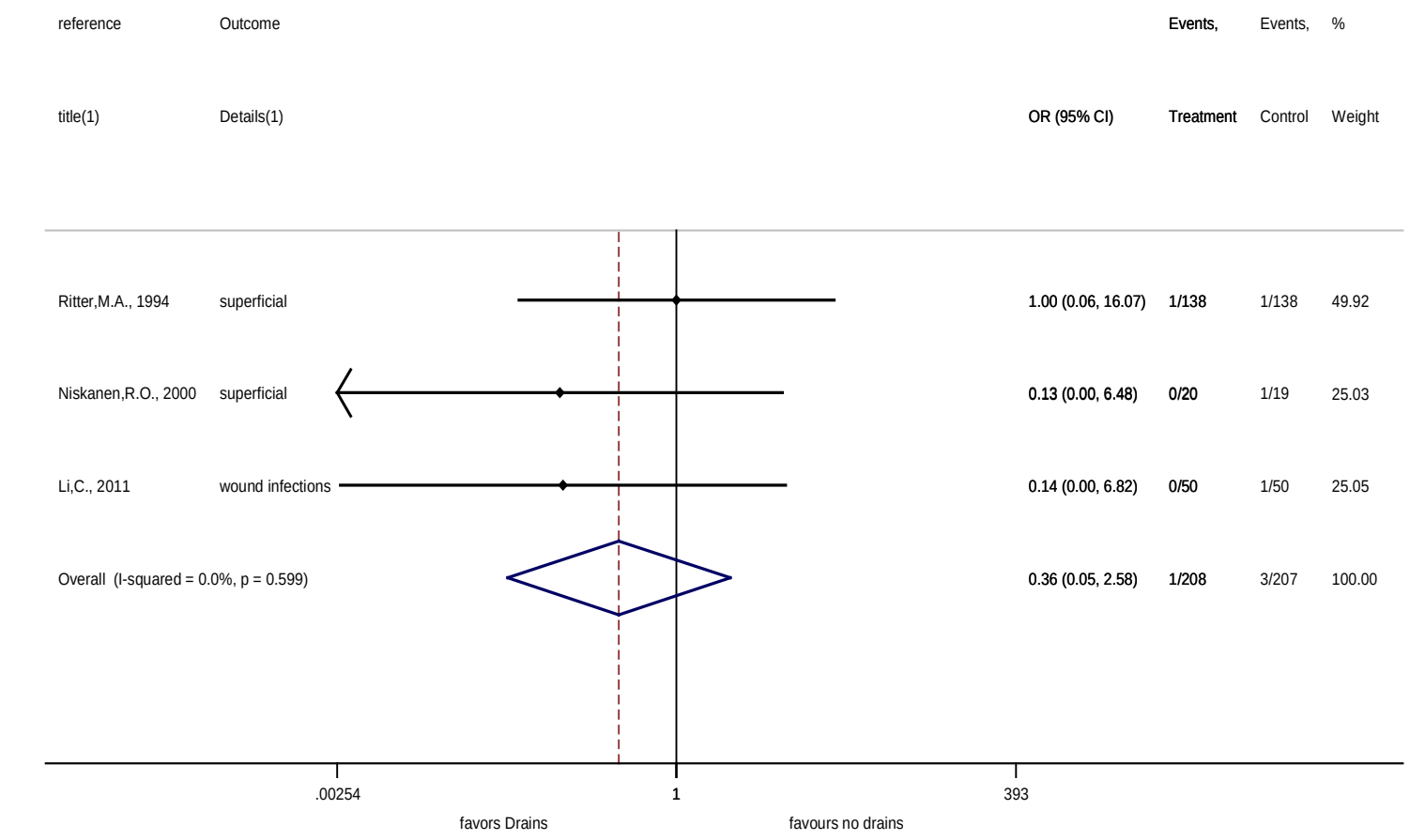
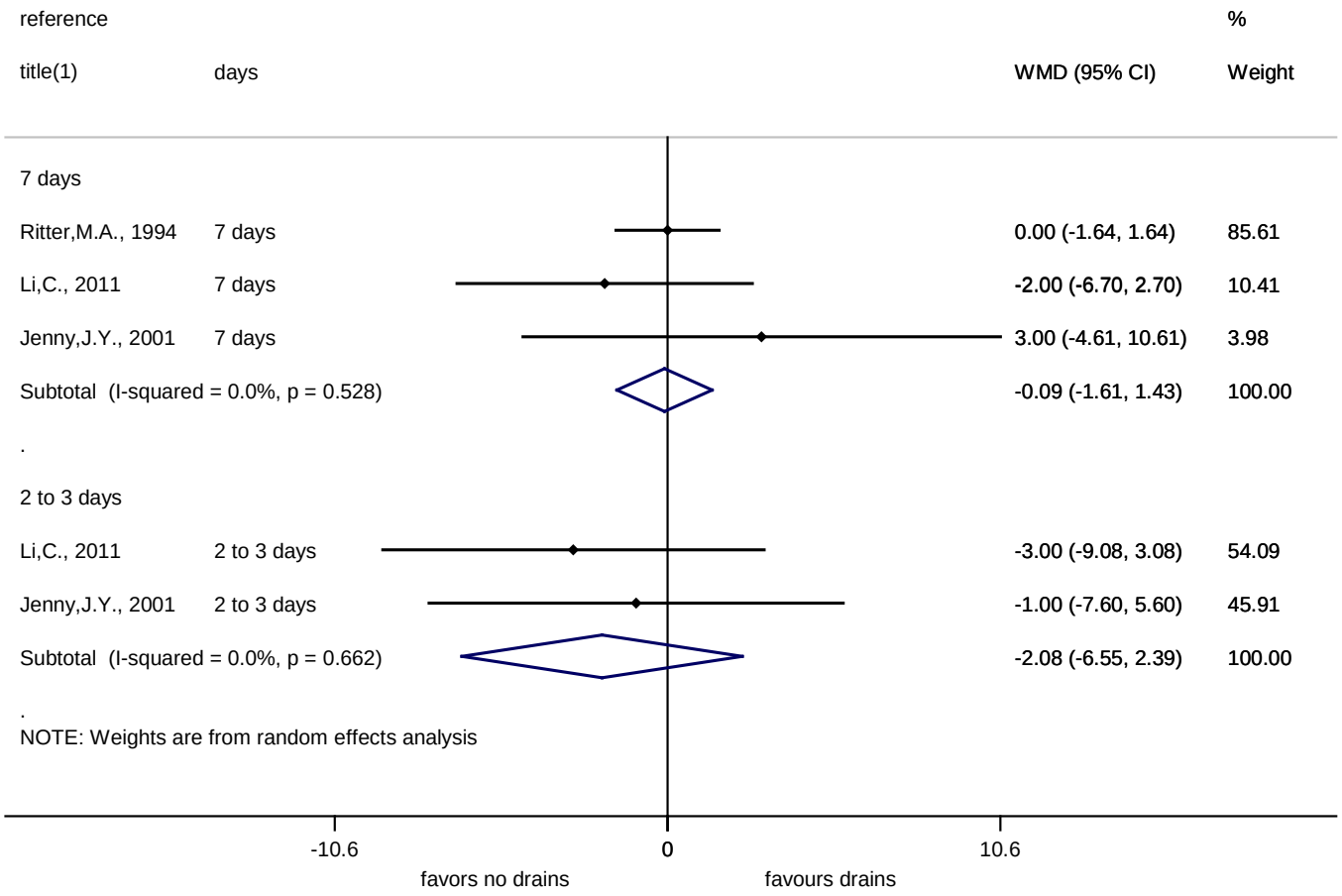


FIGURE 8 DRAINS VERSUS NO DRAINS RANGE OF MOTION IN FLEXION



QUALITY EVALUATION TABLE 1: DRAINS

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Cheng,S.C., 2005	●	●	○	●	○	●	Include	Moderate Quality
Esler,C.N.A., 2003	●	◑	◑	●	●	●	Include	High Quality
Fan,Y., 2013	◑	◑	○	●	●	●	Include	Moderate Quality
Li,C., 2011	◑	◑	◑	●	●	●	Include	High Quality
Niskanen, R.O., 2000	◑	◑	◑	●	●	●	Include	High Quality
Omonbude, D., 2010	●	◑	●	○	●	○	Include	Moderate Quality
Ritter,M.A., 1994	●	◑	●	●	●	●	Include	High Quality

DETAILED DATA TABLES

PART 1 : DRAINS VERSUS NO DRAINS

TABLE 105: PART 1- DRAINS VERSUS NO DRAINS: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Esler,C.N.A., 2003	High Quality	complications other (fever above 30 degrees celsius)	Post-Op	Drains (closed wound drainage)	50	8.00%	No Use Of Drains ( )	50	18.00%	RR	0.44(0.15,1.35)	Not Significant (P-value>.05)
Esler,C.N.A., 2003	High Quality	Deep venous thrombosis( )	Post-Op	Drains (closed wound drainage)	50	0.00%	No Use Of Drains ( )	50	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Esler,C.N.A., 2003	High Quality	Hematoma (hematoma or bruising)	Post-Op	Drains (closed wound drainage)	50	0.00%	No Use Of Drains ( )	50	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Esler,C.N.A., 2003	High Quality	Blood transfusion %(transfusion)	Post-Op	Drains (closed wound drainage)	50	62.00%	No Use Of Drains ( )	50	38.00%	RR	1.63(1.08,2.47)	**Treatment 2 Significant (P-value<.05)**
Jenny,J.Y., 2001	High Quality	Swelling - Other ( )	1 weeks	Drains ( )	30	49(5.00)	No Use Of Drains ( )	30	49(4.00)	Mean Difference	0(-2.29,2.29)	Not Significant (P-value>.05)
Jenny,J.Y., 2001	High Quality	Blood transfusion %( )	Post-Op	Drains ( )	30	36.67%	No Use Of Drains ( )	30	33.33%	RR	1.10(0.55,2.19)	Not Significant (P-value>.05)
Jenny,J.Y., 2001	High Quality	Swelling - Other ( )	2 hours	Drains ( )	30	49(5.00)	No Use Of Drains ( )	30	49(4.00)	Mean Difference	0(-2.29,2.29)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Li,C., 2011	High Quality	Infection-Complications (wound infections)	Post-Op	Drains ( )	50	0.00%	No Use Of Drains ( )	50	2.00%	RD	-0.02(-0.06,0.02)	Not Significant (P-value>.05)
Li,C., 2011	High Quality	Deep venous thrombosis( )	Post-Op	Drains ( )	50	0.00%	No Use Of Drains ( )	50	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Niskanen, R.O., 2000	High Quality	Need Transfusion-Complications (units transfused)	Post-Op	Drains (closed suction drainage)	20	2.3(.)	No Use Of Drains ( )	19	1.4(.)	Author Reported	NA	Not Significant (P-value>.05)
Niskanen, R.O., 2000	High Quality	complications other (prolonged oozing)	Post-Op	Drains (closed suction drainage)	20	5.00%	No Use Of Drains ( )	19	0.00%	RD	0.05(-0.05,0.15)	Not Significant (P-value>.05)
Niskanen, R.O., 2000	High Quality	Infection-Complications (superficial infection)	Post-Op	Drains (closed suction drainage)	20	0.00%	No Use Of Drains ( )	19	5.26%	RD	-0.05(-0.15,0.05)	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	Fall in HB, g/dL(raw HB score)	1 Days	Drains (closed wound drainage)	.	. %	No Use Of Drains ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	Fall in HB, g/dL(raw HB score)	2 Days	Drains (closed wound drainage)	.	. %	No Use Of Drains ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	Fall in HB, g/dL(raw HB score)	5 Days	Drains (closed wound drainage)	.	. %	No Use Of Drains ( )	.	. %	Author Reported	NA	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	Blood transfusion %(raw transfusion in ml)	Post-Op	Drains (closed	.	. %	No Use Of Drains ( )	.	. %	Author Reported	NA	Not Significant

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				wound drainage)								(P-value>.05)
Ritter,M. A., 1994	High Quality	Blood transfusion %(percent needing transjustion)	Post-Op	Drains (closed wound drainage)	138	64.49%	No Use Of Drains ( )	138	67.39%	RR	0.96(0.81,1.13)	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	complications other (need joint immobilization due to excessive bleeding)	Post-Op	Drains (closed wound drainage)	138	21.74%	No Use Of Drains ( )	138	25.36%	RR	0.86(0.56,1.31)	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	Infection-Complications (superficial)	Post-Op	Drains (closed wound drainage)	138	0.72%	No Use Of Drains ( )	138	0.72%	RR	1.00(0.06,15.83)	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	VTE-Complications ( )	Post-Op	Drains (closed wound drainage)	138	0.00%	No Use Of Drains ( )	138	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	Swelling - Other ( )	Post-Op	Drains (closed wound drainage)	138	0.00%	No Use Of Drains ( )	138	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Ritter,M. A., 1994	High Quality	complications other (bleeding dyscrasias)	Post-Op	Drains (closed wound drainage)	138	0.00%	No Use Of Drains ( )	138	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Wound Complications (wound redness)	2 Days	Drains ( )	40	2.50%	No Use Of Drains ( )	40	0.00%	RD	.025(-.02,.07)	Not Significant (P-value>.05)
Omonbude, D., 2010	Moderate Quality	Effusion (maximum depth of thickness in mm)	1 Days	Drains ( )	40	5.91(29.33)	No Use Of Drains ( )	38	6.08(28.05)	Mean Difference	-0.17(-12.91,12.57)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Omonbude, D., 2010	Moderate Quality	hematoma (maximum depth of thickness in mm)	4 Days	Drains ( )	40	8.41(260.05)	No Use Of Drains ( )	38	11.08(251.36)	Mean Difference	-2.67(-116.17,110.83)	Not Significant (P-value>.05)

TABLE 106: PART 1- DRAINS VERSUS NO DRAINS: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Esler,C.N.A., 2003	High Quality	Range Of Motion (overall) - Function (percentage of preoperation flexion regained by day 10)	1.4 weeks	Drains (closed wound drainage)	50	. %	No Use Of Drains ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)
Jenny,J.Y., 2001	High Quality	Range of Motion (flexion) - Function ( )	1 weeks	Drains ( )	30	79(16.00)	No Use Of Drains ( )	30	76(14.00)	Mean Difference	3(-4.61,10.61)	Not Significant (P-value>.05)
Jenny,J.Y., 2001	High Quality	Range of Motion (flexion) - Function ( )	2 Days	Drains ( )	30	48(14.00)	No Use Of Drains ( )	30	49(12.00)	Mean Difference	-1(-7.60,5.60)	Not Significant (P-value>.05)
Li,C., 2011	High Quality	Range Of Motion (overall) - Function (degrees of active flexion)	3 Days	Drains ( )	50	45(15.00)	No Use Of Drains ( )	50	48(16.00)	Mean Difference	-3(-9.08,3.08)	Not Significant (P-value>.05)
Li,C., 2011	High Quality	Range Of Motion (overall) - Function (degrees of active flexion)	1 weeks	Drains ( )	50	68(12.00)	No Use Of Drains ( )	50	70(12.00)	Mean Difference	-2(-6.70,2.70)	Not Significant (P-value>.05)
Li,C., 2011	High Quality	Range Of Motion	2 weeks	Drains ( )	50	82(16.00)	No Use Of Drains ( )	50	83(14.00)	Mean Difference	-1(-6.89,4.89)	Not Significant

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
		(overall) - Function (degrees of active flexion)										(P-value>.05)
Li,C., 2011	High Quality	Range Of Motion (overall) - Function (degrees of active flexion)	1 years	Drains ( )	50	100(12.00)	No Use Of Drains ( )	50	100(10.00)	Mean Difference	0(-4.33,4.33)	Not Significant (P-value>.05)
Ritter,M.A., 1994	High Quality	Range of Motion (flexion) - Function ( )	1 weeks	Drains (closed wound drainage)	138	70(.)	No Use Of Drains ( )	138	72(.)	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function (in flexion)	1 weeks	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function (in flexion)	2 weeks	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function (in flexion)	1 months	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function (during extension)	1 weeks	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function (during extension)	2 weeks	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function (during extension)	1 months	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Range Of Motion (overall) - Function ( )	1 years	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 107: PART 1- DRAINS VERSUS NO DRAINS: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Esler,C.N.A., 2003	High Quality	Length Of Recovery-Length Of Stay ( )	Post-Op	Drains (closed wound drainage)	50	. %	No Use Of Drains ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 108: PART 1- DRAINS VERSUS NO DRAINS: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Esler,C.N.A., 2003	High Quality	Vas Pain (10cm)-Pain ( )	2 Days	Drains (closed	50	. %	No Use Of Drains ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
				wound drainage)								
Esler,C.N.A., 2003	High Quality	Vas Pain (10cm)-Pain ( )	6 Days	Drains (closed wound drainage)	50	. %	No Use Of Drains ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)
Esler,C.N.A., 2003	High Quality	Vas Pain (10cm)-Pain ( )	1.4 weeks	Drains (closed wound drainage)	50	. %	No Use Of Drains ( )	50	. %	Author Reported	NA	Not Significant (P-value>.05)
Jenny,J.Y., 2001	High Quality	Vas Pain (10cm)-Pain ( )	2 Days	Drains ( )	30	5.3(2.80)	No Use Of Drains ( )	30	5.1(1.80)	Mean Difference	0.2(-0.99,1.39)	Not Significant (P-value>.05)
Jenny,J.Y., 2001	High Quality	Vas Pain (10cm)-Pain ( )	1 weeks	Drains ( )	30	4.9(2.20)	No Use Of Drains ( )	30	5(2.20)	Mean Difference	-0.1(-1.21,1.01)	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Vas Pain (10cm)-Pain ( )	3 Days	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Vas Pain (10cm)-Pain ( )	1 Days	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
Fan,Y., 2013	Moderate Quality	Vas Pain (10cm)-Pain ( )	5 Days	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Vas Pain (10cm)-Pain ( )	1 weeks	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)
Fan,Y., 2013	Moderate Quality	Vas Pain (10cm)-Pain ( )	2 weeks	Drains ( )	40	. %	No Use Of Drains ( )	40	. %	Author Reported	NA	Not Significant (P-value>.05)

CRYOTHERAPY DEVICES

Moderate evidence supports that cryotherapy devices after knee arthroplasty (KA) do not improve outcomes.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

The literature extraction and review revealed one high quality study, two moderate quality studies, and one low quality study.

The high quality study (Ivey 1994) used a cryotherapy sleeve on all of the patients and randomized the target temperatures up to including 70°F. There was no evidence for dose dependent differences in need for pain medication including the control of 70°F. There is some issue with this control, in that it does have a cooling effect. As the only high level study it falls to a moderate level of evidence for this guideline.

Of the two moderate quality studies that used cryotherapy, one (Holmstram 2005) consisted of postoperative unicompartmental knees that were randomized between epidural anesthesia, cryotherapy, and a third arm that does not document the use of simple cold packs/ice. It reported less pain medication consumption in the two treatment arms.

The second of the moderate quality studies (Su 2012) compared cryotherapy/compression to cryotherapy alone, including the early post-discharge period, and showed no significant outcome differences other than less overall narcotics used over the broad period of the first two weeks and higher levels of patient satisfaction. The study involved 11 sites and the patients could not be blinded to treatment.

One low quality study (Theinpoint, 2014) demonstrated less flexion in the cryotherapy group at an intermediate time period; this was attributed to the patient having less freedom to bend their knee while in the device.

The lack of dose effect in reducing narcotic consumption in the high level study contradicts the findings in the two relevant moderate level studies, both of which were not internally supported by significant differences in visual analogue pain scales. There were no other significant differences in other outcomes in the two relevant moderate studies.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Frostbite (cold burn) is a potential harm for the use of cryotherapy. It is possible that a unique patient population at risk for complications from pain medication might benefit from less narcotic consumption in the early post-operative period using cryotherapy.

* *See Appendix XIII for details regarding support*

FUTURE RESEARCH

The varied temperature study (Ivey 1994) could be replicated with larger numbers to confirm the lack of dose effect from the cooling mechanisms.

A larger multi-center study that compared simple cold packs or ice with cryotherapy devices and also followed the patients for a longer period of time will be very valuable. Using patient reported outcomes in addition to satisfaction scores to measure differences between the groups will be appropriate.

Further randomized controlled trials of the use of compression in cryotherapy compared to standard treatments (cryotherapy alone or compression alone) would be appropriate.

RESULTS

SUMMARY OF FINDINGS TABLE 26: CRYOTHERAPY

Summary of Findings	High Quality	Moderate Quality		Low Quality
● Favors Cryotherapy ● Favors No Cryotherapy ○ Not Significant	Ivey,M., 1994	HolmstrÃm,A., 2005	Su,E.P., 2012	Thienpont,E., 2014
Complications				
Fall in HB, g/dL				○
Overall Complications- Complications		○		
Manipulation Under Anesthesia			○	
Swelling		○	○	
Function				
Range of Motion		○	○	
Timed Functional Tests			○	
Pain				
Vas Pain		○	○	
Postoperative Pain Control				
Additional Medication- Postoperative Pain Control	○			
Morphine consumption (mg)	○			
Narcotic Use			●	
Perioperative Use Of Narcotics- Pain		●		
Other				
Patient satisfaction			●	

QUALITY EVALUATION TABLE 17: CRYOTHERAPY

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Holmström,A., 2005	◑	◑	○	●	●	●	Include	Moderate Quality
Ivey,M., 1994	●	●	●	●	●	●	Include	High Quality
Su,E.P., 2012	●	●	○	○	●	●	Include	Moderate Quality
Thienpont,E., 2014	○	○	○	◑	○	●	Include	Low Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 109: CRYOTHERAPY VERSUS NO CRYOTHERAPY: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Thienpont,E., 2014	Low Quality	Fall in HB, g/dL(Recorded as actual HB levels - not loss)	2 days	Cryotherapy(4 hrs of continuous cooling at 11C after surgery. 2 hrs before and after PT first postoperative day)	50	12(1.00)	No Cryotherapy(Cold packs applied 15 min at a time at 2 and 4 hours after surgery, after PT, and at night as needed.)	50	12(1.00)	Mean Difference	0(-0.39,0.39)	Not Significant (P-value>.05)
Thienpont,E., 2014	Low Quality	Fall in HB, g/dL(Recorded as actual HB levels - not loss)	4 days	Cryotherapy(4 hrs of continuous cooling at 11C after surgery. 2 hrs before and after PT first postoperative day)	50	11.5(1.00)	No Cryotherapy(Cold packs applied 15 min at a time at 2 and 4 hours after surgery, after PT, and at night as needed.)	50	11.5(0.50)	Mean Difference	0(-0.31,0.31)	Not Significant (P-value>.05)
HolmstrÃm,A., 2005	Moderate Quality	Overall Complications - Complications ( )	NR	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	4.35%	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	5.88%	RR	0.74(0.05,11.00)	Not Significant (P-value>.05)
HolmstrÃm,A., 2005	Moderate Quality	Swelling - Other((mm))	1 week	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	. %	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	. %	Author Reported	NA	Not Significant (P-value>.05)
HolmstrÃm,A., 2005	Moderate Quality	Swelling - Other((mm))	6 weeks	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	. %	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Su,E.P., 2012	Moderate Quality	Swelling - Other(knee girth)	2 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	. %	No Cryotherapy(ice packs with static compression)	84	. %	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Manipulation Under Anesthesia-Other( )	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	5.83%	No Cryotherapy(ice packs with static compression)	84	8.33%	RR	0.70(0.24,2.00)	Not Significant (P-value>.05)

TABLE 110: CRYOTHERAPY VERSUS NO CRYOTHERAPY: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
HolmstrÃm,A., 2005	Moderate Quality	Range of Motion(flexion) - Function(Active and passive)	6 weeks	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	. %	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Range of Motion(extension) - Function( )	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-1.7(.)	No Cryotherapy(ice packs with static compression)	84	-1.5(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Range of Motion(extension) - Function( )	2 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	1.5(.)	No Cryotherapy(ice packs with static compression)	84	1.6(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Range of Motion(flexion) - Function( )	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-9.5(.)	No Cryotherapy(ice packs with static compression)	84	-8.6(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Range of Motion(flexion) - Function( )	2 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-33(.)	No Cryotherapy(ice packs with static compression)	84	-28.7(.)	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Su,E.P., 2012	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(six minute walk test (meters))	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	29.4(.)	No Cryotherapy(ice packs with static compression)	84	7.9(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(six minute walk test (meters))	2 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-118.2(.)	No Cryotherapy(ice packs with static compression)	84	-107.7(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(timed up and go (sec))	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-1.5(.)	No Cryotherapy(ice packs with static compression)	84	-2.4(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(timed up and go (sec))	2 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	4.5(.)	No Cryotherapy(ice packs with static compression)	84	5(.)	Author Reported	NA	Not Significant (P-value>.05)

TABLE 111: CRYOTHERAPY VERSUS NO CRYOTHERAPY: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Su,E.P., 2012	Moderate Quality	Patient satisfaction( )	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	. %	No Cryotherapy(ice packs with static compression)	84	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 112: CRYOTHERAPY VERSUS NO CRYOTHERAPY: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
HolmstrÃm,A., 2005	Moderate Quality	Vas Pain (10cm)-Pain(Percent of patients free of pain at rest (VAS=0))	6 weeks	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	73.91%	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	64.71%	RR	1.14(0.75,1.75)	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Vas Pain (100mm)-Pain( )	6 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-23.4(.)	No Cryotherapy(ice packs with static compression)	84	-22.1(.)	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Vas Pain (100mm)-Pain( )	2 weeks	Cryotherapy(Game Ready cryopneumatic device with cooling and compression set by patient as tolerated)	103	-9(.)	No Cryotherapy(ice packs with static compression)	84	-13.5(.)	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 113: CRYOTHERAPY VERSUS NO CRYOTHERAPY: POST-OP PAIN CONTROL

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ivey,M., 1994	High Quality	Additional Medication-Postoperative Pain Control(PCA attempts per hour)	Post-Op	Cryotherapy(Cooling set to 50 degrees)	28	3.6(2.40)	No Cryotherapy(Cooling set to 70 degrees (room temperature))	30	3.9(3.00)	Mean Difference	-0.3(-1.69,1.09)	Not Significant (P-value>.05)
Ivey,M., 1994	High Quality	Additional Medication-Postoperative Pain Control(PCA attempts per hour)	Post-Op	Cryotherapy(Cooling set to 60 degrees)	30	3.4(2.80)	No Cryotherapy(Cooling set to 70 degrees (room temperature))	30	3.9(3.00)	Mean Difference	-0.5(-1.97,0.97)	Not Significant (P-value>.05)
Ivey,M., 1994	High Quality	Additional Medication-Postoperative Pain Control(PCA attempts per hour)	Post-Op	Cryotherapy(Cooling set to 50 degrees)	28	3.6(2.40)	Cryotherapy(Cooling set to 60 degrees)	30	3.4(2.80)	Mean Difference	0.2(-1.14,1.54)	Not Significant (P-value>.05)
Ivey,M., 1994	High Quality	Morphine consumption (mg)(mg/h)	Post-Op	Cryotherapy(Cooling set to 50 degrees)	28	1.6(0.80)	No Cryotherapy(Cooling set to 70 degrees (room temperature))	30	1.3(0.60)	Mean Difference	0.3(-0.07,0.67)	Not Significant (P-value>.05)
Ivey,M., 1994	High Quality	Morphine consumption (mg)(mg/h)	Post-Op	Cryotherapy(Cooling set to 60 degrees)	30	1.4(0.70)	No Cryotherapy(Cooling set to 70 degrees (room temperature))	30	1.3(0.60)	Mean Difference	0.1(-0.23,0.43)	Not Significant (P-value>.05)

* *See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ivey,M., 1994	High Quality	Morphine consumption (mg)(mg/h)	Post-Op	Cryotherapy(Cooling set to 50 degrees)	28	1.6(0.80)	Cryotherapy(Cooling set to 60 degrees)	30	1.4(0.70)	Mean Difference	0.2(-0.19,0.59)	Not Significant (P-value>.05)
HolmstrÃm, A., 2005	Moderate Quality	Perioperative Use Of Narcotics-Pain(Morphine use)	1 day	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	. %	No Cryotherapy(Traditional pain management with no cryotherapy.)	23	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**
HolmstrÃm, A., 2005	Moderate Quality	Perioperative Use Of Narcotics-Pain(Morphine use)	2 days	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	. %	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	. %	Author Reported	NA	Not Significant (P-value>.05)
HolmstrÃm, A., 2005	Moderate Quality	Perioperative Use Of Narcotics-Pain(Morphine use)	3 days	Cryotherapy(Cryo/Cuff applied circulating ice water at 10-15 degrees C for 48 hours.)	23	. %	No Cryotherapy(Traditional pain management with no cryotherapy.)	17	. %	Author Reported	NA	Not Significant (P-value>.05)
Su,E.P., 2012	Moderate Quality	Narcotic Use( )	2 weeks	Cryotherapy(GameReady cryopneumatic device with cooling and compression set by patient as tolerated)	103	. %	No Cryotherapy(ice packs with static compression)	84	. %	Author Reported	NA	**Treatment 1 Significant (P-value<.05)**

CONTINUOUS PASSIVE MOTION (CPM)

Strong evidence supports that CPM after knee arthroplasty (KA) does not improve outcomes.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

RATIONALE

Two high quality studies (Beaupre 2001, Denis 2006) and five moderate quality studies (Can 2003, Chan 2013, Herbold 2014, MacDonald 2000, Montgomery 1996) compared the utilization of continuous passive motion during hospital stay to no utilization of continuous passive motion. The combined results provide strong evidence that the surgical outcomes for those who used continuous passive motion are not better than for those who did not use continuous passive motion.

Five of the seven studies measured outcomes of physical function and quality of life. Beaupre et al, Denis et al, Herbold et al, and MacDonald et al found no significant differences in a gamut of outcomes (WOMAC, SF-36, Timed "up + go" [TUG], functional independence measure [FIM], and Knee Society Score). Chen et al reported better quality of life in the group that did not use continuous passive motion. Knee range of motion was investigated by Beaupre et al, Denis et al, and Chen et al. Meta-analysis showed no differences in knee range of motion. Complications were evaluated by Beaupre et al and Denis et al and were not statistically different between groups. Beaupra et al, Can et al, Chen et al, MacDonald et al, and Montgomery et al demonstrated that pain and stiffness were not decreased by CPM, whereas Denis et al reported significantly less pain in the continuous passive motion group (12 points difference in VAS ranging from 0-100). Meta-analysis from Denis et al, Herbold et al, and Montgomery et al showed no differences in length of hospital stay.

One high quality study (Lenssen 2008) demonstrated no statistically significant benefits in functional outcome scores or range of motion with the use of continuous passive motion in conjunction with physical therapy compared to physical therapy alone. The continuous passive motion was used for 17 consecutive days after surgery (about 2 weeks after discharge).

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no known harms associated with implementing this recommendation.

FUTURE RESEARCH

The strong evidence indicated that no further research is needed on the routine use of continuous passive motion after total knee arthroplasty, but there are patients who are at significant risk of postoperative stiffness, for whom additional studies are appropriate. Continued comparative multicenter prospective studies may further define optimal postoperative rehabilitation after total knee arthroplasty.

* *See Appendix XIII for details regarding support*

RESULTS

SUMMARY OF FINDINGS TABLE 25: CONTINUOUS PASSIVE MOTION

Summary of Findings ● Favors CPM ● Favors No CPM ○ Not Significant	High Quality			Moderate Quality					
	BeauprÃ,L.A., 2001	Denis,M., 2006	Lenssen,T.A., 2008	Can,F., 2003	Chen,L.H., 2013	Herbold,J.A., 2014	MacDonald,S.J., 2000	Montgomery,F., 1996	Meta-Anlysis
Complications									
Manipulation Under Anesthesia	○	○							
Swelling						○		●	
Composite									
SF-36 Physical component summary	○								
Womac-overall		○	○						
Sf-36 Overall					●				
Function									
Functional independence measure (FIM)						○			
Knee Society Score KSS			○				○		
Range of Motion	○	○	○		○				○
Sf-36 Mental Health- Function	○								
Sf-36 Physical Functioning- Function	○								
Sf-36 Physical Role Functioning- Function	○								
Sf-36 Social Role Functioning- Function	○								
Timed Functional Test		○				○			
Womac-function	○	○	○						NA
Length of Stay									
Days- Length Of Stay		○				○		○	○
Length Of Recovery- Length Of Stay		○						●	
Other									
SF-36 Emotional Role Functioning	○								
Sf-36 General Health Perceptions- Other	○								
SF-36 Mental Component summary	○								
Sf-36 Vitality- Other	○								
Pain									
Knee Society Score-Pain				○					
Sf-36 Bodily Pain	○								
Vas Pain (10cm)				○	○			○	NA
Womac-Pain	○	●	○						NA
Stiffness									
Womac-Stiffness Likert (0-8)	○	○	○						NA

** See Appendix XIII for details regarding support*

QUALITY EVALUATION TABLE 15: CONTINOUS PASSIVE MOTION

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention - Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Ververeli,P.A., 1995	○	●	○	◑	●	●	Include	Low Quality
Jordan,L.R., 1995	○	●	●	●	●	●	Not best available evidence	Low Quality

QE - Intervention - Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Beaupré,L.A., 2001	●	◑	○	●	●	●	Include	High Quality
Can,F., 2003	◑	◑	●	○	●	●	Include	Moderate Quality
Chen,L.H., 2013	◑	◑	○	●	●	●	Include	Moderate Quality
Denis,M., 2006	●	◑	○	●	●	●	Include	High Quality
Herbold,J.A., 2014	○	○	○	●	●	●	Include	Moderate Quality
MacDonald, S.J., 2000	●	◑	○	●	○	●	Include	Moderate Quality
Montgomery,F., 1996	◑	◑	○	○	●	●	Include	Moderate Quality
Johnson,D.P., 1992	◑	◑	○	●	●	●	Not best available evidence	Moderate Quality
Kumar,P.J., 1996	●	◑	○	○	○	○	Not best available evidence	Low Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 114: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Manipulation Under Anesthesia-Other( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	40	2.50%	No Post-op Cpm (In-Hospital)(Standard exercise)	40	0.00%	RD	0.03(-0.02,0.07)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Manipulation Under Anesthesia-Other( )	Discharge	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	0.00%	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Manipulation Under Anesthesia-Other( )	Discharge	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	0.00%	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	0.00%	RD	0.00(0.00,0.00)	Not Significant (P-value>.05)
Ververeli,P.A., 1995	Low Quality	Manipulation Under Anesthesia-Other(Manipulations done if patient failed to maintain 50 degrees flexion beyond 10th post operative day.)	1.3 months	Cpm used post-op (In Hospital)(CPM initiated in recovery room. Patients used device approx 20 hours per day for 7 days.)	51	0.00%	No Post-op Cpm (In-Hospital)(No intervention.)	52	3.85%	RD	-0.04(-0.09,0.01)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Ververeli,P.A., 1995	Low Quality	Manipulation Under Anesthesia-Other(Manipulations done if patient failed to maintain 50 degrees flexion beyond 10th post operative day.)	10 days	Cpm used post-op (In Hospital)(CPM initiated in recovery room. Patients used device approx 20 hours per day for 7 days.)	51	0.00%	No Post-op Cpm (In-Hospital)(No intervention.)	52	5.77%	RD	-0.05(-0.11,0.01)	Not Significant (P-value>.05)
Ververeli,P.A., 1995	Low Quality	Swelling - Other(Knee circumference measured at mid-patella. (mm))	1 week	Cpm used post-op (In Hospital)(CPM initiated in recovery room. Patients used device approx 20 hours per day for 7 days.)	51	23.5(17.90)	No Post-op Cpm (In-Hospital)(No intervention.)	52	22.2(13.10)	Mean Difference	1.3(-4.77,7.37)	Not Significant (P-value>.05)
Herbold,J.A., 2014	Moderate Quality	Swelling - Other(Knee girth in cm)	8 days	Cpm used post-op (In Hospital)(2 hrs/day of CPM in addition to conventional PT)	70	46.1(5.30)	No Post-op Cpm (In-Hospital)(3 hrs/day of conventional PT)	71	46.2(5.00)	Mean Difference	-0.1(-1.80,1.60)	Not Significant (P-value>.05)
Montgomery,F., 1996	Moderate Quality	Swelling - Other(Measured as difference in mid-patellar circumference pre/post-op.)	Discharge	Cpm used post-op (In Hospital)(CPM for 3 hours 3 times daily, 7 days a week.)	28	1.3(2.00)	No Post-op Cpm (In-Hospital)(Active and passive motion exercises with a physical therapist 30 minutes twice daily, 5 days a week.)	32	4.6(8.00)	Mean Difference	-3.3(-6.17,-0.43)	**Treatment 1 Significant (P-value<.05)**

TABLE 115: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	SF-36 Physical component summary( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	29(6.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	29(8.00)	Mean Difference	0(-3.33,3.33)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	SF-36 Physical component summary( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	36(10.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	38(10.00)	Mean Difference	-2(-6.69,2.69)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	32.2(20.60)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	37.1(22.60)	Mean Difference	-4.9(-16.34,6.54)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	41.2(17.60)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	37.1(22.60)	Mean Difference	4.1(-6.78,14.98)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-overall-Composite Likert (0-96)( )	17 days	Cpm used post-discharge (In Home)( )	30	69.9(15.90)	No Post-Discharge Cpm (In-Home)( )	30	65.4(16.40)	Mean Difference	4.5(-3.67,12.67)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-overall-Composite Likert (0-96)( )	6 weeks	Cpm used post-discharge (In Home)( )	30	75(13.60)	No Post-Discharge Cpm (In-Home)( )	30	74.5(16.10)	Mean Difference	0.5(-7.04,8.04)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Lenssen,T.A., 2008	High Quality	Womac-overall-Composite Likert (0-96)( )	3 months	Cpm used post-discharge (In Home)( )	30	80.5(7.50)	No Post-Discharge Cpm (In-Home)( )	30	82.8(0.50)	Mean Difference	-2.3(-4.99,0.39)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Sf-36 Overall - Composite( )	6 weeks	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	2.53(0.14)	No Post-op Cpm (In-Hospital)( )	39	2.56(0.16)	Mean Difference	-0.03(-0.09,0.03)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Sf-36 Overall - Composite( )	2 weeks	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	3.38(0.16)	No Post-op Cpm (In-Hospital)( )	39	3.47(0.14)	Mean Difference	-0.09(-0.15,-0.03)	**Treatment 2 Significant (P-value<.05)**
Chen,L.H., 2013	Moderate Quality	Sf-36 Overall - Composite( )	3 months	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	2.08(0.14)	No Post-op Cpm (In-Hospital)( )	39	2.01(0.18)	Mean Difference	0.07(0.00,0.14)	**Treatment 1 Significant (P-value<.05)**
Chen,L.H., 2013	Moderate Quality	Sf-36 Overall - Composite( )	6 months	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	1.77(0.15)	No Post-op Cpm (In-Hospital)( )	39	1.83(0.16)	Mean Difference	-0.06(-0.12,0.00)	Not Significant (P-value>.05)

TABLE 116: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Range of Motion(extension) - Function(Active extension. Hypoextension reported as negative values.)	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	33	4(4.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	32	3(6.00)	Mean Difference	1(-1.49,3.49)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Range of Motion(extension) - Function(Active extension. Hypoextension reported as negative values.)	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	33	4(4.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	32	2(5.00)	Mean Difference	2(-0.21,4.21)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Range of Motion(extension) - Function(Active extension. Hypoextension reported as negative values.)	Discharge	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	40	8(4.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	40	8(4.00)	Mean Difference	0(-1.75,1.75)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Range of Motion(flexion) - Function(Active flexion)	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	33	94(11.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	32	91(11.00)	Mean Difference	3(-2.35,8.35)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Range of Motion(flexion) - Function(Active flexion)	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	33	98(13.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	32	94(21.00)	Mean Difference	4(-4.52,12.52)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Range of Motion(flexion) - Function(Active flexion)	Discharge	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	40	61(14.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	40	65(13.00)	Mean Difference	-4(-9.92,1.92)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Mental Health-Function( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	79(17.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	74(19.00)	Mean Difference	5(-3.46,13.46)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Mental Health-Function( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	83(13.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	79(19.00)	Mean Difference	4(-3.73,11.73)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Physical Functioning-Function( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	46(18.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	45(20.00)	Mean Difference	1(-7.93,9.93)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Physical Functioning-Function( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	46(20.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	55(27.00)	Mean Difference	-9(-20.18,2.18)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Physical Role Functioning-Function( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	19(26.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	28(41.00)	Mean Difference	-9(-25.19,7.19)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Sf-36 Physical Role Functioning-Function( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	40(40.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	43(40.00)	Mean Difference	-3(-21.75,15.75)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Social Role Functioning-Function( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	75(23.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	69(24.00)	Mean Difference	6(-5.02,17.02)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Social Role Functioning-Function( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	81(22.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	79(25.00)	Mean Difference	2(-9.06,13.06)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Womac-function averaged VAS Version (0-100)( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	34	73(13.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	72(17.00)	Mean Difference	1(-6.19,8.19)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Range of Motion(extension) - Function(Active extension. Reviewer judgement that author reported negative values for hypo-extension.)	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	7(3.70)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	8(3.50)	Mean Difference	-1(-2.94,0.94)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Denis,M., 2006	High Quality	Range of Motion(flexion) - Function(Active flexion. Outcome measured at discharge (8 day aprrox.))	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	78.7(10.60)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	80.4(11.80)	Mean Difference	-1.7(-7.73,4.33)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Timed Up and Go (in seconds))	8 days	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	52.3(34.90)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	41.9(21.40)	Mean Difference	10.4(-4.84,25.64)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Timed Up and Go (in seconds))	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	50.7(22.60)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	41.9(21.40)	Mean Difference	8.8(-3.06,20.66)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-function averaged VAS Version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	31(23.90)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	33(22.70)	Mean Difference	-2(-14.32,10.32)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-function averaged VAS Version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	40(20.20)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	33(22.70)	Mean Difference	7(-4.56,18.56)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Knee Society Score KSS( )	17 days	Cpm used post-discharge (In Home)( )	30	67.6(19.60)	No Post-Discharge Cpm (In-Home)( )	30	67.3(14.90)	Mean Difference	0.3(-8.51,9.11)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Lenssen,T.A., 2008	High Quality	Knee Society Score KSS( )	6 weeks	Cpm used post-discharge (In Home)( )	30	77.3(14.90)	No Post-Discharge Cpm (In-Home)( )	30	73.6(13.80)	Mean Difference	3.7(-3.57,10.97)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Knee Society Score KSS( )	3 months	Cpm used post-discharge (In Home)( )	30	80.4(5.30)	No Post-Discharge Cpm (In-Home)( )	30	78.8(5.30)	Mean Difference	1.6(-1.08,4.28)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Range of Motion(extension) - Function(Active extension.)	17 days	Cpm used post-discharge (In Home)( )	30	6.3(3.90)	No Post-Discharge Cpm (In-Home)( )	30	8.1(4.80)	Mean Difference	-1.8(-4.01,0.41)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Range of Motion(extension) - Function(Active extension.)	6 weeks	Cpm used post-discharge (In Home)( )	30	6.3(4.00)	No Post-Discharge Cpm (In-Home)( )	30	6.9(5.40)	Mean Difference	-0.6(-3.00,1.80)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Range of Motion(extension) - Function(Active extension.)	3 months	Cpm used post-discharge (In Home)( )	30	4.8(3.90)	No Post-Discharge Cpm (In-Home)( )	30	4.3(4.70)	Mean Difference	0.5(-1.69,2.69)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Range of Motion(flexion) - Function(Active flexion.)	17 days	Cpm used post-discharge (In Home)( )	30	89.9(9.10)	No Post-Discharge Cpm (In-Home)( )	30	86.7(8.50)	Mean Difference	3.2(-1.26,7.66)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Range of Motion(flexion) - Function(Active flexion.)	6 weeks	Cpm used post-discharge (In Home)( )	30	98.2(11.70)	No Post-Discharge Cpm (In-Home)( )	30	98.7(11.20)	Mean Difference	-0.5(-6.30,5.30)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Range of Motion(flexion) - Function(Active flexion.)	3 months	Cpm used post-discharge (In Home)( )	30	105.7(2.50)	No Post-Discharge Cpm (In-Home)( )	30	106.2(0.60)	Mean Difference	-0.5(-1.42,0.42)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Lenssen,T.A., 2008	High Quality	Womac-Function likert version (0-68)( )	17 days	Cpm used post-discharge (In Home)( )	30	49.1(11.90)	No Post-Discharge Cpm (In-Home)( )	30	45.3(12.30)	Mean Difference	3.8(-2.32,9.92)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Function likert version (0-68)( )	6 weeks	Cpm used post-discharge (In Home)( )	30	53(9.50)	No Post-Discharge Cpm (In-Home)( )	30	52.7(12.00)	Mean Difference	0.3(-5.18,5.78)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Function likert version (0-68)( )	3 months	Cpm used post-discharge (In Home)( )	30	57.6(4.20)	No Post-Discharge Cpm (In-Home)( )	30	58.6(8.40)	Mean Difference	-1(-4.36,2.36)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Range of Motion(flexion) - Function( )	6 weeks	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	110.51(9.74)	No Post-op Cpm (In-Hospital)( )	39	113.21(10.03)	Mean Difference	-2.7(-6.61,1.21)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Range of Motion(flexion) - Function( )	2 weeks	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	102.33(9.17)	No Post-op Cpm (In-Hospital)( )	39	105(10.76)	Mean Difference	-2.67(-6.69,1.35)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Range of Motion(flexion) - Function( )	3 months	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	119.26(8.86)	No Post-op Cpm (In-Hospital)( )	39	119.1(9.31)	Mean Difference	0.16(-3.44,3.76)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Range of Motion(flexion) - Function( )	6 months	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	125.51(5.99)	No Post-op Cpm (In-Hospital)( )	39	125.13(6.44)	Mean Difference	0.38(-2.09,2.85)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Herbold,J.A., 2014	Moderate Quality	Functional independence measure (FIM)(Higher scores indicate higher level of independence)	8 days	Cpm used post-op (In Hospital)(2 hrs/day of CPM in addition to conventional PT)	70	107(4.10)	No Post-op Cpm (In-Hospital)(3 hrs/day of conventional PT)	71	107.8(3.20)	Mean Difference	-0.8(-2.02,0.42)	Not Significant (P-value>.05)
Herbold,J.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(TUG (s))	8 days	Cpm used post-op (In Hospital)(2 hrs/day of CPM in addition to conventional PT)	70	19.9(7.50)	No Post-op Cpm (In-Hospital)(3 hrs/day of conventional PT)	71	19.8(6.10)	Mean Difference	0.1(-2.16,2.36)	Not Significant (P-value>.05)
MacDonald,S.J., 2000	Moderate Quality	Knee Society Score KSS( )	1 year	Cpm used post-op (In Hospital)(CPM set to 0-50 degress ROM starting in recovery room and ending the next postoperative day.)	40	166(23.00)	No Post-op Cpm (In-Hospital)(Control Group recieving standard care.)	40	166(25.00)	Mean Difference	0(-10.53,10.53)	Not Significant (P-value>.05)
MacDonald,S.J., 2000	Moderate Quality	Knee Society Score KSS( )	1 year	Cpm used post-op (In Hospital)(CPM set to 70-110 degress ROM starting in revery room until next postoperative day.)	40	165(18.00)	No Post-op Cpm (In-Hospital)(Control Group recieving standard care.)	40	166(25.00)	Mean Difference	-1(-10.55,8.55)	Not Significant (P-value>.05)

TABLE 117: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Denis,M., 2006	High Quality	Days- Length Of Stay(Real Length of Stay)	NA	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	8(2.10)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	7.8(2.00)	Mean Difference	0.2(-0.88,1.28)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Days- Length Of Stay(Real Length of Stay)	NA	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	8.1(2.00)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	7.8(2.00)	Mean Difference	0.3(-0.78,1.38)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Length Of Recovery-Length Of Stay(Theoretical Length of Stay. Time to achieve discharge criteria for knee. ROM of approx. 75)	NA	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	7.9(1.60)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	7.5(1.40)	Mean Difference	0.4(-0.41,1.21)	Not Significant (P-value>.05)
Herbold,J.A., 2014	Moderate Quality	Days- Length Of Stay( )	NR	Cpm used post-op (In Hospital)(2 hrs/day of CPM in addition to conventional PT)	70	8.3(1.70)	No Post-op Cpm (In-Hospital)(3 hrs/day of conventional PT)	71	8.7(2.70)	Mean Difference	-0.4(-1.14,0.34)	Not Significant (P-value>.05)
Montgomery,F., 1996	Moderate Quality	Length Of Recovery-Length Of Stay(Days to reach ROM 70 degrees flexion.)	NA	Cpm used post-op (In Hospital)(CPM for 3 hours 3 times daily, 7 days a week.)	28	5(2.00)	No Post-op Cpm (In-Hospital)(Active and passive motion exercises with a physical therapist 30 minutes twice daily, 5 days a week.)	32	7(3.00)	Mean Difference	-2(-3.28,-0.72)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Montgomery,F., 1996	Moderate Quality	Days- Length Of Stay(Criteria for discharge was when patients reach 70 degrees active knee flexion, no wound problems, ability to walk including stairs.)	NA	Cpm used post-op (In Hospital)(CPM for 3 hours 3 times daily, 7 days a week.)	28	9(3.00)	No Post-op Cpm (In-Hospital)(Active and passive motion exercises with a physical therapist 30 minutes twice daily, 5 days a week.)	32	10(4.00)	Mean Difference	-1(-2.78,0.78)	Not Significant (P-value>.05)

TABLE 118: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	SF-36 Emotional Role Functioning( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	68(41.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	84(32.00)	Mean Difference	-16(-33.18,1.18)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	SF-36 Emotional Role Functioning( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	73(39.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	81(34.00)	Mean Difference	-8(-25.11,9.11)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	SF-36 Mental Component summary( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	54(10.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	55(9.00)	Mean Difference	-1(-5.45,3.45)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	SF-36 Mental Component summary( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	57(8.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	56(9.00)	Mean Difference	1(-3.00,5.00)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 General Health Perceptions-Other( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	69(21.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	69(19.00)	Mean Difference	0(-9.37,9.37)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 General Health Perceptions-Other( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	73(21.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	70(22.00)	Mean Difference	3(-7.09,13.09)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Sf-36 Vitality-Other( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	53(20.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	56(17.00)	Mean Difference	-3(-11.68,5.68)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Vitality-Other( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	60(18.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	59(21.00)	Mean Difference	1(-8.31,10.31)	Not Significant (P-value>.05)

TABLE 119: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Sf-36 Bodily Pain- Pain( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	56(18.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	55(22.00)	Mean Difference	1(-8.45,10.45)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Sf-36 Bodily Pain- Pain( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	36	57(19.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	64(22.00)	Mean Difference	-7(-16.65,2.65)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Womac-Pain averaged VAS Version (0-100)( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	34	73(17.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	73(18.00)	Mean Difference	0(-8.32,8.32)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Womac-Pain averaged VAS Version (0-100)( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	34	76(15.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	79(16.00)	Mean Difference	-3(-10.37,4.37)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-Pain averaged VAS Version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	27.7(17.10)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	39.8(24.80)	Mean Difference	-12.1(-23.40,-0.80)	**Treatment 1 Significant (P-value<.05)**
Denis,M., 2006	High Quality	Womac-Pain averaged VAS Version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	36.8(15.60)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	39.8(24.80)	Mean Difference	-3(-14.11,8.11)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Pain Likert Version (0-20)( )	17 days	Cpm used post-discharge (In Home)( )	30	15.8(4.70)	No Post-Discharge Cpm (In-Home)( )	30	15.3(4.10)	Mean Difference	0.5(-1.73,2.73)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Lenssen,T.A., 2008	High Quality	Womac-Pain Likert Version (0-20)( )	6 weeks	Cpm used post-discharge (In Home)( )	30	16(3.70)	No Post-Discharge Cpm (In-Home)( )	30	16.6(4.00)	Mean Difference	-0.6(-2.55,1.35)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Pain Likert Version (0-20)( )	3 months	Cpm used post-discharge (In Home)( )	30	17.3(3.80)	No Post-Discharge Cpm (In-Home)( )	30	17.5(0.90)	Mean Difference	-0.2(-1.60,1.20)	Not Significant (P-value>.05)
Can,F., 2003	Moderate Quality	Knee Society Score-Pain-Pain( )	1 day	Cpm used post-op (In Hospital)(CPM 4 to 6 hours daily starting immediately after surgery.)	16	10.32(6.45)	No Post-op Cpm (In-Hospital)( )	16	8(6.02)	Mean Difference	2.32(-2.00,6.64)	Not Significant (P-value>.05)
Can,F., 2003	Moderate Quality	Knee Society Score-Pain-Pain( )	3 months	Cpm used post-op (In Hospital)(CPM 4 to 6 hours daily starting immediately after surgery.)	16	45.1(8.63)	No Post-op Cpm (In-Hospital)( )	16	45.17(7.12)	Mean Difference	-0.07(-5.55,5.41)	Not Significant (P-value>.05)
Can,F., 2003	Moderate Quality	Knee Society Score-Pain-Pain( )	3 weeks	Cpm used post-op (In Hospital)(CPM 4 to 6 hours daily starting immediately after surgery.)	16	35.65(9.32)	No Post-op Cpm (In-Hospital)( )	16	35.15(9.11)	Mean Difference	0.5(-5.89,6.89)	Not Significant (P-value>.05)
Can,F., 2003	Moderate Quality	Vas Pain (10cm)- Pain( )	1 day	Cpm used post-op (In Hospital)(CPM 4 to 6 hours daily starting immediately after surgery.)	16	. %	No Post-op Cpm (In-Hospital)( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Can,F., 2003	Moderate Quality	Vas Pain (10cm)- Pain( )	3 months	Cpm used post-op (In Hospital)(CPM 4 to 6 hours daily starting immediately after surgery.)	16	. %	No Post-op Cpm (In-Hospital)( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Can,F., 2003	Moderate Quality	Vas Pain (10cm)- Pain( )	3 weeks	Cpm used post-op (In Hospital)(CPM 4 to 6 hours daily starting immediately after surgery.)	16	. %	No Post-op Cpm (In-Hospital)( )	16	. %	Author Reported	NA	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Vas Pain (10cm)- Pain(1-10 scale (cm))	6 weeks	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	3.22(1.28)	No Post-op Cpm (In-Hospital)( )	39	3.05(1.54)	Mean Difference	0.17(-0.40,0.74)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Vas Pain (10cm)- Pain(1-10 scale (cm))	2 weeks	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	5.12(1.39)	No Post-op Cpm (In-Hospital)( )	39	4.77(1.56)	Mean Difference	0.35(-0.24,0.94)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Vas Pain (10cm)- Pain(1-10 scale (cm))	3 months	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	1.43(1.00)	No Post-op Cpm (In-Hospital)( )	39	1.03(1.11)	Mean Difference	0.4(-0.02,0.82)	Not Significant (P-value>.05)
Chen,L.H., 2013	Moderate Quality	Vas Pain (10cm)- Pain(1-10 scale (cm))	6 months	Cpm used post-op (In Hospital)(CPM used for 2 hours 3 times daily starting day after surgery.)	68	0.37(0.60)	No Post-op Cpm (In-Hospital)( )	39	0.21(0.47)	Mean Difference	0.16(-0.05,0.37)	Not Significant (P-value>.05)
Montgomery,F., 1996	Moderate Quality	Vas Pain (10cm)- Pain(Recorded at day 1, day 3, and day 5 post operatively.)	5 days	Cpm used post-op (In Hospital)(CPM for 3 hours 3 times daily, 7 days a week.)	28	. %	No Post-op Cpm (In-Hospital)(Active and passive motion exercises with a physical therapist 30 minutes twice daily, 5 days a week.)	32	. %	Author Reported	NA	Not Significant (P-value>.05)

TABLE 120: CONTINUOUS PASSIVE MOTION VERSUS NO CONTINUOUS PASSIVE MOTION: STIFFNESS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
BeauprÃ,L.A., 2001	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	3 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	34	63(18.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	62(18.00)	Mean Difference	1(-7.56,9.56)	Not Significant (P-value>.05)
BeauprÃ,L.A., 2001	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	6 months	Cpm used post-op (In Hospital)(Three 2 hour sessions each day with increasing range.)	34	65(21.00)	No Post-op Cpm (In-Hospital)(Standard exercise)	34	69(19.00)	Mean Difference	-4(-13.52,5.52)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 2 hours daily.)	28	50.1(24.10)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	53.8(26.10)	Mean Difference	-3.7(-16.99,9.59)	Not Significant (P-value>.05)
Denis,M., 2006	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	8 days	Cpm used post-op (In Hospital)(CPM used 35 min daily.)	26	59.3(19.30)	No Post-op Cpm (In-Hospital)(Standard physical therapy)	27	53.8(26.10)	Mean Difference	5.5(-6.83,17.83)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Stiffness Likert (0-8)( )	17 days	Cpm used post-discharge (In Home)( )	30	5(1.80)	No Post-Discharge Cpm (In-Home)( )	30	4.8(1.60)	Mean Difference	0.2(-0.66,1.06)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Stiffness Likert (0-8)( )	6 weeks	Cpm used post-discharge (In Home)( )	30	5.4(1.50)	No Post-Discharge Cpm (In-Home)( )	30	4.8(1.50)	Mean Difference	0.6(-0.16,1.36)	Not Significant (P-value>.05)
Lenssen,T.A., 2008	High Quality	Womac-Stiffness Likert (0-8)( )	3 months	Cpm used post-discharge (In Home)( )	30	5.5(1.40)	No Post-Discharge Cpm (In-Home)( )	30	5.3(1.60)	Mean Difference	0.2(-0.56,0.96)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

POSTOPERATIVE MOBILIZATION

A. POSTOPERATIVE MOBILIZATION: LENGTH OF STAY

Strong evidence supports that rehabilitation started on the day of the total knee arthroplasty (TKA) reduces length of hospital stay.

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

B. POSTOPERATIVE MOBILIZATION: PAIN AND FUNCTION

Moderate evidence supports that rehabilitation started on day of total knee arthroplasty (TKA) compared to rehabilitation started on postop day 1 reduces pain and improves function.

Strength of Recommendation: Moderate Evidence ★★★☆

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

RATIONALE

Two high quality studies (Labraca et al 2011; Larsen et al 2008) investigated the effects of starting rehabilitation on the day of surgery compared to delayed rehabilitation (start on the day after surgery or later). Labraca et al compared a group who initiated rehabilitation within the first 24 hours post-surgery to a control group who remained at rest during the first 24 hours and started rehabilitation after that. They found that the group who started rehabilitation within 24 hours had fewer days of hospital stay, reduced pain, and improved physical function (balance, muscle strength and range of knee motion). Larsen et al compared an intervention group who received a new accelerated peri-operative protocol compared to a control group who received conventional perioperative procedure. The accelerated protocol aimed to mobilize the patient in bed and out of bed in the day of surgery and progressed to four hours out of bed (combination of physical and occupational therapy) on the first postoperative day, and eight hours of mobilization for the rest of the hospital stay. The control group started mobilization in and out of bed on the day after surgery and increased mobilization according to patient's state. The accelerated protocol also included education, pain relief, nausea control, nutrition, and elimination. The study found that the accelerated group had less length of stay as compared to the control group. Quality of life was not different between the groups.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

Although there are no known harms associated with implementing this recommendation, the promotion of early and accelerated rehabilitation depends on hospital support to accessible rehabilitation services; and cohesive coordination between surgeons, anesthesiologists, nurses, and physical therapists to manage pain, nausea, orthostatic intolerance, and other hindrances to early mobilization.

** See Appendix XIII for details regarding support*

FUTURE RESEARCH

Prospective randomized trials to evaluate the dose-response of rehabilitation protocols during hospital stay to decrease variability of care. There is no consistency in the amount of rehabilitation during acute care - protocols have varied from as low as 20 minutes to as high as eight hours per day of rehabilitative care.

RESULTS

SUMMARY OF FINDINGS TABLE 24: ACCELERATED MOBILIZATION

Summary of Findings ● Favors Accelerated ● Favors Non-accelerated Mobilization ○ Not Significant	High Quality Labraca,N.S., 2011	 Larsen,K., 2008
Complications		
Readmission		○
Function		
Balance- Function	●	
Barthel Index - Function	○	
Muscle Strength- Function	●	
Range of Motion - Function	●	
Length of Stay		
Days- Length Of Stay	●	●
Pain		
Vas Pain (10cm)- Pain	●	
Quality of Life		
Euroqol-5d(Eq-5d) Total		○

QUALITY EVALUATION TABLE 14: ACCELERATED MOBILIZATION

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention – Observational

Study	Design	Participant Recruitment	Allocation	Confounding Variables	Follow-Up Length	Other Bias? (If retrospective comparative, mark Yes)	Inclusion	Strength
Jordan,L.R., 1995	○	●	●	●	●	●	Not best available evidence	Low Quality

QE - Intervention – Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Labraca,N.S., 2011	●	●	○	●	●	●	Include	High Quality
Larsen,K., 2008	●	●	○	●	●	●	Include	High Quality

** See Appendix XIII for details regarding support*

DETAILED DATA TABLES

TABLE 121: ACCELERATED MOBILIZATION VERSUS NON-ACCELERATED MOBILIZATION: COMPLICATIONS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Larsen,K., 2008	High Quality	Readmission-Length Of Stay(Number of patients re-admitted due to pain/complications within the specified follow up.)	3 months	Accelerated Post-Op Mobilization(4h of mobilization day of surgery. 8h of mobilization per day goal for each day after.)	15	6.67%	Non-Accelerated Post-Op Mobilization(Control group receiving standard care for post-op mobilization. Post-op therapy does not begin until)	12	8.33%	RR	0.80(0.06,11.50)	Not Significant (P-value>.05)

TABLE 122: ACCELERATED MOBILIZATION VERSUS NON-ACCELERATED MOBILIZATION: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Labraca,N. S., 2011	High Quality	Balance-Function(Tinetti test. Static balance subscale. (0=abnormal, 1=adaptive, 2=normal). Reported as dichotomous data where N events=N of normal patients.)	Discharge	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	98.55%	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	92.59%	RR	1.06(1.01,1.12)	**Treatment 1 Significant (P-value<.05)**
Labraca,N. S., 2011	High Quality	Balance-Function(Tinetti test. Gait subscale. (0=abnormal, 1=adaptive, 2=normal). Reported as dichotomous data where N events=N of normal patients.)	Discharge	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	97.10%	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	89.63%	RR	1.08(1.02,1.16)	**Treatment 1 Significant (P-value<.05)**
Labraca,N. S., 2011	High Quality	Barthel Index - Function(Number of patients completely independent on Barthel Index)	Discharge	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	89.86%	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery.	135	83.70%	RR	1.07(0.98,1.18)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
							(Standard care control group).)					
Labraca,N. S., 2011	High Quality	Muscle Strength-Function(Quadricep strength (0=no activity to 5=normal muscle response))	Post-Op	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	3.91(0.56)	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	3.01(0.52)	Mean Difference	0.9(0.77,1.03)	**Treatment 1 Significant (P-value<.05)**
Labraca,N. S., 2011	High Quality	Muscle Strength-Function(Hamstring muscles (0=no activity to 5=normal muscle response))	Post-Op	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	4.02(0.82)	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	2.97(0.59)	Mean Difference	1.05(0.88,1.22)	**Treatment 1 Significant (P-value<.05)**
Labraca,N. S., 2011	High Quality	Range of Motion(flexion) - Function( )	Post-Op	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	88.11(2.35)	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	71.82(16.81)	Mean Difference	16.29(13.43,19.15)	**Treatment 1 Significant (P-value<.05)**

TABLE 123: ACCELERATED MOBILIZATION VERSUS NON-ACCELERATED MOBILIZATION: LENGTH OF STAY

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Labraca,N.S., 2011	High Quality	Days-Length Of Stay( )	NA	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	6.37(1.16)	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	8.46(2.63)	Mean Difference	-2.09(-2.57,-1.61)	**Treatment 1 Significant (P-value<.05)**
Larsen,K., 2008	High Quality	Days-Length Of Stay( )	NA	Accelerated Post-Op Mobilization(4h of mobilization day of surgery. 8h of mobilization per day goal for each day after.)	15	6.1(3.50)	Non-Accelerated Post-Op Mobilization(Control group receiving standard care for post-op mobilization. Post-op therapy does not begin until)	12	9.3(2.50)	Mean Difference	-3.2(-5.47,-0.93)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 124: ACCELERATED MOBILIZATION VERSUS NON-ACCELERATED MOBILIZATION: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Labraca,N.S., 2011	High Quality	Vas Pain (10cm)-Pain( )	Post-Op	Accelerated Post-Op Mobilization(Begins mobilization with first 24 hours of surgery.)	138	3.01(2.35)	Non-Accelerated Post-Op Mobilization(Does not begin mobilization until day after surgery. (Standard care control group).)	135	5.36(2.54)	Mean Difference	-2.35(-2.93,-1.77)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 125: ACCELERATED MOBILIZATION VERSUS NON-ACCELERATED MOBILIZATION: QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group1 N	Mean1/ P1 (SD1)	Treatment 2 (Details)	Group2 N	Mean2/ P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Larsen,K., 2008	High Quality	Euroqol-5d(Eq-5d) Total-Composite (Eq-5D for TKA patients only)	3 months	Accelerated Post-Op Mobilization(4h of mobilization day of surgery. 8h of mobilization per day goal for each day after.)	15	0.86(0.11)	Non-Accelerated Post-Op Mobilization(Control group receiving standard care for post-op mobilization. Post-op therapy does not begin until)	12	0.86(0.09)	Mean Difference	0(-0.08,0.08)	Not Significant (P-value>.05)

* *See Appendix XIII for details regarding support*

STRUCTURED EXERCISE PROGRAM

A. EARLY STAGE SUPERVISED EXERCISE PROGRAM: FUNCTION

Moderate evidence supports that a supervised exercise program during the first two months after total knee arthroplasty (TKA) improves physical function.

Strength of Recommendation: Moderate Evidence 

Description: Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.

B. EARLY STAGE SUPERVISED EXERCISE PROGRAM: PAIN

Limited evidence supports that a supervised exercise program during the first two months after total knee arthroplasty (TKA) decreases pain.

Strength of Recommendation: Limited Evidence 

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

C. LATE STAGE POSTOPERATIVE SUPERVISED EXERCISE PROGRAM: FUNCTION

Limited evidence supports that selected patients might be referred to an intensive supervised exercise program during late stage post total knee arthroplasty (TKA) to improve physical function.

Strength of Recommendation: Limited Evidence 

*Description: Evidence from two or more "Low" strength studies with consistent findings **or** evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.*

RATIONALE

One high quality study (Evgeniadis 2008) and one moderate quality study (Akbaba 2014) investigated supervised exercise programs started after hospital discharge compared to no exercise or minimal exercise during the first two months after surgery. Evgeniadis et al compared a group of patients post total knee arthroplasty who received a home exercise program of eight weeks (three times a week) that consisted of lower extremity strength training, to a group who did not receive supervised exercises. The exercise group had significantly better physical function and knee flexion and extension range of motion. Akbaba et al compared a group of patients with bilateral total knee arthroplasty who received a month of intensive supervised rehabilitation (two times a week for one hour) to a control group who received supervised rehabilitation once every 15 days. The intense supervised group had less pain and stiffness, and better balance and physical function than the control group.

** See Appendix XIII for details regarding support*

Two high quality studies (Liao 2013, Moffet 2004) and one moderate quality study (Valtonen 2010) investigated supervised intensive exercise programs started two or more months after surgery (late stage post total knee arthroplasty) compared to no or less exercise. Liao et al compared a group who performed functional exercise supplemented with balance training to a group who performed functional training only. The exercise programs lasted eight weeks and started two months post-surgery. The group who received a combination of functional and balance exercises had better patient reported and performance-based outcomes of physical function. Moffet et al compared a group who received intensive functional training during eight weeks to a standard care group who received minimal rehabilitative care. Pain and emotional health was significantly better in the intensive functional training group at 4 and 6 months, but the effects were no longer significant at the 12 months' time point. Valtonen et al compared a group who performed a high-intensity progressive aquatic resistance training of six week duration that started at least four months after surgery to a control group who did not exercise. The outcomes of both groups were similar.

RISKS AND HARMS OF IMPLEMENTING THIS RECOMMENDATION

There are no risks or Harms with implementation

FUTURE RESEARCH

Continued comparative studies of supervised exercise programs that are aligned with recommendations from national guidelines. Future research from multi-site studies utilizing a standardized training program with large populations of patients with co-existing chronic conditions. In addition, there is a need to investigate protocols (i.e., exercise type, intensity), delivery of interventions (i.e., more emphasis during early stage versus late stage), and strategies to improve adherence to optimize outcome. Future research should also address the influence of physical activity on prevention of weight gain and on survival of prosthesis. Issues of cost and cost-effectiveness should be incorporated into future clinical studies.

RESULTS

SUMMARY OF FINDINGS TABLE 31: POST-OP STRUCTURED EXERCISE EARLY POST-OP OUTCOMES

Summary of Findings ● Favors Post-op Structured Exercise ● Favors No/less Post-op Structured Exercise ○ Not Significant	High Quality Evgeniadis,G., 2008	Moderate Quality Akbaba,Y.A., 2014
Function		
Balance		●
Iowa Level of Assistance Scale (ILAS)	●	
Range of Motion	●	
Timed Functional Tests		●
Womac-Function		●
Pain		
Womac-Pain		●
Stiffness		
Womac-Stiffness		●

** See Appendix XIII for details regarding support*

SUMMARY OF FINDINGS TABLE 32: POST-OP STRUCTURED EXERCISE LATE POST-OP OUTCOMES

** See Appendix XIII for details regarding support*

Summary of Findings

● **Favors Exercise during late stage post surgery**

● **Favors No/less exercise during late stage post surgery**

○ **Not Significant**

	High Quality				Moderate Quality	
	Kauppila,A.M., 2010	Liao,C.D., 2013	Vuorenmaa,M., 2014	Moffet,H., 2004	Valtonen,A., 2010	Meta Analysis
Composite						
SF-36 Physical component summary			○			
Womac-overall	○	●		○	○	NA
Function						
Balance		●				
Muscle Power (w)					○	
Muscle Strength			●		●	
Range of Motion	○		○			
Sf-36 Physical Functioning- Function				○		
Sf-36 Physical Role Functioning- Function				○		
Sf-36 Social Role Functioning- Function				○		NA
Timed Functional Tests	○	●	●	○	○	NA
Womac-function averaged VAS Version (0-100)	○		○	○	○	
Other						
Sf-36 Mental Health- Function				●		
Pain						
Sf-36 Bodily Pain- Pain				○		NA
Womac-Pain averaged VAS Version (0-100)	○		○	●	○	
Quality of Life						
HRQoL 15D	○					
Stiffness						NA
Womac-stiffness averaged VAS Version (0-100)	○		○	○	○	

QUALITY EVALUATION TABLE 21: POST-OPERATIVE STRUCTURED EXERCISE

Quality Chart Key

● =No Flaw in Domain of Interest

○ =Flaw in Domain of Interest

◑ = Half flaw in domain of interest

QE - Intervention – Randomized

Study	Random Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Reporting	Other Bias	Inclusion	Strength
Akbaba,Y.A., 2014	●	◑	○	○	●	○	Include	Moderate Quality
Codine,Ph, 2004	◑	◑	○	●	●	●	Include	Moderate Quality
Evgeniadis,G., 2008	●	●	○	●	●	●	Include	High Quality
Han,A.S., 2014	●	●	○	●	●	○	Include	Moderate Quality
Kauppila,A.M., 2010	●	◑	○	●	●	●	Include	High Quality
Liao,C.D., 2013	●	●	○	●	●	●	Include	High Quality
Minns Lowe,C.J., 2012	●	●	○	●	●	●	Include	High Quality
Moffet,H., 2004	●	●	○	○	●	●	Include	Moderate Quality
Valtonen,A., 2010	●	◑	○	●	●	●	Include	High Quality
Vuorenmaa,M., 2014	●	●	○	●	●	●	Include	High Quality

DETAILED DATA TABLES

TABLE 126: PART 1- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING EARLY STAGE POST SURGERY: FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function(ILAS Total (0-50))	6 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	9.16(0.93)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	10.08(1.16)	Mean Difference	-0.92(-1.61,-0.23)	**Treatment 1 Significant (P-value<.05)**
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function(ILAS Total (0-50))	2 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	20.5(1.20)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	20.3(1.97)	Mean Difference	0.2(-0.86,1.26)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function(ILAS Total (0-50))	10 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	2.79(0.64)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	4.87(0.73)	Mean Difference	-2.08(-2.54,-1.62)	**Treatment 1 Significant (P-value<.05)**
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function(ILAS Total (0-50))	3 days	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	28.2(2.40)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	28.9(3.30)	Mean Difference	-0.7(-2.59,1.19)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Evgeniadis,G., 2008	High Quality	Iowa Level of Assistance Scale (ILAS) - Function(ILAS Total (0-50))	14 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	0.14(0.39)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	0.38(0.56)	Mean Difference	-0.24(-0.55,0.07)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion(extension) - Function(Active extension. Hypoextension reported as negative values)	2 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	5.67(3.12)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	6.5(3.83)	Mean Difference	-0.83(-3.13,1.47)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion(extension) - Function(Active extension. Hypoextension reported as negative values)	10 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	2.6(1.80)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	7(3.95)	Mean Difference	-4.4(-6.36,-2.44)	**Treatment 1 Significant (P-value<.05)**
Evgeniadis,G., 2008	High Quality	Range of Motion(extension) - Function(Active extension. Hypoextension reported as negative values)	14 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	1.8(1.27)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	6.42(3.60)	Mean Difference	-4.62(-6.32,-2.92)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Evgeniadis,G., 2008	High Quality	Range of Motion(flexion) - Function(Active flexion)	2 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	66(8.32)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	70.25(11.30)	Mean Difference	-4.25(-10.75,2.25)	Not Significant (P-value>.05)
Evgeniadis,G., 2008	High Quality	Range of Motion(flexion) - Function(Active flexion)	10 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	84.7(9.26)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	76.08(10.30)	Mean Difference	8.62(2.11,15.13)	**Treatment 1 Significant (P-value<.05)**
Evgeniadis,G., 2008	High Quality	Range of Motion(flexion) - Function(Active flexion)	14 weeks	Post-Op: Structured Exercise Program or PT(8 week post-op strengthening exercise program)	15	98.42(11.30)	Pre-Op: No Structured Exercise program (control)(Did not receive additional exercise program either pre-op or post-op.)	20	80.42(10.20)	Mean Difference	18(10.74,25.26)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Balance-Function(Left single leg stance, sec)	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	15.8(17.40)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	3.2(2.20)	Mean Difference	12.6(4.91,20.29)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Balance-Function(Left single leg stance, sec)	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	42.6(32.50)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	8.1(6.20)	Mean Difference	34.5(20.00,49.00)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Akbaba,Y.A., 2014	Moderate Quality	Balance-Function(Right single leg stance, sec)	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	15.3(16.80)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	3.2(1.80)	Mean Difference	12.1(4.69,19.51)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Balance-Function(Right single leg stance, sec)	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	44.2(32.20)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	13.8(9.70)	Mean Difference	30.4(15.66,45.14)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(20-m walk test, sec)	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	95.5(16.70)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	89(21.00)	Mean Difference	6.5(-5.26,18.26)	Not Significant (P-value>.05)
Akbaba,Y.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(20-m walk test, sec)	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	106.7(17.70)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	102(14.30)	Mean Difference	4.7(-5.27,14.67)	Not Significant (P-value>.05)
Akbaba,Y.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(Timed up and go, sec)	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	19(10.30)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	26.7(17.60)	Mean Difference	-7.7(-16.64,1.24)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Akbaba,Y.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(Timed up and go, sec)	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	12.9(2.90)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	18.2(11.40)	Mean Difference	-5.3(-10.46,-0.14)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(stair test, sec)	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	34.9(20.50)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	46.5(23.90)	Mean Difference	-11.6(-25.40,2.20)	Not Significant (P-value>.05)
Akbaba,Y.A., 2014	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(stair test, sec)	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	17.5(7.20)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	30.1(12.30)	Mean Difference	-12.6(-18.85,-6.35)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Womac-Function likert version (0-68)(Turkish version (0-30))	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	4.7(2.50)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	6.2(1.70)	Mean Difference	-1.5(-2.82,-0.18)	**Treatment 1 Significant (P-value<.05)**
Akbaba,Y.A., 2014	Moderate Quality	Womac-Function likert version (0-68)(Turkish version (0-30))	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	1.9(0.90)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	4(1.70)	Mean Difference	-2.1(-2.94,-1.26)	**Treatment 1 Significant (P-value<.05)**

TABLE 127: PART 1- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING EARLY STAGE POST SURGERY: PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Akbaba,Y.A., 2014	Moderate Quality	Womac-Pain Likert Version (0-20)(Turkish version (0-30))	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	3.3(2.10)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	3.3(1.20)	Mean Difference	0(-1.06,1.06)	Not Significant (P-value>.05)
Akbaba,Y.A., 2014	Moderate Quality	Womac-Pain Likert Version (0-20)(Turkish version (0-30))	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	1.4(1.00)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	2.6(1.30)	Mean Difference	-1.2(-1.92,-0.48)	**Treatment 1 Significant (P-value<.05)**

** See Appendix XIII for details regarding support*

TABLE 128: PART 1- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING EARLY STAGE POST SURGERY: STIFFNESS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Akbaba,Y.A., 2014	Moderate Quality	Womac-Stiffness Likert (0-8)(Turkish version (0-30))	1 month	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	5.8(2.20)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	5.2(2.80)	Mean Difference	0.6(-0.96,2.16)	Not Significant (P-value>.05)
Akbaba,Y.A., 2014	Moderate Quality	Womac-Stiffness Likert (0-8)(Turkish version (0-30))	2 months	Post-Op: Structured Exercise Program or PT(1-hr exercise program with physical therapist 2 times/week for a month)	20	2.5(1.60)	Post-Op: Structured Exercise Program or PT(exercise program with physical therapist once every 2 weeks)	20	4(2.10)	Mean Difference	-1.5(-2.66,-0.34)	**Treatment 1 Significant (P-value<.05)**

TABLE 129: PART 2- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING LATE STAGE POST SURGERY (AFTER 2 MONTHS): COMPOSITE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)
Liao,C.D., 2013	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	-38.98(9.47)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	-34.31(8.70)	Mean Difference	-4.67(-8.02,-1.32)	**Treatment 1 Significant (P-value<.05)**
Moffet,H., 2004	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	13.5(14.10)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	19.4(17.60)	Mean Difference	-5.9(-13.07,1.27)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	12(12.80)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	18.6(18.50)	Mean Difference	-6.6(-13.82,0.62)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Womac-overall-Composite averaged VAS version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	11.6(13.80)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	15.3(16.30)	Mean Difference	-3.7(-10.92,3.52)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	SF-36 Mental Component summary( )	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	4(11.35)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	3(11.14)	Mean Difference	1(-3.29,5.29)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	SF-36 Physical component summary( )	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	8(11.35)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	6(11.14)	Mean Difference	2(-2.24,6.24)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Womac-overall-Composite averaged VAS version (0-100)( )	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	17.9(8.50)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	18.3(16.00)	Mean Difference	-0.4(-8.01,7.21)	Not Significant (P-value>.05)

TABLE 130: PART 2- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING LATE STAGE POST SURGERY (AFTER 2 MONTHS): FUNCTION

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Range of Motion(extension) - Function(active extension. Hypo-extension reported as positive values.)	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	6(3.00)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	38	6(3.00)	Mean Difference	0(-1.37,1.37)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Range of Motion(extension) - Function(active extension. Hypo-extension reported as positive values.)	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	5(4.00)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	38	4(4.00)	Mean Difference	1(-0.82,2.82)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Range of Motion(flexion) - Function(active flexion)	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	105(12.00)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	38	103(11.00)	Mean Difference	2(-3.25,7.25)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Range of Motion(flexion) - Function(active flexion)	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	107(11.00)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	38	105(9.00)	Mean Difference	2(-2.59,6.59)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Stair test - down (in seconds))	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	10.7(5.00)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	36	10.5(4.10)	Mean Difference	0.2(-1.91,2.31)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Stair test - down (in seconds))	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	10.7(5.30)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	34	10.7(5.00)	Mean Difference	0(-2.41,2.41)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Stair test - up (in seconds))	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	11(5.60)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	36	9.6(3.40)	Mean Difference	1.4(-0.74,3.54)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Stair test - up (in seconds))	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	10.3(3.70)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	34	10(4.10)	Mean Difference	0.3(-1.53,2.13)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Timed Functional Test (lower scores better, units of time)-Function(time to complete 15-m walk (in seconds))	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	13.4(2.40)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	13.3(2.50)	Mean Difference	0.1(-1.01,1.21)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Timed Functional Test (lower scores better, units of time)-Function(time to complete 15-m walk (in seconds))	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	13.8(3.60)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	37	13.7(2.90)	Mean Difference	0.1(-1.40,1.60)	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Womac-function averaged VAS Version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Womac-function averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	-32.4(26.40)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	-32.8(20.10)	Mean Difference	0.4(-10.29,11.09)	Not Significant (P-value>.05)
Liao,C.D., 2013	High Quality	Balance-Function(Single leg stance (s) with eyes closed)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	4.07(1.20)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	2.69(1.30)	Mean Difference	1.38(0.92,1.84)	**Treatment 1 Significant (P-value<.05)**
Liao,C.D., 2013	High Quality	Balance-Function(Single leg stance (s) with eyes open)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	4.69(0.74)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	2.23(1.34)	Mean Difference	2.46(2.06,2.86)	**Treatment 1 Significant (P-value<.05)**
Liao,C.D., 2013	High Quality	Balance-Function(functional reach test measured as ratio of functional reach to body height)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	0.19(0.05)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	0.13(0.04)	Mean Difference	0.06(0.04,0.7)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Liao,C.D., 2013	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(timed chair rising test, 30 sec)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	3.32(1.39)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	2.13(1.57)	Mean Difference	1.19(0.64,1.74)	**Treatment 1 Significant (P-value<.05)**
Liao,C.D., 2013	High Quality	Timed Functional Test (lower scores better, units of time)-Function(10-m walk test, sec)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	-4.03(1.55)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	58	-2.58(1.68)	Mean Difference	-1.45(-2.04,-0.86)	**Treatment 1 Significant (P-value<.05)**
Liao,C.D., 2013	High Quality	Timed Functional Test (lower scores better, units of time)-Function(Timed Up-and-Go, sec)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	-3.01(1.52)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	-1.67(1.50)	Mean Difference	-1.34(-1.90,-0.78)	**Treatment 1 Significant (P-value<.05)**
Liao,C.D., 2013	High Quality	Timed Functional Test (lower scores better, units of time)-Function(stair climbing test, sec)	2 months	Post-Op: Structured Exercise Program or PT(90 minute sessions of functional training and balance exercises over 8 weeks)	58	-4.17(1.35)	Post-Op: No Structured Exercise Program (control)(60 minute sessions of functional training exercises only over 8 weeks)	55	-2.39(1.55)	Mean Difference	-1.78(-2.32,-1.24)	**Treatment 1 Significant (P-value<.05)**

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Sf-36 Physical Functioning-Function( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	58.9(23.80)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	56.8(23.70)	Mean Difference	2.1(-8.58,12.78)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Physical Functioning-Function( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	62.4(23.80)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	58.3(18.90)	Mean Difference	4.1(-5.61,13.81)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Physical Functioning-Function( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	63.8(24.30)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	60.3(20.40)	Mean Difference	3.5(-7.05,14.05)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Physical Role Functioning-Function( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	44.7(39.90)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	50.7(42.10)	Mean Difference	-6(-24.44,12.44)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Sf-36 Physical Role Functioning-Function( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	69.1(38.30)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	52.7(44.40)	Mean Difference	16.4(-2.39,35.19)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Physical Role Functioning-Function( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	70.4(37.60)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	72.6(36.10)	Mean Difference	-2.2(-19.65,15.25)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Social Role Functioning-Function( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	78.9(22.90)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	79.3(17.00)	Mean Difference	-0.4(-9.47,8.67)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Social Role Functioning-Function( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	82.6(20.90)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	78.7(16.60)	Mean Difference	3.9(-4.63,12.43)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Sf-36 Social Role Functioning-Function( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	84.9(22.00)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	84.3(16.10)	Mean Difference	0.6(-8.40,9.60)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(6 minute walk test (in meters))	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	377.7(74.50)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	346.7(95.30)	Mean Difference	31(-7.46,69.46)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(6 minute walk test (in meters))	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	392.1(92.20)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	360.3(77.40)	Mean Difference	31.8(-6.69,70.29)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(6 minute walk test (in meters))	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	399.7(94.20)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	369.7(80.10)	Mean Difference	30(-11.14,71.14)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Womac-function averaged VAS Version (0-100)( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	13.6(15.00)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	18.9(17.70)	Mean Difference	-5.3(-12.68,2.08)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Womac-function averaged VAS Version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	12.4(14.40)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	18.6(18.70)	Mean Difference	-6.2(-13.77,1.37)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Womac-function averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	12(14.80)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	15.8(17.60)	Mean Difference	-3.8(-11.58,3.98)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	Muscle Strength-Function(isometric knee strength-extension, kg)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	15.1(9.46)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	13.1(11.14)	Mean Difference	2(-1.90,5.90)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Vuorenmaa,M., 2014	High Quality	Muscle Strength-Function(isometric knee strength-flexion, kg)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	4.4(4.92)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	2.4(3.71)	Mean Difference	2(0.36, 3.64)	**Treatment 1 Significant (P-value<.05)**
Vuorenmaa,M., 2014	High Quality	Range of Motion(extension) - Function(active extension deficit)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	-5.9(5.30)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	-6(3.71)	Mean Difference	0.1(-1.62,1.82)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	Range of Motion(extension) - Function(passive extension deficit)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	-3.7(4.92)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	-3.5(4.09)	Mean Difference	-0.2(-1.90,1.50)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	Range of Motion(flexion) - Function(active flexion)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	14.4(11.35)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	14.2(14.49)	Mean Difference	0.2(-4.72,5.12)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Vuorenmaa,M., 2014	High Quality	Range of Motion(flexion) - Function(passive flexion)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	13.2(10.97)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	13.9(11.89)	Mean Difference	-0.7(-5.02,3.62)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(Timed up and go, s)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	-1.58(3.59)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	-1.43(2.15)	Mean Difference	-0.15(-1.26,0.96)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(max walking speed, m/s)	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	0.32(0.23)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	0.17(0.26)	Mean Difference	0.15(0.06,0.24)	**Treatment 1 Significant (P-value<.05)**
Vuorenmaa,M., 2014	High Quality	Womac-function averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	-18(22.70)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	-13(18.57)	Mean Difference	-5(-12.81,2.81)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Valtonen,A., 2010	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(Habitual walking speed, over 10m. (m/s))	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	1.41(0.24)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	1.29(0.26)	Mean Difference	0.12(-0.03,0.27)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Timed Functional Test (higher scores better, distance, distance/time)-Function(Maximal walking speed, over 3m. (m/s))	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	1.96(0.31)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	1.87(0.52)	Mean Difference	0.09(-0.16,0.34)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Timed Functional Test (lower scores better, units of time)-Function(Stair test - ascending (in seconds))	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	4.27(1.67)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	4.71(1.74)	Mean Difference	-0.44(-1.43,0.55)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Womac-function averaged VAS Version (0-100)( )	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	18.5(9.40)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	17(11.50)	Mean Difference	1.5(-4.65,7.65)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Valtonen,A., 2010	Moderate Quality	Knee extensor power (KEP) - operated leg (watts)	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	23	145.6(64)	Post-Op: No Structured Exercise Program (control)(No intervention.)	20	129.3(44.8)	Mean Difference	16.3(-18.18,50.78)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Knee flexor power (KFP) - operated leg (watts)	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	23	135.9(60)	Post-Op: No Structured Exercise Program (control)(No intervention.)	20	160.4(56.9)	Mean Difference	-24.5(-60.62,11.62)	Not Significant (P-value>.05)

TABLE 131: PART 2- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING LATE STAGE POST SURGERY (AFTER 2 MONTHS): OTHER OUTCOMES

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Sf-36 Mental Health-Function( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	78.4(22.90)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	80.9(14.40)	Mean Difference	-2.5(-11.10,6.10)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Mental Health-Function( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	76.3(15.50)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	83.4(12.10)	Mean Difference	-7.1(-13.38,-0.82)	**Treatment 1 Significant (P-value<.05)**
Moffet,H., 2004	High Quality	Sf-36 Mental Health-Function( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	76.4(17.70)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	82.7(14.00)	Mean Difference	-6.3(-13.78,1.18)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 132: PART 2- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING LATE STAGE POST SURGERY (AFTER 2 MONTHS): PAIN

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Womac-Pain averaged VAS Version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Womac-Pain averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Bodily Pain- Pain( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	58.8(22.90)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	57.5(19.40)	Mean Difference	1.3(-8.24,10.84)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Sf-36 Bodily Pain- Pain( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	63.6(22.70)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	63.2(22.20)	Mean Difference	0.4(-9.76,10.56)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Sf-36 Bodily Pain- Pain( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	63.7(21.40)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	63.6(19.00)	Mean Difference	0.1(-9.44,9.64)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Womac-Pain averaged VAS Version (0-100)( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	9.6(11.50)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	17.2(17.10)	Mean Difference	-7.6(-14.15,-1.05)	**Treatment 1 Significant (P-value<.05)**
Moffet,H., 2004	High Quality	Womac-Pain averaged VAS Version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	8.9(9.60)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	16(18.10)	Mean Difference	-7.1(-13.68,-0.52)	**Treatment 1 Significant (P-value<.05)**
Moffet,H., 2004	High Quality	Womac-Pain averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	9.4(12.40)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	11.8(13.00)	Mean Difference	-2.4(-8.44,3.64)	Not Significant (P-value>.05)

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Vuorenmaa,M., 2014	High Quality	Womac-Pain averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	-15(18.92)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	-14(18.57)	Mean Difference	-1(-8.07,6.07)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Womac-Pain averaged VAS Version (0-100)( )	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	13(8.70)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	15.5(12.40)	Mean Difference	-2.5(-8.81,3.81)	Not Significant (P-value>.05)

TABLE 133: PART 2- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING LATE STAGE POST SURGERY (AFTER 2 MONTHS): QUALITY OF LIFE

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	HRQoL 15D( )	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	HRQoL 15D( )	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	0.034(0.09)	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	0.035(0.08)	Mean Difference	-0.001(-0.04,0.04)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

TABLE 134: PART 2- STRUCTURED EXERCISE VERSUS NO/LESS STRUCTURED EXERCISE DURING LATE STAGE POST SURGERY (AFTER 2 MONTHS): STIFFNESS

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Kauppila,A.M., 2010	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)
Kauppila,A.M., 2010	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(10 day multidisciplinary rehab program 2-4 months after surgery. Supervised group sessions.)	36	. %	Post-Op: No Structured Exercise Program (control)(Standard amount of post-op PT)	39	. %	Author Reported	NA	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	4 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	22.1(25.30)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	38	28.8(25.70)	Mean Difference	-6.7(-18.17,4.77)	Not Significant (P-value>.05)

** See Appendix XIII for details regarding support*

Reference Title	Quality	Outcome Details	Duration	Treatment 1 (Details)	Group 1 N	Mean1/P1 (SD1)	Treatment 2 (Details)	Group 2 N	Mean2/P2 (SD2)	Effect Measure	Result (95% CI)	Favored Treatment
Moffet,H., 2004	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	6 months	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	16.2(19.60)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	37	25.2(24.90)	Mean Difference	-9(-19.16,1.16)	Not Significant (P-value>.05)
Moffet,H., 2004	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(12 supervised rehab session with physical therapist starting 2 months after TKA.)	38	13.7(16.80)	Post-Op: No Structured Exercise Program (control)(All patients taught home-exercises in hospital. No additional care after discharge.)	31	19.3(20.90)	Mean Difference	-5.6(-14.69,3.49)	Not Significant (P-value>.05)
Vuorenmaa,M., 2014	High Quality	Womac-stiffness averaged VAS Version (0-100)( )	1 year	Post-Op: Structured Exercise Program or PT(Individual guidance at baseline with check-ups at 3 and 6 months post-operativaly to adjust exercise program)	55	-25(26.49)	Post-Op: No Structured Exercise Program (control)(No additional guidance; standard care)	53	-17(29.71)	Mean Difference	-8(-18.63,2.63)	Not Significant (P-value>.05)
Valtonen,A., 2010	Moderate Quality	Womac-stiffness averaged VAS Version (0-100)( )	3 months	Post-Op: Structured Exercise Program or PT(12 week group course with aquatic based exercises.)	25	25.9(20.60)	Post-Op: No Structured Exercise Program (control)(No intervention.)	21	30.3(25.50)	Mean Difference	-4.4(-17.97,9.17)	Not Significant (P-value>.05)

I. APPENDIXES

APPENDIX I. GUIDELINE DEVELOPMENT GROUP ROSTER

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APPENDIX II
AAOS BODIES THAT APPROVED THIS CLINICAL PRACTICE GUIDELINE

Committee on Evidence Based Quality and Value

The committee on Evidence Based Quality and Value (EBQV) consists of twenty AAOS members who implement evidence-based quality initiatives such as clinical practice guidelines (CPGs) and appropriate use criteria (AUCs). They also oversee the dissemination of related educational materials and promote the utilization of orthopaedic value products by the Academy's leadership and its members.

Council on Research and Quality

The Council on Research and Quality promotes ethically and scientifically sound clinical and translational research to sustain patient care in musculoskeletal disorders. The Council also serves as the primary resource for educating its members, the public, and public policy makers regarding evidenced-based medical practice, orthopaedic devices and biologics, regulatory pathways and standards development, patient safety, occupational health, technology assessment, and other related important errors.

The Council is comprised of the chairs of the committees on Biological Implants, Biomedical Engineering, Occupational Health and Workers' Compensation, Patient Safety, Research Development, U.S. Bone and Joint Decade, and chair and Appropriate Use Criteria and Clinical Practice Guideline section leaders of the Evidence Based Quality and Value committee. Also on the Council are the second vice-president, three members at large, and representatives of the Diversity Advisory Board, Women's Health Issues Advisory Board, Board of Specialty Societies (BOS), Board of Councilors (BOC), Communications Cabinet, Orthopaedic Research Society (ORS), Orthopedic Research and Education Foundation (OREF).

Board of Directors

The 17 member Board of Directors manage the affairs of the AAOS, set policy, and oversee the Strategic Plan.

APPENDIX III
PICO QUESTIONS USED TO DEFINE LITERATURE SEARCH

Short Title	PICO Question
Drains	In adult patients with osteoarthritis undergoing TKA who have a drain put in at the time of surgery, is there a reduction in complications or an improvement in outcomes compared with patients who do not have a drain placed?
Antibiotic bone cement	In adult patients with osteoarthritis undergoing cemented KA, does the use of antibiotic bone cement improve outcomes when compared to patients with bone cement without antibiotics?
Unicompartmental	In adult patients with osteoarthritis undergoing unicompartmental KA for predominantly unicompartmental OA, are outcomes and/or implant survivorship improved compared to those patients undergoing osteotomy (distal femoral for lateral compartment involvement, proximal tibial for medial compartment involvement, and tibial tubercle for patellofemoral involvement) or TKA? (2 questions)
Regional Anesthesia	In adult patients with osteoarthritis undergoing KA and with no known contraindications to specific anesthesia, does neuraxial anesthesia reduce complications or improve outcomes compared to general anesthesia?
Peripheral Nerve Blockade	In adult patients with osteoarthritis undergoing KA and with no known contraindications to specific anesthesia, does peri-operative peripheral nerve block for pain control reduce complications or improve outcomes compared to using no peripheral nerve block?
Tranexamic acid	In adult patients with osteoarthritis undergoing KA and with no known contraindications to the use of tranexamic acid, does the use of topical or intravenous tranexamic acid reduce complications and / or improve outcomes compared to not using tranexamic acid?
Bone Cement	a) In adult patients with osteoarthritis undergoing KA, does the use of bone cement fixation for one or more of the knee arthroplasty components improve outcomes or reduce complications when compared with use of bony ingrowth components (hybrid vs no use of bone cement)?
	b) In adult patients with osteoarthritis undergoing KA, does the use of bone cement fixation for all knee arthroplasty components improve outcomes or reduce complications when compared with use of bony ingrowth components (completely cemented vs no use of bone cement)?
	c) In adult patients with osteoarthritis undergoing KA, does the use of bone cement fixation for one or more of the knee arthroplasty components improve outcomes or reduce complications when compared with use of bone cement fixation for all knee arthroplasty components (hybrid vs completed cement)?
Bilateral TKA	In adult patients with bilateral osteoarthritis undergoing TKA and with no known contraindications, does bilateral simultaneous KA (both knee surgeries during the same anesthetic) have improved outcomes or reduced complications compared with the combined complications of both individual KA (two knee surgeries, with two separate anesthetics) either within 90 days or within 6 months?
Surgical Navigation	In adult patients with osteoarthritis undergoing KA and with no known contraindications to surgical navigation, does intraoperative surgical navigation improve outcomes or decrease complications compared with not using surgical navigation?
Radiographs	In adult patients with osteoarthritis undergoing KA, does the use of a preoperative long-standing (hip to ankle) AP or PA radiograph improve outcomes or decrease complications compared with not using this radiograph?

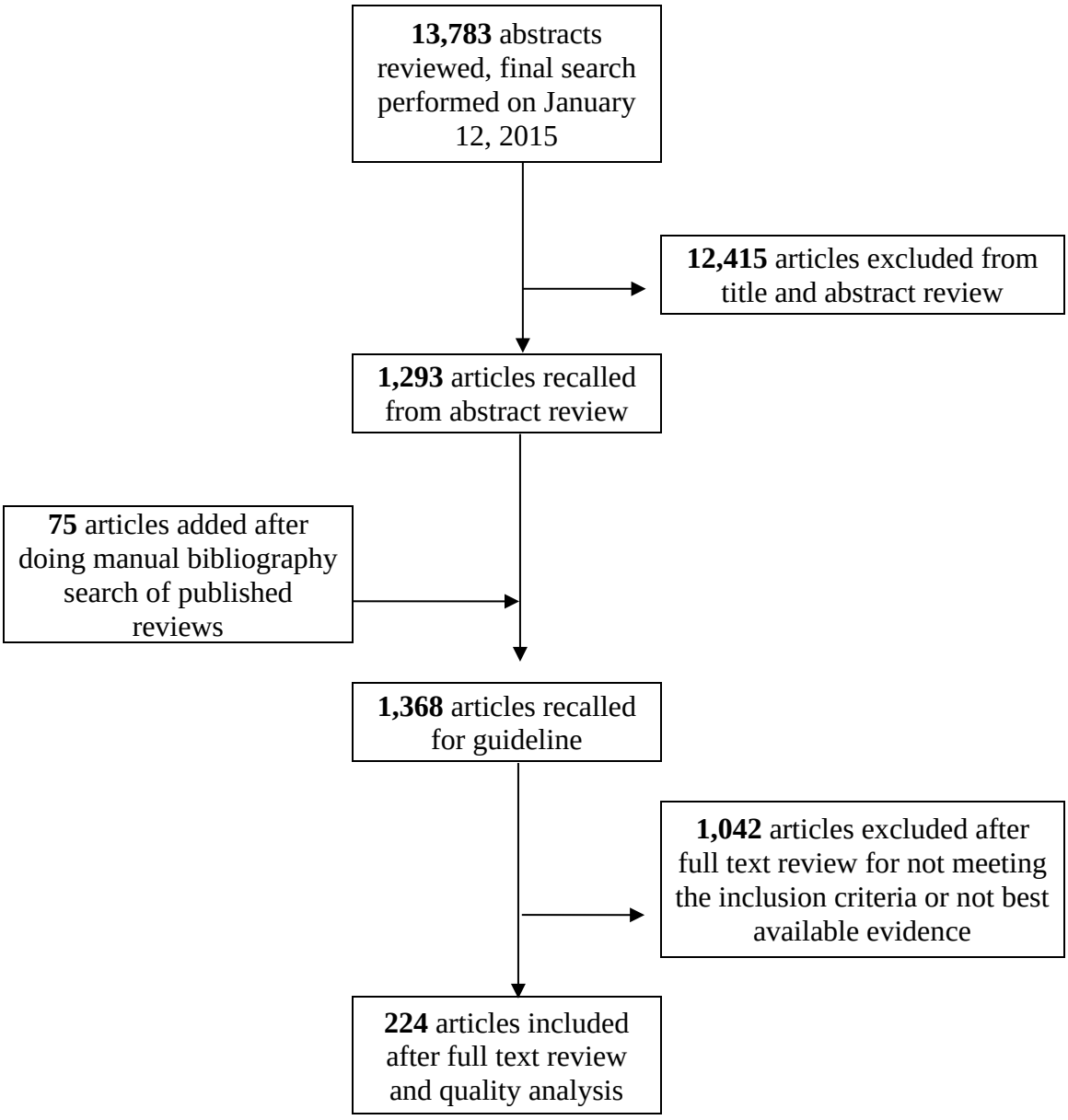
* *See Appendix XIII for details regarding support*

Short Title	PICO Question
Axial Imaging	In adult patients with osteoarthritis undergoing KA and with no known contraindications to MRI or CT scan, does obtaining a preoperative MRI or CT scan (diagnostic imaging) in addition to standard pre-operative radiographs improve outcomes or decrease complications compared with not obtaining an MRI or CT scan?
Delay TKA	In adult patients with osteoarthritis undergoing KA (who have already failed non-surgical management), does a delay of X days/weeks/months in surgical intervention lead to worse outcomes or higher complications compared to no delay?
Risk Stratification	a) Obesity: In obese adult patients (using the WHO definitions) with osteoarthritis undergoing KA, are outcomes diminished or complications increased compared with non-obese patients undergoing KA?
	b) Depression: In depressed adult patients with osteoarthritis undergoing KA, are outcomes diminished or complications increased compared with non-depressed patients undergoing KA?
	c) Diabetes: In diabetic adult patients with osteoarthritis undergoing KA, are outcomes diminished or complications increased compared with non-diabetic patients undergoing KA?
	d) Smoking: In adult currently tobacco-smoking patients with osteoarthritis undergoing KA, are outcomes diminished or complications increased compared with non-currently tobacco-smoking patients undergoing KA?
	e-n) Additional Risk Factors: Search literature for metabolic syndrome, osteoporosis, anemia, liver disease, renal insufficiency, chronic pain, sleep apnea, HIV, neurologic disease and formulate questions similar to those above
Physical Therapy	In adult patients with osteoarthritis undergoing KA, does active participation in a pre-operative structured exercise program improve outcomes or decrease complications compared with not engaging in such a program?
Tourniquet	In adult patients with osteoarthritis undergoing TKA and with no known contraindications, does using a tourniquet during surgery improve outcomes or decrease complications compared with not using a tourniquet?
Post-operative mobilization	In adult patients with osteoarthritis undergoing TKA and with no known contraindications, does (accelerated) mobilization on the day of surgery improve outcomes and / or decrease complications compared with (non-accelerated) mobilization on post-operative day number 1 (the day after surgery)?
Continuous Passive Motion (CPM)	In adult patients with osteoarthritis undergoing KA and with no known contraindications, does the use of a continuous passive motion (CPM) machine during the post-operative hospital stay improve outcomes and/or decrease complications compared to not using CPM in the hospital?
Transfusion	In adult patients with osteoarthritis and acute post-op anemia undergoing KA, does use of a restricted transfusion protocol (define as X) improve outcomes and / or decrease complications compared with not using such a protocol?
Rehabilitation Facility	In adult patients with osteoarthritis undergoing KA, does discharge to an acute rehabilitation facility or skilled nursing facility improve outcomes and / or decrease complications compared with discharge to home, with or without home services?
Manipulation	In adult patients with osteoarthritis and stiffness/poor range of motion after KA and with no known contraindications, does manipulation under anesthesia postoperatively improve outcomes and / or decrease complications compared with non-manipulation (under anesthesia) interventions for post-operative stiffness?

Short Title	PICO Question
Cryotherapy	In adult patients with osteoarthritis undergoing KA and with no known contraindications, does post-operative cryotherapy (all cooling techniques) improve outcomes and/or decrease complications compared with no use of cryotherapy?
Home CPM	In adult patients with osteoarthritis undergoing KA and with no known contraindications, does the use of a continuous passive motion (CPM) machine after hospital discharge improve outcomes and / or decrease complications compared not using CPM after hospital discharge?
MSSA/MRSA	a) In adult patients with osteoarthritis scheduled for TKA, does pre-operative screening and treatment for MRSA and MSSA improve outcomes and / or decrease complications compared to not screening and treating for MRSA and MSSA?
	b) In adult patients with osteoarthritis scheduled for KA, does pre-operative screening and treatment for MRSA and MSSA improve outcomes and / or decrease complications compared to universal treatment (e.g., bactroban, hibiclens w/o screening) for MRSA and MSSA?
Skin Treatment	In adult patients with osteoarthritis scheduled for TKA, does pre-operative skin treatment with chlorhexidine showers and/ or skin wipes improve outcomes and/or decrease complications compared to not treating with chlorhexidine showers and/ or skin wipes?
Skin Prep	In adult patients with osteoarthritis undergoing KA, does pre-operative skin preparation with a pre-prepared (second generation) alcohol based skin preparation solution (e.g. Chloroprep or Duraprep) improve outcomes and / or decrease complications compared to not treating with a pre-prepared (second generation) alcohol based skin preparation solution?
Body Isolation suits	In adult patients with osteoarthritis undergoing KA, does intraoperative use of body isolation suits (space suits or exhaust suits) by one or more of the surgical team improve outcomes and / or decrease complications compared to not using body isolation suits (space suits or exhaust suits)?
OR Environment	In adult patients with osteoarthritis undergoing TKA, do alterations of the OR environment (uv light, low traffic, use of bear hugger, laminar airflow, minimizing door swings) improve outcomes and / or decrease complications compared to not altering OR environment?
Patellar Resurfacing	In adult patients with osteoarthritis undergoing TKA, does patellar resurfacing improve outcomes or decrease complications when compared to patients without patellar resurfacing?
Cruciate Retaining Arthroplasty	In adult patients with osteoarthritis undergoing TKA, does the use of cruciate retaining arthroplasty design improve outcomes or decrease complications when compared to patients with posterior stabilized arthroplasty design?
Patient Specific Technology	In adult patients with osteoarthritis undergoing KA, does the use of patient specific technology improve outcomes and / or decrease complications when compared to standard knee replacement technique?

Short Title	PICO Question
Volume	a) In adult patients with osteoarthritis undergoing KA, does surgery performed at a high volume center improve outcomes and / or decrease complications when compared to patients undergoing surgery at a lower volume center
	b) In adult patients with osteoarthritis undergoing KA, does surgery performed by a high volume surgeon improve outcomes and / or decrease complications when compared to patients undergoing surgery by a lower volume surgeon?
Structured Exercise Program	In adult patients with osteoarthritis who have undergone KA, does a post-operative, prescribed, supervised, structured exercise program at either short- term (three months or less) or long-term (greater than 3 months improve outcomes or decrease complications compared with not engaging in such a program?
Peri-articular Local Infiltration	In adult patients with osteoarthritis undergoing KA and with no known contraindications to specific medications used, does peri-articular local infiltration (anesthetic and/or anti-inflammatory and/or analgesic) reduce complications or improve outcomes compared to not injecting this mixture?
Poly-tibias	In adult patients with osteoarthritis undergoing KA, does use of an all-polyethylene tibial component increase complications or diminish outcomes compared to a modular (metal and polyethylene) tibial component?

APPENDIX IV
STUDY ATTRITION FLOWCHART



** See Appendix XIII for details regarding support*

APPENDIX V
LITERATURE SEARCH STRATEGIES

Database: PubMed (PubMed.gov interface)
Date searched: December 9, 2013 [updated search January 29, 2015]

#1"Osteoarthritis, Knee"[mh] OR gonitis[tiab] OR gonarthritis[tiab] OR gonarthros*[tiab]
#2("Knee Joint"[mh] OR "Knee"[mh] OR “knee”[tiab] OR “knees”[tiab] OR “patellofemoral”[tiab]) AND (Osteoarthritis[mh:noexp] OR Arthritis[mh:noexp] OR osteoarthr*[tiab] OR arthriti*[tiab] OR “arthrosis”[tiab])
#3“Arthroplasty, Replacement, Knee”[mh] OR “Knee Prosthesis”[mh] OR “arthroplasty”[tiab] OR “arthroplasties”[tiab] OR “replacement”[tiab] OR “replacements”[tiab] OR “resurfacing”[tiab]
#4(#1 OR #2) AND #3
#5English[la]
#6 (animal[mh] NOT human[mh]) OR cadaver[mh] OR cadaver*[ti] OR comment[pt] OR editorial[pt] OR letter[pt] OR "historical article"[pt] OR addresses[pt] OR news[pt] OR "newspaper article"[pt] OR "in vitro"[pt] OR "case report"[ti]
#7(#4 AND #5) NOT #6

Database: EMBASE (Embase.com interface)
Date searched: December 9, 2013 [updated search January 29, 2015]

#1'knee osteoarthritis'/exp OR gonitis:ab,ti OR gonarthritis:ab,ti OR gonarthros*:ab,ti
#2('knee'/exp OR 'knee':ab,ti OR 'knees':ab,ti OR 'patellofemoral':ab,ti) AND ('osteoarthritis'/de OR 'arthritis'/de OR osteoarthr*:ab,ti OR arthriti*:ab,ti OR 'arthrosis':ab,ti)
#3'knee arthroplasty'/exp OR 'knee prosthesis'/exp OR ‘arthroplasty’:ab,ti OR ‘arthroplasties’:ab,ti OR ‘replacement’:ab,ti OR ‘replacements’:ab,ti OR ‘resurfacing’:ab,ti
#4(#1 OR #2) AND #3
#5[english]/lim
#6cadaver/de OR 'in vitro study'/exp OR 'abstract report'/de OR book/de OR editorial/de OR note/de OR (letter/de NOT 'types of study'/exp)
#7(#4 AND #5) NOT #6

Database: The Cochrane Library (Wiley interface)
Date searched: December 9, 2013 [updated search January 29, 2015]

#1MeSH descriptor: [Osteoarthritis, Knee] explode all trees
#2MeSH descriptor: [Knee Joint] explode all trees
#3MeSH descriptor: [Knee] explode all trees

#4MeSH descriptor: [Osteoarthritis] this term only
#5MeSH descriptor: [Arthritis] this term only
#6MeSH descriptor: [Arthroplasty, Replacement, Knee] explode all trees
#7MeSH descriptor: [Knee Prosthesis] explode all trees
#8gonitis or gonarthritis or gonarthrosis:ti,ab,kw (Word variations searched)
#9knee or knees or patellofemoral:ti,ab,kw (Word variations searched)
#10osteoarthr* or arthriti* or arthrosis:ti,ab,kw (Word variations searched)
#11arthroplasty or arthroplasties or replacement or replacements or resurfacing:ti,ab,kw (Word variations searched)
#12#1 or #8
#13(#2 or #3 or #9) and (#4 or #5 or #10)
#14#6 or #7 or #11
#15(#12 or #13) and #14

Supplementary Anesthesia Search (PICOs #4-5)

Database: PubMed (PubMed.gov interface)
Date searched: December 23, 2014

#1"Knee Joint/surgery"[mh] OR "Knee/surgery"[mh] OR (Arthroplasty[mh:noexp] AND (Knee[mh] OR Knee Joint[mh])) OR (Arthroplasty, Replacement[mh:noexp] AND (Knee[mh] OR Knee Joint[mh])) OR Arthroplasty, Replacement, Knee[mh] OR Lower Extremity/surgery[mh:noexp] OR ("Orthopedic Procedures"[mh] AND (Knee[mh] OR Knee Joint[mh]))
#2 (Knee[tiab] OR knees[tiab]) AND (arthroplast*[tiab] OR replacement*[tiab] OR operat*[tiab] OR surg*[tiab])
#3#1 OR #2
#4 Anesthesia, Conduction[mh] OR Anesthesia[mh:noexp]
#5 "neuraxial"[tiab] OR "epidural"[tiab] OR "nerve block"[tiab] OR "nerve blocks"[tiab] OR "nerve blockade"[tiab]
#6#4 OR #5
#7#3 AND #6
#8English[la]
#9 (animal[mh] NOT human[mh]) OR cadaver[mh] OR cadaver*[ti] OR comment[pt] OR editorial[pt] OR letter[pt] OR "historical article"[pt] OR addresses[pt] OR news[pt] OR "newspaper article"[pt] OR "in vitro"[pt] OR "case report"[ti]
#10(#7 AND #8) NOT #9

Database: EMBASE (Embase.com interface)
Date searched: January 7, 2015

#1'knee surgery'/exp

#2knee:ab,ti OR knees:ab,ti AND (arthroplast*:ab,ti OR replacement*:ab,ti OR operat*:ab,ti OR surg*:ab,ti)
#3'anesthesia'/exp
#4'neuraxial':ab,ti OR 'epidural':ab,ti OR 'nerve block':ab,ti OR 'nerve blocks':ab,ti OR 'nerve blockade':ab,ti
#5(#1 OR #2) AND (#3 OR #4)
#6[english]/lim NOT [medline]/lim
#7'cadaver'/de OR 'in vitro study'/exp OR 'abstract report'/de OR 'book'/de OR 'editorial'/de OR 'note'/de OR ('letter'/de NOT 'types of study'/exp)
#8'meta analysis':de,ab,ti OR 'systematic review':de,ab,ti OR medline:de,ab,ti
#9random*:de,ab,ti OR 'clinical trial':de,ab,ti OR 'health care quality'/exp
#10#5 AND #6 NOT #7
#11#10 AND #8
#12#10 AND #9 NOT #8
#13#10 NOT (#8 OR #9)

Database: The Cochrane Library (Wiley interface)
Date searched: January 12, 2015

#1MeSH descriptor: [Knee] explode all trees and with qualifier(s): [Surgery - SU]
#2MeSH descriptor: [Knee Joint] explode all trees and with qualifier(s): [Surgery - SU]
#3MeSH descriptor: [Knee] explode all trees
#4MeSH descriptor: [Knee Joint] explode all trees
#5MeSH descriptor: [Arthroplasty, Replacement, Knee] explode all trees
#6MeSH descriptor: [Orthopedic Procedures] explode all trees
#7MeSH descriptor: [Anesthesia, Conduction] explode all trees
#8MeSH descriptor: [Anesthesia] this term only
#9"neuraxial" or "epidural" or "nerve block" or "nerve blocks" or "nerve blockade"
#10"knee" or "knees":ti,ab,kw (Word variations have been searched)
#11#1 or #2 or #5 or (#6 and (#3 or #4)) or #10
#12#11 and (#7 or #8 or #9)

APPENDIX VI
OPINION BASED RECOMMENDATIONS

A guideline can contain recommendations for which there is no evidence. Guideline development groups might make the decision to issue opinion-based recommendations. Although expert opinion is a form of evidence, it is also important to avoid liberal use in a guideline since research shows that expert opinion can be incorrect.

Opinion-based recommendations are developed only in instances where not establishing a recommendation would lead to catastrophic consequences for a patient (e.g. loss of life or limb). To ensure that an opinion-based recommendation is absolutely necessary, the AAOS has adopted rules to guide the content of the rationales that are based on those outlined by the U.S. Preventive Services Task Force (USPSTF).[166] Specifically, rationales based on expert opinion must:

- Not contain references to or citations from articles not included in the systematic review.

- Not contain the AAOS guideline language "the practitioner should/should not", "the practitioner could/could not" or "The practitioner might/might not."

- Contain an explanation of the potential preventable burden of disease. This involves considering both the incidence and/or prevalence of the disease, disorder, or condition and the associated burden of suffering. To paraphrase the USPSTF, when evidence is insufficient, provision of a treatment (or diagnostic) for a serious condition might be viewed more favorably than provision of a treatment (or diagnostic) for a condition that does not cause as much suffering. The AAOS understands that evaluating the "burden of suffering" is subjective and involves judgment. This evaluation should be informed by patient values and concerns. It is not appropriate for a guideline to recommend widespread use of a technology backed by little data and for which there is limited experience. Such technologies are addressed in the AAOS' Technology Overviews.

- Address potential harms.

- Address apparent discrepancies in the logic of different recommendations. If there are no relevant data for several recommendations and the guideline development group chooses to issue an opinion-based recommendation in some cases but not in other cases, the rationales must explain why.

- Consider current practice. The USPSTF specifically states that clinicians justifiably fear not providing a service that is practiced on a widespread basis will lead to litigation.[166] Not providing a service that is not widely available or commonly used has less serious consequences than not providing a treatment accepted by the medical profession that patients expect. The patient's "expectation of treatment" must be tempered by the treating physician's guidance about the reasonable outcomes that the patient can expect.

- Justify when applicable why a more costly device, drug, or procedure is being recommended.

Guideline development group members write the rationales for opinion based recommendations on the first day of the final guideline development group meeting. When the guideline development group reconvenes on the second day, members approve the rationales. If the guideline development group cannot adopt a rationale after three votes, the rationale and the opinion-based recommendation will be withdrawn, and a "recommendation" stating that the group can neither recommend for or against the recommendation in question will appear in the guideline.

Sometimes guideline development group members change their views. At any time during the discussion of the rationales, any member of the guideline development group can make a motion to withdraw a recommendation. The guideline will state that the guideline development group can neither recommend for or against the recommendation in question.

COMPANION CONSENSUS STATEMENTS

For PICO questions which returned no evidence and do not meet the AAOS criteria for developing a consensus statement, the guideline development group is asked to refer the question to a relevant specialty society to form a companion consensus statement.

If the designated specialty society accepts the invitation to create a consensus companion statement, the AAOS Evidence-Based Medicine Unit assists the society in assembling a writing panel and voting panel made up of their members. After the panels are assembled, the AAOS EBM Unit guides them through a modified Delphi process to construct a companion consensus statement. If the companion consensus statement is approved by the designated specialty society and AAOS bodies, it is published in a separate document alongside the guideline on the AAOS website: www.aaos.org/guidelines

Appendix VIII

APPENDIX VII

PARTICIPATING PEER REVIEW ORGANIZATIONS

Peer review of the guideline is completed by interested external organizations. The AAOS solicits reviewers for each guideline. They consist of experts in the topic area and represent professional societies other than AAOS. Review organizations are nominated by the guideline development group at the introductory meeting. For this guideline, 21 organizations were invited to review the full guideline. Six societies participated in the review of the guideline on surgical management of osteoarthritis of the knee and have given consent to be listed below:

American Association of Hip and Knee Surgeons
American College of Radiology
American Geriatrics Society
American Society of Regional Anesthesia and Pain Medicine
American Society of Anesthesiologists
American Physical Therapy Association

Peer review comments will be available on www.aaos.org.

Participation in the AAOS guideline peer review process does not constitute an endorsement nor does it imply that the reviewer supports this document.

STRUCTURED PEER REVIEW FORM

Peer reviewers are asked to read and review the draft of the clinical practice guideline with a particular focus on their area of expertise. Their responses to the answers below are used to assess the validity, clarity, and accuracy of the interpretation of the evidence.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The overall objective(s) of the guideline is (are) specifically described.	○	○	○	○	○
2. The health question(s) covered by the guideline is (are) specifically described.	○	○	○	○	○
3. The guideline's target audience is clearly described.	○	○	○	○	○
4. The guideline development group includes individuals from all the relevant professional groups.	○	○	○	○	○
5. There is an explicit link between the recommendations and the supporting evidence.	○	○	○	○	○
6. Given the nature of the topic and the data, all clinically important outcomes are considered.	○	○	○	○	○
7. The patients to whom this guideline is meant to apply are specifically described.	○	○	○	○	○
8. The criteria used to select articles for inclusion are appropriate.	○	○	○	○	○
9. The reasons why some studies were excluded are clearly described.	○	○	○	○	○
10. All important studies that met the article inclusion criteria are included.	○	○	○	○	○
11. The validity of the studies is appropriately appraised.	○	○	○	○	○
12. The methods are described in such a way as to be reproducible.	○	○	○	○	○
13. The statistical methods are appropriate to the material and the objectives of this guideline.	○	○	○	○	○
14. Important parameters (e.g., setting, study population, study design) that could affect study results are systematically addressed.	○	○	○	○	○
15. Health benefits, side effects, and risks are adequately addressed.	○	○	○	○	○
16. The writing style is appropriate for health care professionals.	○	○	○	○	○
17. The grades assigned to each recommendation are appropriate.	○	○	○	○	○

Please provide a brief explanation of both your positive and negative answers in the preceding section. If applicable, please specify the draft page and line numbers in your comments. Please feel free to also comment on the overall structure and content of the Guideline.

Would you recommend these guidelines for use in clinical practice?*

- Strongly Recommend
- Recommend
- Would Not Recommend
- Unsure

Additional Comments:

To view an exampleof the structured peer review form, please select the following link: Structured Peer Review Form

APPENDIX VIII
INTERPRETING THE FOREST PLOTS

We use descriptive diagrams known as forest plots to present data from studies comparing the differences in outcomes between two treatment groups when a meta-analysis has been performed (combining results of multiple studies into a single estimate of overall effect). The overall effect is shown at the bottom of the graph as a diamond to illustrate the confidence intervals. The standardized mean difference or odds ratio are measures used to depict differences in outcomes between treatment groups. The horizontal line running through each point represents the 95% confidence interval for that point estimate. The solid vertical line represents “no effect” and is where the standardized mean difference = 0 or odds ratio = 1.

APPENDIX IX
CONFLICT OF INTEREST

Prior to the development of this guideline, guideline development group members disclose conflicts of interest (COI). They disclose COIs in writing to the American Academy of Orthopaedic Surgeons via a private on-line reporting database and also verbally at the recommendation approval meeting.

Disclosure Items: (n) = Respondent answered 'No' to all items indicating no conflicts. 1 = Royalties from a company or supplier; 2 = Speakers bureau/paid presentations for a company or supplier; 3A = Paid employee for a company or supplier; 3B = Paid consultant for a company or supplier; 3C = Unpaid consultant for a company or supplier; 4 = Stock or stock options in a company or supplier; 5 = Research support from a company or supplier as a PI; 6 = Other financial or material support from a company or supplier; 7 = Royalties, financial or material support from publishers; 8 = Medical/Orthopaedic publications editorial/governing board; 9 = Board member/committee appointments for a society.

Brian Joseph McGrory, MD, Workgroup Chair: American Association of Hip and Knee Surgeons: Board or committee member; Arthroplasty Today: Editorial or governing board; Submitted on: 10/05/2014

Kristy L Weber, MD, Workgroup Co-Chair: Current Surgery Reviews: Editorial or governing board; Journal of Bone and Joint Surgery - American: Editorial or governing board; Musculoskeletal Tumor Society: Board or committee member Orthopaedic Research Society: Board or committee member; Ruth Jackson Orthopaedic Society: Board or committee member; Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support; Submitted on: 12/12/2014

Gregory Alexander Brown, MD, PhD: AAOS: Board or committee member; ASTM: Board or committee member; International Standards Organization: Board or committee member; KareMetrix LLC: Stock or stock Options; Orthopaedic Solutions LLC: Stock or stock Options; Smith & Nephew: Paid presenter or speaker; Research support; Submitted on: 04/07/2015

Vinod Dasa, MD: Bioventus: Paid consultant; Paid presenter or speaker; Cropper medical: Research support; Ferring Pharmaceuticals: Paid consultant; Myoscience: Paid consultant; SKK Japan: Consultant; Submitted on: 10/03/2014

Charles M Davis III, MD: AAOS: Board or committee member; American Association of Hip and Knee Surgeons: Board or committee member; Journal of Arthroplasty: Editorial or governing board; Submitted on: 12/22/2014

COL. (ret) Tad L Gerlinger, MD: Smith & Nephew: Paid consultant; Society of Military Orthopaedic Surgeons: Board or committee member; Submitted on: 04/02/2015

James R Hebl, MD: Minnesota Society of Anesthesiologists: Board or committee member; Oxford University Press: Publishing royalties, financial or material support;

* *See Appendix XIII for details regarding support*

Regional Anesthesia and Pain Medicine: Editorial or governing board; Submitted on: 03/18/2015

Atul F Kamath, MD: AAOS: Board or committee member; BMC Musculoskeletal Disorders: Editorial or governing board; Procter & Gamble: Stock or stock Options; Submitted on: 10/01/2014

John A Lynott, MD: (This individual reported nothing to disclose); Submitted on: 04/01/2014

Sara Piva, PT, PhD: (This individual reported nothing to disclose); Submitted on: 03/18/2015

John C Richmond, MD: American Orthopaedic Society for Sports Medicine: Board or committee member; Arthroscopy Association of North America: Board or committee member; Eastern Orthopaedic Association: Board or committee member; Histogenics Corporation: Paid consultant; Mitek: Paid consultant; Springer: Publishing royalties, financial or material support; Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support; Submitted on: 02/17/2015

Tomas Villanueva, DO, MBA, FACPE: Bristol-Myers Squibb: Paid presenter or speaker; Johnson & Johnson: Paid presenter or speaker; Norvartis: Paid presenter or speaker; Pfizer: Paid presenter or speaker; Sanofi-Aventis: Paid presenter or speaker; Submitted on: 04/08/2015

Chick J Yates Jr, MD: American Association of Hip and Knee Surgeons: Board or committee member; Submitted on: 10/10/2014

David Jevsevar, MD, MBA (This individual reported nothing to disclose); Submitted on: 10/02/2014

William O Shaffer, MD: (This individual reported nothing to disclose); Submitted on: 04/13/2014

Deborah S Cummins, PhD: (This individual reported nothing to disclose); Submitted on: 05/22/2014

Jayson Murray, MA: (This individual reported nothing to disclose); Submitted on: 05/19/2014

Ben Brenton: (This individual reported nothing to disclose); Submitted on 07/31/2014

Patrick Donnelly: (This individual reported nothing to disclose); Submitted on: 04/09/2015

Nilay Patel: (This individual reported nothing to disclose); Submitted on 07/31/2014

Anne Woznica: (This individual reported nothing to disclose); Submitted on: 04/01/2015

Erica Linskey: (This individual reported nothing to disclose); Submitted on: 06/29/2015

Kaitlyn Sevarino: (This individual reported nothing to disclose); Submitted on: 04/02/2015

Peter Shores: (This individual reported nothing to disclose); Submitted on: 10/06/2014

APPENDIX X
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INTRODUCTION AND METHODS

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Yoon,H.S., Han,C.D., Yang,I.H. Comparison of simultaneous bilateral and staged bilateral total knee arthroplasty in terms of perioperative complications. J Arthroplasty 2010/2; 2: 179-185

LOWER QUALITY STUDIES THAT MET THE INCLUSION CRITERIA BUT WERE EXCLUDED FOR NOT BEST AVAILABLE EVIDENCE

Authors	Year	Title
Abu-Rajab,R.B.; Watson,W.S.; Walker,B.; Roberts,J.; Gallacher,S.J.; Meek,R.M.	2006	Peri-prosthetic bone mineral density after total knee arthroplasty. Cemented versus cementless fixation
Adam,R.; Orban,C.; Orban,H.	2014	Comparative study of design and PCL-substituting systems of total knee prosthesis
Aglietti,P.; Buzzi,R.; De,Felice R.; Giron,F.	1999	The Insall-Burstein total knee replacement in osteoarthritis: a 10-year minimum follow-up
Ali,S.I.Q.; Landry,D.E.	2013	Pain control after total knee arthroplasty in continuous femoral nerve infusion group versus single shot group
Amin,A.K.; Patton,J.T.; Cook,R.E.; Gaston,M.; Brenkel,I.J.	2006	Unicompartmental or total knee arthroplasty?: Results from a matched study
Anderson,K.C.; Buehler,K.C.; Markel,D.C.	2005	Computer assisted navigation in total knee arthroplasty: Comparison with conventional methods
Arbuthnot,J.E.; McNicholas,M.J.; McGurty,D.W.; Rowley,D.I.	2004	Total knee replacement and patellofemoral pain
Baker,M.W.; Tullos,H.S.; Bryan,W.J.; Oxspring,H.	1989	The use of epidural morphine in patients undergoing total knee arthroplasty
Barrack,R.L.; Nakamura,S.J.; Hopkins,S.G.; Rosenzweig,S.	2004	Winner of the 2003 James A. Rand Young Investigator's Award. Early failure of cementless mobile-bearing total knee arthroplasty
Berend,K.R.; Lombardi,A.V.,Jr.; Mallory,T.H.; Adams,J.B.; Groseth,K.L.	2005	Early failure of minimally invasive unicompartmental knee arthroplasty is associated with obesity
Berti,L.; Benedetti,M.G.; Ensini,A.; Catani,F.; Giannini,S.	2006	Clinical and biomechanical assessment of patella resurfacing in total knee arthroplasty
Bhattacharya,R.; Scott,C.E.; Morris,H.E.; Wade,F.; Nutton,R.W.	2012	Survivorship and patient satisfaction of a fixed bearing unicompartmental knee arthroplasty incorporating an all-polyethylene tibial component
Binici,Bedir E.; Kurtulmus,T.; Basyigit,S.; Bakir,U.; Saglam,N.; Saka,G.	2014	A comparison of epidural analgesia and local infiltration analgesia methods in pain control following total knee arthroplasty
Broome,C.B.; Burnikel,B.	2014	Novel strategies to improve early outcomes following total knee arthroplasty: a case control study of intra articular injection versus femoral nerve block
Broughton,N.S.; Newman,J.H.; Baily,R.A.	1986	Unicompartmental replacement and high tibial osteotomy for osteoarthritis of the knee. A comparative study after 5-10 years' follow-up
Cavaignac,E.; Lafontan,V.; Reina,N.; Pailhe,R.; Warmy,M.; Laffosse,J.M.; Chiron,P.	2013	Obesity has no adverse effect on the outcome of unicompartmental knee replacement at a minimum follow-up of seven years
Cheung,K.W.; Chiu,K.H.	2009	Imageless computer navigation in total knee arthroplasty
Cinotti,G.; Ripani,F.R.; Sessa,P.; Giannicola,G.	2012	Combining different rotational alignment axes with navigation may reduce the need for lateral retinacular release in total knee arthroplasty
Clements,W.J.; Miller,L.; Whitehouse,S.L.; Graves,S.E.; Ryan,P.; Crawford,R.W.	2010	Early outcomes of patella resurfacing in total knee arthroplasty
Collins,D.N.; Heim,S.A.; Nelson,C.L.; Smith,III P.	1991	Porous-coated anatomic total knee arthroplasty: A prospective analysis comparing cemented and cementless fixation

Authors	Year	Title
Czurda,T.; Fennema,P.; Baumgartner,M.; Ritschl,P.	2010	The association between component malalignment and post-operative pain following navigation-assisted total knee arthroplasty: results of a cohort/nested case-control study
D'Apuzzo,M.R.; Cabanela,M.E.; Trousdale,R.T.; Sierra,R.J.	2012	Primary total knee arthroplasty in patients with fibromyalgia
Dejour,D.; Deschamps,G.; Garotta,L.; Dejour,H.	1999	Laxity in posterior cruciate sparing and posterior stabilized total knee prostheses
Dennis,D.A.; Komistek,R.D.; Stiehl,J.B.; Walker,S.A.; Dennis,K.N.	1998	Range of motion after total knee arthroplasty: The effect of implant design and weight-bearing conditions
Dowsey,M.M.; Liew,D.; Stoney,J.D.; Choong,P.F.	2010	The impact of pre-operative obesity on weight change and outcome in total knee replacement: a prospective study of 529 consecutive patients
Epinette,J.A.; Manley,M.T.	2008	Outcomes of patellar resurfacing versus nonresurfacing in total knee arthroplasty: a 9-year experience based on a case series of scorpio PS knees
Foran,J.R.; Mont,M.A.; Rajadhyaksha,A.D.; Jones,L.C.; Etienne,G.; Hungerford,D.S.	2004	Total knee arthroplasty in obese patients: a comparison with a matched control group
Ganapathy,S.; Wasserman,R.A.; Watson,J.T.; Bennett,J.; Armstrong,K.P.; Stockall,C.A.; Chess,D.G.; MacDonald,C.	1999	Modified continuous femoral three-in-one block for postoperative pain after total knee arthroplasty
Gi,E.; Yamauchi,M.; Yamakage,M.; Kikuchi,C.; Shimizu,H.; Okada,Y.; Kawamura,S.; Suzuki,T.	2014	Effects of local infiltration analgesia for posterior knee pain after total knee arthroplasty: comparison with sciatic nerve block
Guo,L.; Yang,L.; Briard,J.L.; Duan,X.J.; Wang,F.Y.	2012	Long-term survival analysis of posterior cruciate-retaining total knee arthroplasty
Horasanli,E.; Gamli,M.; Pala,Y.; Erol,M.; Sahin,F.; Dikmen,B.	2010	A comparison of epidural anesthesia and lumbar plexus-sciatic nerve blocks for knee surgery
Ikejiani,C.E.; Leighton,R.; Petrie,D.P.	2000	Comparison of patellar resurfacing versus nonresurfacing in total knee arthroplasty
Irisson,E.; Hemon,Y.; Pauly,V.; Parratte,S.; Argenson,J.N.; Kerbaul,F.	2012	Tranexamic acid reduces blood loss and financial cost in primary total hip and knee replacement surgery
Jenny,J.-Y.; Boeri,C.; Schneider,L.	2008	Medial knee osteophytes have little influence on the medial collateral laxity during total knee replacement
Johnson,D.P.; Eastwood,D.M.	1992	Beneficial effects of continuous passive motion after total condylar knee arthroplasty
Jordan,L.R.; Siegel,J.L.; Olivo,J.L.	1995	Early flexion routine: An alternative method of continuous passive motion
Keene,G.; Simpson,D.; Kalairajah,Y.	2006	Limb alignment in computer-assisted minimally-invasive unicompartmental knee replacement
Keyes,B.J.; Markel,D.C.; Meneghini,R.M.	2013	Evaluation of limb alignment, component positioning, and function in primary total knee arthroplasty using a pinless navigation technique compared with conventional methods
Kozinn,S.C.; Marx,C.; Scott,R.D.	1989	Unicompartmental knee arthroplasty. A 4.5-6-year follow-up study with a metal-backed tibial component
Kubiak,P.; Archibeck,M.J.; White,Jr	2008	Cruciate-Retaining Total Knee Arthroplasty in Patients with at Least Fifteen Degrees of Coronal Plane Deformity

Authors	Year	Title
Kumar,P.J.; McPherson,E.J.; Dorr,L.D.; Wan,Z.; Baldwin,K.	1996	Rehabilitation after total knee arthroplasty: a comparison of 2 rehabilitation techniques
Lee,R.M.; Lim Tey,J.B.; Chua,N.H.	2012	Postoperative pain control for total knee arthroplasty: continuous femoral nerve block versus intravenous patient controlled analgesia
Lindstrand,A.; Robertsson,O.; Lewold,S.; Toksvig-Larsen,S.	2001	The patella in total knee arthroplasty: resurfacing or nonresurfacing of patella
Lizaur-Utrilla,A.; Miralles-Munoz,F.A.; Sanz-Reig,J.; Collados-Maestre,I.	2014	Cementless total knee arthroplasty in obese patients: a prospective matched study with follow-up of 5-10 years
Luring,C.; Kauper,M.; Bathis,H.; Perlick,L.; Beckmann,J.; Grifka,J.; Tingart,M.; Rath,B.	2012	A five to seven year follow-up comparing computer-assisted vs freehand TKR with regard to clinical parameters
Matsumoto,T.; Tsumura,N.; Kurosaka,M.; Muratsu,H.; Yoshiya,S.; Kuroda,R.	2006	Clinical values in computer-assisted total knee arthroplasty
Matsumoto,T.; Kuroda,R.; Kubo,S.; Muratsu,H.; Mizuno,K.; Kurosaka,M.	2009	The intra-operative joint gap in cruciate-retaining compared with posterior-stabilised total knee replacement
McCalden,R.W.; MacDonald,S.J.; Charron,K.D.; Bourne,R.B.; Naudie,D.D.	2010	The role of polyethylene design on postoperative TKA flexion: an analysis of 1534 cases
Mohanlal,P.K.; Sandiford,N.; Skinner,J.A.; Samsani,S.	2013	Comparision of blood loss between computer assisted and conventional total knee arthroplasty
Nafei,A.; Nielsen,S.; Kristensen,O.; Hvid,I.	1992	The press-fit Kinemax knee arthroplasty. High failure rate of non-cemented implants
Nafei,A.; Kristensen,O.; Knudsen,H.M.; Hvid,I.; Jensen,J.	1996	Survivorship analysis of cemented total condylar knee arthroplasty. A long-term follow-up report on 348 cases
Napier,D.E.; Bass,S.S.	2007	Postoperative benefits of intrathecal injection for patients undergoing total knee arthroplasty
Ng,F.Y.; Chiu,K.Y.; Yan,C.H.; Ng,K.F.	2012	Continuous femoral nerve block versus patient-controlled analgesia following total knee arthroplasty
Otten,C.; Dunn,K.	2011	Mulitmodal analgesia for postoperative total knee arthroplasty
Pachauri,A.; Acharya,K.K.; Tiwari,A.K.	2014	The effect of tranexamic acid on hemoglobin levels during total knee arthroplasty
Pandit,H.; Jenkins,C.; Gill,H.S.; Smith,G.; Price,A.J.; Dodd,C.A.; Murray,D.W.	2011	Unnecessary contraindications for mobile-bearing unicompartmental knee replacement
Perlas,A.; Kirkham,K.R.; Billing,R.; Tse,C.; Brull,R.; Gandhi,R.; Chan,V.W.	2013	The impact of analgesic modality on early ambulation following total knee arthroplasty
Rorabeck,C.H.; Bourne,R.B.; Nott,L.	1988	The cemented kinematic-II and the non-cemented porous-coated anatomic prostheses for total knee replacement. A prospective evaluation
Rosenberger,R.E.; Hoser,C.; Quirbach,S.; Attal,R.; Hennerbichler,A.; Fink,C.	2008	Improved accuracy of component alignment with the implementation of image-free navigation in total knee arthroplasty
Schlueter-Brust,K.; Kugland,K.; Stein,G.; Henckel,J.; Christ,H.; Eysel,P.; Bontemps,G.	2014	Ten year survivorship after cemented and uncemented medial Uniglide(R) unicompartmental knee arthroplasties

Authors	Year	Title
Shakespeare,D.; Ledger,M.; Kinzel,V.	2006	Flexion after total knee replacement. A comparison between the Medial Pivot knee and a posterior stabilised implant
Sinha,S.K.; Abrams,J.H.; Houle,T.T.; Weller,R.S.	2009	Ultrasound-guided obturator nerve block: an interfascial injection approach without nerve stimulation
Stickles,B.; Phillips,L.; Brox,W.T.; Owens,B.; Lanzer,W.L.	2001	Defining the relationship between obesity and total joint arthroplasty
Tantry,T.P.; B G M; Hukkery,R.	2012	Use of a single injection femoral nerve block in the patients of total knee replacement with concomitant epidural analgesia
Thompson,S.A.; Liabaud,B.; Nellans,K.W.; Geller,J.A.	2013	Factors associated with poor outcomes following unicompartmental knee arthroplasty: redefining the "classic" indications for surgery
Thorsell,M.; Holst,P.; Hyldahl,H.C.; Weidenhielm,L.	2010	Pain control after total knee arthroplasty: a prospective study comparing local infiltration anesthesia and epidural anesthesia
Toman,J.; Iorio,R.; Healy,W.L.	2012	All-polyethylene and metal-backed tibial components are equivalent with BMI of less than 37.5
Tripuraneni,K.R.; Woolson,S.T.; Giori,N.J.	2011	Local infiltration analgesia in TKA patients reduces length of stay and postoperative pain scores
Udomkiat,P.; Meng,B.J.; Dorr,L.D.; Wan,Z.	2000	Functional comparison of posterior cruciate retention and substitution knee replacement
Vazquez-Vela,Johnson G.; Worland,R.L.; Keenan,J.; Norambuena,N.	2003	Patient demographics as a predictor of the ten-year survival rate in primary total knee replacement
Weng,Y.J.; Hsu,R.W.; Hsu,W.H.	2009	Comparison of computer-assisted navigation and conventional instrumentation for bilateral total knee arthroplasty
Xie,F.; Lo,N.N.; Tarride,J.E.; O'Reilly,D.; Goeree,R.; Lee,H.P.	2010	Total or partial knee replacement? Cost-utility analysis in patients with knee osteoarthritis based on a 2-year observational study

EXCLUDED STUDIES

Authors	Year	Title	Reason for Exclusion
Ahmad,I., Konduru,S.	2007	Change in functional status of patients whilst awaiting prinmary total knee arthroplasty	Very Low Quality Rating
Best,M.J.; Buller,L.T.; Klika,A.K.; Barsoum,W.K.	2014	Increase in Perioperative Complications Following Primary Total Hip and Knee Arthroplasty in Patients With Hepatitis C Without Cirrhosis	the percentage of patiens with knee osteoarthritis among TKA patients was unclear
Bong,M.R.; Patel,V.; Chang,E.; Issack,P.S.; Hebert,R.; Di Cesare,P.E.	2004	Risks associated with blood transfusion after total knee arthroplasty	Not relevant to PICO question.
Borden,L.S.; Perry,J.E.; Davis,B.L.; Owings,T.M.; Grabiner,M.D.	1999	A biomechanical evaluation of one-stage vs two-stage bilateral knee arthroplasty patients	<10 patients per group
Bourne,R.B.; Rorabeck,C.H.; Vaz,M.; Kramer,J.	1998	A randomised clinical trial comparing patellar resurfacing to not resurfacing the patella during total knee arthropasty in osteoarthritic patients [Abstract]	Abstract
Breeman,S.; Campbell,M.; Dakin,H.; Fiddian,N.; Fitzpatrick,R.; Grant,A.; Gray,A.; Johnston,L.; Maclennan,G.; Morris,R.; Murray,D.	2011	Patellar resurfacing in total knee replacement: five-year clinical and economic results of a large randomized controlled trial (Structured abstract)	abstract
Chang,C.C.; Lin,H.C.; Lin,H.W.; Lin,H.C.	2010	Anesthetic management and surgical site infections in total hip or knee replacement: a population-based study	combines hip and knee arthroplast
Chen,A.F.; Heyl,A.E.; Xu,P.Z.; Rao,N.; Klatt,B.A.	2013	Preoperative decolonization effective at reducing staphylococcal colonization in total joint arthroplasty patients	Not relevant patient population
Chen,A.F.; Wessel,C.B.; Rao,N.	2013	Staphylococcus aureus screening and decolonization in orthopaedic surgery and reduction of surgical site infections	Not relevant patient population

** See Appendix XIII for details regarding support*

Authors	Year	Title	Reason for Exclusion
Desmeules,F., Dionne,C.E., Belzile,E.L., Bourbonnais,R., Fremont,P.	2012	The impacts of pre-surgery wait for total knee replacement on pain, function and health-related quality of life six months after surgery	Very low quality rating
Ersozlu,S.; Akkaya,T.; Ozgur,A.F.; Sahin,O.; Senturk,I.; Tandogan,R.	2008	Bilateral staged total knee arthroplasty in obese patients	unclear if 90% of patients had knee OA
Esenkaya,I.; Unay,K.; Akan,K.	2012	Proximal tibial osteotomies for the medial compartment arthrosis of the knee: a historical journey	systematic review
Frassanito,L.; Vergari,A.; Messina,A.; Pitoni,S.; Puglisi,C.; Chierichini,A.	2009	Anaesthesia for total knee arthroplasty: Efficacy of single-injection or continuous lumbar plexus associated with sciatic nerve blocks - A randomized controlled study	control is local shot not general
Fu,Y.; Wang,G.; Fu,Q.	2011	Patellar resurfacing in total knee arthroplasty for osteoarthritis: a meta-analysis (Provisional abstract)	Systematic Review
Gibbs,D.M.; Green,T.P.; Esler,C.N.	2012	The local infiltration of analgesia following total knee replacement: a review of current literature	
Hirvonen,J., Blom,M., Tuominen,U., Seitsalo,S., Lehto,M., Paavolainen,P., Hietaniemi,K., Rissanen,P., Sintonen,H.	2007	Evaluating waiting time effect on health outcomes at admission: a prospective randomized study on patients with osteoarthritis of the knee joint	Not relevant. Only preoperative outcomes were considered
Jamsen,E.; Huhtala,H.; Puolakka,T.; Moilanen,T.	2009	Risk factors for infection after knee arthroplasty. A register-based analysis of 43,149 cases	less than 10 patients had staged bilateral surgery. Also, less than 90 percent of the knees had surgery for OA
Kable,A.; Gibberd,R.; Spigelman,A.	2008	Predictors of adverse events in surgical admissions in Australia	unclear if 90% of patients had knee OA
Keeney,J.A.; Eunice,S.; Pashos,G.; Wright,R.W.; Clohisy,J.C.	2011	What is the evidence for total knee arthroplasty in young patients?: a systematic review of the literature	systematic review
Krushell,R.J.; Fingeroth,R.J.	2007	Primary Total Knee Arthroplasty in Morbidly Obese Patients: a 5- to 14-year follow-up study	less than 90% of patients had knee OA

Authors	Year	Title	Reason for Exclusion
Liao,C.D.; Huang,Y.C.; Lin,L.F.; Huang,S.W.; Liou,T.H.	2014	Body Mass Index and Functional Mobility Outcome Following Early Rehabilitation after a Total Knee Replacement: A Retrospective Study in Taiwan	unclear if 90% of patients had knee OA
Luring,C.; Beckmann,J.; Haibock,P.; Perlick,L.; Grifka,J.; Tingart,M.	2008	Minimal invasive and computer assisted total knee replacement compared with the conventional technique: a prospective, randomised trial	unclear if 90% of patients had knee OA
McGrory,J.E.; Trousdale,R.T.; Pagnano,M.W.; Nigbur,M. Nwachukwu,B.U.;	2002	Preoperative hip to ankle radiographs in total knee arthroplasty	Not relevant patient population
Bozic,K.J.; Schairer,W.W.; Bernstein,J.L.; Jevsevar,D.S.; Marx,R.G.; Padgett,D.E.	2014	Current Status of Cost Utility Analyses in Total Joint Arthroplasty: A Systematic Review	cost analysis; systematic review
Oakes,D.A.; Hanssen,A.D.	2004	Bilateral total knee replacement using the same anesthetic is not justified by assessment of the risks	literature review
Oldmeadow,L.B.; McBurney,H.; Robertson,V.J.	2002	Hospital stay and discharge outcomes after knee arthroplasty: Implications for physiotherapy practice	Not relevant to PICO question.
Orozco,F.; Post,Z.D.; Baxi,O.; Miller,A.; Ong,A.	2014	Fibrosis in hepatitis C patients predicts complications after elective total joint arthroplasty	unclear if 90% of patients had knee OA
Patel,A.D.; Albrizio,M.	2008	Relationship of body mass index to early complications in knee replacement surgery	unclear if all patients have osteoarthritis
Perka,C.; Arnold,U.; Buttgereit,F.	2000	Influencing factors on perioperative morbidity in knee arthroplasty	not all patients had knee OA
Rand,J.A.; Trousdale,R.T.; Ilstrup,D.M.; Harmsen,W.S.	2003	Factors affecting the durability of primary total knee prostheses	less than 90% of patients had knee OA
Raut,S.; Mertes,S.C.; Muniz-Terrera,G.; Khanduja,V.	2012	Factors associated with prolonged length of stay following a total knee replacement in patients aged over 75	

Authors	Year	Title	Reason for Exclusion
	2005	Total knee replacement: an evidence-based analysis (Structured abstract)	abstract
Restrepo,C.; Parvizi,J.; Dietrich,T.; Einhorn,T.A.	2007	Safety of simultaneous bilateral total knee arthroplasty. A meta-analysis	meta analysis
Ritter,M.A.; Harty,L.D.; Davis,K.E.; Meding,J.B.; Berend,M.	2003	Simultaneous bilateral, staged bilateral, and unilateral total knee arthroplasty. A survival analysis	average length between surgeries was 1 to 5 years. also different indications were used for surgery, and it is unclear if relevant covariates were controlled for in the analysis
Rouanet,T.; Combes,A.; Migaud,H.; Pasquier,G.	2013	Do bone loss and reconstruction procedures differ at revision of cemented unicompartmental knee prostheses according to the use of metal-back or all-polyethylene tibial component?	no patient oriented outcomes, and would likely not be best available evidence
Schrama,J.C.; Espehaug,B.; Hallan,G.; Engesaeter,L.B.; Furnes,O.; Havelin,L.I.; Fevang,B.T.	2010	Risk of revision for infection in primary total hip and knee arthroplasty in patients with rheumatoid arthritis compared with osteoarthritis: a prospective, population-based study on 108,786 hip and knee joint arthroplasties from the Norwegian Arthroplasty Register	not relevant compares OA and RA patients
Scott,R.D.	2009	Stiffness associated with total knee arthroplasty	
Sridhar,M.S.; Jarrett,C.D.; Xerogeanes,J.W.; Labib,S.A.	2012	Obesity and symptomatic osteoarthritis of the knee	Commentary
Stubbs,G.; Pryke,S.E.; Tewari,S.; Rogers,J.; Crowe,B.; Bridgfoot,L.; Smith,N.	2005	Safety and cost benefits of bilateral total knee replacement in an acute hospital	very low quality
Vinciguerra,B.; Pascarel,X.; Honton,J.L.	1994	[Results of total knee prostheses with or without preservation of the posterior cruciate ligament]	foreign language
Wilairatana,V.; Tantavisut,S.; Tanavalee,A.;	2012	The comparison of wound drainage after TKA between postoperative cast immobilization and	does cast v. no cast qualify as immobilize v not immobilize day0v.1?

Authors	Year	Title	Reason for Exclusion
Ngarmukos,S.; Wangroongsub,Y.		non-immobilization: A randomized controlled trial	
Xie,F.; Lo,N.N.; Tarride,J.E.; O'Reilly,D.; Goeree,R.; Lee,H.P.	2010	Total or partial knee replacement? Cost-utility analysis in patients with knee osteoarthritis based on a 2-year observational study (Provisional abstract)	abstract
Cheng,S.C.; Hung,T.S.; Tse,P.Y.	2005	Investigation of the use of drained blood reinfusion after total knee arthroplasty: a prospective randomised controlled study	not relevant
Cheung,K.W.; Chiu,K.H.	2006	Effect of drain pressure in total knee arthroplasty	not relevant. compares two types of drainage methods
Dalen,T.; Bengtsson,A.; Brorsson,B.; Engstrom,K.G.	2003	Inflammatory mediators in autotransfusion drain blood after knee arthroplasty, with and without leucocyte reduction	outcome measures in vitro
Demirkale,I.; Tecimel,O.; Sesen,H.; Kilicarslan,K.; Altay,M.; Dogan,M.	2014	Nondrainage decreases blood transfusion need and infection rate in bilateral total knee arthroplasty	different sugical techiniques, other than drain use, were different between groups, meaning causal effect of drains cannot be drawn from results
Dutton,T.; De-Souza,R.; Parsons,N.; Costa,M.L.	2012	The timing of tourniquet release and 'retransfusion' drains in total knee arthroplasty: A stratified randomised pilot investigation	unclear if all patients have osteoarthritis
Keska,R.; Paradowski,T.P.; Witonski,D.	2014	Outcome in primary cemented total knee arthroplasty with or without drain: A prospective comparative study	less than 90% of patients had knee OA
Kim,Y.H.; Cho,S.H.; Kim,R.S.	1998	Drainage versus nondrainage in simultaneous bilateral total knee arthroplasties	less than 90% of patients had knee OA
Kirkos,J.M.; Krystallis,C.T.; Konstantinidis,P.A.; Papavasiliou,K.A.; Kyrkos,M.J.; Ikonomidis,L.G.	2006	Postoperative re-perfusion of drained blood in patients undergoing total knee arthroplasty: is it effective and cost-efficient?	not relevance comparison. drains were used in both groups, so does not answer pico question
Lakshmanan,P.; Purushothaman,B.; Sharma,A.	2010	Impact of reinfusion drains on hemoglobin level in total knee arthroplasty	not relevant. compares regular drains to reinfusion drains

Authors	Year	Title	Reason for Exclusion
Lin,J.; Fan,Y.; Chang,X.; Wang,W.; Weng,X.S.; Qiu,G.X.	2009	[Comparative study of one stage bilateral total knee arthroplasty with or without drainage]	foreign language
Madadi,F.; Mehrvarz,A.S.; Madadi,F.; Boreiri,M.; Abachizadeh,K.; Ershadi,A.	2010	Comparison of drain clamp after bilateral total knee arthroplasty	not relevant. compares drain clamping at 12 hours versus no drain clamping
Morgan-Jones,R.L.; Perko,M.M.J.; Cross,M.J.	2000	Uncemented total knee replacement - The favourable influence of low over high pressure drainage	not relevant to pico questions. compares high and low pressure drainsnot all patients had knee OA
Ovadia,D.; Luger,E.; Bickels,J.; Menachem,A.; Dekel,S.	1997	Efficacy of closed wound drainage after total joint arthroplasty: A prospective randomized study	exclude. less than 90% of all patients had OA
Pornrattanamaneewong,C.; Narkbunnam,R.; Siriwattanasakul,P.; Chareancholvanich,K.	2012	Three-hour interval drain clamping reduces postoperative bleeding in total knee arthroplasty: a prospective randomized controlled trial	not relevant. compares drain clamping to no drain clamping
Prasad,N.; Padmanabhan,V.; Mullaji,A.	2005	Comparison between two methods of drain clamping after total knee arthroplasty	Study pop TKA, does not specify OAK
Sundaram,R.O.; Parkinson,R.W.	2007	Closed suction drains do not increase the blood transfusion rates in patients undergoing total knee arthroplasty	very low quality
Wood,G.C.; Kapoor,A.; Javed,A.	2008	Autologous drains in arthroplasty a randomized control trial	comparison group is not relevant. compares timing of drain removal, which does not answer this pico question
Zhang,Q.D.; Guo,W.S.; Zhang,Q.; Liu,Z.H.; Cheng,L.M.; Li,Z.R.	2011	Comparison between closed suction drainage and nondrainage in total knee arthroplasty: a meta-analysis	meta-analysis (reviewed bib search)
Zhang,Q.D.; Guo,W.S.; Zhang,Q.; Liu,Z.H.; Cheng,L.M.; Li,Z.R.	2011	Comparison between closed suction drainage and nondrainage in total knee arthroplasty: a meta-analysis (Provisional abstract)	meta-analysis (reviewed bib search)
Drosos,G.I.; Blatsoukas,K.S.;	2012	Blood transfusion and cytokines' changes in total knee replacement	Pico 1: no patient oriented outcomes or any important

Authors	Year	Title	Reason for Exclusion
Ververidis,A.; Tripsianis,G.; Chloropoulou,P.; Iatrou,C.; Kazakos,K.; Verettas,D.A.			outcomes listed in pico question. PICO 18: Same protocol used in all patients to determine need for transfusion.
Minoda,Y.; Sakawa,A.; Fukuoka,S.; Tada,K.; Takaoka,K.	2004	Blood management for patients with hemoglobin level lower than 130 g/l in total knee arthroplasty	less than 90% OA patient population. Patient population does not meet inclusion criteria (OA and RA patients). Comparison groups not relevant to question of interest.
Charoencholvanich,K.; Siriwattanasakul,P.	2011	Efficacy of temporary clamping of drains combined with tranexamic acid in the control of bleeding following total knee arthroplasty: A prospective randomized controlled trial	not full text. abstract only
Aglietti,P.; Buzzi,R.; Segoni,F.; Zaccherotti,G.	1995	Insall-Burstein posterior-stabilized knee prosthesis in rheumatoid arthritis	RA
Allen,J.E.; Taylor,K.S.	2004	Physical examination of the knee	narrative
Arora,J.; Sharma,S.; Blyth,M.	2005	The role of pre-operative templating in primary total knee replacement	Not relevant, study of templating
Babazadeh,S.; Dowsey,M.M.; Bingham,R.J.; Ek,E.T.; Stoney,J.D.; Choong,P.F.M.	2013	The long leg radiograph is a reliable method of assessing alignment when compared to computer-assisted navigation and computer tomography	1 of study subjects had RA (others OA).
Boya,H.; Ozcan,O.; Oztekin,H.H.	2008	Radiological evaluation of the proximal tibiofibular joint in knees with severe primary osteoarthritis	Not relevant, no data after KA
Buck,F.M.; Guggenberger,R.; Koch,P.P.; Pfirrmann,C.W.A.	2012	Femoral and tibial torsion measurements with 3D models based on low-dose biplanar radiographs in comparison with standard CT measurements	Not relevant, comparing CT to Radiographs
Hilding,M.B.; Lanshammar,H.; Ryd,L.	1995	A relationship between dynamic and static assessments of knee joint load. Gait analysis and radiography before and after knee replacement in 45 patients	Not relevant, osteoarthritis patients not specified in the study

Authors	Year	Title	Reason for Exclusion
Jagannath,D.; Parsons,C.; Cushnaghan,J.; Cooper,C.; Edwards,M.H.; Dennison,E.	0	Does radiographic osteoarthritis predict a subsequent clinical diagnosis of knee osteoarthritis? findings from the hertfordshire cohort study	outcome is OA diagnosis
Meding,J.B.; Ritter,M.A.; Faris,P.M.; Keating,E.M.; Harris,W.	2001	Does the preoperative radiographic degree of osteoarthritis correlate to results in primary total knee arthroplasty?	retrospective review
Peck,C.N.; Childs,J.; McLauchlan,G.J.	2014	Inferior outcomes of total knee replacement in early radiological stages of osteoarthritis	Not relevant, does not answer pico question
White,D.; Zhang,Y.; Niu,J.; Felson,D.T.; Keysor,J.J.; Nevitt,M.; Lewis,C.	2009	Do worsening knee radiographs mean more chance of poor functional outcome? The MOST study	Abstract
Chesnut,W.J.	1991	Preoperative diagnostic protocol to predict candidates for unicompartmental arthroplasty	unrelated to imaging...
Cicuttini,F.; Hankin,J.; Jones,G.; Wluka,A.	2005	Comparison of conventional standing knee radiographs and magnetic resonance imaging in assessing progression of tibiofemoral joint osteoarthritis	Not relevant, study of joint space width over time
Ickinger,C.; Tikly,M.	2010	Current approach to diagnosis and management of osteoarthritis	Review (reviewed bibsearch)
Ickinger,C.; Tikly,M.	2011	Current approach to diagnosis and management of osteoarthritis	Review (reviewed bibsearch) - duplicate
Karahan,M.	2003	Diagnosis and management of unicompartmental knee osteoarthritis	narrative review
Rubello,D.; Rampin,L.; Banti,E.; Massaro,A.; Cittadin,S.; Cattelan,A.M.; Al-Nahhas,A.	2008	Diagnosis of infected total knee arthroplasty with anti-granulocyte scintigraphy: the importance of a dual-time acquisition protocol	Not relevant, postoperative scintigraphy study
Sheikh,A.; Schweitzer,M.	2009	Imaging in Pre- and Post-operative Assessment in Joint Preserving and Replacing Surgery	systematic review?
Simmons,T.D.; Stern,S.H.	1996	Diagnosis and management of the infected total knee arthroplasty	narrative review
Soucacos,P.N.; Johnson,E.O.; Soultanis,K.;	2004	Diagnosis and management of the osteonecrotic triad of the knee	Commentary

Authors	Year	Title	Reason for Exclusion
Vekris,M.D.; Theodorou,S.J.; Beris,A.E. Tanamas,S.K.; Wluka,A.E.; Jones,G.; Cicuttini,F.M.	2010	Imaging of knee osteoarthritis	systematic review?
Wong,C.S.; Yan,C.H.; Gong,N.J.; Li,T.; Chan,Q.; Chu,Y.C.	2013	Imaging biomarker with T1rho and T2 mappings in osteoarthritis - in vivo human articular cartilage study	Not relevant, Imaging biomaker mappinng study
Eckstein,F.; Cicuttini,F.; Raynauld,J.P.; Waterton,J.C.; Peterfy,C.	2006	Magnetic resonance imaging (MRI) of articular cartilage in knee osteoarthritis (OA): morphological assessment	systematic review?
Eckstein,F.; Kwoh,K.; Boudreau,R.; Wang,Z.; Hannon,M.; Cotofana,S.; Wirth,W.; Guermazi,A.; Nevitt,M.; John,M.; Hunter,D.	2012	Quantitative magnetic-resonance-imaging measures of cartilage predict knee replacement-a case-control study from the osteoarthritis initiative	Abstract
Graichen,H.; von Eisenhart-Rothe,R.; Vogl,T.; Englmeier,K.H.; Eckstein,F.	2004	Quantitative assessment of cartilage status in osteoarthritis by quantitative magnetic resonance imaging: technical validation for use in analysis of cartilage volume and further morphologic parameters	Doesn't assess surgery outcomes, only compares cartilage sizes of diff imaging techniques.
Hunter,D.J.; Zhang,W.; Conaghan,P.G.; Hirko,K.; Menashe,L.; Li,L.; Reichmann,W.M.; Losina,E.	2011	Systematic review of the concurrent and predictive validity of MRI biomarkers in OA	Systematic Review (reviewed bibsearch)
Hurst,J.M.; Berend,K.R.; Morris,M.J.; Lombardi,A.V.,Jr.	2013	Abnormal preoperative MRI does not correlate with failure of UKA	re abnormal MRIs, not MRI as a measurement tool
Jones,E.F.; Schooler,J.; Miller,D.C.; Drake,C.R.; Wahnishe,H.; Siddiqui,S.; Li,X.; Majumdar,S.	2012	Characterization of human osteoarthritic cartilage using optical and magnetic resonance imaging	in vitro

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Kornaat,P.R.; Doornbos,J.; Van Der Molen,A.J.; Kloppenburg,M.; Nelissen,R.G.; Hogendoorn,P.C.W.; Bloem,J.L.	2004	Magnetic resonance imaging of knee cartilage using a water selective balanced steady-state free precession sequence	uses cartilage samples as part of outcome measure
Ostlere,S.	2007	Imaging the knee	systematic review?
Park,A.; Nam,D.; Friedman,M.V.; Duncan,S.T.; Hillen,T.J.; Barrack,R.L.	2014	Inter-Observer Precision and Physiologic Variability of MRI Landmarks Used to Determine Rotational Alignment in Conventional and Patient-Specific TKA	Not relevant, does not answer pico question
Pelletier,J.-P.; Peterfy,C.; Brandi,M.L.; Bruyere,O.; Chapurlat,R.; Cicuttini,F.; Conaghan,P.; Doherty,M.; Genant,H.K.; Guermazi,A.; Hochberg,M.; Hunter,D.; Kanis,J.A.; Kloppenburg,M.; Laredo,J.-D.; Martel-Pelletier,J.; McAlindon,T.; Nevitt,M.; Raynauld,J.-P.; Rizzoli,R.; Zilkens,C.; Reginster,J.-Y.; Cooper,C.	2013	What is the predictive value of MRI for the occurrence of hard clinical endpoints in knee osteoarthritis?	systematic review?
Pelletier,J.P.; Cooper,C.; Peterfy,C.; Reginster,J.Y.; Brandi,M.L.; Bruyere,O.; Chapurlat,R.; Cicuttini,F.; Conaghan,P.G.; Doherty,M.; Genant,H.; Giacovelli,G.; Hochberg,M.C.; Hunter,D.J.; Kanis,J.A.; Kloppenburg,M.; Laredo,J.D.; McAlindon,T.; Nevitt,M.;	2013	What is the predictive value of MRI for the occurrence of knee replacement surgery in knee osteoarthritis?	narrative review

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Raynauld,J.P.; Rizzoli,R.; Zilkens,C.; Roemer,F.W.; Martel-Pelletier,J.; Guermazi,A.			
Rautiainen,J.; Nissi,M.J.; Salo,E.N.; Tiitu,V.; Finnila,M.A.; Aho,O.M.; Saarakkala,S.; Lehenkari,P.; Ellermann,J.; Nieminen,M.T.	2014	Multiparametric MRI assessment of human articular cartilage degeneration: Correlation with quantitative histology and mechanical properties	Not relevant, does not answer pico question
Sharpe,I.; Tyrrell,P.N.; White,S.H.	2001	Magnetic resonance imaging assessment for unicompartmental knee replacement: a limited role	Not relevant, study of MRI and ACL
Spencer,B.A.; Mont,M.A.; McGrath,M.S.; Boyd,B.; Mitrick,M.F.	2009	Initial experience with custom-fit total knee replacement: intra-operative events and long-leg coronal alignment	Not relevant to PICO 11
Takai,S.; Yoshino,N.; Isshiki,T.; Hirasawa,Y.	2003	Kneeling view: A new roentgenographic technique to assess rotational deformity and alignment of the distal femur	Not relevant,does not answer the PICO question
Tummala,S.; Karsdal,M.A.; Bay-Jensen,A.C.; Dam,E.B.	2009	Tibial and femoral cartilage smoothness: Diagnostic markers of early osteoarthritis?	Abstract
Vincken,P.W.J.; Ter Braak,B.P.M.; Van Erkel,A.R.; Coerkamp,E.G.; De Rooy,T.P.W.; Mallens,W.M.C.; Bloem,J.L.	2006	Magnetic resonance imaging of the knee: A review	systematic review?
Wang,Y.; Wluka,A.E.; Jones,G.; Ding,C.; Cicuttini,F.M.	2012	Use magnetic resonance imaging to assess articular cartilage	narrative review
Desmeules,F.; Dionne,C.E.; Belzile,E.; Bourbonnais,R.; Fremont,P.	2010	The burden of wait for knee replacement surgery: effects on pain, function and health-related quality of life at the time of surgery	Not relevant, no data after KA

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Hoogeboom,T.J.; van den Ende,C.H.; van der Sluis,G.; Elings,J.; Dronkers,J.J.; Aiken,A.B.; van Meeteren,N.L.	2009	The impact of waiting for total joint replacement on pain and functional status: a systematic review	systematic review (reviewed bibsearch)
Kirwan,J.R.; Currey,H.L.; Freeman,M.A.; Snow,S.; Young,P.J.	1994	Overall long-term impact of total hip and knee joint replacement surgery on patients with osteoarthritis and rheumatoid arthritis	Includes RA subjects
Kopta,J.A.	1973	Surgery in the arthritic knee	narrative review
Riddle,D.L.; Jiranek,W.A.	2015	Knee osteoarthritis radiographic progression and associations with pain and function prior to knee arthroplasty: A multicenter comparative cohort study	Not relevant, does not answer pico question
Williams,J.I.; Llewellyn,Thomas H.; Arshinoff,R.; Young,N.; Naylor,C.D.	1997	The burden of waiting for hip and knee replacements in Ontario. Ontario Hip and Knee Replacement Project Team	Knee and Hip data not separated
Hirvonen,J.; Blom,M.; Tuominen,U.; Seitsalo,S.; Lehto,M.; Paavolainen,P.; Hietaniemi,K.; Rissanen,P.; Sintonen,H.	2007	Is longer waiting time associated with health and social services utilization before treatment? A randomized study	Knee and Hip data not separated
Amin,A.K.; Sales,J.D.; Brenkel,I.J.	2006	Obesity and total knee and hip replacement	review
Amusat,N.; Beaupre,L.; Jhangri,G.S.; Pohar,S.L.; Simpson,S.; Warren,S.; Jones,C.A.	2014	Diabetes that impacts on routine activities predicts slower recovery after total knee arthroplasty: an observational study	Patient population not specific to OA.
Anand,E.; Scott,L.; Harrison,W.	2012	Hip and Knee Replacement in the HIV positive patient	review
Astephen-Wilson,J.L.; Wilson,D.A.; Dunbar,M.J.; Deluzio,K.J.	2010	Preoperative gait patterns and BMI are associated with tibial component migration	unclear if all patients have osteoarthritis
Baumann,C.; Rat,A.C.; Osnowycz,G.; Mainard,D.;	2006	Do clinical presentation and pre-operative quality of life predict satisfaction with care after total hip or knee replacement?	less than 90% of patients had knee OA

Authors	Year	Title	Reason for Exclusion
Delagoutte,J.P.; Cuny,C.; Guillemin,F.			
Berend,K.R.; Lombardi,A.V.,Jr.; Adams,J.B.	2007	Obesity, young age, patellofemoral disease, and anterior knee pain: identifying the unicondylar arthroplasty patient in the United States	the bmi cutoff of 32 did not meet the WHO criteria for obesity.
Blackburn,J.; Qureshi,A.; Amirfeyz,R.; Bannister,G.	2012	Does preoperative anxiety and depression predict satisfaction after total knee replacement?	unclear if all patients have osteoarthritis
Bliddal,H.; Christensen,R.	2006	The management of osteoarthritis in the obese patient: practical considerations and guidelines for therapy	review
Bostman,O.M.	1994	Prevalence of obesity among patients admitted for elective orthopaedic surgery	does not answer if any relevant prognostic factors effect outcome for knee arthroplasty
Brummett,C.M.; Hallstrom,B.; Urquhart,A.; Morris,M.; Clauw,D.J.; Williams,D.A.	2011	Psychological predictors of failure to improve after lower extremity joint arthroplasty	Abstrat presentation
Bryan,D.; Parvizi,J.; Austin,M.; Backe,H.; Valle,C.D.; Kolessar,D.J.; Kreuzer,S.; Malinzak,R.; Masri,B.; McGrory,B.J.; Mochel,D.; Yates,A.	2013	Obesity and total joint arthroplasty. A literature based review	review
Callahan,C.M.; Drake,B.G.; Heck,D.A.; Dittus,R.S.	1994	Patient outcomes following tricompartmental total knee replacement. A meta-analysis	systematic review
Cameron,H.U.; Cameron,G.	1987	Stress-relief osteoporosis of the anterior femoral condyles in total knee replacement. A study of 185 patients	does not look at risk factors relevant to pico question
Chang,C.B.; Kim,T.K.; Kang,Y.G.; Seong,S.C.; Kang,S.B.	2014	Prevalence of osteoporosis in female patients with advanced knee osteoarthritis undergoing total knee arthroplasty	No outcomes of interest. Does not answer question.
Chen,J.; Cui,Y.; Li,X.; Miao,X.; Wen,Z.; Xue,Y.; Tian,J.	2013	Risk factors for deep infection after total knee arthroplasty: a meta-analysis	meta-analysis

Authors	Year	Title	Reason for Exclusion
Citak,M.; Dersch,K.; Kamath,A.F.; Haasper,C.; Gehrke,T.; Kendoff,D.	2014	Common causes of failed unicompartmental knee arthroplasty: a single-centre analysis of four hundred and seventy one cases	UKA. Not TKA
Cohen,I.; Heim,M.; Martinowitz,U.; Chechick,A.	2000	Orthopaedic outcome of total knee replacement in haemophilia A	doesn't have comparison to answer pico question
Collins,R.A.; Walmsley,P.J.; Amin,A.K.; Brenkel,I.J.; Clayton,R.A.	2012	Does obesity influence clinical outcome at nine years following total knee replacement?	unclear if all patients have osteoarthritis
Conaghan,P.G.; D'Agostino,M.A.; Le,Bars M.; Baron,G.; Schmidely,N.; Wakefield,R.; Ravaud,P.; Grassi,W.; Martin-Mola,E.; So,A.; Backhaus,M.; Malaise,M.; Emery,P.; Dougados,M.	2010	Clinical and ultrasonographic predictors of joint replacement for knee osteoarthritis: results from a large, 3-year, prospective EULAR study	not relevant. assess prognostic factors that predict the need for knee replacement
Culliford,D.	2013	Exploring multiple imputation with time-dependent covariates in survival analysis: Body mass index and total knee replacement	Not full text.
Dahl,A.; Robertsson,O.; Lidgren,L.; Miller,L.; Davidson,D.; Graves,S.	2010	Unicompartmental knee arthroplasty in patients aged less than 65	no relevant risk factors
Dahm,D.L.; Kalisvaart,M.M.; Stuart,M.J.; Slettedahl,S.W.	2014	Patellofemoral arthroplasty: outcomes and factors associated with early progression of tibiofemoral arthritis	not best avialable evidence for BMI. for smoking, there were less than 10 current smokers.
Dakin,H.; Gray,A.; Fitzpatrick,R.; Maclennan,G.; Murray,D.	2012	Rationing of total knee replacement: a cost-effectiveness analysis on a large trial data set	cost-effectiveness
Das,S.K.; Farooqi,A.	2008	Osteoarthritis	Commentary
Dauty,M.; Schmitt,X.; Menu,P.; Rousseau,B.; Dubois,C.	2012	Using the Risk Assessment and Predictor Tool (RAPT) for patients after total knee replacement surgery	no relevant risk factors

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De Leeuw,J.M.; Villar,R.N.	1998	Obesity and quality of life after primary total knee replacement	unvalidated quality of life outcome. British Orthopaedic Association Scores were subjectively translated into Rosser Index Scores.
de,Guia N.; Zhu,N.; Keresteci,M.; Shi,J.E.	2006	Obesity and joint replacement surgery in Canada: findings from the Canadian Joint Replacement Registry (CJRR)	unclear if all patients have osteoarthritis
Deleuran,T.; Vilstrup,H.V.; Overgaard,S.; Jepsen,P.	2013	Cirrhosis patients' risk of complications after total hip or knee replacement for primary osteoarthritis-a Danish population-based cohort study	not full text. abstract only
Deleuran,T.; Vilstrup,H.; Overgaard,S.; Jepsen,P.	2014	Cirrhosis patients have increased risk of complications after hip or knee arthroplasty	Hip and knee
Deshmukh,R.G.; Hayes,J.H.; Pinder,I.M.	2002	Does body weight influence outcome after total knee arthroplasty? A 1-year analysis	insufficient data reporting. data was presented in a manner where we cannot determine the individual effect of BMI from the statistical model
Driban,J.B.; Hootman,J.M.; Sitler,M.R.; Harris,K.; Cattano,N.M.	2015	Is Participation in Certain Sports Associated With Knee Osteoarthritis? A Systematic Review	systematic review. not tka
Fisher,D.A.; Bernasek,T.L.; Puri,R.D.; Burgess,M.L.	2011	Rotating platform spinouts with cruciate-retaining mobile-bearing knees	unclear how many patients had knee oa
Font-Vizcarra,L.; Lozano,L.; Rios,J.; Forga,M.T.; Soriano,A.	2011	Preoperative nutritional status and post-operative infection in total knee replacements: a prospective study of 213 patients	no relevant risk factors
Foran,J.R.; Mont,M.A.; Etienne,G.; Jones,L.C.; Hungerford,D.S.	2004	The outcome of total knee arthroplasty in obese patients	unclear if all patients have osteoarthritis
Gadinsky,N.E.; Ehrhardt,J.K.; Urband,C.; Westrich,G.H.	2011	Effect of body mass index on range of motion and manipulation after total knee arthroplasty	unclear if all patients have osteoarthritis

Authors	Year	Title	Reason for Exclusion
Gadinsky,N.E.; Manuel,J.B.; Lyman,S.; Westrich,G.H.	2012	Increased operating room time in patients with obesity during primary total knee arthroplasty: conflicts for scheduling	unclear if all patients have osteoarthritis
Gao,F.Q.; Li,Z.J.; Zhang,K.; Huang,D.; Liu,Z.J.	2011	Risk factors for lower limb swelling after primary total knee arthroplasty	inadequate presentation of results. the study present regression analyses for swelling below and above the knee. the text says bmi was a significant predictor below the knee, but the table says it was significant above the knee. unsure which side is actually significant
Gillespie,G.N.; Porteous,A.J.	2007	Obesity and knee arthroplasty	review
Gilson,M.; Gossec,L.; Mariette,X.; Gherissi,D.; Guyot,M.H.; Berthelot,J.M.; Wendling,D.; Michelet,C.; Dellamonica,P.; Tubach,F.; Dougados,M.; Salmon,D.	2010	Risk factors for total joint arthroplasty infection in patients receiving tumor necrosis factor alpha-blockers: a case-control study	most patients had rheumatoid arthritis
Goudie,S.T.; Deakin,A.H.; Ahmad,A.; Maheshwari,R.; Picard,F.	2011	Flexion contracture following primary total knee arthroplasty: risk factors and outcomes	retrospective case series
Guenther,D.; Schmidl,S.; Klatte,T.O.; Widhalm,H.K.; Omar,M.; Krettek,C.; Gehrke,T.; Kendoff,D.; Haasper,C.	2015	Overweight and obesity in hip and knee arthroplasty: Evaluation of 6078 cases	No relevant outcomes
Habermann,B.; Eberhardt,C.; Kurth,A.A.	2008	Total joint replacement in HIV positive patients	retrospective case series
Hahn,M.H.; Won,Y.Y.	2013	Bone mineral density changes after total knee replacement in women over the age of 65	No relevant outcomes. Doesn't answer question.
Hamoui,N.; Kantor,S.; Vince,K.; Crookes,P.F.	2006	Long-term outcome of total knee replacement: does obesity matter?	less than 90% of patients had knee OA

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Harrison,M.M.; Childs,A.; Carson,P.E.	2003	Incidence of undiagnosed sleep apnea in patients scheduled for elective total joint arthroplasty	not relevant. the outcome was requiring knee arthroplasty
Harrysson,O.L.; Robertsson,O.; Nayfeh,J.F.	2004	Higher cumulative revision rate of knee arthroplasties in younger patients with osteoarthritis	no risk factors applicable to PICO question
Howard,K.J.; Ellis,H.B.; Khaleel,M.A.	2010	Psychological factors that may influence outcome after joint replacement surgery	review
Husted,H.; Holm,G.; Jacobsen,S.	2008	Predictors of length of stay and patient satisfaction after hip and knee replacement surgery: fast-track experience in 712 patients	combines hip and knee patients
Issa,K.; Rifai,A.; Boylan,M.R.; Pourtaheri,S.; McInerney,V.K.; Mont,M.A.	2014	Do Various Factors Affect the Frequency of Manipulation Under Anesthesia After Primary Total Knee Arthroplasty?	Any TKA patient regardless of diagnosis. Not specific to OA.
Jarvholm,B.; Lewold,S.; Malchau,H.; Vingard,E.	2005	Age, bodyweight, smoking habits and the risk of severe osteoarthritis in the hip and knee in men	not relevant. assess the risk of osteoarthritis among patients who did not have OA at baseline
Jenkins,P.J.; Clement,N.D.; Hamilton,D.F.; Gaston,P.; Patton,J.T.; Howie,C.R.	2013	Predicting the cost-effectiveness of total hip and knee replacement: a health economic analysis	unclear if all patients have osteoarthritis
Jones,C.A.; Beaupre,L.A.; Jhangri,G.S.; Suarez-Almazor,M.E.	2011	Identifying comorbid conditions that affect the 6 month recovery pattern of total knee arthroplasty	Abstract
Jones,D.L.; Bhanegaonkar,A.J.; Billings,A.A.; Kriska,A.M.; Irrgang,J.J.; Crossett,L.S.; Kwoh,C.K.	2012	Differences between actual and expected leisure activities after total knee arthroplasty for osteoarthritis	no risk factors relevan to pico question
Jonsson,H.; Helgadottir,G.P.; Aspelund,T.; Eiriksdottir,G.; Sigurdsson,S.;	2009	Hand osteoarthritis severity and severe hip OA combine with bmi as major risk factors for total knee joint replacement. the AGES-Reykjavik Study	not relevant. outcome is having TKA

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Ingvarsson,T.; Harris,T.B.; Launer,L.; Gudnason,V. Kerkhoffs,G.M.; Servien,E.; Dunn,W.; Dahm,D.; Bramer,J.A.; Haverkamp,D.	2012	The influence of obesity on the complication rate and outcome of total knee arthroplasty: a meta-analysis and systematic literature review (Provisional abstract)	meta-analysis (reviewed bib search)
Kerkhoffs,G.M.; Servien,E.; Dunn,W.; Dahm,D.; Bramer,J.A.; Haverkamp,D.	2012	The influence of obesity on the complication rate and outcome of total knee arthroplasty: a meta-analysis and systematic literature review	meta-analysis (reviewed bib search)
Kim,G.K.; Mortazavi,S.M.; Purtill,J.J.; Sharkey,P.F.; Hozack,W.J.; Parvizi,J.	2010	Stiffness after revision total knee arthroplasty	unclear if all patients have osteoarthritis
Kramers-de Quervain,I.A.; Kampfen,S.; Munzinger,U.; Mannion,A.F.	2012	Prospective study of gait function before and 2 years after total knee arthroplasty	less than 90% of patients had knee OA
Lalmohamed,A.; Vestergaard,P.; De,Boer A.; Leufkens,H.G.; van Staa,T.P.; de,Vries F.	2014	Changes in mortality patterns following total hip or knee arthroplasty over the past two decades: a nationwide cohort study	No relevant risk factors
Lavernia,C.J.; Laoruengthana,A.; Contreras,J.S.; Rossi,M.D.	2009	All-Patient Refined Diagnosis-Related Groups in Primary Arthroplasty	unclear how many patients had knee oa
Lee,D.H.; Padhy,D.; Lee,S.H.; Nha,K.W.; Park,J.H.; Han,S.B.	2012	Osteoporosis affects component positioning in computer navigation-assisted total knee arthroplasty	no relevant risk factors are used to predict patient oriented outcomes
Leung,Y.Y.; Ang,L.W.; Thumboo,J.; Wang,R.; Yuan,J.M.; Koh,W.P.	2014	Cigarette smoking and risk of total knee replacement for severe osteoarthritis among Chinese in Singapore--the Singapore Chinese health study	No outcomes of interest.
Liabaud,B.; Patrick,D.A.,Jr.; Geller,J.A.	2013	Higher body mass index leads to longer operative time in total knee arthroplasty	unclear if all patients have osteoarthritis
Liljensoe,A.; Lauersen,J.O.; Soballe,K.; Mechlenburg,I.	2013	Overweight preoperatively impairs clinical outcome after knee arthroplasty: a cohort study of 197 patients 3-5 years after surgery	less than 90% of patients had knee OA

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Lingard,E.A.; Katz,J.N.; Wright,E.A.; Sledge,C.B.	2004	Predicting the outcome of total knee arthroplasty	results for relevant predictors are not reported.
Liu,B.; Balkwill,A.; Banks,E.; Cooper,C.; Green,J.; Beral,V.	2007	Relationship of height, weight and body mass index to the risk of hip and knee replacements in middle-aged women	not relevant. outcome is having TKA
Lopez-Olivo,M.; Kallen,M.; Pak,C.; Siff,S.J.; Landon,G.C.; Edelstein,D.; Robinson,K.C.	2009	Psychosocial and educational barriers to surgical success after knee arthroplasty	Abstract
Losina,E.; Collins,J.; Lerner,V.; Reichmann,W.M.; Wright,J.; Ghazinouri,R.; Donnell-Fink,L.; Katz,J.N.	2012	Trajectories of functional recovery post TKR: Does BMI matter?	not full text. abstract only
Lovecchio,F.; Beal,M.; Kwasny,M.; Manning,D.	2014	Do Patients With Insulin-dependent and Noninsulin-dependent Diabetes Have Different Risks for Complications After Arthroplasty?	Hip and knee
Lozano,L.M.; Nunez,M.; Segur,J.M.; Macule,F.; Sastre,S.; Nunez,E.; Suso,S.	2008	Relationship between knee anthropometry and surgical time in total knee arthroplasty in severely and morbidly obese patients: a new prognostic index of surgical difficulty	no patient oriented outcomes
Lozano,L.M.; Lopez,V.; Rios,J.; Popescu,D.; Torner,P.; Castillo,F.; Macule,F.	2012	Better outcomes in severe and morbid obese patients (BMI > 35 kg/m2) in primary Endo-Model rotating-hinge total knee arthroplasty	less than 90% of patients had knee OA
Macaulay,W.; Geller,J.A.; Brown,A.R.; Cote,L.J.; Kiernan,H.A.	2010	Total knee arthroplasty and Parkinson disease: enhancing outcomes and avoiding complications	narrative review
Mackie,A.; Muthumayandi,K.; Shirley,M.; Deehan,D.; Gerrand,C.	2014	Association Between Body Mass Index Change and Outcome in the First Year After Total Knee Arthroplasty	Patient population includes all TKA patients in 5 year period regardless of diagnosis. Study unclear if these are only OA patients.

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Malinzak,R.A.; Ritter,M.A.; Berend,M.E.; Meding,J.B.; Olberding,E.M.; Davis,K.E.	2009	Morbidly Obese, Diabetic, Younger, and Unilateral Joint Arthroplasty Patients Have Elevated Total Joint Arthroplasty Infection Rates	the percentage of patiens with knee osteoarthritis among TKA patients was unclear
Masselin-Dubois,A.; Attal,N.; Fletcher,D.; Jayr,C.; Albi,A.; Fermanian,J.; Bouhassira,D.; Baudic,S.	2013	Are psychological predictors of chronic postsurgical pain dependent on the surgical model? A comparison of total knee arthroplasty and breast surgery for cancer	not relevent. the study is cocerned with depressive symptoms (measured by beck depression scale) only on the day before surgery, and therefore excludes patients diagnosed with major depression.
Massin,P.; Lautridou,C.; Cappelli,M.; Petit,A.; Odri,G.; Ducellier,F.; Sabatier,C.; Hulet,C.; Canciani,J.P.; Letenneur,J.; Burdin,P.	2009	Total knee arthroplasty with limitations of flexion	no relevant risk factors
Matharu,G.; Robb,C.; Baloch,K.; Pynsent,P.	2012	The Oxford medial unicompartmental knee replacement: survival and the affect of age and gender	no relevant risk factors
McGovern,T.F.; Ammeen,D.J.; Collier,J.P.; Currier,B.H.; Engh,G.A.	2002	Rapid polyethylene failure of unicondylar tibial components sterilized with gamma arradiation in air and implanted after a long shelf life	no relevant risk factors are used
Mnatzaganian,G.; Ryan,P.; Reid,C.M.; Davidson,D.C.; Hiller,J.E.	2013	Smoking and primary total hip or knee replacement due to osteoarthritis in 54,288 elderly men and women	not relevant. outcome is requiring tka
Mont,M.A.; Mathur,S.K.; Krackow,K.A.; Loewy,J.W.; Hungerford,D.S.	1996	Cementless total knee arthroplasty in obese patients: A comparison with a matched control group	less than 90% of patients had knee OA
Mulhall,K.J.; Ghomrawi,H.M.; Mihalko,W.; Cui,Q.; Saleh,K.J.	2007	Adverse effects of increased body mass index and weight on survivorship of total knee arthroplasty and subsequent outcomes of revision TKA	unclear if all patients have OA

Authors	Year	Title	Reason for Exclusion
Mullaji,A.B.; Shetty,G.M.; Kanna,R.	2011	Postoperative limb alignment and its determinants after minimally invasive Oxford medial unicompartmental knee arthroplasty	no patient oriented outcomes
Murray,D.W.; Pandit,H.; Weston-Simons,J.S.; Jenkins,C.; Gill,H.S.; Lombardi,A.V.; Dodd,C.A.F.; Berend,K.R.	2013	Does body mass index affect the outcome of unicompartmental knee replacement?	Patient pop. does not meet inclusion criteria: osteoarthritis and osteonecrosis
Nicholls,A.S.; Kiran,A.; Javaid,M.K.; Hart,D.J.; Spector,T.D.; Carr,A.J.; Arden,N.K.	2012	Change in body mass index during middle age affects risk of total knee arthoplasty due to osteoarthritis: a 19-year prospective study of 1003 women	not relevant. looks at risk for needing TKA
Norman-Taylor,F.H.; Palmer,C.R.; Villar,R.N.	1996	Quality-of-life improvement compared after hip and knee replacement	not relevant compares tka and tha
Novicoff,W.M.; Rion,D.; Mihalko,W.M.; Saleh,K.J.	2009	Does concomitant low back pain affect revision total knee arthroplasty outcomes?	unclear if all patients have osteoarthritis
Nunez,M.; Lozano,L.; Nunez,E.; Segur,J.M.; Sastre,S.	2011	Factors influencing health-related quality of life after TKA in patients who are obese	No relevant risk factors
Oren,T.W.; Botolin,S.; Williams,A.; Bucknell,A.; King,K.B.	2011	Arthroplasty in veterans: analysis of cartilage, bone, serum, and synovial fluid reveals differences and similarities in osteoarthritis with and without comorbid diabetes	no patient oriented outcomes
Park,I.H.; Lee,S.C.; Park,I.S.; Nam,C.H.; Ahn,H.S.; Park,H.Y.; Gondalia,V.H.; Jung,K.A.	2014	Asymptomatic peripheral vascular disease in total knee arthroplasty: preoperative prevalence and risk factors	Not relevant to PICO. Does not answer question.
Patterson,B.M.; Insall,J.N.	1992	Surgical management of gonarthrosis in patients with poliomyelitis	Less than 10 patients per group
Perruccio,A.V.; Badley,E.M.; Hogg-Johnson,S.; Davis,A.	2009	The significance of self-rated health and mental well-being in predicting outcomes following TJR surgery for OA	combines hip and knee patients
Peters,T.J.; Sanders,C.; Dieppe,P.; Donovan,J.	2005	Factors associated with change in pain and disability over time: a community-based prospective observational study of hip and knee osteoarthritis	unclear if 90% of patients had knee OA

Authors	Year	Title	Reason for Exclusion
Phillips,J.R.A.; Hopwood,B.; Arthur,C.; Stroud,R.; Toms,A.D.	2014	The natural history of pain and neuropathic pain after knee replacement: A prospective cohort study of the point prevalence of pain and neuropathic pain to a minimum three-Year follow-up	less than 10 patients had depression
Pivec,R.; Johnson,A.J.; Naziri,Q.; Issa,K.; Mont,M.A.; Bonutti,P.M.	2013	Lumbar spinal stenosis impairs function following total knee arthroplasty	unclear if all patients have osteoarthritis
Riddle,D.L.; Wade,J.B.; Jiranek,W.A.; Kong,X.	2009	Preoperative pain catastrophizing predicts pain outcome following knee arthroplasty	not full text. abstract only
Riddle,D.L.; Dumenci,L.	2013	Self-rated health and symptomatic knee osteoarthritis over three years: data from a multicenter observational cohort study	most patient did not undergo arthroplasty
Robertson,F.; Geddes,J.; Ridley,D.; McLeod,G.; Cheng,K.	2012	Patients with Type 2 diabetes mellitus have a worse functional outcome post knee arthroplasty: a matched cohort study	no patient oriented outcomes
Rodriguez-Merchan,E.C.	2012	Aspects of current management: orthopaedic surgery in haemophilia	systematic review
Rose,P.S.; Johnson,C.A.; Hungerford,D.S.; McFarland,E.G.	2004	Total knee arthroplasty in Ehlers-Danlos syndrome	no relevant risk factors
Rossi,R.; Bruzzone,M.; Bonasia,D.E.; Ferro,A.; Castoldi,F.	2010	No early tibial tray loosening after surface cementing technique in mobile-bearing TKA	less than 90% of patients had knee OA
Salih,S.; Sutton,P.	2013	Obesity, knee osteoarthritis and knee arthroplasty: a review	review (reviewed bib search)
Serna,F.; Mont,M.A.; Krackow,K.A.; Hungerford,D.S.	1994	Total knee arthroplasty in diabetic patients. Comparison to a matched control group	less than 90% of patients had knee OA
Seyler,T.M.; Mont,M.A.; Lai,L.P.; Xie,J.; Marker,D.R.; Zywiel,M.G.; Bonutti,P.M.	2009	Mid-term results and factors affecting outcome of a metal-backed unicompartmental knee design: a case series	less than 90% of patients had knee OA
Silber,J.H.; Rosenbaum,P.R.; Kelz,R.R.; Reinke,C.E.;	2012	Medical and financial risks associated with surgery in the elderly obese	unclear if all patients have osteoarthritis

Authors	Year	Title	Reason for Exclusion
Neuman,M.D.; Ross,R.N.; Even-Shoshan,O.; David,G.; Saynisch,P.A.; Kyle,F.A.; Bratzler,D.W.; Fleisher,L.A.			
Singh,J.A.; Gabriel,S.E.; Lewallen,D.G.	2011	Higher body mass index is not associated with worse pain outcomes after primary or revision total knee arthroplasty	
Singh,J.A.; Kundukulam,J.; Riddle,D.L.; Strand,V.; Tugwell,P.	2011	Early postoperative mortality following joint arthroplasty: a systematic review	systematic review
Singh,J.A.; Kwoh,C.K.; Richardson,D.; Chen,W.; Ibrahim,S.A.	2013	Sex and surgical outcomes and mortality after primary total knee arthroplasty: a risk-adjusted analysis	unclear if all patients have osteoarthritis
Smith,B.E.; Askew,M.J.; Gradisar,Jr; Gradisar,J.S.; Lew,M.M.	1992	The effect of patient weight on the functional outcome of total knee arthroplasty	unclear if all patients have osteoarthritis
Sosdian,L.; Dobson,F.; Wrigley,T.V.; Paterson,K.; Bennell,K.; Dowsey,M.; Choong,P.; Allison,K.; Hinman,R.S.	2014	Longitudinal changes in knee kinematics and moments following knee arthroplasty: A systematic review	systematic review
Spicer,D.D.; Pomeroy,D.L.; Badenhausen,W.E.; Schaper,L.A.,Jr.; Curry,J.I.; Suthers,K.E.; Smith,M.W.	2001	Body mass index as a predictor of outcome in total knee replacement	unclear how many patients had knee oa versus post traumatic arthritis
Stevens-Lapsley,J.E.; Petterson,S.C.; Mizner,R.L.; Snyder-Mackler,L.	2010	Impact of body mass index on functional performance after total knee arthroplasty	
Suzuki,G.; Saito,S.; Ishii,T.; Motojima,S.; Tokuhashi,Y.; Ryu,J.	2011	Previous fracture surgery is a major risk factor of infection after total knee arthroplasty	unclear if all patients have osteoarthritis
Tarasevicius,S.; Stucinskas,J.;	2009	Introduction of total knee arthroplasty in Lithuania: Results from the first 10 years	none of the risk factors studied are relevant to pico question

Authors	Year	Title	Reason for Exclusion
Robertsson,O.; Wingstrand,H. Thompson,L.R.; Boudreau,R.; Newman,A.B.; Hannon,M.J.; Chu,C.R.; Nevitt,M.C.; Kent,Kwoh C.	2010	The association of osteoarthritis risk factors with localized, regional and diffuse knee pain	patients did not recive arthroplasty
Thornqvist,C.; Gislason,G.H.; Kober,L.; Jensen,P.F.; Torp-Pedersen,C.; Andersson,C.	2014	Body mass index and risk of perioperative cardiovascular adverse events and mortality in 34,744 Danish patients undergoing hip or knee replacement	Only 45% knee patients. The rest are hip patients. Results not reported separately.
Tinning,C.G.; Cochrane,L.A.; Singer,B.R.	2013	Primary total knee arthroplasty in patients with Parkinson's disease: analysis of outcomes	the N's aren't adequately presented for the control group, so we cant tell if the Minimum N criteria is met for each follow up
Utrillas-Compaired,A.; De la Torre-Escuredo BJ; Tebar-Martinez,A.J.; Asunsolo-Del,Barco A.	2014	Does preoperative psychologic distress influence pain, function, and quality of life after TKA?	
Vaidya,S.V.; Arora,A.; Mathesul,A.A.	2013	Effect of total knee arthroplasty on type II diabetes mellitus and hypertension: A prospective study	does not compare diabetic patients to non diabetic patients
Viens,N.A.; Hug,K.T.; Marchant,M.H.; Cook,C.; Vail,T.P.; Bolognesi,M.P.	2012	Role of diabetes type in perioperative outcomes after hip and knee arthroplasty in the United States	unclear if all patients have osteoarthritis
Vince,K.G.; Insall,J.N.; Bannerman,C.E.	1989	Total knee arthroplasty in the patient with Parkinson's disease	retrospective case series
Wagner,P.; Olsson,H.; Lidgren,L.; Robertsson,O.; Ranstam,J.	2011	Increased cancer risks among arthroplasty patients: 30 year follow-up of the Swedish Knee Arthroplasty Register	does not look at risk factors relevant to pico question
Wallace,G.; Judge,A.; Prieto-Alhambra,D.; de,Vries F.; Arden,N.K.; Cooper,C.	2014	The effect of body mass index on the risk of post-operative complications during the 6 months following total hip replacement ortotal knee replacement surgery	Patient population does not meet inclusion criteria. Not specific to OA.

Authors	Year	Title	Reason for Exclusion
Wang,S.; Zhao,Y.	2013	Diabetes Mellitus and the Incidence of Deep Vein Thrombosis after Total Knee Arthroplasty: A Retrospective Study	unclear if 90% of patients had knee OA
Whiteside,L.A.; Vigano,R.	2007	Young and heavy patients with a cementless TKA do as well as older and lightweight patients	comparison does not adequately answer if bmi is an independant risk factor
Wylde,V.; Hewlett,S.; Learmonth,I.D.; Dieppe,P.	2011	Persistent pain after joint replacement: prevalence, sensory qualities, and postoperative determinants	unclear if all patients have osteoarthritis
Yang,Z.; Liu,H.; Xie,X.; Tan,Z.; Qin,T.; Kang,P.	2014	The influence of diabetes mellitus on the post-operative outcome of elective primary total knee replacement: a systematic review and meta-analysis	systematic review
Yeung,E.; Thornton-Bott,P.; Walter,W.L.	2010	Patient obesity: A growing concern of successful total knee arthroplasty	review
Zeni,J.,Jr.; Abujaber,S.; Pozzi,F.; Raisis,L.	2014	Relationship between strength, pain, and different measures of functional ability in patients with end-stage hip osteoarthritis	study of hip OA
Zhang,X.H.; Li,S.C.; Xie,F.; Lo,N.N.; Yang,K.Y.; Yeo,S.J.; Fong,K.Y.; Thumboo,J.	2012	An exploratory study of response shift in health-related quality of life and utility assessment among patients with osteoarthritis undergoing total knee replacement surgery in a tertiary hospital in Singapore	no risk factors relevant to pico question
Zhang,Y.; McAlindon,T.E.; Hannan,M.T.; Chaisson,C.E.; Klein,R.; Wilson,P.W.; Felson,D.T.	1998	Estrogen replacement therapy and worsening of radiographic knee osteoarthritis: the Framingham Study	Not retrevable
Fox,J.L.; Poss,R.	1981	The role of manipulation following total knee replacement	Does not compare manipulation to any other nonsurgical techniques.
Namba,R.S.; Inacio,M.C.; Paxton,E.W.; Ake,C.F.; Wang,C.; Gross,T.P.; Marinac-Dabic,D.; Sedrakyan,A.	2012	Risk of revision for fixed versus mobile-bearing primary total knee replacements	appraised as moderate quality prognostic study for risk stratification, but is not best available evidence for bmi and revision. If appraised as a

Authors	Year	Title	Reason for Exclusion
			treatment study for hospital volume, it would be very low quality due to bing retrospective and because of high risk form multicolinearity by including hospital and surgeon volume in the same model
Scuderi,G.R.; Insall,J.N.; Windsor,R.E.; Moran,M.C.	1989	Survivorship of cemented knee replacements	less than 90% of patients had knee OA
Ageberg,E.; Nilsdotter,A.; Kosek,E.; Roos,E.M.	2013	Effects of neuromuscular training (NEMEX-TJR) on patient-reported outcomes and physical function in severe primary hip or knee osteoarthritis: a controlled before-and-after study	Not relevant, no data after KA
Beaupre,L.A.; Lier,D.; Davies,D.M.; Johnston,D.B.	2004	The effect of a preoperative exercise and education program on functional recovery, health related quality of life, and health service utilization following primary total knee arthroplasty	Not relevant, osteoarthritis patients not specified in the study
Brouwer,R.W.; van Raaij,T.M.; Verhaar,J.A.N.; Coene,L.N.J.E.; Bierma-Zeinstra,S.M.A.	2006	Brace treatment for osteoarthritis of the knee: a prospective randomized multi-centre trial	Not relevant, not pre KA rehab study, brace study
Casale,R.; Damiani,C.; Rosati,V.; Atzeni,F.; Sarzi-Puttini,P.; Nica,A.S.	2012	Efficacy of a comprehensive rehabilitation programme combined with pharmacological treatment in reducing pain in a group of OA patients on a waiting list for total joint replacement	no arthroplasty
Cheatham,S.W.	2013	Do patient factors and prehabilitation improve outcomes after total knee arthroplasty?	lit review
Clayton,M.L.; Thompson,T.R.	1987	Activity, air boots, and aspirin as thromboembolism prophylaxis in knee arthroplasty. A multiple regimen approach	Not relevant, not pre KA rehab study

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Coudeyre,E.; Jardin,C.; Givron,P.; Ribinik,P.; Revel,M.; Rannou,F.	2007	Could preoperative rehabilitation modify postoperative outcomes after total hip and knee arthroplasty? Elaboration of French clinical practice guidelines	Systematic Review
Crowe,J.; Henderson,J.	2003	Pre-arthroplasty rehabilitation is effective in reducing hospital stay	Not relevant, KA data not seperated from HA
Desmeules,F.; Hall,J.; Woodhouse,L.J.	2013	Prehabilitation improves physical function of individuals with severe disability from hip or knee osteoarthritis	Data includes both Hip and knee patients
Eschalier,B.; Descamps,S.; Pereira,B.; Girard,M.G.; Boisgard,S.; Coudeyre,E.	2012	Evaluation of a pre operative education approach for patient undergoing total knee replacement	Abstract
Farrokhi,S.; Fitzgerald,G.K.	2012	The role of physical activity and therapeutic exercise in development and management of knee osteoarthritis	reveiw
Foster,N.	2007	The value of acupuncture or exercise-based physiotherapy for patients waiting for knee replacement surgery: Commentary	Commentary
Gill,S.D.; McBurney,H.	2013	Does exercise reduce pain and improve physical function before hip or knee replacement surgery? A systematic review and meta-analysis of randomized controlled trials (Structured abstract)	Systematic review, bib search
Huang,S.W.; Chen,P.H.; Chou,Y.H.	2012	Effects of a preoperative simplified home rehabilitation education program on length of stay of total knee arthroplasty patients (Provisional abstract)	Duplicate
Ishii,Y.; Noguchi,H.; Matsuda,Y.; Takeda,M.; Kiga,H.; Toyabe,S.-I.	2008	Range of motion during the perioperative period in total knee arthroplasty	No prehab intervention..
Lenssen,A.F.; de Bie,R.A.	2006	Role of physiotherapy in peri-operative management in total knee and hip surgery	Commentary
Li,C.S.; Ayeni,O.R.; Sprague,S.; Truong,V.; Bhandari,M.	2013	Conservative treatments, surgical treatments, and the Kinespringspi(registered trademark) Knee implant system for Knee osteoarthritis: A systematic review	Systematic review, bib search

Authors	Year	Title	Reason for Exclusion
Matassi,F.; Duerinckx,J.; Vandenneucker,H.; Bellemans,J.	2012	Range of motion after total knee arthroplasty: the effect of a preoperative home exercise program	Not relevant, osteoarthritis patients not specified in the study
McDonald,Steve; Hetrick,Sarah E.; Green,Sally	2004	Pre-operative education for hip or knee replacement	Systematic Review (reviewed bib search)
Melton,J.T.; Wyatt,M.R.; Yein,K.; Williamson,L.	2009	Severe osteoarthritis of the knee: a randomised controlled trial comparing standardised western acupuncture, supervised exercise therapy and standard management for patients awaiting knee arthroplasty	Abstract
Mitchell,C.; Walker,J.; Walters,S.; Morgan,A.B.; Binns,T.; Mathers,N.	2005	Costs and effectiveness of pre- and post-operative home physiotherapy for total knee replacement: randomized controlled trial	Comparison groups not relevant.
Mora,M.; Shell,J.E.; Thomas,C.S.; Ortiguera,C.J.; O'Connor,M.I.	2012	Gender differences in questions asked in an online preoperative patient education program	Not relevant
Nankaku,M.; Tsuboyama,T.; Akiyama,H.; Kakinoki,R.; Fujita,Y.; Nishimura,J.; Yoshioka,Y.; Kawai,H.; Matsuda,S.	2013	Preoperative prediction of ambulatory status at 6 months after total hip arthroplasty	Hip arthroplasty study
Reeves,N.D.; Bowling,F.L.	2011	Conservative biomechanical strategies for knee osteoarthritis	Systematic Review
Riddle,D.L.; Keefe,F.J.; Nay,W.T.; McKee,D.; Attarian,D.E.; Jensen,M.P.	2010	Pain coping skills training for patients with elevated pain catastrophizing who are scheduled for knee arthroplasty: A quasi-experimental study	Abstract
Rodgers,J.A.; Garvin,K.L.; Walker,C.W.; Morford,D.; Urban,J.; Bedard,J.	1998	Preoperative physical therapy in primary total knee arthroplasty	
Santa,Mina D.; Clarke,H.; Ritvo,P.; Leung,Y.W.; Matthew,A.G.; Katz,J.;	2014	Effect of total-body prehabilitation on postoperative outcomes: A systematic review and meta-analysis	Systematic review, bib search2

Authors	Year	Title	Reason for Exclusion
Trachtenberg,J.; Alibhai,S.M.H.			
Silkman,Baker C.; McKeon,J.M.	2012	Does preoperative rehabilitation improve patient-based outcomes in persons who have undergone total knee arthroplasty? A systematic review	systematic review
Soni,A.; Mudge,N.; Joshi,A.; Wyatt,M.; Williamson,L.	2010	Severe knee osteoarthritis: A study of combined acupuncture and physiotherapy vs home exercise advice in patients awaiting total knee arthroplasty	Abstract
Swank,A.M.; Kachelman,J.B.; Bibeau,W.; Quesada,P.M.; Nyland,J.; Malkani,A.; Topp,R.V.	2011	Prehabilitation before total knee arthroplasty increases strength and function in older adults with severe osteoarthritis	No follow up after KA
Van Leeuwen,D.M.; De Ruiter,C.J.; Nolte,P.A.; De,Haan A.	2014	Preoperative strength training for elderly patients awaiting total knee arthroplasty	Does not have 10 in each group at post-op follow ups
Villadsen,A.; Overgaard,S.; Holsgaard-Larsen,A.; Christensen,R.; Roos,E.M.	2014	Immediate efficacy of neuromuscular exercise in patients with severe osteoarthritis of the hip or knee: a secondary analysis from a randomized controlled trial	Outcomes assessed prior to surgery only.
Wallis,J.A.; Taylor,N.F.	2011	Pre-operative interventions (non-surgical and non-pharmacological) for patients with hip or knee osteoarthritis awaiting joint replacement surgery - a systematic review and meta-analysis (Provisional abstract)	Systematic Review (reviewed bib search)
Walls,R.J.; McHugh,G.; Moyna,N.M.; O'Byrne,J.M.	2008	Neuromuscular electrical stimulation improves preoperative strength and function in total knee arthroplasty for osteoarthritis [abstract]	Abstract
Walls,R.J.; McHugh,G.; O'Gorman,D.J.; Moyna,N.M.; O'Byrne,J.M.	2010	Effects of preoperative neuromuscular electrical stimulation on quadriceps strength and functional recovery in total knee arthroplasty. A pilot study	Less than 10 patients per group

Authors	Year	Title	Reason for Exclusion
Williamson,L.; Wyatt,M.R.; Yein,K.; Melton,J.T.	2007	Severe knee osteoarthritis: a randomized controlled trial of acupuncture, physiotherapy (supervised exercise) and standard management for patients awaiting knee replacement	Not relevant, no data after KA
Mounasamy,V.; Beizile,E.L.; Moskal,J.T.; Brown,T.E.	2008	Stiffness following total knee arthroplasty: Evaluation and treatment	Narrative Review
Logerstedt,D.; Zeni,Sr; Snyder-Mackler,L.	2013	Different recovery groups 2 years after total knee arthroplasty	Not full text.
Chiu,F.Y.; Hung,S.H.; Chuang,T.Y.; Chiang,S.C.	2012	The impact of exsanguination by Esmarch bandage on venous hemodynamic changes in total knee arthroplasty - A prospective randomized study of 38 knees	not relevant to pico question. compares application of esmarch bandage before tourniquet inflation to elevation before tourniquet application
Fukuda,A.; Hasegawa,M.; Kato,K.; Shi,D.; Sudo,A.; Uchida,A.	2007	Effect of tourniquet application on deep vein thrombosis after total knee arthroplasty	very low quality
Huang,Z.Y.; Pei,F.X.; Ma,J.; Yang,J.; Zhou,Z.K.; Kang,P.D.; Shen,B.	2014	Comparison of three different tourniquet application strategies for minimally invasive total knee arthroplasty: a prospective non-randomized clinical trial	all groups get tourniquet
Husted,H.; Toftgaard,Jensen T.	2005	Influence of the pneumatic tourniquet on patella tracking in total knee arthroplasty: a prospective randomized study in 100 patients	doesn't answer pico question. compares tourniquet on straight leg versus flexed leg
Li,B.; Wen,Y.; Wu,H.; Qian,Q.; Lin,X.; Zhao,H.	2009	The effect of tourniquet use on hidden blood loss in total knee arthroplasty	less than 90% of patients had knee OA
Lohmann-Jensen,R.; Holsgaard-Larsen,A.; Emmeluth,C.; Overgaard,S.; Jensen,C.	2014	The efficacy of tourniquet assisted total knee arthroplasty on patient-reported and performance-based physical function: a randomized controlled trial protocol	only study methodology is presented
Madarevic,T.; Tudor,A.; Sestan,B.; Santic,V.; Gulan,G.; Prpic,T.; Ruzic,L.	2011	Postoperative blood loss management in total knee arthroplasty: a comparison of four different methods	does not answer pico question. compares application of compression bandage before tourniquet release vs no bandage

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Marson,B.M.; Tokish,J.T.	1999	The effect of a tourniquet on intraoperative patellofemoral tracking during total knee arthroplasty	not relevant. all groups get tournequet
Olivecrona,C.; Tidermark,J.; Hamberg,P.; Ponzer,S.; Cederfjall,C.	2006	Skin protection underneath the pneumatic tourniquet during total knee arthroplasty: a randomized controlled trial of 92 patients	does not answer pico question. all groups get tourniquet, and skin protection techniques are compared
Prasad,N.; Padmanabhan,V.; Mullaji,A.	2007	Blood loss in total knee arthroplasty: an analysis of risk factors	less than 90% of patients had knee OA
Ratchford,S.M.; Bailey,A.N.; Senesac,H.A.; Hocker,A.D.; Smolkowski,K.; Lantz,B.A.; Jewett,B.A.; Gilbert,J.S.; Dreyer,H.C.	2012	Proteins regulating cap-dependent translation are downregulated during total knee arthroplasty	not relevant. tourniquet is not compared to no tourniquet
Schinsky,M.F.; Macaulay,W.; Parks,M.L.; Kiernan,H.; Nercessian,O.A.	2001	Nerve injury after primary total knee arthroplasty	less than 90% of patients had knee OA
Schuh,A.; Hausel,M.; Salminen,S.	2003	[Effect of tourniquet use on blood loss in total knee arthroplasty]	foreign language
Bade,M.J.; Stevens-Lapsley,J.E.	2011	Early high-intensity rehabilitation following total knee arthroplasty improves outcomes	Less than 10 patients per group.
Lenssen,A.F.; Crijns,Y.H.; Waltje,E.M.; van Steyn,M.J.; Geesink,R.J.; van den Brandt,P.A.; de Bie,R.A.	2006	Efficiency of immediate postoperative inpatient physical therapy following total knee arthroplasty: an RCT	Not relevant to PICO. Does not answer question.
Liebenson,C.	2007	Functional problems associated with the knee-Part two: Rehabilitation fundamentals for common knee conditions	Narrative review not relevant to the question of interest.
Peerbhoy,D.	1999	The systematic assessment of short-term functional recovery after major joint arthroplasty	Patient population does not meet inclusion criteria (hip and knee patients).

Authors	Year	Title	Reason for Exclusion
Reilly,K.A.; Beard,D.J.; Barker,K.L.; Dodd,C.A.; Price,A.J.; Murray,D.W.	2005	Efficacy of an accelerated recovery protocol for Oxford unicompartmental knee arthroplasty: a randomised controlled trial (Structured abstract)	Patient population does not meet inclusion criteria (not total knee arthroplasty).
Zietek,P.; Zietek,J.; Szczypior,K.; Safranow,K.	2014	Effect of adding one, 15-minute walk on the day of surgery to fast-track rehabilitation after total knee arthroplasty: A randomized, single-blind study	Not relevant to PICO. Does not answer question.
Widuchowski,W.; Widuchowski,J.; Reszka,P.	2002	Postoperative treatment and rehabilitation after total knee arthroplasty	re: model
Oldmeadow,L.B.; McBurney,H.; Robertson,V.J.	2001	Hospital stay and discharge outcomes after knee arthroplasty	Patient population does not meet inclusion criteria (OA and RA patients , total and partial knee arthroplasty). Outcomes of interest not addressed.
Westby,M.D.	2012	Rehabilitation and total joint arthroplasty	Narrative review. Not relevant to question of interest.
Alkire,M.R.; Swank,M.L.	2010	Use of inpatient continuous passive motion versus no CPM in computer-assisted total knee arthroplasty	Does not meet required OA/RA cutoff.
Beaupre,L.A.; Davies,D.M.; Jones,C.A.; Cinats,J.G.	2001	Exercise combined with continuous passive motion or slider board therapy compared with exercise only: a randomized controlled trial of patients following total knee arthroplasty	Duplicate
Brosseau,L.; Milne,S.; Wells,G.; Tugwell,P.; Robinson,V.; Casimiro,L.; Pelland,L.; Noel,M.J.; Davis,J.; Drouin,H.	2004	Efficacy of continuous passive motion following total knee arthroplasty: a metaanalysis	Meta-analysis
Harvey,L.A.; Brosseau,L.; Herbert,R.D.	2014	Continuous passive motion following total knee arthroplasty in people with arthritis	systematic review
He,Mao Lin; Xiao,Zeng Ming; Lei,Ming; Li,Ting Song; Wu,Hao; Liao,Jun	2014	Continuous passive motion for preventing venous thromboembolism after total knee arthroplasty	systematic review

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John,Kumar P.; McPherson,E.J.; Dorr,L.D.; Wan,Z.; Baldwin,K.	1996	Rehabilitation after total knee arthroplasty: A comparison of 2 rehabilitation techniques	Duplicate
Johnson,D.P.	1990	The effect of continuous passive motion on wound-healing and joint mobility after knee arthroplasty	Does not meet required OA/RA cutoff.
Lake,P.; Moore,F.	1990	Continuous passive mobilisation following total knee replacement: A retrospective review	Very Low Quality
Maloney,W.J.; Schurman,D.J.; Hangen,D.; Goodman,S.B.; Edworthy,S.; Bloch,D.A.	1990	The influence of continuous passive motion on outcome in total knee arthroplasty	OA and RA
Maniar,R.N.; Baviskar,J.V.; Singhi,T.; Rathi,S.S.	2012	To use or not to use continuous passive motion post-total knee arthroplasty presenting functional assessment results in early recovery	Does not meet required OA/RA cutoff.
Marti,R.K.; Kerkhoffs,G.M.; Rademakers,M.V.	2007	Correction of lateral tibial plateau depression and valgus malunion of the proximal tibia	No comparison group. Not relevant to question of interest.
McInnes,J.; Larson,M.G.; Daltroy,L.H.; Brown,T.; Fossel,A.H.; Eaton,H.M.; Shulman-Kirwan,B.; Steindorf,S.; Poss,R.; Liang,M.H.	1992	A controlled evaluation of continuous passive motion in patients undergoing total knee arthroplasty	Does not meet required OA/RA cutoff.
Milne,S.; Brosseau,L.; Robinson,V.; Noel,M.J.; Davis,J.; Drouin,H.; Wells,G.; Tugwell,P.	2003	Continuous passive motion following total knee arthroplasty	systematic review (reviewed bib search)
Romness,D.W.; Rand,J.A.	1988	The role of continuous passive motion following total knee arthroplasty	Very Low Quality. Patient popular includes any TKA regardless of diagnosis.
Shih,K.Z.; Liu,T.K.	1990	The role of continuous passive motion following total knee arthroplasty	Very Low Quality
Synder,M.; Kozlowski,P.; Drobniewski,M.;	2004	The use of Continuous Passive Motion (CPM) in the rehabilitation of patients after total knee arthroplasty	Not in English

Authors	Year	Title	Reason for Exclusion
Grzegorzewski,A.; Glowacka,A.	1987	Continuous passive motion after total knee arthroplasty	Does not meet required OA/RA cutoff.
Vince,K.G.; Kelly,M.A.; Beck,J.; Insall,J.N.			
Brosseau,L.; Milne,S.; Wells,G.; Tugwell,P.; Robinson,V.; Casimiro,L.; Pelland,L.; Noel,M.J.; Davis,J.; Drouin,H.	2004	Efficacy of continuous passive motion following total knee arthroplasty: a metaanalysis (Structured abstract)	Meta-analysis
Lenssen,A.F.; Crijns,Y.H.; Waltje,E.M.; Roox,G.M.; van Steyn,M.J.; Geesink,R.J.; van den Brandt,P.A.; de Bie,R.A.	2006	Effectiveness of prolonged use of continuous passive motion (CPM) as an adjunct to physiotherapy following total knee arthroplasty: design of a randomised controlled trial [ISRCTN85759656]	Not a completed study. Methodology only.
McInnes,J.; Larson,M.G.; Daltroy,L.H.; Brown,T.; Fossel,A.H.; Eaton,H.M.; Shulman,K.B.; Steindorf,S.; Poss,R.; Liang,M.H.	1991	Continuous passive motion: a controlled clinical trial	Not full text article.
Guerin,S.; Collins,C.; Kapoor,H.; McClean,I.; Collins,D.	2007	Blood transfusion requirement prediction in patients undergoing primary total hip and knee arthroplasty	No protocols in place to guide transfusion policy.
Hadjianastassiou,V.G.; Virich,G.; Lennox,I.A.	2001	Transfusion practice in primary unilateral total knee replacement arthroplasty; the need for guidelines	No protocols in place to guide transfusion policy.
Hadjianastassiou,V.G.; Virich,G.; Lennox,I.A.	2002	Use of the blood transfusion service in total knee replacement arthroplasty. The cost implications	Retrospective study where there was no specific transfusion protocol in place. Outcomes in study are purely cost related; no important clinical outcomes reported.
Jakovina,Blazekovic S.; Bicanic,G.; Hrabac,P.; Tripkovic,B.; Delimar,D.	2014	Pre-operative autologous blood donation versus no blood donation in total knee arthroplasty: A prospective randomised trial	Not relevant to PICO. Does not answer question.

Authors	Year	Title	Reason for Exclusion
Jonas,S.C.; Smith,H.K.; Blair,P.S.; Dacombe,P.; Weale,A.E.	2013	Factors influencing length of stay following primary total knee replacement in a UK specialist orthopaedic centre	Does not answer any question of interest.
Kang,Y.; Zhang,Z.-J.; Fu,M.; Xu,D.-L.; Sheng,P.-Y.; Liao,W.-M.	2013	Blood transfusion and drainage catheter clamping are associated with ecchymosis formation at the surgical site after total knee arthroplasty: An analysis of 102 unilateral cases	Study not relevant to PICO. No comparison of transfusion protocols.
Menezes,S.; Manso,T.; Seifert,I.; Rodrigues,R.; Gil,G.	2011	Blood loss in total hip/knee replacement surgery	Patient population does not meet inclusion criteria (OA and RA patients). Not relevant to question of interest.
Rojewski,M.; Krol,R.; Krzykawski,R.; Prochacki,P.	2009	Value of the autotransfusion of blood recovered from the post-operative wound in arthroplasty patients	Patient population does not meet inclusion criteria (hip and knee patients). Does not answer question of interest.
Wang,X.; Rintala,D.H.; Garber,S.L.; Henson,H.K.	2005	Association of hemoglobin levels, acute hemoglobin decrease, age, and co-morbidities with rehabilitation outcomes after total knee replacement	Does not asnswer PICO 18. Only gives descriptives associated with hemoglobin levels.
Bini,S.A.; Fithian,D.C.; Paxton,L.W.; Khatod,M.X.; Inacio,M.C.; Namba,R.S.	2010	Does discharge disposition after primary total joint arthroplasty affect readmission rates?	Very Low Quality. Unclear if limited to OA patients. Does not meat inclusion criteria.
Mahomed,N.N.; Koo Seen Lin,M.J.; Levesque,J.; Lan,S.; Bogoch,E.R.	2000	Determinants and outcomes of inpatient versus home based rehabilitation following elective hip and knee replacement	Patient population does not meet inclusion criteria (hip and knee patients).
Kolisek,F.R.; Gilmore,K.J.; Peterson,E.K.	2000	Slide and flex, tighten, extend (SAFTE): a safe, convenient, effective, and no-cost approach to rehabilitation after total knee arthroplasty	Not relevant to any question of interest (PICO 19, 32).
Mahomed,N.N.; Davis,A.M.; Hawker,G.; Badley,E.; Davey,J.R.; Syed,K.A.; Coyte,P.C.; Gandhi,R.; Wright,J.G.	2008	Inpatient compared with home-based rehabilitation following primary unilateral total hip or knee replacement: a randomized controlled trial	Patient population does not meet inclusion criteria (OA and RA patients, hip and knee).
Pozzi,F.; Snyder-Mackler,L.; Zeni,J.	2013	Physical exercise after knee arthroplasty: a systematic review of controlled trials	Systematic review (reviewed bib search)

Authors	Year	Title	Reason for Exclusion
Bose,W.J.; Gearen,P.F.; Randall,J.C.; Petty,W.	1995	Long-term outcome of 42 knees with chronic infection after total knee arthroplasty	patients in both groups get antibiotic cement. not all patients had knee OA
Cameron,H.U.; Jung,Y.B.	1993	Noncemented stem tibial component in total knee replacement: the 2- to 6-year results	does not compare antibiotic bone cement to no antibiotic bone cement
Ceffa,R.; Andreoni,S.; Borre,S.; Ghisellini,F.; Fornara,P.; Brugo,G.; Ritter,M.A.	2002	Mucoraceae infections of antibiotic-loaded cement spacers in the treatment of bacterial infections caused by knee arthroplasty	Case report
Gandhi,R.; Razak,F.; Pathy,R.; Davey,J.R.; Syed,K.; Mahomed,N.N.	2009	Antibiotic bone cement and the incidence of deep infection after total knee arthroplasty	very low quality: the groups were treated by different surgeons, no test for multicolinearity, and less than 10 infections per independent variable in the model could lead to overfitted statistical model. .not all patients had knee OA
Jia,Y.-T.; Zhang,Y.; Ding,C.; Zhang,N.; Zhang,D.-H.; Sun,Z.-H.; Tian,M.-Q.; Liu,J.	2012	Antibiotic-loaded articulating cement spacers in twostage revision for infected total knee arthroplasty: Individual antibiotic treatment and early results of 21 cases	does not compare antibiotic bone cement to no antibiotic bone cement
Namba,R.S.; Chen,Y.; Paxton,E.W.; Slipchenko,T.; Fithian,D.C.	2009	Outcomes of Routine Use of Antibiotic-Loaded Cement in Primary Total Knee Arthroplasty	very low quality: study had to be downgraded because the registry did not have data on BMI, which could not be included as a covariate in the analysis. also, some variables had large amounts of missing data, and it is unclear if any imputation method was used.not all patients had knee OA
Hanssen,A.D.; Rand,J.A.; Osmon,D.R.	1994	Treatment of the infected total knee arthroplasty with insertion of another prosthesis: The effect of antibiotic-impregnated bone cement	Not relevant

Authors	Year	Title	Reason for Exclusion
Namba,R.S.; Inacio,M.C.; Paxton,E.W.	2013	Risk factors associated with deep surgical site infections after primary total knee arthroplasty: an analysis of 56,216 knees	very low quality if used as a therapeutic study: the authors note that potential confounding factors, such as wound classifcation, were not measured in the registry and could not be controlled for; also, there could be residual confounding present because higher risk patients may have been more likely to get antibiotic bone cement. for. also, not all patients had knee OA
Choy,W.S.; Yang,D.S.; Lee,K.W.; Lee,S.K.; Kim,K.J.; Chang,S.H.	2014	Cemented Versus Cementless Fixation of a Tibial Component in LCS Mobile-Bearing Total Knee Arthroplasty Performed by a Single Surgeon	comparison isn't relevant to pico 7 or pico 2. anti biotic bone cement is compared to patients who get uncemented arthroplasties
Bae,D.K.; Lee,H.K.; Cho,J.H.	1995	Arthroscopy of symptomatic total knee replacements	Doesn't answer PICO question. Comparison groups not relevant.
Ellis,T.J.; Beshires,E.; Brindley,G.W.; Adams,R.L.; Preece,C.	1999	Knee manipulation after total knee arthroplasty	Appraised as Very Low Quality
Ghani,H.; Maffulli,N.; Khanduja,V.	2012	Management of stiffness following total knee arthroplasty: a systematic review	systematic review (reviewed bib search)
Ipach,I.; Schafer,R.; Lahrmann,J.; Kluba,T.	2011	Stiffness after knee arthrotomy: evaluation of prevalence and results after manipulation under anaesthesia	comparison groups not relevant
Issa,K.; Banerjee,S.; Kester,M.A.; Khanuja,H.S.; Delanois,R.E.; Mont,M.A.	2014	The effect of timing of manipulation under anesthesia to improve range of motion and functional outcomes following total knee arthroplasty	Doesn't answer PICO question. Comparison groups not relevant. Consider looking at anyways.
Joon,Cheol Choi; Sculco,T.P.	1999	Manipulation after total knee replacement	Comparison groups not relevant; Early vs late manipulation, but no control group not receiving manipulation.

Authors	Year	Title	Reason for Exclusion
Keating,E.M.; Ritter,M.A.; Harty,L.D.; Haas,G.; Meding,J.B.; Faris,P.M.; Berend,M.E.	2007	Manipulation after total knee arthroplasty	Patient population and comparison groups not relevant for PICO 20.
Lee,D.C.; Kim,D.H.; Scott,R.D.; Suthers,K.	1998	Intraoperative flexion against gravity as an indication of ultimate range of motion in individual cases after total knee arthroplasty	Patient population does not meet inclusion criteria (OA and RA patients). Not relevant to question of interest.
Licciardone,J.C.; Stoll,S.T.; Cardarelli,K.M.; Gamber,R.G.; Swift,J.N.,Jr.; Winn,W.B.	2004	A randomized controlled trial of osteopathic manipulative treatment following knee or hip arthroplasty	Does not answer question of interest.
Maloney,W.J.	2002	The stiff total knee arthroplasty: evaluation and management	
Manrique,J.; Gomez,M.M.; Parvizi,J.	2014	Stiffness after Total Knee Arthroplasty	Narrative review
Rubinstein,Jr; DeHaan,A.	2010	The incidence and results of manipulation after primary total knee arthroplasty	duplicate citation per anne woznica
Rubinstein,R.A.,Jr.; DeHaan,A.	2010	The incidence and results of manipulation after primary total knee arthroplasty	Comparison groups not relevant. Only patients receiving manipulation included.
Schiavone,Panni A.; Cerciello,S.; Vasso,M.; Tartarone,M.	2009	Stiffness in total knee arthroplasty	Systematic review (reviewed bib search)
Schurman,D.J.; Parker,J.N.; Ornstein,D.	1985	Total condylar knee replacement. A study of factors influencing range of motion as late as two years after arthroplasty	less than 10 patients had staged bilateral surgery. Also, less than 50 percent of the knees had surgery for OA
Su,E.P.; Su,S.L.; Gonzalez,Della,V	2011	The stiff knee-exposure and management	Narrative review.
Yercan,H.S.; Sugun,T.S.; Bussiere,C.; Ait Si,Selmi T.; Davies,A.; Neyret,P.	2006	Stiffness after total knee arthroplasty: prevalence, management and outcomes	Patient population: OA and RA. Comparison groups do not meet criteria: MUA vs surgical.
Adie,S.; Kwan,A.; Naylor,J.M.; Harris,I.A.; Mittal,R.	2012	Cryotherapy following total knee replacement	systematic review (reviewed bib search)

Authors	Year	Title	Reason for Exclusion
Gibbons,C.E.; Solan,M.C.; Ricketts,D.M.; Patterson,M.	2001	Cryotherapy compared with Robert Jones bandage after total knee replacement: a prospective randomized trial	Does not meet required OA/RA cutoff.
Hecht,P.J.; Bachmann,S.; Booth,R.E.,Jr.; Rothman,R.H.	1983	Effects of thermal therapy on rehabilitation after total knee arthroplasty. A prospective randomized study	Not relevant to PICO since it does not study use of a cryotherapy device
Kang,J.I.; Kim,Y.N.; Choi,H.	2014	Effects of Low-intensity Pulsed Ultrasound and Cryotherapy on Recovery of Joint Function and C-reactive Protein Levels in Patients after Total Knee Replacement Surgery	Comparison groups not relevant.
Morsi,E.	2002	Continuous-flow cold therapy after total knee arthroplasty	homa made device that would not be used in standard practice
Webb,J.M.; Williams,D.; Ivory,J.P.; Day,S.; Williamson,D.M.	1998	The use of cold compression dressings after total knee replacement: A randomized controlled trial	Does not meet required OA/RA cutoff.
Akodu,A.K.; Giwa,S.O.; Akinbo,S.R.; Ahmed,U.A.	2011	Physiotherapy in the management of total knee arthroplasty: a review	Systematic Review
Dretler,R.; Branch,T.	2005	MRSA knee infection treated successfully with daptomycin after two failed prolonged high-dose courses of vancomycin	Case report
Holm,S.; Larsson,S.E.	1982	The penetration of flucloxacillin into cortical and cancellous bone during arthroplasty of the knee	Not relevant
Rao,N.; Cannella,B.; Crossett,L.S.; Yates,A.J.,Jr.; McGough,R.,III	2008	A preoperative decolonization protocol for staphylococcus aureus prevents orthopaedic infections	Not relevant patient population
Rao,N.; Cannella,B.A.; Crossett,L.S.; Yates,A.J.,Jr.; McGough,R.L.,III; Hamilton,C.W.	2011	Preoperative screening/decolonization for Staphylococcus aureus to prevent orthopedic surgical site infection: prospective cohort study with 2-year follow-up	Not relevant patient population
Lidwell,O.M.; Elson,R.A.; Lowbury,E.J.; Whyte,W.; Blowers,R.; Stanley,S.J.; Lowe,D.	1987	Ultraclean air and antibiotics for prevention of postoperative infection. A multicenter study of 8,052 joint replacement operations	Review

Authors	Year	Title	Reason for Exclusion
Simcock,X.C.; Yoon,R.S.; Chalmers,P.; Geller,J.A.; Kiernan,H.A.; Macaulay,W.	2008	Intraoperative music reduces perceived pain after total knee arthroplasty: a blinded, prospective, randomized, placebo-controlled clinical trial	Not relevant, not an OR environment study
Ackroyd,C.E.; Newman,J.H.; Evans,R.; Eldridge,J.D.; Joslin,C.C.	2007	The Avon patellofemoral arthroplasty: five-year survivorship and functional results	not relevant. does not compare patellar resurfacing to no patellar resurfacing
Beitzel,K.; Cotic,M.; Imhoff,A.B.	2011	Clinical and radiological results afterisolated and combined patellofemoral arthroplasty with the journey PFJ trochleashield-a prospective study with a follow up of 2 years	not full text. abstract only
Bergquist,P.E.; Baumann,P.A.; Finn,H.A.	2001	Total knee arthroplasty in an adult with congenital dislocation of the patella	Case report
Bischoff,M.J.; van Raaij,T.M.; Reininga,I.H.; van Raay,J.J.	2014	Patellar resurfacing in posterior cruciate ligament retaining total knee arthroplasty (PATRES): design of a randomized controlled clinical trial	no results included in article. It is only a methodology description
Boyd,Jr; Ewald,F.C.; Thomas,W.H.; Poss,R.; Sledge,C.B.	1993	Long-term complications after total knee arthroplasty with or without resurfacing of the patella	very low quality
Burnett,R.S.; Bourne,R.B.	2004	Indications for patellar resurfacing in total knee arthroplasty	Narrative review
Calvisi,V.; Camillieri,G.; Lupparelli,S.	2009	Resurfacing versus nonresurfacing the patella in total knee arthroplasty: A critical appraisal of the available evidence	Systematic review
Chen,K.; Li,G.; Fu,D.; Yuan,C.; Zhang,Q.; Cai,Z.	2013	Patellar resurfacing versus nonresurfacing in total knee arthroplasty: a meta-analysis of randomised controlled trials	meta-analysis
Enis,J.E.; Gardner,R.; Robledo,M.A.; Latta,L.; Smith,R.	1990	Comparison of patellar resurfacing versus nonresurfacing in bilateral total knee arthroplasty	less than 90% of patients had knee OA
Feng,B.; Weng,X.; Lin,J.; Jin,J.; Qian,W.; Wang,W.; Qiu,G.	2014	Long term follow up of clinical outcome between patellar resurfacing and nonresurfacing in total knee arthroplasty: Chinese experience	less than 90% of patients had knee OA

Authors	Year	Title	Reason for Exclusion
Forster,M.C.	2004	Patellar resurfacing in total knee arthroplasty for osteoarthritis: a systematic review (Structured abstract)	systematic review
Garneti,N.; Mahadeva,D.; Khalil,A.; McLaren,C.A.	2008	Patellar resurfacing versus no resurfacing in Scorpio total knee arthroplasty	very low quality
Greenfield,M.A.; Insall,J.N.; Case,G.C.; Kelly,M.A.	1996	Instrumentation of the patellar osteotomy in total knee arthroplasty. The relationship of patellar thickness and lateral retinacular release	both groups get resurfacing
Hanna,B.C.; Thompson,N.W.; Wilson,D.S.; Mollan,R.A.B.	2002	Extra-articular migration of the patellar component following total knee arthroplasty	Case report
Hanssen,A.D.	2003	Orthopaedic crossfire--All patellae should be resurfaced during primary total knee arthroplasty: in the affirmative	Systematic review?
Harrington,K.D.	1992	Long-term results for the McKeever patellar resurfacing prosthesis used as a salvage procedure for severe chondromalacia patellae	does not compare patellar resurfacing to no resurfacing
He,J.-Y.; Jiang,L.-S.; Dai,L.-Y.	2011	Is patellar resurfacing superior than nonresurfacing in total knee arthroplasty? A meta-analysis of randomized trials	meta-analysis (reviewed bib search)
Holt,G.E.; Dennis,D.A.	2003	The role of patellar resurfacing in total knee arthroplasty	review
Hwang,B.H.; Yang,I.H.; Han,C.D.	2012	Comparison of patellar retention versus resurfacing in LCS mobile-bearing total knee arthroplasty	very low quality
Joo,J.H.; Lee,S.C.; Ahn,N.K.; Ahn,H.S.; Jung,K.A.	2013	Patellar resurfacing versus no resurfacing in two-stage revision of infected total knee arthroplasty	unclear if all patients have osteoarthritis
Levai,J.P.; McLeod,H.C.; Freeman,M.A.	1983	Why not resurface the patella?	Retrospective Review; majority RA
Levitsky,K.A.; Harris,W.J.; McManus,J.; Scott,R.D.	1993	Total knee arthroplasty without patellar resurfacing. Clinical outcomes and long-term follow-up evaluation	Retrospective Review
Li,B.; Bai,L.; Fu,Y.; Wang,G.; He,M.; Wang,J.	2012	Comparison of clinical outcomes between patellar resurfacing and nonresurfacing in total	very low quality

Authors	Year	Title	Reason for Exclusion
		knee arthroplasty: retrospective study of 130 cases	
Li,S.; Chen,Y.; Su,W.; Zhao,J.; He,S.; Luo,X.	2011	Systematic review of patellar resurfacing in total knee arthroplasty (Provisional abstract)	systematic review (reviewed bio search)
Lombardi,Jr; Mallory,T.H.; Maitino,P.D.; Herrington,S.M.; Kefauver,C.A.	1998	Freehand resection of the patella in total knee arthroplasty referencing the attachments of the quadriceps tendon and patellar tendon	does not compare patellar resurfacing to no resurfacing
Lygre,S.H.L.; Espehaug,B.; Havelin,L.I.; Vollset,S.E.; Furnes,O.	2010	Does patella resurfacing really matter? Pain and function in 972 patients after primary total knee arthroplasty: An observational study from the Norwegian Arthroplasty Register	Not best available evidence
Munoz-Mahamud,E.; Popescu,D.; Nunez,E.; Lozano,L.M.; Nunez,M.; Sastre,S.; Torner,P.; Segur,J.M.; Macule,F.	2011	Secondary patellar resurfacing in the treatment of patellofemoral pain after total knee arthroplasty	does not compare patellar resurfacing to no resurfacing
Myles,C.M.; Rowe,P.J.; Nutton,R.W.; Burnett,R.	2006	The effect of patella resurfacing in total knee arthroplasty on functional range of movement measured by flexible electrogoniometry	unclear if all patients have osteoarthritis
Ogon,M.; Hartig,F.; Bach,C.; Nogler,M.; Steingruber,I.; Biedermann,R.	2002	Patella resurfacing: no benefit for the long-term outcome of total knee arthroplasty. A 10- to 16.3-year follow-up	very low quality
Park,S.J.; Jung,Y.B.; Jeong,H.J.; Shin,H.K.; Jung,H.J.; Lim,J.J.; Yoon,J.W.; Kim,E.	2010	Long-term results of primary total knee arthroplasty with and without patellar resurfacing	very low quality
Patel,K.; Raut,V.	2011	Patella in total knee arthroplasty: to resurface or not to--a cohort study of staged bilateral total knee arthroplasty	less than 90% of patients had knee OA
Peng,C.W.; Tay,B.K.; Lee,B.P.H.	2003	Prospective trial of resurfaced patella versus non-resurfaced patella in simultaneous bilateral total knee replacement	Not best available evidence

Authors	Year	Title	Reason for Exclusion
Picetti III,G.D.; McGann,W.A.; Welch,R.B.	1990	The patellofemoral joint after total knee arthroplasty without patellar resurfacing	not relevant. does not compare patellar resurfacing to no patellar resurfacing
Rae,P.J.; Noble,J.; Hodgkinson,J.P.	1990	Patellar resurfacing in total condylar knee arthroplasty	less than 90% of patients had knee OA
Scott,W.N.; Kim,H.	2001	Resurfacing the patella offers lower complication and revision rates	Systematic review?
Scott,W.N.; Clarke,H.D.	2003	Routine patellar resurfacing: a viable option	Narrative review
Shen,J.; Ye,Q.; Li,S.; Qiu,G.	1994	Patella and patellofemoral resurfacing (37 cases report)	not relevant comares resurfacing techniques
van Hemert,W.L.; Senden,R.; Grimm,B.; Kester,A.D.; van der Linde,M.J.; Heyligers,I.C.	2009	Patella retention versus replacement in total knee arthroplasty; functional and clinimetric aspects	very low quality
Waikakul,S.; Vanadurongwan,V.; Bintachitt,P.	2000	The effects of patellar resurfacing in total knee arthroplasty on position sense: a prospective randomized study	inadequate reporting of relevant outcomes. the authors say they use the hospital for special surgery score in the methods section, but report knee rating scale in results. unclear if the knee rating scale is supposed to be the HSS. other patient oriented outcomes are not validated
Zha,G.-C.; Sun,J.-Y.; Dong,S.-J.	2014	Less anterior knee pain with a routine lateral release in total knee arthroplasty without patellar resurfacing: A prospective, randomized study	all patients did not get resurfacing
Zhang,Z.Y.; Hu,S.	2011	Clinical efficacies of resurfacing and non-resurfacing patella in total knee arthroplasty for osteoarthritis: a meta-analysis (Provisional abstract)	Meta-analysis?
Aglietti,P.; Buzzi,R.; Gaudenzi,A.	1988	Patellofemoral functional results and complications with the posterior stabilized total condylar knee prosthesis	does not compare patellar resurfacing to no resurfacing

Authors	Year	Title	Reason for Exclusion
Stiehl,J.B.; Hamelynck,K.J.; Voorhorst,P.E.	2006	International multi-centre survivorship analysis of mobile bearing total knee arthroplasty	the osteoarthritis data that is relevant to the pico question is low quality. the higher quality analysis includes less than 90% oa patients
Abdel,M.P.; Morrey,M.E.; Jensen,M.R.; Morrey,B.F.	2011	Increased long-term survival of posterior cruciate-retaining versus posterior cruciate-stabilizing total knee replacements	less than 90% of patients had knee OA
Bin Abd Razak,H.R.; Pang,H.N.; Yeo,S.J.; Tan,M.H.; Lo,N.N.; Chong,H.C.	2013	Joint line changes in cruciate-retaining versus posterior-stabilized computer-navigated total knee arthroplasty	very low quality retrospective and differences in baseline bmi not adjusted for
Boom,L.G.; Brouwer,R.W.; Akker,Scheek,I; Bulstra,S.K.; Raaij,J.J.	2009	Retention of the posterior cruciate ligament versus the posterior stabilized design in total knee arthroplasty: a prospective randomized controlled clinical trial	no results presented: methodology description for future study
Bradley,M.P.; Mayor,M.B.; Collier,J.P.	2004	Differences in articular track area of posterior-stabilized and cruciate-retaining retrieved total knee implants	would be appraised as very low quality since baseline differences were not assessed or controlled for in statistical analysis, and because it was retrospective
Breugem,S.J.; van,Ooij B.; Haverkamp,D.; Sierevelt,I.N.; van Dijk,C.N.	2012	No difference in anterior knee pain between a fixed and a mobile posterior stabilized total knee arthroplasty after 7.9 years	not relevant. does not compare posterior stabilized arthroplasty to cruciate retaining arthroplasty
Carvalho,L.H.,Jr.; Temponi,E.F.; Soares,L.F.; Goncalves,M.J.	2014	Relationship between range of motion and femoral rollback in total knee arthroplasty	no patient oriented outcomes and would be appraised as very low quality due to using clinical characteristics to decide which patients got pcl sacrifice. this would cause selection bias
Choi,W.C.; Lee,S.; Seong,S.C.; Jung,J.H.; Lee,M.C.	2010	Comparison between standard and high-flexion posterior-stabilized rotating-platform mobile-bearing total knee arthroplasties: a randomized controlled study	not relevant. compares two different posterior stabilized designs

Authors	Year	Title	Reason for Exclusion
Comfort,T.; Baste,V.; Froufe,M.A.; Namba,R.; Bordini,B.; Robertsson,O.; Cafri,G.; Paxton,E.; Sedrakyan,A.; Graves,S.	2014	International comparative evaluation of fixed-bearing non-posterior-stabilized and posterior-stabilized total knee replacements	meta analysis of various registries
Cope,M.R.; O'Brien,B.S.; Nanu,A.M.	2002	The influence of the posterior cruciate ligament in the maintenance of joint line in primary total knee arthroplasty: A radiologic study	no patient oriented outcomes
Dennis,D.A.; Heekin,R.D.; Clark,C.R.; Murphy,J.A.; O'Dell,T.L.; Dwyer,K.A.	2013	Effect of implant design on knee flexion	not relevant comparison. compares two different posterior stabilized methods
Digennaro,V.; Zambianchi,F.; Marcovigi,A.; Mugnai,R.; Fiacchi,F.; Catani,F.	2014	Design and kinematics in total knee arthroplasty	both groups get posterior stabilized arthroplasty
Fukunaga,K.; Kobayashi,A.; Minoda,Y.; Iwaki,H.; Hashimoto,Y.; Takaoka,K.	2009	The incidence of the patellar clunk syndrome in a recently designed mobile-bearing posteriorly stabilised total knee replacement	not relevant. does not compare posterior stabilized arthroplasty to cruciate retaining arthroplasty
Gidwani,S.; Langkamer,V.G.	2001	Recurrent dislocation of a posterior-stabilized prosthesis: a series of three cases	n<10
Guild,G.N.; Labib,S.A.	2014	Clinical outcomes in high flexion total knee arthroplasty were not superior to standard posterior stabilized total knee arthroplasty. A multicenter, prospective, randomized study	all patients got cruciate sacrificing arthroplasty
Han,C.W.; Yang,I.H.; Lee,W.S.; Park,K.K.; Han,C.D.	2012	Evaluation of postoperative range of motion and functional outcomes after cruciate-retaining and posterior-stabilized high-flexion total knee arthroplasty	very low quality for the patient oriented outcomes relevant to this question
Huang,C.H.; Cheng,C.K.; Lee,Y.T.; Lee,K.S.	1996	Muscle strength after successful total knee replacement: a 6- to 13-year followup	no patient oriented outcomes, and would likely be very low quality due to different follow up times, and no adjustment for confounding
Jacobs,W.C.; Clement,D.J.; Wymenga,A.B.	2005	Retention versus removal of the posterior cruciate ligament in total knee replacement: a	systematic review (reviewed bib search)

Authors	Year	Title	Reason for Exclusion
		systematic literature review within the Cochrane framework (Structured abstract)	
Laskin,R.S.	1997	Cemented total knee replacement in patients with osteoarthritis: A five-year follow-up study using a prosthesis allowing both retention and resection of the posterior cruciate ligament	very low quality
Lattanzio,P.-J.; Chess,D.G.; MacDermid,J.C.	1998	Effect of the posterior cruciate ligament in knee-joint proprioception in total knee arthroplasty	very low quality
Lozano-Calderon,S.A.; Shen,J.; Doumato,D.F.; Greene,D.A.; Zelicof,S.B.	2013	Cruciate-retaining vs posterior-substituting inserts in total knee arthroplasty: functional outcome comparison	Meta-analysis
Luna,J.T.; Sembrano,J.N.; Gioe,T.J.	2010	Mobile and fixed-bearing (all-polyethylene tibial component) total knee arthroplasty designs: surgical technique	not relevant. description of surgical technique
Minoda,Y.; Iwaki,H.; Ikebuchi,M.; Yoshida,T.; Mizokawa,S.; Itokazu,M.; Nakamura,H.	2014	Mobile-bearing prosthesis and intraoperative gap balancing are not predictors of superior knee flexion: a prospective randomized study	does not compare posterior stabilized to cruciate retaining KA
Mizu-uchi,H.; Matsuda,S.; Miura,H.; Nabeyama,R.; Okazaki,K.; Iwamoto,Y.	2006	Anteroposterior Stability in Posterior Cruciate Ligament-Retaining Total Knee Arthroplasty	not relevant. does not compare posterior stabilized arthroplasty to cruciate retaining arthroplasty
Morrison,T.A.; Liabaud,B.; Geller,J.A.	2013	Functional results of cruciate-retaining total knee arthroplasty using inside-out soft-tissue balancing in the valgus knee	not relevant. does not compare posterior stabilized arthroplasty to cruciate retaining arthroplasty
Murphy,M.; Journeaux,S.; Hides,J.; Russell,T.	2012	Does flexion of the femoral implant in total knee arthroplasty increase knee flexion: A randomised controlled trial	not relevent. compares two cruciate retaining methods
Nishizawa,Y.; Matsumoto,T.; Kubo,S.; Muratsu,H.; Matsushita,T.; Oka,S.; Ishida,K.; Matsuzaki,T.; Nishida,K.; Akisue,T.; Kuroda,R.; Kurosaka,M.	2013	The influence of patella height on soft tissue balance in cruciate-retaining and posterior-stabilised total knee arthroplasty	no patient oriented outcomes

Authors	Year	Title	Reason for Exclusion
Okamoto,N.; Breslauer,L.; Hedley,A.K.; Mizuta,H.; Banks,S.A.	2011	In vivo knee kinematics in patients with bilateral total knee arthroplasty of 2 designs	most patients in control group also get cruciate retaining arthroplasty
Paletta,Jr; Laskin,R.S.	1995	Total knee arthroplasty after a previous patellectomy	less than 10 patients per group
Peters,C.L.; Mulkey,P.; Erickson,J.; Anderson,M.B.; Pelt,C.E.	2014	Comparison of total knee arthroplasty with highly congruent anterior-stabilized bearings versus a cruciate-retaining design knee	less than 90% of patients had knee OA
Pritchett,J.W.	2004	Patient preferences in knee prostheses	very low quality
Sumino,T.; Rubash,H.E.; Li,G.	2013	Does cruciate-retaining total knee arthroplasty enhance knee flexion in Western and East Asian patient populations? A meta-analysis	meta-analysis
Thomsen,M.G.; Husted,H.; Bencke,J.; Curtis,D.; Holm,G.; Troelsen,A.	2012	Do we need a gender-specific total knee replacement? A randomised controlled trial comparing a high-flex and a gender-specific posterior design	not relevant. compares different posterior stablized arthroplasties
van den Boom,L.G.; Brouwer,R.W.; van,den Akker-Scheek,I; Bulstra,S.K.; van Raaij,J.J.	2009	Retention of the posterior cruciate ligament versus the posterior stabilized design in total knee arthroplasty: a prospective randomized controlled clinical trial	description of methods. no results presented
Warren,P.J.; Olanlokun,T.K.; Cobb,A.G.; Bentley,G.	1993	Proprioception after knee arthroplasty. The influence of prosthetic design	no patient oriented outcomes
Hui,C.; Salmon,L.; Maeno,S.; Roe,J.; Walsh,W.; Pinczewski,L.	2011	Five-year comparison of oxidized zirconium and cobalt-chromium femoral components in total knee arthroplasty: a randomized controlled trial	intervention not CR vs PS
Cho,W.-S.; Youm,Y.-S.	2009	Migration of Polyethylene Fixation Screw After Total Knee Arthroplasty	not relevant. does not compare posterior stabilized arthroplasty to cruciate retaining arthroplasty
Forster,M.C.	2003	Survival analysis of primary cemented total knee arthroplasty: which designs last?	combines results from multiple other studies
Redha,A.; Malki,A.A.; Al-Mousawi,F.; Al-Sawad,Y.; Booz,M.M.Y.	2005	Bilateral total knee replacements using two different implant designs - Preliminary report	<10 patients per group

Authors	Year	Title	Reason for Exclusion
Ackroyd,C.E.; Whitehouse,S.L.; Newman,J.H.; Joslin,C.C.	2002	A comparative study of the medial St Georg sled and kinematic total knee arthroplasties. Ten-year survivorship	very low quality
Alnahdi,A.H.; Zeni,J.A.; Snyder-Mackler,L.	2011	Gait after unilateral total knee arthroplasty: frontal plane analysis	does not compare uka to tka or osteotomy
Aly,T.; Mousa,W.; El-Sallakh,S.	2010	The Oxford unicompartmental knee prosthesis: Midterm follow-up	Not relevant, does not compare UKA to HTO/TKA
Amendola,A.; Panarella,L.	2005	High tibial osteotomy for the treatment of unicompartmental arthritis of the knee	systematic review?
Asik,M.; Sen,C.; Kilic,B.; Goksan,S.B.; Ciftci,F.; Taser,O.F.	2006	High tibial osteotomy with Puddu plate for the treatment of varus gonarthrosis	Does not answer PICO question. uka is not compared to osteotomy or TKA
Australian,Safety; -Efficacy-Register-of-New-Interventional-Procedures-	2005	Unicompartmental knee arthroplasty for unicompartmental osteoarthritis: a systematic review. Report no 44 (Structured abstract)	Systematic review (reviewed bib search)
Barck,A.L.	1989	10-year evaluation of compartmental knee arthroplasty	Compares diff UKA prostheses not UKA to HTO/TKA
Benzakour,T.; Hefti,A.; Lemseffer,M.; El Ahmadi,J.D.; Bouyarmane,H.; Benzakour,A.	2010	High tibial osteotomy for medial osteoarthritis of the knee: 15 years follow-up	Does not answer PICO question. uka is not compared to osteotomy or TKA
Berger,R.A.; Kusuma,S.K.; Sanders,S.A.; Thill,E.S.; Sporer,S.M.	2009	The feasibility and perioperative complications of outpatient knee arthroplasty	unclear if TKA group had unicompartmental arthritis.
Berruto,M.; Bianchi,M.; Laura,G.	1993	Surgical treatment of arthritic valgus knee: femoral supracondylar osteotomy or knee replacement?	very low quality rating.
Bert,J.M.	2008	Unicompartmental arthroplasty for unicompartmental knee arthritis	systematic review?
Brinkman,J.M.; Freiling,D.; Lobenhoffer,P.; Staubli,A.E.; van Heerwaarden,R.J.	2014	Supracondylar femur osteotomies around the knee : Patient selection, planning, operative techniques, stability of fixation, and bone healing	narrative review

Authors	Year	Title	Reason for Exclusion
Callahan,C.M.; Drake,B.G.; Heck,D.A.; Dittus,R.S.	1995	Patient outcomes following unicompartmental or bicompartmental knee arthroplasty: a meta-analysis (Structured abstract)	meta-analysis
Cameron,H.U.; Jung,Y.B.	1988	Clinical results with an uncemented plastic tibial component in unicompartmental knee replacement	not relevant. does not compare uka to tka or osteotomy
Cartier,P.; Mammeri,M.; Villers,P.	1982	Clinical and radiographic evaluation of modular knee replacement. A review of 95 cases	<90% OA patients
Chung,J.Y.; Min,B.-H.	2013	Is bicompartmental knee arthroplasty more favourable to knee muscle strength and physical performance compared to total knee arthroplasty?	study of bicompartmental knee arthroplasty
Collier,M.B.; McAuley,J.P.; Szuszczewicz,E.S.; Engh,G.A.	2004	Proprioceptive deficits are comparable before unicondylar and total knee arthroplasties, but greater in the more symptomatic knee of the patient	pre-op measures
Confalonieri,N.; Manzotti,A.; Cerveri,P.; De,Momi E.	2009	Bi-unicompartmental versus total knee arthroplasty: a matched paired study with early clinical results	patients have bicompartmental arthritis, not unicompartmental
Coventry,M.B.	1984	Upper tibial osteotomy	RA
Coventry,M.B.; Ilstrup,D.M.; Wallrichs,S.L.	1993	Proximal tibial osteotomy. A critical long-term study of eighty-seven cases	Does not answer PICO question. Osteotomy is not compared to unicompartmental arthroplasty
Craik,J.D.; El Shafie,S.A.; Singh,V.K.; Twyman,R.S.	2014	Revision of Unicompartmental Knee Arthroplasty Versus Primary Total Knee Arthroplasty	would be appraised as very low quality since it is retrospective and doesn not adjust for preoperative differences in age and BMI
Dahl,A.; Robertsson,O.; Lidgren,L.	2010	Surgery for knee osteoarthritis in younger patients	very low quality
Dahl,A.; Robertsson,O.; Lohmander,L.S.	2012	High tibial osteotomy in Sweden, 1998-2007: a population-based study of the use and rate of revision to knee arthroplasty	Does not answer PICO question. uka is not compared to osteotomy or TKA
Dalury,D.F.; Jiranek,W.A.	1999	A comparison of the midvastus and paramedian approaches for total knee arthroplasty	not relevant to pico question. compares to TKA approaches

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Dalury,D.F.; Fisher,D.A.; Adams,M.J.; Gonzales,R.A.	2009	Unicompartmental knee arthroplasty compares favorably to total knee arthroplasty in the same patient	Not retrevable
El Amrani,M.H.; Levy,B.; Scharycki,S.; Asselineau,A.	2010	Patellar height relevance in opening-wedge high tibial osteotomy	Does not answer PICO question. uka is not compared to osteotomy or TKA
Emerson,Jr; Head,W.C.; Peters,Jr	1992	Soft tissue balance and alignment in medical unicompartmental knee arthroplasty	mobile v fixed bearing
Emerson,Jr	2005	Unicompartmental mobile-bearing knee arthroplasty	mobile v fixed bearing
Engh,G.A.; Parks,N.L.; Whitney,C.E.	2014	A Prospective Randomized Study of Bicompartmental vs. Total Knee Arthroplasty with Functional Testing and Short Term Outcome	not relevant comparison, compares bicompartment arthroplasty to total knee arthroplasty
Erak,S.; Naudie,D.; MacDonald,S.J.; McCalden,R.W.; Rorabeck,C.H.; Bourne,R.B.	2011	Total knee arthroplasty following medial opening wedge tibial osteotomy: technical issues early clinical radiological results	very low quality
Fisher,D.E.	1998	Proximal tibial osteotomy 1970-1995	retrospective review
Fu,D.; Li,G.; Chen,K.; Zhao,Y.; Hua,Y.; Cai,Z.	2013	Comparison of high tibial osteotomy and unicompartmental knee arthroplasty in the treatment of unicompartmental osteoarthritis: a meta-analysis (Provisional abstract)	meta-analysis
Fu,D.; Li,G.; Chen,K.; Zhao,Y.; Hua,Y.; Cai,Z.	2013	Comparison of high tibial osteotomy and unicompartmental knee arthroplasty in the treatment of unicompartmental osteoarthritis: a meta-analysis (Provisional abstract)	systematic review
Gandhi,R.; Ayeni,O.; Davey,J.R.; Mahomed,N.N.	2009	High tibial osteotomy compared with unicompartmental arthroplasty for the treatment of medial compartment osteoarthritis: a meta-analysis (Structured abstract)	meta-analysis
Gandhi,R.; Ayeni,O.; Davey,J.R.; Mahomed,N.N.	2009	High tibial osteotomy compared with unicompartmental arthroplasty for the treatment of medial compartment osteoarthritis: A meta-analysis	meta-analysis

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Gioe,T.J.; Killeen,K.K.; Hoeffel,D.P.; Bert,J.M.; Comfort,T.K.; Scheltema,K.; Mehle,S.; Grimm,K.	2003	Analysis of unicompartmental knee arthroplasty in a community-based implant registry	unclear all of the TKA patients had unicompartmental arthroplasty
Griffin,T.; Rowden,N.; Morgan,D.; Atkinson,R.; Woodruff,P.; Maddern,G.	2007	Unicompartmental knee arthroplasty for the treatment of unicompartmental osteoarthritis: a systematic study	Systematic review (reviewed bib search)
Gstottner,M.; Pedross,F.; Liebensteiner,M.; Bach,C.	2008	Long-term outcome after high tibial osteotomy	does not answer pico question. does not compare uka to osteotomy or tka
Ha'eri,G.B.; Wiley,A.M.	1980	High tibial osteotomy combined with joint debridement: a long-term study of results	does not compare osteotomy to uka
Hassaballa,M.A.; Porteous,A.J.; Newman,J.H.	2004	Observed kneeling ability after total, unicompartmental and patellofemoral knee arthroplasty: perception versus reality	not relevant
Hassaballa,M.A.; Porteous,A.J.; Learmonth,I.D.	2007	Functional outcomes after different types of knee arthroplasty: kneeling ability versus descending stairs	unvalidated outcomes
Haviv,B.; Bronak,S.; Thein,R.; Kidron,A.; Thein,R.	2012	Mid-term outcome of opening-wedge high tibial osteotomy for varus arthritic knees	Does not answer PICO question. uka is not compared to osteotomy or TKA
Hay,G.C.; Kampshoff,J.; Kuster,M.S.	2010	Lateral subvastus approach with osteotomy of the tibial tubercle for total knee replacement: a two-year prospective, randomised, blinded controlled trial	would not answer the pico question. compares subvastus arthroplasty combined with osteotomy to medial parapattellar arthroplasty. comparison could not prove the comparative effectiveness of arthroplasty or osteotomy, because both groups get arthroplasty
Heyse,T.J.; Reinhardt,K.; Tibesku,C.O.; Mayman,D.J.; Pearle,A.D.	2012	Different compartments, different operation: A comparison of the technique and indications for medial and lateral unicondylar knee arthroplasty	Systematic review

Authors	Year	Title	Reason for Exclusion
Hui,C.; Salmon,L.J.; Kok,A.; Williams,H.A.; Hockers,N.; van der Tempel,W.M.; Chana,R.; Pinczewski,L.A.	2011	Long-term survival of high tibial osteotomy for medial compartment osteoarthritis of the knee	Does not answer PICO question. uka is not compared to osteotomy or TKA
Isaac,S.M.; Barker,K.L.; Danial,I.N.; Beard,D.J.; Dodd,C.A.; Murray,D.W.	2007	Does arthroplasty type influence knee joint proprioception? A longitudinal prospective study comparing total and unicompartmental arthroplasty	very low quality
Ivarsson,I.; Gillquist,J.	1991	Rehabilitation after high tibial osteotomy and unicompartmental arthroplasty. A comparative study	very low quality
Jarvenpaa,J.; Kettunen,J.; Miettinen,H.; Kroger,H.	2010	The clinical outcome of revision knee replacement after unicompartmental knee arthroplasty versus primary total knee arthroplasty: 8-17 years follow-up study of 49 patients	primary v revision comparison
Johnson,T.C.; Tatman,P.J.; Mehle,S.; Gioe,T.J.	2012	Revision surgery for patellofemoral problems	not relevant compares TKA to bicompartmental arthroplasty
Karabatsos,B.; Mahomed,N.N.; Maistrelli,G.L.	2002	Functional outcome of total knee arthroplasty after high tibial osteotomy	TKA not primary (post HTO)
Karamitev,S.S.; Stavrev,V.P.; Chifligarov,A.G.	2014	Comparative analysis of the results obtained after unicondylar knee arthroplasty and high tibial osteotomy in isolated gonarthrosis	very low quality
Karpman,R.R.; Volz,R.G.	1982	Osteotomy versus unicompartmental prosthetic replacement in the treatment of unicompartmental arthritis of the knee	very low quality. study was retrospective and due to small numbers, no adjusment could be made for defferences in severiity level not all patients had knee OA
Kazakos,K.J.; Chatzipapas,C.; Verettas,D.; Galanis,V.; Xarchas,K.C.; Psillakis,I.	2008	Mid-term results of total knee arthroplasty after high tibial osteotomy	TKA not primary (post HTO)
Keblish,P.A.	1994	The case for unicompartmental knee arthroplasty	Systematic review

Authors	Year	Title	Reason for Exclusion
Keene,G.C.R.; Forster,M.C.	2005	(iii) Modern unicompartmental knee replacement	Systematic review
Khan,O.H.; Davies,H.; Newman,J.H.; Weale,A.E.	2004	Radiological changes ten years after St. Georg Sled unicompartmental knee replacement	does not compare uka to tka or osteotomy
Khanna,G.; Levy,B.A.	2007	Oxford unicompartmental knee replacement: literature review	Systematic review
Kroll,M.A.; Otis,J.C.; Sculco,T.P.; Lee,A.C.; Paget,S.A.; Bruckenstein,R.; Jensen,D.A.	1989	The relationship of stride characteristics to pain before and after total knee arthroplasty	does not compare tka to osteotomy or uka
Leonard,L.; Williamson,D.M.; Ivory,J.P.; Jennison,C.	2003	An Evaluation of the Safety and Efficacy of Simultaneous Bilateral Total Knee Arthroplasty	less than 90% had knee oa. also would likely be low quality evidence due to lack of adjustment for confounding
Li,C.S.; Bhandari,M.	2013	Cost-effectiveness of unicompartmental knee arthroplasty, high tibial osteotomy, and KineSpring(registered trademark) knee implant system for unicompartmental osteoarthritis of the knee	coste effectiveness review
Liddle,A.D.; Judge,A.; Pandit,H.; Murray,D.W.	2014	Adverse outcomes after total and unicompartmental knee replacement in 101 330 matched patients: a study of data from the National Joint Registry for England and Wales	unclear if all patients in tkr group had unicompartmental arthroplasty
Lyons,M.C.; MacDonald,S.J.; Somerville,L.E.; Naudie,D.D.; McCalden,R.W.	2011	Unicompartmental Versus Total Knee Arthroplasty Database Analysis: Is There a Winner?	very low strength of evidence
Lyons,M.C.; MacDonald,S.J.; Somerville,L.E.; Naudie,D.D.; McCalden,R.W.	2012	Unicompartmental versus total knee arthroplasty database analysis: is there a winner?	very low quality

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Madan,S.; Rushforth,G.F.	2002	Clinical effectiveness of high tibial osteotomy for osteoarthritis of the knee	Does not answer PICO question. uka is not compared to osteotomy or TKA
Madelaine,A.; Villa,V.; Yela,C.; Lording,T.; Lustig,S.; Servien,E.; Neyret,P.	2014	Results and complications of single-stage total knee arthroplasty and high tibial osteotomy	does not answer pico question. all patients recieve osteotomy and uka, and the procedures are not compared
Mallory,T.H.; Danyi,J.	1983	Unicompartmental total knee arthroplasty. A five- to nine-year follow-up study of 42 procedures	Does not answer PICO question. uka is not compared to osteotomy or TKA
Mancuso,F.; Hamilton,T.W.; Kumar,V.; Murray,D.W.; Pandit,H.	2014	Clinical outcome after UKA and HTO in ACL deficiency: a systematic review	systematic review
Matsuda,S.; Miura,H.; Nagamine,R.; Urabe,K.; Harimaya,K.; Matsunobu,T.; Iwamoto,Y.	1999	Changes in knee alignment after total knee arthroplasty	does not compare uka to tka or osteotomy
Matthews,D.J.; Hossain,F.S.; Patel,S.; Haddad,F.S.	2013	A Cohort Study Predicts Better Functional Outcomes and Equivalent Patient Satisfaction Following UKR Compared with TKR	very low quality
McAllister,C.M.	2008	The role of unicompartmental knee arthroplasty versus total knee arthroplasty in providing maximal performance and satisfaction	Systematic review
Mecs,L.; Sohar,G.; Gality,H.; Wellinger,K.; Toth,K.	2010	Long term follow-up of unicondylar arthroplasty	not full text. abstract only
Mintz,L.; Tsao,A.K.; McCrae,C.R.; Stulberg,S.D.; Wright,T.	1991	The arthroscopic evaluation and characteristics of severe polyethylene wear in total knee arthroplasty	does not compare tka to uka or osteotomy
Mizner,R.L.; Stevens,J.E.; Snyder-Mackler,L.	2003	Voluntary activation and decreased force production of the quadriceps femoris muscle after total knee arthroplasty	Does not answer PICO question. does not compare tka and unicompartimental ka
Mont,M.A.; Yoon,T.R.; Krackow,K.A.; Hungerford,D.S.	1999	Eliminating patellofemoral complications in total knee arthroplasty: clinical and radiographic results of 121 consecutive cases using the Duracon system	Does not answer PICO question. does not compare tka and unicompartimental ka

Authors	Year	Title	Reason for Exclusion
Morrey,B.F.	1989	Upper tibial osteotomy for secondary osteoarthritis of the knee	Does not answer PICO question. Osteotomy is not compared to unicompartmental arthroplasty
Morsi,E.; Habib,M.E.; Hadhoud,M.	2014	Comparison Between Results of High Tibial Osteotomy Above and Below Tibial Tubercle in Relation to Future Total Knee Arthroplasty	both groups get osteotomy
Myles,C.M.; Rowe,P.J.; Walker,C.R.; Nutton,R.W.	2002	Knee joint functional range of movement prior to and following total knee arthroplasty measured using flexible electrogoniometry	not relevant. compares knee oa patients to health patients'
Noticewala,M.S.; Geller,J.A.; Lee,J.H.; Macaulay,W.	2012	Unicompartmental knee arthroplasty relieves pain and improves function more than total knee arthroplasty	patients in the TKA group did not have unicompartmental OA
O'Donnell,T.; Neil,M.J.	2010	The Repicci II(R) unicondylar knee arthroplasty: 9-year survivorship and function	Does not answer PICO question. uka is not compared to osteotomy or TKA
Olin,M.D.; Vail,T.P.	2001	High tibial osteotomy: Will new techniques provide better results?	Systematic review
Pandit,H.; Jenkins,C.; Gill,H.S.; Barker,K.; Dodd,C.A.; Murray,D.W.	2011	Minimally invasive Oxford phase 3 unicompartmental knee replacement: results of 1000 cases	minimally invasive
Panni,A.S.; Vasso,M.; Cerciello,S.; Felici,A.	2012	Unicompartmental knee replacement provides early clinical and functional improvement stabilizing over time	Does not answer PICO question. uka is not compared to osteotomy or TKA
Partio,E.; Orava,T.; Lehto,M.U.; Lindholm,S.T.	1994	Survival of the Townley knee. 360 cases with 8 (0.1-15) years' follow-up	Does not answer PICO question. does not compare tka and unicompartimental ka
Pennington,D.W.; Swienckowski,J.J.; Lutes,W.B.; Drake,G.N.	2003	Unicompartmental knee arthroplasty in patients sixty years of age or younger	Does not answer PICO question. uka is not compared to osteotomy or TKA
Preston,C.F.; Fulkerson,E.W.; Meislin,R.; Di Cesare,P.E.	2005	Osteotomy about the knee: applications, techniques, and results	narrative review
Price,A.J.; Beard,D.; Jackson,W.; Svard,U.	2011	Minimum 20-year follow-up of the oxford mobile bearing unicompartmental knee arthroplasty	not full text. abstract only

Authors	Year	Title	Reason for Exclusion
Puddu,G.; Cerullo,G.; Cipolla,M.; Franco,V.; Gianni,E.; Panarella,L.	2007	Technique and Outcomes of Opening Wedge High Tibial Osteotomy	non-comparative
Repicci,J.A.	2003	Mini-invasive knee unicompartmental arthroplasty: bone-sparing technique	minimally invasive
Ritter,M.A.; Carr,K.; Keating,E.M.; Faris,P.M.; Meding,J.B.	1996	Tibial shaft fracture following tibial tubercle osteotomy	tibial tubercle not high tibial osteotomy
Robertsson,O.; Borgquist,L.; Knutson,K.; Lewold,S.; Lidgren,L.	1999	Use of unicompartmental instead of tricompartmental prostheses for unicompartmental arthrosis in the knee is a cost-effective alternative. 15,437 primary tricompartmental prostheses were compared with 10,624 primary medial or lateral unicompartmental prostheses	unclear if all patients have osteoarthritis
Robertsson,O.	2000	Unicompartmental arthroplasty. Results in Sweden 1986-1995	very low quality
Rodolfo,Masera F.; Bassani,A.; Rodolfo,Masera M.	2012	Painful unicompartmental knee prostheses: Wrong indication, wrong surgical technique or wrong implant choice?	not full text. abstract only
Roe,J.; Salmon,L.; Waller,A.; Scanelli,J.; Pinczewski,L.	2012	10 year outcome of high tibial osteotomy for medial compartment osteoarthritis of the knee	Does not answer PICO question. Osteotomy is not compared to unicompartmental arthroplasty
Rossi,R.; Bonasia,D.E.; Amendola,A.	2011	The role of high tibial osteotomy in the varus knee	narrative review
Saito,T.; Takeuchi,R.; Yamamoto,K.; Yoshida,T.; Koshino,T.	2003	Unicompartmental knee arthroplasty for osteoarthritis of the knee: remaining postoperative flexion contracture affecting overall results	does not compare uka to tka or osteotomy
Scott,R.D.	1990	Robert Brigham unicondylar knee surgical technique	narrative
Scott,R.D.	2003	Unicondylar arthroplasty: redefining itself	Commentary
Servien,E.; Aitsiselmi,T.; Neyret,P.; Verdonk,P.	2008	How to select candidates for lateral unicompartmental prosthesis	study design "personal experience..?"
Sessa,V.; Forconi,F.; Celentano,U.; Trovato,U.	2011	Mid-term outcomes of unicompartmental knee arthroplasty	not full text. abstract only

Authors	Year	Title	Reason for Exclusion
Sessa,V.; Celentano,U.; Trovato,U.	2012	Unicompartmental knee arthroplasty versus total knee arthroplasty in the same patient: A comparative study on 12 patients	not full text. abstract only
Soohoo,N.F.; Sharifi,H.; Kominski,G.; Lieberman,J.R.	2006	Cost-effectiveness analysis of unicompartmental knee arthroplasty as an alternative to total knee arthroplasty for unicompartmental osteoarthritis (Structured abstract)	
Spahn,G.; Hofmann,G.O.; von Engelhardt,L.V.; Li,M.; Neubauer,H.; Klinger,H.M.	2013	The impact of a high tibial valgus osteotomy and unicondylar medial arthroplasty on the treatment for knee osteoarthritis: a meta-analysis	meta-analysis
Stukenborg,Colsman C.; Wirth,C.J.; Lazovic,D.; Wefer,A.	2001	High tibial osteotomy versus unicompartmental joint replacement in unicompartmental knee joint osteoarthritis: 7-10-year follow-up prospective randomised study	repeat article
Tan,S.M.; Dutton,A.Q.; Bea,K.C.; Kumar,V.P.	2013	Bicompartmental versus total knee arthroplasty for medial and patellofemoral osteoarthritis	patients had bicompartmental oa and not unicompartmental
Tankersley,W.S.; Hungerford,D.S.	1995	Total knee arthroplasty in the very aged	not relevant. does not compare uka to tka or osteotomy
Vorlat,P.; Verdonk,R.; Schauvlieghe,H.	2000	The Oxford unicompartmental knee prosthesis: a 5-year follow-up	not relevant does not compare uka to tka or osteotomy
Waimann,C.A.; Fernandez-Mazarambroz,R.J.; Cantor,S.B.; Lopez-Olivo,M.; Zhang,H.; Landon,G.C.; Siff,S.J.	2011	Impact of slow recovery and poor functional outcomes on direct and indirect costs after total knee replacement in osteoarthritis patients	Abstract
Weale,A.E.; Newman,J.H.	1994	Unicompartmental arthroplasty and high tibial osteotomy for osteoarthrosis of the knee. A comparative study with a 12- to 17-year follow-up period	very low quality
Weale,A.E.; Murray,D.W.; Crawford,R.; Psychoyios,V.; Bonomo,A.; Howell,G.;	1999	Does arthritis progress in the retained compartments after 'Oxford' medial unicompartmental arthroplasty? A clinical and radiological study with a minimum ten-year follow-up	Does not answer PICO question. uka is not compared to osteotomy or TKA

Authors	Year	Title	Reason for Exclusion
O'Connor,J.; Goodfellow,J.W. Weale,A.E.; Halabi,O.A.; Jones,P.W.; White,S.H.	2001	Perceptions of outcomes after unicompartmental and total knee replacements	"perceptions" outcome measure
Webster,K.E.; Wittwer,J.E.; Feller,J.A.	2003	Quantitative gait analysis after medial unicompartmental knee arthroplasty for osteoarthritis	does not compare uka to tka or osteotomy
Winder,R.P.; Severson,E.P.; Trousdale,R.T.; Pagnano,M.W.; Wood-Wentz,C.M.; Sierra,R.J.	2014	No difference in 90-day complications between bilateral unicompartmental and total knee arthroplasty	unclear if all tka patients had oa
Wright,J.M.; Crockett,H.C.; Slawski,D.P.; Madsen,M.W.; Windsor,R.E.	2005	High tibial osteotomy	Systematic review (reviewed bib search)
Yang,K.Y.; Wang,M.C.; Yeo,S.J.; Lo,N.N.	2003	Minimally invasive unicondylar versus total condylar knee arthroplasty: early results of a matched-pair comparison (Structured abstract)	very low strength
Yang,K.Y.; Wang,M.C.; Yeo,S.J.; Lo,N.N.	2003	Minimally invasive unicondylar versus total condylar knee arthroplasty--early results of a matched-pair comparison	repeat
Yim,J.H.; Song,E.K.; Seo,H.Y.; Kim,M.S.; Seon,J.K.	2013	Comparison of high tibial osteotomy and unicompartmental knee arthroplasty at a minimum follow-up of 3 years	very low quality
Zhang,Q.; Guo,W.; Zhang,Q.; Sun,R.; Liu,Z.; Cheng,L.; Xia,Y.; Chen,G.; Ding,R.; Zhu,D.; Li,Z.	2010	Comparison of unicompartmental knee arthroplasty and total knee arthroplasty in the treatment of unicompartmental osteoarthritis: A meta-analysis	meta-analysis
Zhang,Q.; Guo,W.; Zhang,Q.; Sun,R.; Liu,Z.; Cheng,L.; Xia,Y.; Chen,G.; Ding,R.; Zhu,D.; Li,Z.	2010	Comparison of unicompartmental knee arthroplasty and total knee arthroplasty in the treatment of unicompartmental osteoarthritis: a meta-analysis (Structured abstract)	meta-analysis

Authors	Year	Title	Reason for Exclusion
Mont,M.A.; Mitzner,D.L.; Jones,L.C.; Hungerford,D.S.	1995	History of the contralateral knee after primary knee arthroplasty for osteoarthritis	retrospective review
Laurencin,C.T.; Zelicof,S.B.; Scott,R.D.; Ewald,F.C.	1991	Unicompartmental versus total knee arthroplasty in the same patient. A comparative study	unclear if the TKA operated knees were for unicompartmental arthroplasty
Spicer,D.D.; Curry,J.I.; Pomeroy,D.L.; Badenhausen,W.E.,Jr.; Schaper,L.A.; Suthers,K.E.; Smith,M.W.	2002	Range of motion after arthroplasty for the stiff osteoarthritic knee	not relevant. does not compare uka to tka or osteotomy
Thadani,P.J.; Spitzer,A.I.	2000	Primary total knee arthroplasty: Indications and long-term results	Systematic review
Ritter,M.A.; Worland,R.; Saliski,J.; Helphenstine,J.V.; Edmondson,K.L.; Keating,E.M.; Faris,P.M.; Meding,J.B.	1995	Flat-on-flat, nonconstrained, compression molded polyethylene total knee replacement	no comparisons relevant to pico questions
Heyse,T.J.; Khefacha,A.; Peersman,G.; Cartier,P.	2012	Survivorship of UKA in the middle-aged	very low quality
Fuzier,R.; Serres,I.; Bourrel,R.; Palmaro,A.; Montastruc,J.L.; Lapeyre-Mestre,M.	2014	Analgesic drug consumption increases after knee arthroplasty: a pharmacoepidemiological study investigating postoperative pain	unclear if all patients getting tka had unicompartmental oa
Berger,R.A.; Meneghini,R.M.; Jacobs,J.J.; Sheinkop,M.B.; Della Valle,C.J.; Rosenberg,A.G.; Galante,J.O.	2005	Results of unicompartmental knee arthroplasty at a minimum of ten years of follow-up	Does not answer PICO question. uka is not compared to osteotomy or TKA
Lecuire,F.; Fayard,J.-P.; Simottel,J.-C.; Charmion,L.; Edorh,G.	2008	Mid-term results of a new cementless hydroxyapatite coated anatomic unicompartmental knee arthroplasty	lack of a comparison group means this study can't answer any pico questions

Authors	Year	Title	Reason for Exclusion
Li,M.G.; Nilsson,K.G.	2000	The effect of the preoperative bone quality on the fixation of the tibial component in total knee arthroplasty	no patient oriented outcomes
O'Rourke,M.R.; Gardner,J.J.; Callaghan,J.J.; Liu,S.S.; Goetz,D.D.; Vittetoe,D.A.; Sullivan,P.M.; Johnston,R.C.	2005	The John Insall Award: unicompartmental knee replacement: a minimum twenty-one-year followup, end-result study	does not compare uka to tka or osteotomy
Petersen,M.M.; Nielsen,P.T.; Lauritzen,J.B.; Lund,B.	1995	Changes in bone mineral density of the proximal tibia after uncemented total knee arthroplasty. A 3-year follow-up of 25 knees	Does not answer PICO question. does not compare tka and unicompartimental ka
Therbo,M.; Petersen,M.M.; Varmarken,J.E.; Olsen,C.A.; Lund,B.	2003	Influence of pre-operative bone mineral content of the proximal tibia on revision rate after uncemented knee arthroplasty	very low quality
van Loon,C.J.; Wisse,M.A.; DE Waal Malefijt,M.C.; Jansen,R.H.; Veth,R.P.	2000	The kinematic total knee arthroplasty. A 10- to 15-year follow-up and survival analysis	Does not answer PICO question. does not compare tka and unicompartimental ka
Gioe,T.J.; Killeen,K.K.; Grimm,K.; Mehle,S.; Scheltema,K.	2004	Why are total knee replacements revised?: analysis of early revision in a community knee implant registry	it is unlikely that all of the TKA patients had unicompartmental arthritis
Emerson,R.H.,Jr.	2007	Preoperative and postoperative limb alignment after Oxford unicompartmental knee arthroplasty	does not compare uka to tka or osteotomy
Hutchinson,J.R.M.; Parish,E.N.; Cross,M.J.	2006	A comparison of bilateral uncemented total knee arthroplasty	very low quality due to preoperative demographic differences, and different lengths of follow up.not all patients had knee OA
Confalonieri,N.; Manzotti,A.	2005	Mini-invasive computer assisted bi-unicompartimental knee replacement	description of navigation technique
Manzotti,A.; Confalonieri,N.; Pullen,C.	2007	Unicompartmental versus computer-assisted total knee replacement for medial compartment knee arthritis: a matched paired study	very low quality

Authors	Year	Title	Reason for Exclusion
Abdel,M.P.; Parratte,S.; Blanc,G.; Ollivier,M.; Pomero,V.; Viehweger,E.; Argenson,J.N.	2014	No benefit of patient-specific instrumentation in TKA on functional and gait outcomes: a randomized clinical trial	unclear if all patients have osteoarthritis
Anderl,W.; Pauzenberger,L.; Kolblinger,R.; Kiesselbach,G.; Brandl,G.; Laky,B.; Kriegleder,B.; Heuberer,P.; Schwameis,E.	2014	Patient-specific instrumentation improved mechanical alignment, while early clinical outcome was comparable to conventional instrumentation in TKA	very low quality
Ast,M.P.; Nam,D.; Haas,S.B.	2012	Patient-specific instrumentation for total knee arthroplasty: a review	Systematic review?
Bali,K.; Walker,P.; Bruce,W.	2012	Custom-fit total knee arthroplasty: our initial experience in 32 knees	for data relevent to this pico question, there are less than 10 patients per group
Barrett,W.; Hoeffel,D.; Dalury,D.; Mason,J.B.; Murphy,J.; Himden,S.	2013	In-Vivo Alignment Comparing Patient Specific Instrumentation with both Conventional and Computer Assisted Surgery (CAS) Instrumentation in Total Knee Arthroplasty	not all patients had knee OA
Boyd,J.L.; Kurtenbach,C.A.; Sikka,R.S.	2014	Patient-Specific Instrumentation and Return to Activities After Unicondylar Knee Arthroplasty	Narrative review
Collins,M.J.	2014	The impact patient-specific instrumentation has had on my practice in the last 5 years	non quantitative data presented
Conteduca,F.; Iorio,R.; Mazza,D.; Caperna,L.; Bolle,G.; Argento,G.; Ferretti,A.	2013	Evaluation of the accuracy of a patient-specific instrumentation by navigation	unclear if all patients have osteoarthritis
Conteduca,F.; Iorio,R.; Mazza,D.; Ferretti,A.	2014	Patient-specific instruments in total knee arthroplasty	narrative review
DeHaan,A.M.; Adams,J.R.; DeHart,M.L.; Huff,T.W.	2014	Patient-specific versus conventional instrumentation for total knee arthroplasty: Peri-operative and cost differences	would be very low quality due being retrospective and due to having significant gender differences that were not adjusted for

Authors	Year	Title	Reason for Exclusion
Dossett,H.G.; Swartz,G.J.; Estrada,N.A.; LeFevre,G.W.; Kwasman,B.G.	2012	Kinematically versus mechanically aligned total knee arthroplasty	unclear if all patients have osteoarthritis
Ensini,A.; Timoncini,A.; Cenni,F.; Belvedere,C.; Fusai,F.; Leardini,A.; Giannini,S.	2014	Intra- and post-operative accuracy assessments of two different patient-specific instrumentation systems for total knee replacement	compares two type of patient specific instrumentation
Gerus,P.; Sartori,M.; Besier,T.F.; Fregly,B.J.; Delp,S.L.; Banks,S.A.; Pandy,M.G.; D'Lima,D.D.; Lloyd,D.G.	2013	Subject-specific knee joint geometry improves predictions of medial tibiofemoral contact forces	not relevant. biomechanical study
Karpman,R.R.; Smith,H.L.	2009	Comparison of the early results of minimally invasive vs standard approaches to total knee arthroplasty: a prospective, randomized study	not relevant. not about patient specific instrumentation
McAllister,C.M.; Stepanian,J.D.	2008	The Impact of Minimally Invasive Surgical Techniques on Early Range of Motion After Primary Total Knee Arthroplasty	not relevant. compares minimally invasive surgery to conventional surgery
Moopanar,T.R.; Amaranath,J.E.; Sorial,R.M.	2014	Component position alignment with patient-specific jigs in total knee arthroplasty	does not compare PSI to conventional instrumentation
Nam,D.; Maher,P.A.; Rebolledo,B.J.; Nawabi,D.H.; McLawhorn,A.S.; Pearle,A.D.	2013	Patient specific cutting guides versus an imageless, computer-assisted surgery system in total knee arthroplasty	unclear if 90% of patients had knee OA
Ng,V.Y.; DeClaire,J.H.; Berend,K.R.; Gulick,B.C.; Lombardi,A.V.,Jr.	2012	Improved accuracy of alignment with patient-specific positioning guides compared with manual instrumentation in TKA	unclear if all patients have osteoarthritis
Nunley,R.M.; Ellison,B.S.; Ruh,E.L.; Williams,B.M.; Foreman,K.; Ford,A.D.; Barrack,R.L.	2012	Are patient-specific cutting blocks cost-effective for total knee arthroplasty?	very low quality

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Nunley,R.M.; Ellison,B.S.; Zhu,J.; Ruh,E.L.; Howell,S.M.; Barrack,R.L.	2012	Do patient-specific guides improve coronal alignment in total knee arthroplasty?	no patient oriented outcomes
Sewell,M.D.; Al-Hadithy,N.; Hanna,S.A.; Al-Khateeb,H.; Carrington,R.W.; Blunn,G.W.; Skinner,J.A.; Briggs,T.W.	2012	Custom rotating-hinge total knee replacement in patients with spina bifida and severe neuromuscular dysfunction	n<10
Silva,A.; Sampaio,R.; Pinto,E.	2014	Patient-specific instrumentation improves tibial component rotation in TKA	no patient oriented outcomes
Stronach,B.M.; Pelt,C.E.; Erickson,J.; Peters,C.L.	2013	Patient-specific total knee arthroplasty required frequent surgeon-directed changes	very low quality
Katz,J.N.; Mahomed,N.N.; Baron,J.A.; Barrett,J.A.; Fossel,A.H.; Creel,A.H.; Wright,J.; Wright,E.A.; Losina,E.	2007	Association of hospital and surgeon procedure volume with patient-centered outcomes of total knee replacement in a population-based cohort of patients age 65 years and older	results are presented in a manner in which we can't tell if the results are caused by hospital or surgeon volume, making it unsuitable to answer this pico question
Losina,E.; Walensky,R.P.; Kessler,C.L.; Emrani,P.S.; Reichmann,W.M.; Wright,E.A.; Holt,H.L.; Solomon,D.H.; Yelin,E.; Paltiel,A.D.; Katz,J.N.	2009	Cost-effectiveness of total knee arthroplasty in the United States: parient risk and hospital volume (Provisional abstract)	cost effectiveness analysis
Pamilo,K.J.; Peltola,M.; Paloneva,J.; Makela,K.; Hakkinen,U.; Remes,V.	2014	Hospital volume affects outcome after total knee arthroplasty	very low quality
Peltola,M.; Malmivaara,A.; Paavola,M.	2012	Introducing a knee endoprosthesis model increases risk of early revision surgery	does not look at hospital knee arthroplasty volume, but rather experience with a new type of endoprosthesis
Zhang,Q.; Zhang,Q.; Guo,W.; Liu,Z.; Cheng,L.; Yue,D.; Zhang,N.	2014	The learning curve for minimally invasive Oxford phase 3 unicompartmental knee arthroplasty: cumulative summation test for learning curve (LC-CUSUM)	does not look at surgeon volume, but rather the learning curve of a new minimially invasive surgery performed by "an experienced knee surgeon"

Authors	Year	Title	Reason for Exclusion
Alnahdi,A.H.; Zeni,J.A.; Snyder-Mackler,L.	2012	The effect of progressive strengthening programs on function and gait mechanics after unilateral total knee arthroplasty: A randomized clinical trial	Not full text
Bade,M.J.; Stevens-Lapsley,J.E.	2012	Restoration of physical function in patients following total knee arthroplasty: an update on rehabilitation practices	Narrative review
Bedekar,N.; Prabhu,A.; Shyam,A.; Sancheti,K.; Sancheti,P.	2012	Comparative study of conventional therapy and additional yogasanas for knee rehabilitation after total knee arthroplasty	Very Low Quality. Outcomes are not validated.
Frost,H.; Lamb,S.E.; Robertson,S.	2002	A randomized controlled trial of exercise to improve mobility and function after elective knee arthroplasty. Feasibility, results and methodological difficulties	Differences in groups do not allow for meaningful comparison needed to answer PICO
Fung,V.; Ho,A.; Shaffer,J.; Chung,E.; Gomez,M.	2012	Use of Nintendo Wii Fit in the rehabilitation of outpatients following total knee replacement: a preliminary randomised controlled trial	Comparison groups not relevant
Giaquinto,S.; Ciotola,E.; Dall'Armi,V.; Margutti,F.	2010	Hydrotherapy after total knee arthroplasty. A follow-up study	Not common clinical practices and incomplete descriptions of interventions do not allow for a meaningful comparison. Groups receiving completely different interventions.
Harmer,A.R.; Naylor,J.M.; Crosbie,J.; Russell,T.	2009	Land-based versus water-based rehabilitation following total knee replacement: a randomized, single-blind trial	No outcomes we can extract. Poor reporting.
Hensman-Crook,A.	2011	The effectiveness of physiotherapy intervention with home exercise programme versus patient directed home exercise programme following total knee replacement	Not full text
Jakobsen,T.L.; Kehlet,H.; Husted,H.; Petersen,J.; Bandholm,T.	2014	Early progressive strength training to enhance recovery after fast-track total knee arthroplasty: a randomized controlled trial	Unclear if all patients are receiving TKA for OA.
Kauppila,A.M.; Sintonen,H.; Aronen,P.;	2011	Economic evaluation of multidisciplinary rehabilitation after primary total knee	Cost effectiveness study which is an extension of a previous study

Authors	Year	Title	Reason for Exclusion
Ohtonen,P.; Kyllonen,E.; Arokoski,J.P.		arthroplasty based on a randomized controlled trial	already makred for inclusion. No additional outcomes to extract.
Ko,V.; Naylor,J.; Harris,I.; Crosbie,J.; Yeo,A.; Mittal,R.	2013	One-to-One Therapy Is Not Superior to Group or Home-Based Therapy After Total Knee Arthroplasty: A Randomized, Superiority Trial	Does not state diagnosis. Not an OA paper.
Kramer,J.F.; Speechley,M.; Bourne,R.; Rorabeck,C.; Vaz,M.	2003	Comparison of clinic- and home-based rehabilitation programs after total knee arthroplasty	Compares similar interventions in different settings. Does not answer PICO question.
Li,J.; Wu,T.; Xu,Z.; Gu,X.	2014	A pilot study of post-total knee replacement gait rehabilitation using lower limbs robot-assisted training system	Does not reflect common clinical practice. Impractical equipment for clinical use.
Liao,C.D.; Lin,L.F.; Huang,Y.C.; Huang,S.W.; Chou,L.C.; Liou,T.H.	2014	Functional outcomes of outpatient balance training following total knee replacement in patients with knee osteoarthritis: A randomized controlled trial	Duplicate
Lowe,C.J.; Barker,K.L.; Holder,R.; Sackley,C.M.	2012	Comparison of postdischarge physiotherapy versus usual care following primary total knee arthroplasty for osteoarthritis: an exploratory pilot randomized clinical trial	Duplicate. Already included
Madsen,M.; Larsen,K.; Kirkegard,Madsen,I; Soe,H.; Hansen,T.B.	2013	Late group-based rehabilitation has no advantages compared with supervised home-exercises after total knee arthroplasty	Two completely different interventions compared, which does not allow for a meaningful comparison to answer the PICO question.
Meier,W.; Mizner,R.L.; Marcus,R.L.; Dibble,L.E.; Peters,C.; Lastayo,P.C.	2008	Total knee arthroplasty: muscle impairments, functional limitations, and recommended rehabilitation approaches	Systematic Review
Minns Lowe,C.J.; Barker,K.L.; Dewey,M.; Sackley,C.M.	2007	Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials	meta-analysis; saved for future reference (reviewed bib search)
Minns-Lowe,C.J.; Barker,K.L.; Dewey,M.; Sackley,C.M.	2007	Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials (Structured abstract)	Systematic review (reviewed bib search)

Authors	Year	Title	Reason for Exclusion
Naylor,J.M.; Crosbie,J.; Ko,V.	2014	Is there a role for rehabilitation streaming following total knee arthroplasty? Preliminary insights from a randomized controlled trial	Patient population does not meet inclusion criteria. Not
Neto,F.J.M.; Almeida,G.J.M.; Fitzgerald,G.K.; Piva,S.R.	2010	The effect of an exercise program in gait asymmetry in patients after total knee arthroplasty	Not full text article.
Petterson,S.C.; Mizner,R.L.; Stevens,J.E.; Raisis,L.; Bodenstab,A.; Newcomb,W.; Snyder-Mackler,L.	2009	Improved function from progressive strengthening interventions after total knee arthroplasty: a randomized clinical trial with an imbedded prospective cohort	See extended notes: no data for comparison of interest.
Piqueras,M.; Marco,E.; Coll,M.; Escalada,F.; Ballester,A.; Cinca,C.; Belmonte,R.; Muniesa,J.M.	2013	Effectiveness of an interactive virtual telerehabilitation system in patients after total knee arthoplasty: a randomized controlled trial	Patients getting TKA. Unclear and not stated whether it is OA patients.
Piva,S.R.; Gil,A.B.; Almeida,G.J.; DiGioia,A.M.,III; Levison,T.J.; Fitzgerald,G.K.	2010	A balance exercise program appears to improve function for patients with total knee arthroplasty: a randomized clinical trial	unclear if diagnosis is for OA
Piva,S.R.; Catelani,M.B.; Almeida,G.J.	2013	Comprehensive behavioral intervention compared to standard of care exercise program after total knee arthroplasty: A pilot randomized trial	Not full text.
Rahmann,A.E.; Brauer,S.G.; Nitz,J.C.	2009	A specific inpatient aquatic physiotherapy program improves strength after total hip or knee replacement surgery: a randomized controlled trial	Hip and knee
Rajan,R.A.; Pack,Y.; Jackson,H.; Gillies,C.; Asirvatham,R.	2004	No need for outpatient physiotherapy following total knee arthroplasty: a randomized trial of 120 patients	No stated diagnosis of knee OA
	2005	Physiotherapy rehabilitation after total knee or hip replacement: an evidence-based analysis	systematic review (reviewed bib search)
Russell,T.G.; Buttrum,P.; Wootton,R.; Jull,G.A.	2011	Internet-based outpatient telerehabilitation for patients following total knee arthroplasty: a randomized controlled trial	Does not state diagnosis. Not an OA paper.

Authors	Year	Title	Reason for Exclusion
Stevens,M.; Reininga,I.H.F.; Bulstra,S.K.; Wagenmakers,R.; van,den Akker-Scheek,I	2012	Physical Activity Participation Among Patients After Total Hip and Knee Arthroplasty	Systematic Review
Stevens-Lapsley,J.E.; Balter,J.E.; Wolfe,P.; Eckhoff,D.G.; Kohrt,W.M.	2012	Early neuromuscular electrical stimulation to improve quadriceps muscle strength after total knee arthroplasty: a randomized controlled trial	Not relevant to PICO. Does not answer question.
Szots,K.; Konradsen,H.; Solgaard,S.; Ostergaard,B.	2014	Telephone follow-up by nurse following total knee arthroplasty - protocol for a randomized clinical trial (NCT 01771315)	Not a completed study. Methodology only. No results.
Tousignant,M.; Moffet,H.; Boissy,P.; Corriveau,H.; Cabana,F.; Marquis,F.	2011	A randomized controlled trial of home telerehabilitation for post-knee arthroplasty	Does not meet required OA/RA cutoff.
Vuorenmaa,M.; Ylinen,J.; Piitulainen,K.; Salo,P.; Kautiainen,H.; Pesola,M.; Hakkinen,A.	2013	Efficacy of a 12-month, monitored home exercise programme compared with normal care commencing 2 months after total knee arthroplasty: A randomized controlled trial	Duplicate
Westby,M.; Kazemi,S.; Jones,D.	2014	Do exercise interventions for total knee arthroplasty have therapeutic validity? A sensitivity analysis of trials included in a cochrane systematic review	Not full text. Systematic review.
Abdallah,F.W.; Chan,V.W.; Gandhi,R.; Koshkin,A.; Abbas,S.; Brull,R.	2014	The Analgesic Effects of Proximal, Distal, or No Sciatic Nerve Block on Posterior Knee Pain after Total Knee Arthroplasty: A Double-blind Placebo-controlled Randomized Trial	Not relevant, does not answer pico question
Affas,F.; Stiller,C.-O.; Nygards,E.-B.; Stephanson,N.; Wretenberg,P.; Olofsson,C.	2012	A randomized study comparing plasma concentration of ropivacaine after local infiltration analgesia and femoral block in primary total knee arthroplasty	Not relevant, does not answer pico question
Al-Zahrani,T.; Doais,K.S.; Aljassir,F.; Alshaygy,I.; Albishi,W.; Terkawi,A.S.	2015	Randomized clinical trial of continuous femoral nerve block combined with sciatic nerve block versus epidural analgesia for unilateral total knee arthroplasty	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Andersen,H.L.; Gyrn,J.; Moller,L.; Christensen,B.; Zaric,D.	2013	Continuous saphenous nerve block as supplement to single-dose local infiltration analgesia for postoperative pain management after total knee arthroplasty	Not relevant, does not answer pico question
Andersen,L.O.; Husted,H.; Otte,K.S.; Kristensen,B.B.; Kehlet,H.	2008	A compression bandage improves local infiltration analgesia in total knee arthroplasty	Not relevant, does not answer pico question
Andersen,L.O.; Kehlet,H.	2014	Analgesic efficacy of local infiltration analgesia in hip and knee arthroplasty: a systematic review	Systematic review, bib search
Anker-Moller,E.; Spangsberg,N.; Dahl,J.B.; Christensen,E.F.; Schultz,P.; Carlsson,P.	1990	Continuous blockade of the lumbar plexus after knee surgery: a comparison of the plasma concentrations and analgesic effect of bupivacaine 0.250% and 0.125%	Not relevant, does not answer pico question
Baldini,A.; Aglietti,P.; Sensi,L.; Coppini,R.	2006	Efficacy of femoral nerve block in conjunction with epidural analgesia for total knee arthroplasty	Not relevant, does not answer pico question
Baranovic,S.; Maldini,B.; Milosevic,M.; Golubic,R.; Nikolic,T.	2011	Peripheral regional analgesia with femoral catheter versus intravenous patient controlled analgesia after total knee arthroplasty: a prospective randomized study	Not relevant, does not answer pico question
Barrington,M.J.; Olive,D.; Low,K.; Scott,D.A.; Brittain,J.; Choong,P.	2005	Continuous femoral nerve blockade or epidural analgesia after total knee replacement: a prospective randomized controlled trial	Not relevant; does not answer PICO question
Barrington,M.J.; Olive,D.J.; McCutcheon,C.A.; Scarff,C.; Said,S.; Kluger,R.; Gillett,N.; Choong,P.	2008	Stimulating catheters for continuous femoral nerve blockade after total knee arthroplasty: a randomized, controlled, double-blinded trial	Not relevant, does not answer pico question
Bergeron,S.G.; Kardash,K.J.; Huk,O.L.; Zukor,D.J.; Antoniou,J.	2009	Functional outcome of femoral versus obturator nerve block after total knee arthroplasty	Not relevant comprison
Bono,J.V.; Robbins,C.E.; Mehio,A.K.; Aghazadeh,M.; Talmo,C.T.	2012	Pharmacologic pain management before and after total joint replacement of the hip and knee	Narrative review

Authors	Year	Title	Reason for Exclusion
Borgwardt,L.; Zerahn,B.; Bliddal,H.; Christiansen,C.; Sylvest,J.; Borgwardt,A.	2009	Similar clinical outcome after unicompartmental knee arthroplasty using a conventional or accelerated care program: a randomized, controlled study of 40 patients	Not relevant, does not answer pico question
Brodner,G.; Buerkle,H.; Van,Aken H.; Lambert,R.; Schweppe-Hartenauer,M.L.; Wempe,C.; Gogarten,W.	2007	Postoperative analgesia after knee surgery: a comparison of three different concentrations of ropivacaine for continuous femoral nerve blockade	Not relevant, does not answer pico question
Bunburaphong,P.; Niruthisard,S.; Werawatganon,T.; Keeyapaj,W.; Vimuktanandana,A.; Toleb,K.	2006	Postoperative analgesia for total knee replacement: comparing between pre-and postoperative "3-in-1" femoral nerve block	Not relevant, does not answer pico question
Campbell,A.; McCormick,M.; McKinlay,K.; Scott,N.B.	2008	Epidural vs. lumbar plexus infusions following total knee arthroplasty: randomized controlled trial	Not relevant, does not answer pico question
Capdevila,X.; Barthelet,Y.; Biboulet,P.; Ryckwaert,Y.; Rubenovitch,J.; d'Athis,F.	1999	Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery	Not relevant, everyone did not get TKR
Chan,E.Y.; Fransen,M.; Sathappan,S.; Chua,N.H.; Chan,Y.H.; Chua,N.	2013	Comparing the analgesia effects of single-injection and continuous femoral nerve blocks with patient controlled analgesia after total knee arthroplasty	Not relevant, does not answer pico question
Chu,C.P.; Yap,J.C.; Chen,P.P.; Hung,H.H.	2006	Postoperative outcome in Chinese patients having primary total knee arthroplasty under general anaesthesia/intravenous patient-controlled analgesia compared to spinal-epidural anaesthesia/analgesia	Not relevant; does not answer PICO question
Daabiss,M.A.; Kandil,A.	2013	Evaluation of the effect of magnesium vs. midazolam as adjunct to epidural bupivacaine in patients undergoing total knee replacement	Not relevant, does not answer pico question
Dahl,J.B.; Daugaard,J.J.; Kristoffersen,E.; Johannsen,H.V.; Dahl,J.A.	1988	Perineuronal morphine: a comparison with epidural morphine	Less than 10 patients per group

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Dahl,J.B.; Daugaard,J.J.; Rasmussen,B.; Egebo,K.; Carlsson,P.; Kehlet,H.	1994	Immediate and prolonged effects of pre- versus postoperative epidural analgesia with bupivacaine and morphine on pain at rest and during mobilisation after total knee arthroplasty	Not relevant, does not answer pico question
Davies,A.F.; Segar,E.P.; Murdoch,J.; Wright,D.E.; Wilson,I.H.	2004	Epidural infusion or combined femoral and sciatic nerve blocks as perioperative analgesia for knee arthroplasty	Not relevant; does not answer PICO question
Desai,A.; Ramankutty,S.; Board,T.; Raut,V.	2009	Does intraarticular steroid infiltration increase the rate of infection in subsequent total knee replacements?	Not relevant, steroid injection study
Dobrydnjov,I.; Anderberg,C.; Olsson,C.; Shapurova,O.; Angel,K.; Bergman,S.	2011	Intraarticular vs. extraarticular ropivacaine infusion following high-dose local infiltration analgesia after total knee arthroplasty: a randomized double-blind study	Not relevant, Rheumatic patient population
Drakeford,M.K.; Pettine,K.A.; Brookshire,L.; Ebert,F.	1991	Spinal narcotics for postoperative analgesia in total joint arthroplasty. A prospective study	Not relevant, hip and knee combined
Eggers,K.A.; Jenkins,B.J.; Power,I.	1999	Effect of oral and i.v. tenoxicam in postoperative pain after total knee replacement	Not relevant patient population, RA and OA patients
El-Kerdawy,H.	2008	Analgesic requirements for patients undergoing lower extremity orthopedic surgery--the effect of combined spinal and epidural magnesium	Not relevant patient population
Eledjam,J.J.; Cuvillon,P.; Capdevila,X.; Macaire,P.; Serri,S.; Gaertner,E.; Jochum,D.	2002	Postoperative analgesia by femoral nerve block with ropivacaine 0.2% after major knee surgery: continuous versus patient-controlled techniques	Not relevant, does not answer pico question
Farid,I.S.; Heiner,E.J.; Fleissner,P.R.	2010	Comparison of femoral nerve block and fascia iliaca block for analgesia following reconstructive knee surgery in adolescents	Not relevant, does not answer pico question
Forster,J.G.; Lumme,H.M.; Palkama,V.J.; Rosenberg,P.H.; Pitkanen,M.T.	2008	Epinephrine 4 microg/mL added to a low-dose mixture of ropivacaine and fentanyl for lumbar epidural analgesia after total knee arthroplasty	Not relevant, does not answer pico question
Fowler,S.J.; Symons,J.; Sabato,S.; Myles,P.S.	2008	Epidural analgesia compared with peripheral nerve blockade after major knee surgery: a	

Authors	Year	Title	Reason for Exclusion
		systematic review and meta-analysis of randomized trials	
Gallelli,L.; Galasso,O.; Falcone,D.; Southworth,S.; Greco,M.; Ventura,V.; Romualdi,P.; Corigliano,A.; Terracciano,R.; Savino,R.; Gulletta,E.; Gasparini,G.; De,Sarro G.	2013	The effects of nonsteroidal anti-inflammatory drugs on clinical outcomes, synovial fluid cytokine concentration and signal transduction pathways in knee osteoarthritis. A randomized open label trial	Less than 10 patients per group
Gao,F.; Waters,B.; Seager,J.; Dowling,C.; Vickers,M.D.	1995	Comparison of bupivacaine plus buprenorphine with bupivacaine alone by caudal blockade for post-operative pain relief after hip and knee arthroplasty	Data includes both Hip and knee patients
Hartrick,C.T.; Martin,G.; Kantor,G.; Koncelik,J.; Manvelian,G.	2006	Evaluation of a single-dose, extended-release epidural morphine formulation for pain after knee arthroplasty	Not relevant; does not answer PICO question
Hassett,P.; Ansari,B.; Gnanamoorthy,P.; Kinirons,B.; Laffey,J.G.	2008	Determination of the efficacy and side-effect profile of lower doses of intrathecal morphine in patients undergoing total knee arthroplasty	Not relevant, does not answer pico question
Heid,F.; Muller,N.; Piepho,T.; Bares,M.; Giesa,M.; Drees,P.; Rumelin,A.; Werner,C.	2008	Postoperative analgesic efficacy of peripheral levobupivacaine and ropivacaine: a prospective, randomized double-blind trial in patients after total knee arthroplasty	Not relevant, Compares two anesthetics
Ho,S.T.; Wang,T.J.; Tang,J.S.; Liaw,W.J.; Ho,C.M.	2000	Pain relief after arthroscopic knee surgery: intravenous morphine, epidural morphine, and intra-articular morphine	Not relevant, does not answer pico question
Hogan,M.V.; Grant,R.E.; Lee,L.,Jr.	2009	Analgesia for total hip and knee arthroplasty: a review of lumbar plexus, femoral, and sciatic nerve blocks	Commentary
Huang,Y.S.; Lin,L.C.; Huh,B.K.; Sheen,M.J.; Yeh,C.C.; Wong,C.S.; Wu,C.T.	2007	Epidural clonidine for postoperative pain after total knee arthroplasty: a dose-response study	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Hunt,K.J.; Bourne,M.H.; Mariani,E.M.	2009	Single-injection femoral and sciatic nerve blocks for pain control after total knee arthroplasty	Not relevant, does not answer pico question
Ickowicz,D.E.; Golovanevski,L.; Haze,A.; Domb,A.J.; Weiniger,C.F.	2013	Extended Release Local Anesthetic Agents in a Postoperative Arthritic Pain Model	Not relevant, animal study
Iqbal,J.; Wig,J.; Bhardwaj,N.; Dhillon,M.S.	2000	Intra-articular clonidine vs. morphine for post-operative analgesia following arthroscopic knee surgery (a comparative evaluation)	Not relevant, does not answer pico question
Jaeger,P.; Zaric,D.; Fomsgaard,J.S.; Hilsted,K.L.; Bjerregaard,J.; Gyrn,J.; Mathiesen,O.; Larsen,T.K.; Dahl,J.B.	2013	Adductor canal block versus femoral nerve block for analgesia after total knee arthroplasty: a randomized, double-blind study	Not relevant, does not answer pico question
Kardash,K.; Hickey,D.; Tessler,M.J.; Payne,S.; Zukor,D.; Velly,A.M.	2007	Obturator versus femoral nerve block for analgesia after total knee arthroplasty	Not relevant; does not answer PICO question
Kehlet,H.; Andersen,L.O.	2011	Local infiltration analgesia in joint replacement: the evidence and recommendations for clinical practice	Review
Kim,M.K.; Nam,S.B.; Cho,M.J.; Shin,Y.S.	2007	Epidural naloxone reduces postoperative nausea and vomiting in patients receiving epidural sufentanil for postoperative analgesia	Not relevant, does not answer pico question
Koh,I.J.; Kang,Y.G.; Chang,C.B.; Song,J.; Jeon,Y.T.; Kim,T.K.	2012	Use of reduced-dose periarticular injection for pain management in simultaneous bilateral total knee arthroplasty	Not relevant, dose
Koyonos,L.; Yanke,A.B.; McNickle,A.G.; Kirk,S.S.; Kang,R.W.; Lewis,P.B.; Cole,B.J.	2009	A randomized, prospective, double-blind study to investigate the effectiveness of adding DepoMedrol to a local anesthetic injection in postmeniscectomy patients with osteoarthritis of the knee	Not relevant, Not a KA study
Krenzel,B.A.; Cook,C.; Martin,G.N.; Vail,T.P.; Attarian,D.E.; Bolognesi,M.P.	2009	Posterior capsular injections of ropivacaine during total knee arthroplasty: a randomized, double-blind, placebo-controlled study	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Lauretti,G.R.; Righeti,C.C.F.; Mattos,A.L.	2013	Intrathecal ketorolac enhances intrathecal morphine analgesia following total knee arthroplasty	
Lee,J.J.; Choi,S.S.; Lee,M.K.; Lim,B.G.; Hur,W.	2012	Effect of continuous psoas compartment block and intravenous patient controlled analgesia on postoperative pain control after total knee arthroplasty	Not relevant, does not answer pico question
Lewis,C.; Gunta,K.; Mitchell,K.; Bobay,K.	2012	Effectiveness of multimodal pain management protocol in total knee arthroplasty patients	Commentary
Ludot,H.; Berger,J.; Pichenot,V.; Belouadah,M.; Madi,K.; Malinovsky,J.M.	2008	Continuous peripheral nerve block for postoperative pain control at home: a prospective feasibility study in children	Not relevant, does not answer pico question
Maldini,B.; Miskulin,M.; Antolic,S.; Goranovic,T.; Sakic-Zdravcevic,K.; Gudelj,G.	2010	Local or spinal anesthesia in acute knee surgery	Not relevant; not a KA study
Mandal,S.; Basu,M.; Kirtania,J.; Sarbapalli,D.; Pal,R.; Kar,S.; Kundu,K.K.; Sarkar,U.; Gupta,S.D.	2011	Impact of general versus epidural anesthesia on early post-operative cognitive dysfunction following hip and knee surgery	Not relevant, hip and knee combined
Mannion,S.; O'Callaghan,S.; Walsh,M.; Murphy,D.B.; Shorten,G.D.	2005	In with the new, out with the old? Comparison of two approaches for psoas compartment block	Not relevant, does not answer pico question
Martin,F.; Martinez,V.; Mazoit,J.X.; Bouhassira,D.; Cherif,K.; Gentili,M.E.; Piriou,P.; Chauvin,M.; Fletcher,D.	2008	Antiinflammatory effect of peripheral nerve blocks after knee surgery: clinical and biologic evaluation	Not relevant comparison
McBeath,D.M.; Shah,J.; Sebastian,L.; Sledzinski,K.	1995	The effect of patient controlled analgesia and continuous epidural infusion on length of hospital stay after total knee or total hip replacement	Not relevant, hip and knee combined

Authors	Year	Title	Reason for Exclusion
Misiran,K.B.; Yahaya,L.S.	2013	The effectiveness of patient-controlled epidural analgesia with ropivacaine 0.165% with fentanyl 2.0 miroc g/ml or levobupivacaine 0.125% with fentanyl 2.0 micro g/ml as a method of postoperative analgesia after major orthopaedic surgery	Not relevant, does not answer pico question
Moiniche,S.; Hjortso,N.C.; Hansen,B.L.; Dahl,J.B.; Rosenberg,J.; Gebuhr,P.; Kehlet,H.	1994	The effect of balanced analgesia on early convalescence after major orthopaedic surgery	Not relevant patient population
Nader,A.; Kendall,M.C.; Wixson,R.L.; Chung,B.; Polakow,L.M.; McCarthy,R.J.	2012	A randomized trial of epidural analgesia followed by continuous femoral analgesia compared with oral opioid analgesia on short- and long-term functional recovery after total knee replacement	Not relevant, does not answer pico question
Nendick,M.	2000	Patient satisfaction with post-operative analgesia	Not relevant patient population
Ozen,M.; Inan,N.; Tumer,F.; Uyar,A.; Baltaci,B.	2006	The effect of 3-in-1 femoral nerve block with ropivacaine 0.375% on postoperative morphine consumption in elderly patients after total knee replacement surgery	Not relevant; does not answer PICO question
Paauwe,J.J.; Thomassen,B.J.; Weterings,J.; van,Rossum E.; Ausems,M.E.	2008	Femoral nerve block using ropivacaine 0.025%, 0.05% and 0.1%: effects on the rehabilitation programme following total knee arthroplasty: a pilot study	Not relevant, does not answer pico question
Paul,J.E.; Arya,A.; Hurlburt,L.; Cheng,J.; Thabane,L.; Tidy,A.; Murthy,Y.	2010	Femoral nerve block improves analgesia outcomes after total knee arthroplasty: a meta-analysis of randomized controlled trials	Not relevant, does not answer pico question
Pham,Dang C.; Gautheron,E.; Guilley,J.; Fernandez,M.; Waast,D.; Volteau,C.; Nguyen,J.M.; Pinaud,M.	2005	The value of adding sciatic block to continuous femoral block for analgesia after total knee replacement	Not relevant; does not answer PICO question
Raimer,C.; Priem,K.; Wiese,A.A.; Birnbaum,J.;	2007	Continuous psoas and sciatic block after knee arthroplasty: good effects compared to epidural	Not relevant; does not answer PICO question

Authors	Year	Title	Reason for Exclusion
Dirkmorfeld,L.M.; Mossner,A.; Matziolis,G.; Perka,C.; Volk,T.		analgesia or i.v. opioid analgesia: a prospective study of 63 patients	
Raj,P.P.; Knarr,D.C.; Vigdorth,E.; Denson,D.D.; Pither,C.E.; Hartrick,C.T.; Hopson,C.N.; Edstrom,H.H.	1987	Comparison of continuous epidural infusion of a local anesthetic and administration of systemic narcotics in the management of pain after total knee replacement surgery	Not relevant patient population
Ranawat,A.S.; Ranawat,C.S.	2007	Pain management and accelerated rehabilitation for total hip and total knee arthroplasty	Commentary
	0	ASRA 37th Annual Regional Anesthesia Meeting and Workshops	
Safa,B.; Gollish,J.; Haslam,L.; McCartney,C.J.	2014	Comparing the effects of single shot sciatic nerve block versus posterior capsule local anesthetic infiltration on analgesia and functional outcome after total knee arthroplasty: a prospective, randomized, double-blinded, controlled trial	Not relevant, does not answer pico question
Schmidt,N.R.; Donofrio,J.A.; England,D.A.; McDonald,L.B.; Motyka,C.L.; Mileto,L.A.	2009	Extended-release epidural morphine vs continuous peripheral nerve block for management of postoperative pain after orthopedic knee surgery: a retrospective study	Not relevant, does not answer pico question
Shanthanna,H.; Huilgol,M.; Manivackam,V.K.; Maniar,A.	2012	Comparative study of ultrasound-guided continuous femoral nerve blockade with continuous epidural analgesia for pain relief following total knee replacement	Not relevant, does not answer pico question
Shum,C.F.; Lo,N.N.; Yeo,S.J.; Yang,K.Y.; Chong,H.C.; Yeo,S.N.	2009	Continuous femoral nerve block in total knee arthroplasty: immediate and two-year outcomes	Not relevant, Comparison
Silvasti,M.; Pitkanen,M.	2001	Patient-controlled epidural analgesia versus continuous epidural analgesia after total knee arthroplasty	Not relevant, Comparison
Singelyn,F.J.; Gouverneur,J.M.	2000	Extended "three-in-one" block after total knee arthroplasty: continuous versus patient-controlled techniques	Not relevant patient population

Authors	Year	Title	Reason for Exclusion
Singh,J.A.; Mahowald,M.L.; Noorbaloochi,S.	2010	Intraarticular botulinum toxin A for refractory painful total knee arthroplasty: a randomized controlled trial	not intraoperative anesthetic
Sinha,S.K.; Abrams,J.H.; Arumugam,S.; D'Alessio,J.; Freitas,D.G.; Barnett,J.T.; Weller,R.S.	2012	Femoral nerve block with selective tibial nerve block provides effective analgesia without foot drop after total knee arthroplasty: a prospective, randomized, observer-blinded study	Not relevant, does not answer pico question
Sitsen,E.; van,Poorten F.; van,Alphen W.; Rose,L.; Dahan,A.; Stienstra,R.	2007	Postoperative epidural analgesia after total knee arthroplasty with sufentanil 1 microg/ml combined with ropivacaine 0.2%, ropivacaine 0.125%, or levobupivacaine 0.125%: a randomized, double-blind comparison	Not relevant, does not answer pico question
Smet,I.; Vlaminck,E.; Vercauteren,M.	2008	Randomized controlled trial of patient-controlled epidural analgesia after orthopaedic surgery with sufentanil and ropivacaine 0.165% or levobupivacaine 0.125%	Not relevant, hip and knee combined
Smith,T.W.; Binning,A.R.; Dahan,A.	2009	Efficacy and safety of morphine-6-glucuronide (M6G) for postoperative pain relief: a randomized, double-blind study	Not relevant, does not answer pico question
Smith-Miller,C.A.; Harlos,L.; Roszell,S.S.; Bechtel,G.A.	2009	A comparison of patient pain responses and medication regimens after hip/knee replacement	Retrospective case series
Spreng,U.J.; Andersson,E.; Dahl,V.	2012	Long-term outcome after total knee arthroplasty local infiltration analgesia (LIA) vs. Epidural analgesia	Abstract
Sundarathiti,P.; Ruananukul,N.; Channum,T.; Kitkunasathean,C.; Mantay,A.; Thammasakulsiri,J.; Sodsee,W.	2009	A comparison of continuous femoral nerve block (CFNB) and continuous epidural infusion (CEI) in postoperative analgesia and knee rehabilitation after total knee arthroplasty (TKA)	Not relevant, Comparison
Trueblood,A.; Manning,D.W.	2007	Analgesia following total knee arthroplasty	Commentary
Tugay,N.; Saricaoglu,F.; Satilmis,T.; Alpar,U.;	2006	Single-injection femoral nerve block. Effects on the independence level in functional	<10 patients per group

Authors	Year	Title	Reason for Exclusion
Akarcali,I.; Citaker,S.; Tugay,U.; Atilla,B.; Tokgozoglu,M.		activities in the early postoperative period in patients with total knee arthroplasty	
Watson,M.W.; Mitra,D.; McLintock,T.C.; Grant,S.A.	2005	Continuous versus single-injection lumbar plexus blocks: comparison of the effects on morphine use and early recovery after total knee arthroplasty	Not relevant; does not answer PICO question
Wei,J.; Lei,G.-H.; Gao,S.-G.; Zeng,C.; Qin,J.-B.; Kong,F.-J.; Yang,T.-B.	2014	Single-dose intra-Articular bupivacaine versus morphine after arthroscopic knee surgery: A meta-Analysis of randomized-controlled studies	
Wu,C.L.; Demeester,J.S.; Herbert,R.; Maine,D.N.; Rowlingson,A.J.; Fleisher,L.A.	2008	Correlation of postoperative epidural analgesia with morbidity and mortality following total knee replacement in Medicare patients	Not relevant, does not answer pico question
Xu,J.; Chen,X.M.; Ma,C.K.; Wang,X.R.	2014	Peripheral nerve blocks for postoperative pain after major knee surgery	
Yadeau,J.T.; Cahill,J.B.; Zawadsky,M.W.; Sharrock,N.E.; Bottner,F.; Morelli,C.M.; Kahn,R.L.; Sculco,T.P.	2005	The effects of femoral nerve blockade in conjunction with epidural analgesia after total knee arthroplasty	Not relevant; does not answer PICO question
Yeh,C.C.; Ho,S.T.; Kong,S.S.; Wu,C.T.; Wong,C.S.	2000	Absence of the preemptive analgesic effect of dextromethorphan in total knee replacement under epidural anesthesia	Not relevant, does not answer pico question
Zaric,D.; Boysen,K.; Christiansen,C.; Christiansen,J.; Stephensen,S.; Christensen,B.	2006	A comparison of epidural analgesia with combined continuous femoral-sciatic nerve blocks after total knee replacement	Not relevant; does not answer PICO question
Abernethy,P.J.; Robinson,C.M.; Fowler,R.M.	1996	Fracture of the metal tibial tray after Kinematic total knee replacement. A common cause of early aseptic failure	less than 90% of patients had knee OA
Bettinson,K.A.; Pinder,I.M.; Moran,C.G.; Weir,D.J.; Lingard,E.A.	2009	All-polyethylene compared with metal-backed tibial components in total knee arthroplasty at	less than 90% of patients had knee OA

Authors	Year	Title	Reason for Exclusion
		ten years. A prospective, randomized controlled trial	
Chaudhary,M.E.; Walker,P.S.	2014	Analysis of an early intervention tibial component for medial osteoarthritis	no patient oriented outcomes
Cheng,T.; Zhang,G.; Zhang,X.	2011	Metal-backed versus all-polyethylene tibial components in primary total knee arthroplasty	systematic review
De Carvalho,B.R.; Yassaie,O.S.; Muir,D.C.	2013	Modular versus all-polyethylene tibial components: comparison of pre- and early post-operative patient scores in total knee replacement	unclear if all patients have osteoarthritis
Engh,G.A.; Parks,N.L.; Ammeen,D.J.	1994	Tibial osteolysis in cementless total knee arthroplasty: A review of 25 cases treated with and without tibial component revision	very low quality
Forster,M.C.; Bauze,A.J.; Keene,G.C.	2007	Lateral unicompartmental knee replacement: fixed or mobile bearing?	very low quality
Gioe,T.J.; Sinner,P.; Mehle,S.; Ma,W.; Killeen,K.K.	2007	Excellent survival of all-polyethylene tibial components in a community joint registry	very low quality due to that the authors attempted to contact those lost to follow up in the poly group but not the metal backed group. revisions would be more under represented in the metal backed group than the poly group.
Gioe,T.J.; Stroemer,E.S.; Santos,E.R.	2007	All-polyethylene and metal-backed tibias have similar outcomes at 10 years: a randomized level I [corrected] evidence study	unclear if all patients have osteoarthritis
Gioe,T.J.; Glynn,J.; Sembrano,J.; Suthers,K.; Santos,E.R.; Singh,J.	2009	Mobile and fixed-bearing (all-polyethylene tibial component) total knee arthroplasty designs. A prospective randomized trial	does not adequately answer the pico question on polyethylene tibial components. compares a mobile bearing implant to a fixed polyethylene implant. unclear if observed effects are from the being a fixed bearing prosthesis, or polyethylene tibial components
Hyldahl,H.; Regner,L.; Carlsson,L.; Karrholm,J.; Weidenhielm,L.	2005	All-polyethylene vs. metal-backed tibial component in total knee arthroplasty-a randomized RSA study comparing early	unclear if all patients have osteoarthritis

Authors	Year	Title	Reason for Exclusion
		fixation of horizontally and completely cemented tibial components: part 1. Horizontally cemented components: AP better fixated than MB	
Hyldahl,H.; Regner,L.; Carlsson,L.; Karrholm,J.; Weidenhielm,L.	2005	All-polyethylene vs. metal-backed tibial component in total knee arthroplasty-a randomized RSA study comparing early fixation of horizontally and completely cemented tibial components: part 2. Completely cemented components: MB not superior to AP components	unclear if all patients have osteoarthritis
Lewis,P.; Rorabeck,C.H.; Bourne,R.B.; Devane,P.	1994	Posteromedial tibial polyethylene failure in total knee replacements	very low quality
Liu,T.K.; Liu,S.H.; Chang,C.H.; Yang,R.S.	1998	Concentration of metal elements in the blood and urine in the patients with cementless total knee arthroplasty	unclear if all patients have osteoarthritis
McCalden,R.W.; MacDonald,S.J.; Bourne,R.B.; Marr,J.T.	2009	A randomized controlled trial comparing "high-flex" vs "standard" posterior cruciate substituting polyethylene tibial inserts in total knee arthroplasty	compares to different cruciate substituting polyethylene devices
Meding,J.B.; Ritter,M.A.; Faris,P.M.	2001	Total knee arthroplasty with 4.4 mm of tibial polyethylene: 10-year followup	less than 90% of patients had knee OA
Mestha,P.; Shenava,Y.; d'Arcy,J.C.	2000	Fracture of the polyethylene tibial post in posterior stabilized (Insall Burstein II) total knee arthroplasty	Case report
Moro,T.; Takatori,Y.; Kyomoto,M.; Ishihara,K.; Saiga,K.; Nakamura,K.; Kawaguchi,H.	2010	Surface grafting of biocompatible phospholipid polymer MPC provides wear resistance of tibial polyethylene insert in artificial knee joints	unclear if all patients have osteoarthritis
Najibi,S.; Iorio,R.; Surdam,J.W.; Whang,W.; Appleby,D.; Healy,W.L.	2003	All-polyethylene and metal-backed tibial components in total knee arthroplasty: a matched pair analysis of functional outcome	very low quality
Oonishi,H.; Aono,M.; Murata,N.; Kushitani,S.	1992	Alumina versus polyethylene in total knee arthroplasty	very low strength
Regner,L.; Carlsson,L.; Karrholm,J.; Herberts,P.	1998	Ceramic coating improves tibial component fixation in total knee arthroplasty	doesn't answer pico questions. compares ceramic coating to no

Authors	Year	Title	Reason for Exclusion
			ceramic coating in uncemented tka's
Rodolfo,Masera F.	2011	Unicompartmental knee prostheses: Comparison between tibial All-Poly and metal-back. Personal experience	not full text. abstract only
Rodriguez,J.A.; Baez,N.; Rasquinha,V.; Ranawat,C.S.	2001	Metal-backed and all-polyethylene tibial components in total knee replacement	would be appraised as very low quality for being retrospective and not adjusting for baseline differences in gender
Sessa,V.; Celentano,U.; Ruggeri,A.; Rosa,M.A.	2012	Unicompartmental knee arthroplasty: all-polyethylene versus metal-backed in patient with medial osteoarthritis. A six-year follow-up study	not full text. abstract only
Shen,B.; Yang,J.; Zhou,Z.; Kang,P.; Wang,L.; Pei,F.	2009	Survivorship comparison of all-polyethylene and metal-backed tibial components in cruciate-substituting total knee arthroplasty-Chinese experience	less than 90% of patients had knee OA
Stilling,M.; Madsen,F.; Odgaard,A.; Romer,L.; Andersen,N.T.; Rahbek,O.; Soballe,K.	2011	Superior fixation of pegged trabecular metal over screw-fixed pegged porous titanium fiber mesh: a randomized clinical RSA study on cementless tibial components	doesn't answer pico question. does not compare metal to polyethylene tibial components
Swanson,A.B.; Swanson,G.D.; Powers,T.; Khalil,M.A.; Maupin,B.K.; Mayhew,D.E.; Moss,S.H.	1985	Unicompartmental and bicompartmental arthroplasty of the knee with a finned metal tibial-plateau implant	less than 90% of patients had knee OA
Thadani,P.J.; Vince,K.G.; Ortaaslan,S.G.; Blackburn,D.C.; Cudiamat,C.V.	2000	Ten- to 12-year followup of the Insall-Burstein I total knee prosthesis	doesn't answer pico question. does not compare metal to polyethylene tibial components
Udomkiat,P.; Dorr,L.D.; Long,W.	2001	Matched-pair analysis of all-polyethylene versus metal-backed tibial components	very low quality
Wasielewski,R.C.; Galante,J.O.; Leighty,R.M.; Natarajan,R.N.; Rosenberg,A.G.	1994	Wear patterns on retrieved polyethylene tibial inserts and their relationship to technical considerations during total knee arthroplasty	less than 90% OA

Authors	Year	Title	Reason for Exclusion
Weber,A.B.; Worland,R.L.; Keenan,J.; Van,Bowen J.	2002	A study of polyethylene and modularity issues in >1,000 posterior cruciate-retaining knees at 5 to 11 years	very low quality
Wright,T.M.; Rimnac,C.M.; Stulberg,S.D.; Mintz,L.; Tsao,A.K.; Klein,R.W.; McCrae,C.	1992	Wear of polyethylene in total joint replacements: Observations from retrieved PCA knee implants	very low quality
Besser,M.I.; Stahl,S.	1986	Arthroscopic surgery performed under local anesthesia as an outpatient procedure	Not relevant, does not answer pico question
Bigsby,E.; Madhusudana,K.	2009	To catheterise or not to catheterise: study in hip and knee primary arthroplasty	Not relevant, hip and knee combined
Buckenmaier,C.C.,III	2002	Anaesthesia for outpatient knee surgery	Commentary
Buvanendran,A.; Tuman,K.J.; McCoy,D.D.; Matusic,B.; Chelly,J.E.	2006	Anesthetic techniques for minimally invasive total knee arthroplasty	Commentary
Casati,A.; Cappelleri,G.; Fanelli,G.; Borghi,B.; Anelati,D.; Berti,M.; Torri,G.	2000	Regional anaesthesia for outpatient knee arthroscopy: a randomized clinical comparison of two different anaesthetic techniques	Not relevant, does not answer pico question
Casati,A.; Ostroff,R.; Casimiro,C.; Faluhelyi,A.; Medina,J.; Fanelli,G.	2008	72-hour epidural infusion of 0.125% levobupivacaine following total knee replacement: a prospective, randomized, controlled, multicenter evaluation	Not relevant, does not answer pico question
Chelly,J.E.; Greger,J.; Gebhard,R.; Coupe,K.; Clyburn,T.A.; Buckle,R.; Criswell,A.	2001	Continuous femoral blocks improve recovery and outcome of patients undergoing total knee arthroplasty	Not relevant, does not answer pico question
Chloropoulou,P.; Iatrou,C.; Vogiatzaki,T.; Kotsianidis,I.; Trypsianis,G.; Tsigalou,C.; Paschalidou,E.; Kazakos,K.; Touloupidis,S.; Simopoulos,K.	2013	Epidural anesthesia followed by epidural analgesia produces less inflammatory response than spinal anesthesia followed by intravenous morphine analgesia in patients with total knee arthroplasty	Not relevant, outcomes of interest

Authors	Year	Title	Reason for Exclusion
Choi,S.; Trang,A.; McCartney,C.J.	2013	Reporting functional outcome after knee arthroplasty and regional anesthesia: a methodological primer	systematic review?
Corbett,K.L.; Reichmann,W.M.; Katz,J.N.; Beagan,C.; Corsello,P.; Ghazinouri,R.; Dang,B.; Mikulinsky,R.; Losina,E.; Wright,J.	2010	One-Day vs Two-Day Epidural Analgesia for Total Knee Arthroplasty (TKA): A Retrospective Cohort Study	Retrospective case series
Dahl,M.R.; Dasta,J.F.; Zuelzer,W.; McSweeney,T.D.	1990	Lidocaine local anesthesia for arthroscopic knee surgery	Not relevant, does not answer pico question
DeWeese,F.T.; Akbari,Z.; Carline,E.	2001	Pain control after knee arthroplasty: intraarticular versus epidural anesthesia	Not relevant, outcomes of interest
Donatelli,F.; Vavassori,A.; Bonfanti,S.; Parrella,P.; Lorini,L.; Fumagalli,R.; Carli,F.	2007	Epidural anesthesia and analgesia decrease the postoperative incidence of insulin resistance in preoperative insulin-resistant subjects only	Not relevant, hip and knee combined
Dorr,L.D.; Raya,J.; Long,W.T.; Boutary,M.; Sirianni,L.E.	2008	Multimodal analgesia without parenteral narcotics for total knee arthroplasty	
Fairclough,J.A.; Graham,G.P.; Pemberton,D.	1990	Local or general anaesthetic in day case arthroscopy?	Not relevant, does not answer pico question
Flo,A.; Aliaga,L.	1998	Anaesthetic techniques for knee arthroscopy	Commentary
Forssblad,M.; Weidenhielm,L.	1999	Knee arthroscopy in local versus general anaesthesia. The incidence of rearthroscopy	not relevant; does not answer PICO question
Frassanito,L.; Vergari,A.; Zanghi,F.; Messina,A.; Bitondo,M.; Antonelli,M.	2010	Post-operative analgesia following total knee arthroplasty: Comparison of low-dose intrathecal morphine and single-shot ultrasound-guided femoral nerve block: A randomized, single blinded, controlled study	re post op analgesia
Gan,T.J.; Collis,R.; Hetreed,M.	1994	Double-blind comparison of ondansetron, droperidol and saline in the prevention of postoperative nausea and vomiting	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Gebhardt,V.; Monnard,M.; Weiss,C.; Schmittner,M.D.	2014	Discharge times for knee arthroscopy in spinal vs. general anesthesia	Not relevant, does not answer pico question
Gonano,C.; Leitgeb,U.; Sitzwohl,C.; Ihra,G.; Weinstabl,C.; Kettner,S.C.	2006	Spinal versus general anesthesia for orthopedic surgery: anesthesia drug and supply costs	
Green,R.J.; Chambers,J.; Thomas,P.W.; Monnery,L.; Titley,G.; Doyle,T.	2007	Comparison of the relative analgesic efficacies of epidural or intramuscular diamorphine following total knee arthroplasty	Not relevant, does not answer pico question
Halperin,N.; Axer,A.; Hirschberg,E.; Agasi,M.	1978	Arthroscopy of the knee under local anesthesia and controlled pressure-irrigation	Not relevant, does not answer pico question
Hedenstierna,G.; Lofstrom,J.	1985	Effect of anaesthesia on respiratory function after major lower extremity surgery. A comparison between bupivacaine spinal analgesia with low-dose morphine and general anaesthesia	Less than 10 patients per group
Hu,S.; Zhang,Z.Y.; Hua,Y.Q.; Li,J.; Cai,Z.D.	2009	A comparison of regional and general anaesthesia for total replacement of the hip or knee: a meta-analysis	Systematic review, bib search
Imbelloni,L.E.; Gouveia,M.A.; Cordeiro,J.A.	2009	Continuous spinal anesthesia versus combined spinal epidural block for major orthopedic surgery: prospective randomized study	Not relevant, hip and knee combined
Jacobson,E.; Forssblad,M.; Rosenberg,J.; Westman,L.; Weidenhielm,L.	2000	Can local anesthesia be recommended for routine use in elective knee arthroscopy? A comparison between local, spinal, and general anesthesia	Not relevant, does not answer pico question
Jaffer,A.K.; Barsoum,W.K.; Krebs,V.; Hurbanek,J.G.; Morra,N.; Brotman,D.J.	2005	Duration of anesthesia and venous thromboembolism after hip and knee arthroplasty	Not relevant, hip and knee combined
Jones,M.J.; Piggott,S.E.; Vaughan,R.S.; Bayer,A.J.; Newcombe,R.G.; Twining,T.C.; Pathy,J.; Rosen,M.	1990	Cognitive and functional competence after anaesthesia in patients aged over 60: controlled trial of general and regional anaesthesia for elective hip or knee replacement	Not relevant, hip and knee combined
Jones,R.E.T.	2011	Total Knee Arthroplasty Without the Use of a Tourniquet	Commentary

Authors	Year	Title	Reason for Exclusion
Joshi,G.P.; McCarroll,S.M.	1994	Evaluation of combined spinal-epidural anesthesia using two different techniques	Not relevant, does not answer pico question
Juelsgaard,P.; Larsen,U.T.; Sorensen,J.V.; Madsen,F.; Soballe,K.	2001	Hypotensive epidural anesthesia in total knee replacement without tourniquet: reduced blood loss and transfusion	Not relevant, does not answer pico question
Kang,S.; Jeon,S.; Choe,J.H.; Bang,S.R.; Lee,K.H.	2014	Comparison of analgesic effects of programmed intermittent epidural bolus and continuous epidural infusion after total knee arthroplasty	Commentary
Kaufmann,S.C.; Wu,C.L.; Pronovost,P.J.; Jermyn,R.M.; Fleisher,L.A.	2002	The association of intraoperative neuraxial anesthesia on anticipated admission to the intensive care unit	Not relevant, does not answer pico question; Outcome of interest
Kelley,T.C.; Adams,M.J.; Mulliken,B.D.; Dalury,D.F.	2013	Efficacy of multimodal perioperative analgesia protocol with periarticular medication injection in total knee arthroplasty: A randomized, double-blinded study	re local anesthetics
Kim,S.H.; Jeon,D.H.; Chang,C.H.; Lee,S.J.; Shin,Y.S.	2009	Spinal anesthesia with isobaric tetracaine in patients with previous lumbar spinal surgery	Not relevant, does not answer pico question
Kirkeby,O.J.; Aase,S.	1987	Knee arthroscopy and arthrotomy under local anesthesia	Not relevant, does not answer pico question
Kleinstuber,M.; Reed,D.	1985	Performing knee arthroscopy under local anesthesia	study about knee arthroscopy
Kordic,K.; Sakic,K.; Oberhofer,D.	2012	Analysis of blood pressure changes in patients undergoing total hip or knee replacement in spinal and general anesthesia	Not relevant, hip and knee combined
Krobbuaban,B.; Kumkeaw,S.; Pakdeesirivong,N.; Diregpoke,S.	2005	Comparison of postanesthetic complaints after general and spinal anesthesia in patients undergoing lower limb surgery	Not relevant, hip and knee combined
Kudoh,A.; Takase,H.; Takazawa,T.	2004	A comparison of anesthetic quality in propofol-spinal anesthesia and propofol-fentanyl anesthesia for total knee arthroplasty in elderly patients	Not relevant, does not answer pico question
Lunn,T.H.; Kristensen,B.B.;	2011	Effect of high-dose preoperative methylprednisolone on pain and recovery after	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Andersen,L.O.; Husted,H.; Otte,K.S.; Gaarn-Larsen,L.; Kehlet,H.		total knee arthroplasty: a randomized, placebo-controlled trial	
Mas,E.; Barden,A.E.; Corcoran,T.B.; Phillips,M.; Roberts,L.J.; Mori,T.A.	2011	Effects of spinal or general anesthesia on F(2)-isoprostanes and isofurans during ischemia/reperfusion of the leg in patients undergoing knee replacement surgery	Not relvant, outcome of interest
McGuire,D.A.; Frost,J.D.; Floerchinger,S.L.	1986	Local anesthesia and arthroscopic surgery of the knee	Not relevant, does not answer pico question
McQueen,D.A.; Kelly,H.K.; Wright,T.F.	1992	A comparison of epidural and non-epidural anesthesia and analgesia in total hip or knee arthroplasty patients	Data includes both Hip and knee patients
Memtsoudis,S.G.; Sun,X.; Chiu,Y.L.; Nurok,M.; Stundner,O.; Pastores,S.M.; Mazumdar,M.	2012	Utilization of critical care services among patients undergoing total hip and knee arthroplasty: epidemiology and risk factors	combines hip and knee arthroplasty
Murali,Krishna T.; Panda,N.B.; Batra,Y.K.; Rajeev,S.	2008	Combination of low doses of intrathecal ketamine and midazolam with bupivacaine improves postoperative analgesia in orthopaedic surgery	Not relevant patient population
Niemi,L.; Pitkanen,M.; Tuominen,M.; Bjorkenheim,J.M.; Rosenberg,P.H.	1994	Intraarticular morphine for pain relief after knee arthroscopy performed under regional anaesthesia	Not relevant, does not answer pico question
O'Donnell,B.D.; Iohom,G.	2008	Regional anesthesia techniques for ambulatory orthopedic surgery	Commentary
Ozkan,D.; Akkaya,T.; Yalcindag,A.; Hanci,T.; Gonen,E.; Gumus,H.; Delibas,N.	2013	Propofol sedation in total knee replacement - Effects on oxidative stress and ischemia-reperfusion damage	Not relevant, does not answer pico question
Patel,N.J.; Flashburg,M.H.; Paskin,S.; Grossman,R.	1986	A regional anesthetic technique compared to general anesthesia for outpatient knee arthroscopy	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Pati,A.B.; Perme,D.C.; Trail,M.; Henry,P.K.; Bryan,W.J.	1994	Rehabilitation parameters in total knee replacement patients undergoing epidural vs. conventional analgesia	Not relevant, analgesia
Perrin,S.B.; Purcell,A.N.	2009	Intraoperative ketamine may influence persistent pain following knee arthroplasty under combined general and spinal anaesthesia: a pilot study	Not relevant, does not answer pico question
Pumberger,M.; Memtsoudis,S.G.; Stundner,O.; Herzog,R.; Boettner,F.; Gausden,E.; Hughes,A.P.	2013	An analysis of the safety of epidural and spinal neuraxial anesthesia in more than 100,000 consecutive major lower extremity joint replacements	Not relevant, hip and knee combined
Rasmussen,L.S.; Schmehl,W.; Jakobsson,J.	2006	Comparison of xenon with propofol for supplementary general anaesthesia for knee replacement: a randomized study	Not relevant, does not answer pico question
Read,G.O.	1983	Local anaesthesia for diagnostic and operative arthroscopy of the knee	Not relevant, does not answer pico question
Reynvoet,M.; Dionys,J.; Vermaut,G.; Van,Aken H.	1990	Surgical analgesia for knee arthroscopy with epidural lignocaine and sufentanil--effect of varying sufentanil doses	Not relevant, does not answer pico question
Sargent,C.A.; Dunfee,M.T.	2005	Knee block anesthesia for arthroscopic procedures	Commentary
Shapiro,M.S.; Safran,M.R.; Crockett,H.; Finerman,G.A.	1995	Local anesthesia for knee arthroscopy. Efficacy and cost benefits	Not relevant, does not answer pico question
Sharrock,N.E.; Hargett,M.J.; Urquhart,B.; Peterson,M.G.; Ranawat,C.; Insall,J.; Windsor,R.	1993	Factors affecting deep vein thrombosis rate following total knee arthroplasty under epidural anesthesia	retrospective review
Singelyn,F.J.; Gouverneur,J.M.; Gribomont,B.F.	1991	Popliteal sciatic nerve block aided by a nerve stimulator: a reliable technique for foot and ankle surgery	Not relevant, does not answer pico question
Stiller,C.O.; Lundblad,H.; Weidenhielm,L.;	2007	The addition of tramadol to morphine via patient-controlled analgesia does not lead to	Not relevant, tramadol controlled study

Authors	Year	Title	Reason for Exclusion
Tullberg,T.; Grantinger,B.; Lafolie,P.; Jansson,K.A.		better post-operative pain relief after total knee arthroplasty	
Wahlen,B.M.; Kilian,M.; Schuster,F.; Muellenbach,R.; Roewer,N.; Kranke,P.	2008	Patient-controlled versus continuous anesthesiologist-controlled sedation using propofol during regional anesthesia in orthopedic procedures--a pilot study	Not relevant, hip and knee combined
Weston-Simons,J.S.; Pandit,H.; Haliker,V.; Dodd,C.A.; Popat,M.T.; Murray,D.W.	2012	Intra-articular local anaesthetic on the day after surgery improves pain and patient satisfaction after Unicompartmental Knee Replacement: a randomised controlled trial	re: day after surgery not during
Wylde,V.; Gooberman-Hill,R.; Horwood,J.; Beswick,A.; Noble,S.; Brookes,S.; Smith,A.J.; Pyke,M.; Dieppe,P.; Blom,A.W.	2011	The effect of local anaesthetic wound infiltration on chronic pain after lower limb joint replacement: a protocol for a double-blind randomised controlled trial	Protocol.
Yacobucci,G.N.; Bruce,R.; Conahan,T.J.; Kitz,D.S.; Torg,J.S.	1990	Arthroscopic surgery of the knee under local anesthesia	Not relevant, does not answer pico question
Yoshiya,S.; Kurosaka,M.; Hirohata,K.; Andrish,J.T.	1988	Knee arthroscopy using local anesthetic	Not relevant, does not answer pico question
Balderi,T.; Carli,F.	2010	Urinary retention after total hip and knee arthroplasty	
Bonicalzi,V.; Gallino,M.	1995	Comparison of two regional anesthetic techniques for knee arthroscopy	Not relevant, does not answer pico question
Goyal,N.; Parikh,A.; Austin,M.	2008	Pain Management After Total Joint Arthroplasty	Commentary
Kiss,H.; Raffl,M.; Neumann,D.; Hutter,J.; Dorn,U.	2005	Epinephrine-augmented hypotensive epidural anesthesia replaces tourniquet use in total knee replacement	Not relevant, use of tourniquet study
Albrecht,E.; Morfey,D.; Chan,V.; Gandhi,R.; Koshkin,A.; Chin,K.J.; Robinson,S.; Frascarolo,P.; Brull,R.	2014	Single-injection or continuous femoral nerve block for total knee arthroplasty?	not relevant control group

Authors	Year	Title	Reason for Exclusion
Andersen,L.O.; Husted,H.; Otte,K.S.; Kristensen,B.B.; Kehlet,H.	2008	High-volume infiltration analgesia in total knee arthroplasty: a randomized, double-blind, placebo-controlled trial	Less than 10 patients per group
Apan,A.; Sari,F.; Ekmekci,A.B.	2010	Single shot "3-in-1" femoral nerve blockade with 0.25% or 0.375% levobupivacaine provides similar postoperative analgesia for total knee replacement	Not relevant, does not answer pico question
Baddoo,H.	2009	A preliminary report on the use of peripheral nerve blocks for lower limb amputations	Not relevant, does not answer pico question
Bagry,H.; de la Cuadra Fontaine JC; Asenjo,J.F.; Bracco,D.; Carli,F.	2008	Effect of a continuous peripheral nerve block on the inflammatory response in knee arthroplasty	Less than 10 patients per group
Beaulieu,P.; Babin,D.; Hemmerling,T.	2006	The pharmacodynamics of ropivacaine and bupivacaine in combined sciatic and femoral nerve blocks for total knee arthroplasty	Not relevant, does not answer pico question
Cao,J.P.; Miao,X.Y.; Liu,J.; Shi,X.Y.	2011	An evaluation of intrathecal bupivacaine combined with intrathecal or intravenous clonidine in children undergoing orthopedic surgery: a randomized double-blinded study	Not relevant patient population
Cappelleri,G.; Ghisi,D.; Fanelli,A.; Albertin,A.; Somalvico,F.; Aldegheri,G.	2011	Does continuous sciatic nerve block improve postoperative analgesia and early rehabilitation after total knee arthroplasty? A prospective, randomized, double-blinded study	Not relevant, does not answer pico question
Chelly,J.E.; Schilling,D.	2008	Thromboprophylaxis and peripheral nerve blocks in patients undergoing joint arthroplasty	Not relevant, does not answer pico question
Choy,W.S.; Lee,S.K.; Kim,K.J.; Kam,B.S.; Yang,D.S.; Bae,K.W.	2011	Two continuous femoral nerve block strategies after TKA	Not relevant, does not answer pico question
Cook,P.; Stevens,J.; Gaudron,C.	2003	Comparing the effects of femoral nerve block versus femoral and sciatic nerve block on pain and opiate consumption after total knee arthroplasty	Not relevant, does not answer pico question
Danninger,T.; Opperer,M.; Memtsoudis,S.G.	2014	Perioperative pain control after total knee arthroplasty: An evidence based review of the role of peripheral nerve blocks	Review

Authors	Year	Title	Reason for Exclusion
de Lima E Souza; Correa,C.H.; Henriques,M.D.; de Oliveira,C.B.; Nunes,T.A.; Gomez,R.S.	2008	Single-injection femoral nerve block with 0.25% ropivacaine or 0.25% bupivacaine for postoperative analgesia after total knee replacement or anterior cruciate ligament reconstruction	Not relevant patient population
Dolan,J.; Williams,A.; Murney,E.; Smith,M.; Kenny,G.N.	2008	Ultrasound guided fascia iliaca block: a comparison with the loss of resistance technique	Not relevant, hip and knee combined
Hebl,J.R.; Kopp,S.L.; Ali,M.H.; Horlocker,T.T.; Dilger,J.A.; Lennon,R.L.; Williams,B.A.; Hanssen,A.D.; Pagnano,M.W.	2005	A comprehensive anesthesia protocol that emphasizes peripheral nerve blockade for total knee and total hip arthroplasty	KA data not reported
Hebl,J.R.; Dilger,J.A.; Byer,D.E.; Kopp,S.L.; Stevens,S.R.; Pagnano,M.W.; Hanssen,A.D.; Horlocker,T.T.	2008	A pre-emptive multimodal pathway featuring peripheral nerve block improves perioperative outcomes after major orthopedic surgery	Not relevant, hip and knee combined
Hirst,G.C.; Lang,S.A.; Dust,W.N.; Cassidy,J.D.; Yip,R.W.	1996	Femoral nerve block. Single injection versus continuous infusion for total knee arthroplasty	Not relevant, does not answer pico question
Ilfeld,B.M.; Le,L.T.; Meyer,R.S.; Mariano,E.R.; Vandenborne,K.; Duncan,P.W.; Sessler,D.I.; Enneking,F.K.; Shuster,J.J.; Theriaque,D.W.; Berry,L.F.; Spadoni,E.H.; Gearen,P.F.	2008	Ambulatory continuous femoral nerve blocks decrease time to discharge readiness after tricompartment total knee arthroplasty: a randomized, triple-masked, placebo-controlled study	Not relevant, does not answer pico question. Article about postoperative perineural ropivacaine
Ilfeld,B.M.; Meyer,R.S.; Le,L.T.; Mariano,E.R.; Williams,B.A.; Vandenborne,K.;	2009	Health-related quality of life after tricompartment knee arthroplasty with and without an extended-duration continuous femoral nerve block: a prospective, 1-year	Not relevant, osteoarthritis patients not specified in the study

Authors	Year	Title	Reason for Exclusion
Duncan,P.W.; Sessler,D.I.; Enneking,F.K.; Shuster,J.J.; Maldonado,R.C.; Gearen,P.F.		follow-up of a randomized, triple-masked, placebo-controlled study	
Jeon,Y.T.	2012	Peripheral nerve block for anesthesia in patients having knee arthroplasty	Commentary
Jochum,D.; O'Neill,T.; Jabbour,H.; Diarra,P.D.; Cuignet-Pourel,E.; Bouaziz,H.	2005	Evaluation of femoral nerve blockade following inguinal paravascular block of Winnie: are there still lessons to be learnt?	Case series, not best available evidence
Johnson,R.L.; Kopp,S.L.; Hebl,J.R.; Erwin,P.J.; Mantilla,C.B.	2013	Falls and major orthopaedic surgery with peripheral nerve blockade: a systematic review and meta-analysis	
Kandasami,M.; Kinninmonth,A.W.; Sarungi,M.; Baines,J.; Scott,N.B.	2009	Femoral nerve block for total knee replacement - a word of caution	Commentary
Klein,S.M.; Greengrass,R.A.; Grant,S.A.; Higgins,L.D.; Nielsen,K.C.; Steele,S.M.	2001	Ambulatory surgery for multi-ligament knee reconstruction with continuous dual catheter peripheral nerve blockade	Not relevant, does not answer pico question
Kramer,S.; Wenk,M.; Fischer,G.; Mollmann,M.; Popping,D.M.	2011	Continuous spinal anesthesia versus continuous femoral nerve block for elective total knee replacement	Not relevant, does not answer pico question
Leach,D.; Bonfe,M.	2009	The effectiveness of femoral/sciatic nerve blocks on postoperative pain management in total knee arthroplasty	Not relevant, does not answer pico question
Lee,A.R.; Choi,D.H.; Ko,J.S.; Choi,S.J.; Hahm,T.S.; Kim,G.H.; Moon,Y.H.	2011	Effect of combined single-injection femoral nerve block and patient-controlled epidural analgesia in patients undergoing total knee replacement	Not relevant, does not answer pico question
Luber,M.J.; Greengrass,R.; Vail,T.P.	2001	Patient satisfaction and effectiveness of lumbar plexus and sciatic nerve block for total knee arthroplasty	Case series, not best available evidence

Authors	Year	Title	Reason for Exclusion
Macalou,D.; Trueck,S.; Meuret,P.; Heck,M.; Vial,F.; Ouologuem,S.; Capdevila,X.; Virion,J.M.; Bouaziz,H.	2004	Postoperative analgesia after total knee replacement: the effect of an obturator nerve block added to the femoral 3-in-1 nerve block	
Marsan,A.; Kirdemir,P.; Mamo,D.; Casati,A.	2004	Prilocaine or mepivacaine for combined sciatic-femoral nerve block in patients receiving elective knee arthroscopy	Not relevant, does not answer pico question
McLeod,G.A.; Dale,J.; Robinson,D.; Checketts,M.; Columb,M.O.; Luck,J.; Wigderowitz,C.; Rowley,D.	2009	Determination of the EC50 of levobupivacaine for femoral and sciatic perineural infusion after total knee arthroplasty	Not relevant, does not answer pico question
McMeniman,T.J.; McMeniman,P.J.; Myers,P.T.; Hayes,D.A.; Cavdarski,A.; Wong,M.S.; Wilson,A.J.; Jones,M.A.; Watts,M.C.	2010	Femoral nerve block vs fascia iliaca block for total knee arthroplasty postoperative pain control: a prospective, randomized controlled trial	not relevant comparison
Motamed,C.; Combes,X.; Ndoko,S.K.; Dhonneur,G.	2009	Effect of pre-incisional continuous regional block on early and late postoperative conditions in tibial osteotomy and total knee arthroplasty	Not relevant, does not answer pico question
Navas,A.M.; Gutierrez,T.V.; Moreno,M.E.	2005	Continuous peripheral nerve blockade in lower extremity surgery	Commentary
Ng,H.P.; Cheong,K.F.; Lim,A.; Lim,J.; Puhaindran,M.E.	2001	Intraoperative single-shot "3-in-1" femoral nerve block with ropivacaine 0.25%, ropivacaine 0.5% or bupivacaine 0.25% provides comparable 48-hr analgesia after unilateral total knee replacement	Not relevant, does not answer pico question
Parvataneni,H.K.; Shah,V.P.; Howard,H.; Cole,N.; Ranawat,A.S.; Ranawat,C.S.	2007	Controlling Pain After Total Hip and Knee Arthroplasty Using a Multimodal Protocol With Local Periarticular Injections. A Prospective Randomized Study	not relevant comparison

Authors	Year	Title	Reason for Exclusion
Peduto,V.A.; Baroncini,S.; Montanini,S.; Proietti,R.; Rosignoli,L.; Tufano,R.; Casati,A.	2003	A prospective, randomized, double-blind comparison of epidural levobupivacaine 0.5% with epidural ropivacaine 0.75% for lower limb procedures	Not relevant, does not answer pico question
Pham,Dang C.; Difalco,C.; Guilley,J.; Venet,G.; Hauet,P.; Lejus,C.	2009	Various possible positions of conventional catheters around the femoral nerve revealed by neurostimulation	Not relevant, does not answer pico question
Raj,P.P.; Parks,R.I.; Watson,T.D.; Jenkins,M.T.	1975	A new single-position supine approach to sciatic-femoral nerve block	Commentary
Rajeev,S.; Batra,Y.K.; Panda,N.B.; Kumar,M.; Nagi,O.N.	2007	Combined continuous "3-in-1" and sciatic nerve blocks provide improved postoperative analgesia with no correlation to catheter tip location after unilateral total knee arthroplasty	Not relevant, does not answer pico question
Salinas,F.V.; Liu,S.S.; Mulroy,M.F.	2006	The effect of single-injection femoral nerve block versus continuous femoral nerve block after total knee arthroplasty on hospital length of stay and long-term functional recovery within an established clinical pathway	Not relevant, does not answer pico question
Sansone,V.; De,Ponti A.; Fanelli,G.; Agostoni,M.	1999	Combined sciatic and femoral nerve block for knee arthroscopy: 4 years' experience	Not relevant, does not answer pico question
Sato,K.; Adachi,T.; Shirai,N.; Naoi,N.	2014	Continuous versus single-injection sciatic nerve block added to continuous femoral nerve block for analgesia after total knee arthroplasty: A prospective, randomized, double-blind study	Not relevant, does not answer pico question
Schloss,B.; Bhalla,T.; Klingele,K.; Phillips,D.; Prestwich,B.; Tobias,J.D.	2014	A retrospective review of femoral nerve block for postoperative analgesia after knee surgery in the pediatric population	Not relevant, does not answer pico question
Siler,J.N.; Rosenberg,H.	1990	Lidocaine hydrochloride versus lidocaine bicarbonate for epidural anesthesia in outpatients undergoing arthroscopic surgery	Not relevant, does not answer pico question
Singelyn,E.J.	2006	Continuous peripheral nerve blocks and postoperative pain management	Commentary
Snoeck,M.M.; Vree,T.B.; Gielen,M.J.; Lagerwert,A.J.	2003	Steady state bupivacaine plasma concentrations and safety of a femoral "3-in-1" nerve block with bupivacaine in patients over 80 years of age	Not relevant, does not answer pico question

Authors	Year	Title	Reason for Exclusion
Spasiano,A.; Flore,I.; Pesamosca,A.; Della,Rocca G.	2007	Comparison between spinal anaesthesia and sciatic-femoral block for arthroscopic knee surgery	Not relevant, does not answer pico question
Sydor,D.; Engen,D.; VanDenKerkhof,E.G.; Orr,E.; Shore,D.; Jaeger,M.	2009	A randomized controlled trial comparing two doses of spinal bupivacaine for total knee arthroplasty and the impact on recovery time	Abstract
Tugay,N.; Saricaoglu,F.; Satilmis,T.; Alpar,U.; Akarcali,I.; Citaker,S.; Tugay,U.; Atilla,B.; Tokgozoglu,M.	2006	Effects on the independence level in functional activities in the early postoperative period in patients with total knee arthroplasty	Less than 10 patients per group
Turjanica,M.A.	2007	Postoperative continuous peripheral nerve blockade in the lower extremity total joint arthroplasty population	Commentary
Vanarase,M.Y.; Pandit,H.; Kimstra,Y.W.; Dodd,C.A.; Popat,M.T.	2007	Pain relief after knee replacement in patients with a bleeding disorder	Not relevant, does not answer pico question
Varitimidis,S.E.; Venouziou,A.I.; Dailiana,Z.H.; Christou,D.; Dimitroulias,A.; Malizos,K.N.	2009	Triple nerve block at the knee for foot and ankle surgery performed by the surgeon: difficulties and efficiency	Retrospective case series
Watts,S.A.; Sharma,D.J.	2007	Long-term neurological complications associated with surgery and peripheral nerve blockade: outcomes after 1065 consecutive blocks	Retrospective case series
Wegener,J.T.; van,Ooij B.; van Dijk,C.N.; Hollmann,M.W.; Preckel,B.; Stevens,M.F.	2011	Value of single-injection or continuous sciatic nerve block in addition to a continuous femoral nerve block in patients undergoing total knee arthroplasty: a prospective, randomized, controlled trial	Not relevant, does not answer pico question
Widmer,B.J.; Scholes,C.J.; Pattullo,G.G.; Oussedik,S.I.; Parker,D.A.; Coolican,M.R.	2012	Is femoral nerve block necessary during total knee arthroplasty?: a randomized controlled trial	not relevant control group

Authors	Year	Title	Reason for Exclusion
Harty,J.A.; Bourne,R.B.	2008	Peripheral Nerve Blocks: Optimal Method to Achieve a Painless Total Hip Arthroplasty-Opposes	Commentary
Alshryda,S.; Mason,J.; Vaghela,M.; Sarda,P.; Nargol,A.; Maheswaran,S.; Tulloch,C.; Anand,S.; Logishetty,R.; Stothart,B.; Hungin,A.P.S.	2013	Topical (intra-articular) tranexamic acid reduces blood loss and transfusion rates following total knee replacement: A randomized controlled trial (TRANX-K)	less than 90% OA
Bradshaw,A.R.; Monoghan,J.; Campbell,D.	2012	Oral tranexamic acid reduces blood loss in total knee replacement arthroplasty	does not answer pico question. tranexamic acid not administered topically or intravenously.
Charoencholvanich,K.; Siriwattanasakul,P.	2011	Tranexamic acid reduces blood loss and blood transfusion after TKA: a prospective randomized controlled trial	treatment group gets IV and Oral TXA
Cid,J.; Lozano,M.	2005	Tranexamic acid reduces allogeneic red cell transfusions in patients undergoing total knee arthroplasty: Results of a meta-analysis of randomized controlled trials	meta-analysis
Everts,P.A.; Devilee,R.J.; Oosterbos,C.J.; Mahoney,C.B.; Schattenkerk,M.E.; Knape,J.T.; van,Zundert A.	2007	Autologous platelet gel and fibrin sealant enhance the efficacy of total knee arthroplasty: improved range of motion, decreased length of stay and a reduced incidence of arthrofibrosis	not relevant. autologous platelet gel vs control
Gautam,V.K.; Sambandam,B.; Singh,S.; Gupta,P.; Gupta,R.; Maini,L.	2013	The role of tranexamic acid in reducing blood loss in total knee replacement	less than 90% of patients had knee OA
Huang,Z.; Ma,J.; Shen,B.; Pei,F.	2014	Combination of intravenous and topical application of tranexamic acid in primary total knee arthroplasty: A prospective randomized controlled trial	both groups get tranexamic acid
Iwai,T.; Tsuji,S.; Tomita,T.; Sugamoto,K.; Hideki,Y.; Hamada,M.	2013	Repeat-dose intravenous tranexamic acid further decreases blood loss in total knee arthroplasty	very low quality

Authors	Year	Title	Reason for Exclusion
Maniar,R.N.; Kumar,G.; Singhi,T.; Nayak,R.M.; Maniar,P.R.	2012	Most effective regimen of tranexamic acid in knee arthroplasty: A prospective randomized controlled study in 240 patients knee	all randomized groups get TXA
Orpen,N.M.; Little,C.; Walker,G.; Crawfurd,E.J.	2006	Tranexamic acid reduces early post-operative blood loss after total knee arthroplasty: a prospective randomised controlled trial of 29 patients	less than 90% of patients had knee OA
Sepah,Y.J.; Umer,M.; Ahmad,T.; Nasim,F.; Chaudhry,M.U.; Umar,M.	2011	Use of tranexamic acid is a cost effective method in preventing blood loss during and after total knee replacement	not best available evidence. multiple RCT's evaluate same outcomes
Simonsen,O.H.; Gorst-Rasmussen,A.; Simonsen,A.B.; Jorgensen,M.B.; Rathleff,M.S.; Lundbye-Christensen,S.	2011	Blood reinfusion combined with femoral nerve block in total knee replacement for patients with increased risk of bleeding	very low quality
Yang,Y.; Lv,Y.M.; Ding,P.J.; Li,J.; Ying-Ze,Z.	2014	The reduction in blood loss with intra-articular injection of tranexamic acid in unilateral total knee arthroplasty without operative drains: a randomized controlled trial	unclear if all patients had knee OA
Albrektsson,B.E.; Carlsson,L.V.; Freeman,M.A.; Herberts,P.; Ryd,L.	1992	Proximally cemented versus uncemented Freeman-Samuelson knee arthroplasty. A prospective randomised study	<10 oa patients per group
Attar,F.G.; Khaw,F.-M.; Kirk,L.M.G.; Gregg,P.J.	2008	Survivorship Analysis at 15 Years of Cemented Press-Fit Condylar Total Knee Arthroplasty	does not compare cemented and uncemented arthroplasty
Azboy,I.; Demirtas,A.; Bulut,M.; Ozturkmen,Y.; Sukur,E.; Caniklioglu,M.	2013	Long-term results of porous-coated cementless total knee arthroplasty with screw fixation	does not answer pico question. does not compare cementless and cemented arthroplasty
Bassett,R.W.	1998	Results of 1,000 Performance knees: cementless versus cemented fixation	less than 90% oak
Beaupre,L.A.; al-Yamani,M.; Huckell,J.R.; Johnston,D.W.	2007	Hydroxyapatite-coated tibial implants compared with cemented tibial fixation in primary total knee arthroplasty. A randomized trial of outcomes at five years	repeat of AAOS ID 13317

Authors	Year	Title	Reason for Exclusion
Beckmann,J.; Luring,C.; Springorum,R.; Kock,F.X.; Grifka,J.; Tingart,M.	2011	Fixation of revision TKA: a review of the literature	Systematic review
Brown,T.E.; Harper,B.L.; Bjorgul,K.	2013	Comparison of cemented and uncemented fixation in total knee arthroplasty	narrative review
Buechel,F.F.; Keblish,P.A.; Lee,J.M.; Pappas,M.J.	1994	Low contact stress meniscal bearing unicompartmental knee replacement: Long-term evaluation of cemented and cementless results	very low quality study due being retrospective, and because there was no attempt to measure or control for potential confounders
Chaudhry,S.; Dunlop,D.	2012	Bone cement in arthroplasty	systematic review?
Chockalingam,S.; Scott,G.	2000	The outcome of cemented vs. cementless fixation of a femoral component in total knee replacement (TKR) with the identification of radiological signs for the prediction of failure	less than 90% oa patients
Cloke,D.J.; Khatri,M.; Pinder,I.M.; McCaskie,A.W.; Lingard,E.A.	2008	284 press-fit Kinemax total knee arthroplasties followed for 10 years: poor survival of uncemented prostheses	less than 90% of patients had knee OA
Cohen,R.G.; Forrest,C.J.; Benjamin,J.B.	1997	Safety and efficacy of bilateral total knee arthroplasty	less than 90% of patients had knee OA
Dalen,T.; Nilsson,K.G.	2005	VersaBond bone cement: Prospective randomized study of the clinical properties of a new bone cement in total knee replacement	not relevant comparison. compares two types of bone cement
Diaz-Borjon,E.; Yamakado,K.; Pinilla,R.; Worland,R.L.	2004	Cement penetration using a tibial punch cement pressurizer in total knee arthroplasty	no patient oriented outcomes
Dodd,C.A.; Hungerford,D.S.; Krackow,K.A.	1990	Total knee arthroplasty fixation. Comparison of the early results of paired cemented versus uncemented porous coated anatomic knee prostheses	less than 90% of patients had knee OA
Duffy,G.P.; Berry,D.J.; Rand,J.A.	1998	Cement versus cementless fixation in total knee arthroplasty	unclear if 90% of patients had knee OA and would be appraised as very low quality due to being retrospetive and using different inclusion criteria for each treatment groups

Authors	Year	Title	Reason for Exclusion
Epinette,J.A.	2014	Long lasting outcome of hydroxyapatite-coated implants in primary knee arthroplasty: a continuous series of two hundred and seventy total knee arthroplasties at fifteen to twenty two years of clinical follow-up	does not compare uncemented and cemented arthroplasties
Forsythe,M.E.; Englund,R.E.; Leighton,R.K.	2000	Unicondylar knee arthroplasty: a cementless perspective	A case-series cross-sectional study
Gao,F.; Henricson,A.; Nilsson,K.G.	2009	Cemented versus uncemented fixation of the femoral component of the NexGen CR total knee replacement in patients younger than 60 years. A Prospective Randomised Controlled RSA Study	doesn't answer pico question. one group has the tibial component cemented and the other has the femoral component cemented. does not answer question as to whether cementing one or more components is better than no cementing or partial cementing.
Gioe,T.J.; Novak,C.; Sinner,P.; Ma,W.; Mehle,S.	2007	Knee arthroplasty in the young patient: survival in a community registry	very low quality due to being retrospective, and not being able to measure important covariates.
Graves,S.; Sedrakyan,A.; Baste,V.; Gioe,T.J.; Namba,R.; Cruz,O.M.; Stea,S.; Paxton,E.; Banerjee,S.; Isaacs,A.J.; Robertsson,O.	2014	International comparative evaluation of knee replacement with fixed or mobile-bearing posterior-stabilized prostheses	all patients got posterior stabilized implants
Gruber,G.; Schlechta,C.; Sturz,H.	1998	Ten-year follow-up of a bicondylar unlinked knee endoprosthesis with particular reference to mid-term results	less than 90%; also would likely be not best available evidence
Hartford,J.M.; Hunt,T.; Kaufer,H.	2001	Low contact stress mobile bearing total knee arthroplasty: results at 5 to 13 years	would be very low quality due to age differences between groups, and an average of 2.7 years difference in follow up
Helm,A.T.; Kerin,C.; Ghalayini,S.R.; McLauchlan,G.J.	2009	Preliminary results of an uncemented trabecular metal tibial component in total knee arthroplasty	does not compare cemented and uncemented arthroplasty

Authors	Year	Title	Reason for Exclusion
Hofmann,A.A.; Wyatt,R.W.B.; Beck,S.W.; Alpert,J.	1991	Cementless total knee arthroplasty in patients over 65 years old	review
Hofmann,A.A.	2010	The design principles of the Natural-Knee system	narrative review
Hooper,G.J.; Maxwell,A.R.; Wilkinson,B.; Mathew,J.; Woodfield,T.B.; Penny,I.D.; Burn,P.J.; Frampton,C.	2012	The early radiological results of the uncemented Oxford medial compartment knee replacement	does not compare cemented and uncemented arthroplasty
Huddleston,J.I.; Wiley,J.W.; Scott,R.D.	2005	Zone 4 femoral radiolucent lines in hybrid versus cemented total knee arthroplasties: are they clinically significant?	less than 90% of patients had knee OA
Kamath,A.F.; Lee,G.-C.; Sheth,N.P.; Nelson,C.L.; Garino,J.P.; Israelite,C.L.	2011	Prospective Results of Uncemented Tantalum Monoblock Tibia in Total Knee Arthroplasty. Minimum 5-Year Follow-up in Patients Younger Than 55 Years	very low quality due to pre-operative differences in knee society score and age that were not controlled for and because of potential conflict of interest
Keblish,P.	1991	Results and complications of the LCS (Low Contact Stress) knee system	very low quality
Kendrick,B.J.; Bottomley,N.J.; Gill,H.S.; Jackson,W.F.; Dodd,C.A.; Price,A.J.; Murray,D.W.	2012	A randomised controlled trial of cemented versus cementless fixation in oxford unicompartmental knee replacement in the treatment of medial gonarthrosis using radiostereometric analysis	not full text. abstract only
Kim,Y.H.	1990	The incidence of deep vein thrombosis after cementless and cemented knee replacement	very low quality
Knahr,K.; Salzer,M.; Schmidt,W.	1990	A radiological analysis of uncemented PCA tibial implants with a follow-up period of 4-7 years	not relevant. does not compare cemented to uncemented arthroplasty
Kolisek,F.R.; Mont,M.A.; Seyler,T.M.; Marker,D.R.; Jessup,N.M.; Siddiqui,J.A.; Monesmith,E.; Ulrich,S.D.	2009	Total knee arthroplasty using cementless keels and cemented tibial trays: 10-year results	does not compare cemented or hybrid versus uncemented ka

Authors	Year	Title	Reason for Exclusion
Laskin,R.S.	1988	Tricon-M uncemented total knee arthroplasty. A review of 96 knees followed for longer than 2 years	not relevant. does not compare cemented to uncemented arthroplasty
Lass,R.; Kubista,B.; Holinka,J.; Pfeiffer,M.; Schuller,S.; Stenicka,S.; Windhager,R.; Giurea,A.	2013	Comparison of cementless and hybrid cemented total knee arthroplasty	less than 90% of patients had knee OA
Liddle,A.D.; Pandit,H.; O'Brien,S.; Doran,E.; Penny,I.D.; Hooper,G.J.; Burn,P.J.; Dodd,C.A.; Beverland,D.E.; Maxwell,A.R.; Murray,D.W.	2013	Cementless fixation in Oxford unicompartmental knee replacement: a multicentre study of 1000 knees	very low quality
Lindstrand,A.; Stenstrom,A.; Egund,N.	1988	The PCA unicompartmental knee. A 1-4-year comparison of fixation with or without cement	very low quality
Lonner,J.H.; Klotz,M.; Levitz,C.; Lotke,P.A.	2001	Changes in bone density after cemented total knee arthroplasty: Influence of stem design	<10 patients per group
Lorentzen,J.S.; Petersen,M.M.; Brot,C.; Madsen,O.R.	1999	Early changes in muscle strength after total knee arthroplasty. A 6-month follow-up of 30 knees	does not compare cemented and uncemented arthroplasty
Mehlhoff,M.A.; Sledge,C.B.	1990	Comparison of cemented and cementless hip and knee replacements	systematic review?
Minoda,Y.; Kobayashi,A.; Iwaki,H.; Ikebuchi,M.; Inori,F.; Takaoka,K.	2010	Comparison of bone mineral density between porous tantalum and cemented tibial total knee arthroplasty components	no patient oriented outcomes
Mont,M.A.; Lee,C.W.; Sheldon,M.; Lennon,W.C.; Hungerford,D.S.	2002	Total knee arthroplasty in patients (less-than or equal to)50 years old	less than 90% of patients had knee OA
Moreland,J.R.; Thomas,R.J.; Freeman,M.A.	1979	ICLH replacement of the knee: 1977 and 1978	less than 90% of patients had knee OA
Mylod,A.G.,Jr.; France,M.P.; Muser,D.E.; Parsons,J.R.	1990	Perioperative blood loss associated with total knee arthroplasty. A comparison of procedures performed with and without cementing	< 10 patients per group in subgroup of patients with OA

Authors	Year	Title	Reason for Exclusion
Nakama,G.Y.; Peccin,M.S.; Almeida,G.J.; Lira Neto,Ode A.; Queiroz,A.A.; Navarro,R.D.	2012	Cemented, cementless or hybrid fixation options in total knee arthroplasty for osteoarthritis and other non-traumatic diseases	meta-analysis
Nielsen,P.T.; Hansen,E.B.; Rechnagel,K.	1992	Cementless total knee arthroplasty in unselected cases of osteoarthritis and rheumatoid arthritis. A 3-year follow-up study of 103 cases	does not compare cemented and uncemented arthroplasty
Nilsson,K.G.; Karrholm,J.; Ekelund,L.; Magnusson,P.	1991	Evaluation of micromotion in cemented vs uncemented knee arthroplasty in osteoarthrosis and rheumatoid arthritis. Randomized study using roentgen stereophotogrammetric analysis	not full text. abstract only
Nilsson,K.G.; Karrholm,J.; Linder,L.	1995	Femoral component migration in total knee arthroplasty: randomized study comparing cemented and uncemented fixation of the Miller-Galante I design	less than 90% of patients had knee OA
Nilsson,K.G.; Henricson,A.; Norgren,B.; Dalen,T.	2006	Uncemented HA-coated implant is the optimum fixation for TKA in the young patient	<90% OA patients
Ocguder,A.; Firat,A.; Tecimel,O.; Solak,S.; Bozkurt,M.	2010	Two-stage total infected knee arthroplasty treatment with articulating cement spacer	less than 90% of patients had knee OA
Onsten,I.; Nordqvist,A.; Carlsson,A.S.; Besjakov,J.; Shott,S.	1998	Hydroxyapatite augmentation of the porous coating improves fixation of tibial components	no patient oriented outcomes
Pecina,M.; Djapic,T.; Haspl,M.	2000	Survival of cementless and cemented porous-coated anatomic knee replacements: retrospective cohort study	less than 90% of patients had knee OA
Pelt,C.E.; Gililland,J.M.; Doble,J.; Stronach,B.M.; Peters,C.L.	2013	Hybrid total knee arthroplasty revisited: Midterm followup of hybrid versus cemented fixation in total knee arthroplasty	very low quality, downgraded for being retrospective, and potential selection bias due to surgeon using clinical criteria to allocate patients to hybrid or cemented fixation.

Authors	Year	Title	Reason for Exclusion
Pijls,B.G.; Valstar,E.R.; Kaptein,B.L.; Fiocco,M.; Nelissen,R.G.	2012	The beneficial effect of hydroxyapatite lasts: a randomized radiostereometric trial comparing hydroxyapatite-coated, uncoated, and cemented tibial components for up to 16 years	less than 90% of patients had knee OA
RegnÃ©r,L.R.; Carlsson,L.V.; KÃ¤rrholm,J.N.; Hansson,T.H.; Herberts,P.G.; Swanpalmer,J.	1999	Bone mineral and migratory patterns in uncemented total knee arthroplasties: a randomized 5-year follow-up study of 38 knees	no patient oriented outcomes
Regner,L.R.; Carlsson,L.V.; Karrholm,J.N.; Hansson,T.H.; Herberts,P.G.; Swanpalmer,J.	1999	Bone mineral and migratory patterns in uncemented total knee arthroplasties: a randomized 5-year follow-up study of 38 knees	no patient oriented outcomes
Reichen,A.; Ruegsegger,M.	2012	Five-year results of total knee arthroplasty with the Vario Knee System: a prospective analysis	very low quality
Ritter,M.A.	2008	20 Year follow-up of the AGC total knee replacement	Not retrevable
Rorabeck,C.H.; Bourne,R.B.; Lewis,P.L.; Nott,L.	1993	The Miller-Galante knee prosthesis for the treatment of osteoarthrosis. A comparison of the results of partial fixation with cement and fixation without any cement	very low quality
Rorabeck,C.H.	1999	Total knee replacement: should it be cemented or hybrid?	no patient oriented outcomes
Signorelli,J.J.; Bernini,P.M.; Shirreffs,T.G.	2011	Uncemented total knee arthroplasty: 2-year follow-up of 100 knees with a rotating platform, cruciate-retaining design	doesn't answer pico question because there is no comparison to cemented arthroplasty
Small,S.R.; Ritter,M.A.; Merchun,J.G.; Davis,K.E.; Rogge,R.D.	2013	Changes in tibial bone density measured from standard radiographs in cemented and uncemented total knee replacements after ten years' follow-up	no patient oriented outcomes
Specchiulli,F.; Gabrieli,R.; Borsetti,D.; Di,Carlo,V	2007	Midterm results of mobile-bearing knee replacements	does not compare cemented and uncemented arthroplasty

Authors	Year	Title	Reason for Exclusion
Stern,S.H.; Bowen,M.K.; Insall,J.N.; Scuderi,G.R.	1990	Cemented total knee arthroplasty for gonarthrosis in patients 55 years old or younger	does not compare cemented and uncemented arthroplasty
Toksvig-Larsen,S.; Ryd,L.; Lindstrand,A.	1998	Early inducible displacement of tibial components in total knee prostheses inserted with and without cement. A randomized study with roentgen stereophotogrammetric analysis	uses non patient oriented and composite outcomes
Uvehammer,J.; Karrholm,J.; Carlsson,L.	2007	Cemented versus hydroxyapatite fixation of the femoral component of the Freeman-Samuelson total knee replacement: a radiostereometric analysis	no patient oriiented outcomes
Volz,R.G.; Benjamin,J.B. Walker,P.S.;	1990	The current status of total joint replacement	Systematic review
Sathasivam,S.; Cobb,A.; Learmonth,I.D.; Grobler,G.P.; Pinder,I.M.; Marchetti,N.; Spinelli,M.D.; Welsby,A.	2000	A comparison between cemented, press-fit, and HA-coated interfaces in Kinemax total knee replacement	less than 90% of patients had knee OA
Yang,J.-H.; Yoon,J.-R.; Oh,C.-H.; Kim,T.-S.	2012	Hybrid component fixation in total knee arthroplasty. Minimum of 10-year follow-up study	all patients get hybrid arthroplasty
Cornell,C.N.; Ranawat,C.S.; Burstein,A.H.	1986	A clinical and radiographic analysis of loosening of total knee arthroplasty components using a bilateral model	Pico 7: doesnt compare cement to no cement. Pico 13: combines results for RA and OA for risk factor analysis
Cushner,F.D.; Friedman,R.J.	1991	Blood loss in total knee arthroplasty	very low quality
Hwang,S.C.; Kong,J.Y.; Nam,D.C.; Kim,D.H.; Park,H.B.; Jeong,S.T.; Cho,S.H.	2010	Revision total knee arthroplasty with a cemented posterior stabilized, condylar constrained or fully constrained prosthesis: a minimum 2-year follow-up analysis	does not compare cemented or hybrid versus uncemented ka
Font-Rodriguez,D.E.; Scuderi,G.R.; Insall,J.N.	1997	Survivorship of cemented total knee arthroplasty	less than 90% of patients had knee OA
Laskin,R.S.	1993	Total knee arthroplasty using an uncemented, polyethylene tibial implant. A seven-year follow-up study	does not compare cemented and uncemented arthroplasty

Authors	Year	Title	Reason for Exclusion
Adili,A.; Bhandari,M.; Petruccelli,D.; de,Beer J.	2001	Sequential bilateral total knee arthroplasty under 1 anesthetic in patients (greater-than or equal to)75 years old: Complications and functional outcomes	not all patients in the unilateral group had bilateral surgery, since the authors note that 33 right and 49 left knee surgeries were performed in this group
Alemparte,J.; Johnson,G.V.; Worland,R.L.; Jessup,D.E.; Keenan,J.	2002	Results of simultaneous bilateral total knee replacement: a study of 1208 knees in 604 patients	retrospective review
Alosh,H.; Shah,R.P.; Courtney,P.M.; Virk,S.; Israelite,C.L.	2014	One-week staged bilateral total knee arthroplasty protocol: a safety comparison of intended and completed surgeries	not relevant comparison. staged TKA patients compared to ptients who cancelled their second TKA surgery
Bagsby,D.; Pierson,J.L.	2015	Functional outcomes of simultaneous bilateral versus unilateral total knee arthroplasty	not all patient in the unilateral group had staged bilateral surgery
Bakirhan,S.; Angin,S.; Karatosun,V.; Unver,B.; Gunal,I.	2012	Physical performance parameters during standing up in patients with unilateral and bilateral total knee arthroplasty	Compares unilat & bilat but not staged/simult bilat
Benjamin,J.; Tucker,T.; Ballesteros,P.	2001	Is obesity a contraindication to bilateral total knee arthroplasties under one anesthetic?	not all patients had bilateral oa. patients who had simultaneous arthroplasty were compared to a unilateral group, but only some of the unilateral patients had multiple operations
Bini,S.A.; Khatod,M.; Inacio,M.C.S.; Paxton,E.W.	2014	Same-Day Versus Staged Bilateral Total Knee Arthroplasty Poses No Increase in Complications in 6672 Primary Procedures	Appraised as very low quality due to preoperative differences in BMI, ASA status, surgeon volume and age which were not controlled for in the analysis. not all patients had knee OA
Capeci,C.M.; Brown,E.C.,III; Scuderi,G.R.; Scott,W.N.	2006	Component asymmetry in simultaneous bilateral total knee arthroplasty	does not compare simultaneous to staged tka
Chan,W.C.; Musonda,P.; Cooper,A.S.;	2009	One-stage versus two-stage bilateral unicompartmental knee replacement: a	very low quality

Authors	Year	Title	Reason for Exclusion
Glasgow,M.M.; Donell,S.T.; Walton,N.P.		comparison of immediate post-operative complications	
Chen,J.Y.; Lo,N.N.; Jiang,L.; Chong,H.C.; Tay,D.K.; Chin,P.L.; Chia,S.L.; Yeo,S.J.	2013	Simultaneous versus staged bilateral unicompartmental knee replacement	very low quality
Courtney,P.M.; Melnic,C.M.; Alosh,H.; Shah,R.P.; Nelson,C.L.; Israelite,C.L.	2014	Is Bilateral Total Knee Arthroplasty Staged at a One-Week Interval Safe? A Matched Case Control Study	would be very low quality due to being retrospective, and for not adusting for preoperative differences in age ,bmi and comorbidities between the staged and simultaneous groups.
Dimitris,C.N.; Taylor,B.C.; Mowbray,J.G.; Steensen,R.N.; Gaines,S.T.	2011	Perioperative morbidity and mortality of 2-team simultaneous bilateral total knee arthroplasty	includes 7 RA subjects
Fajardo,M.; Collins,J.; Landa,J.; Adler,E.; Meere,P.; Di Cesare,P.E.	2011	Effect of a perioperative intra-articular injection on pain control and early range of motion following bilateral TKA	intervention is re: anesthetic
Gradillas,E.L.; Volz,R.G.	1979	Bilateral total knee replacement under one anesthetic	Compares unilat & bilat but not staged/simult bilat
Han,I.; Seong,S.C.; Lee,S.; Yoo,J.H.; Lee,M.C.	2008	Simultaneous bilateral MIS-TKA results in faster functional recovery	intervention abt minimal invasion
Hardaker,W.T.,Jr.; Ogden,W.S.; Musgrave,R.E.; Goldner,J.L.	1978	Simultaneous and staged bilateral total knee arthroplasty	very low quality rating due to different lengths of follow up between groups (i.e. difference of 8 months) and selective outcomes reporting. not all patients had knee OA. 38 % of the patients had RA and there were less than 10 OA patients in each treatment group
Hashmi,F.R.; Barlas,K.; Mann,C.F.; Howell,F.R.	2007	Staged bilateral hip or knee arthroplasties	unilat v bilat; includes hip arthroplasties
Husted,H.; Troelsen,A.; Otte,K.S.; Kristensen,B.B.; Holm,G.; Kehlet,H.	2011	Fast-track surgery for bilateral total knee replacement	appraised as very low quality due to not controlling for preoperative differences in age and knee

Authors	Year	Title	Reason for Exclusion
			extension. not all patients had knee OA
Hutchinson,J.R.; Parish,E.N.; Cross,M.J.	2006	A comparison of bilateral uncemented total knee arthroplasty: simultaneous or staged?	Study pop includes other diagnoses for TKA
Ishii,Y.; Noguchi,H.; Takeda,M.; Sato,J.; Toyabe,S.I.	2013	Time between the first and second operations for staged total knee arthroplasties when the interval is determined by the patient	case series
Jain,S.; Wasnik,S.; Mittal,A.; Sohoni,S.; Kasture,S.	2013	Simultaneous bilateral total knee replacement: a prospective study of 150 patients	case series
Jankiewicz,J.J.; Sculco,T.P.; Ranawat,C.S.; Behr,C.; Tarrentino,S.	1994	One-stage versus 2-stage bilateral total knee arthroplasty	less than 90% oak
Kilincoglu,V.; Unay,K.; Akan,K.; Esenkaya,I.; Poyanli,O.	2010	Component alignment in simultaneous bilateral or unilateral total knee arthroplasty	unclear if control group had operations on both knees.
Kim,S.; Meehan,J.P.; White,R.	2011	Operative risk of staged bilateral knee arthroplasty is underestimated in retrospective studies	Systematic review (reviewed bib search)
Kim,S.Y.; An,Y.J.; Kim,S.H.; Kim,H.K.; Park,J.S.; Shin,Y.S.	2011	The effect of postoperative pain on postoperative blood loss after sequential bilateral total knee arthroplasty	Intervention is neither simult nor staged
Kim,Y.-H.; Kim,J.-S.; Choi,Y.	2009	Osteolysis After Unidirectional and Multidirectional Mobile-Bearing Total Knee Arthroplasty in Young Patients	Intervention is type of prosthesis in simult bilat tka not simult v staged
Kim,Y.H.; Choi,Y.W.; Kim,J.S.	2009	Simultaneous bilateral sequential total knee replacement is as safe as unilateral total knee replacement	Compares unilat & bilat but not staged/simult bilat
Liu,T.K.; Chen,S.H.	1998	Simultaneous bilateral total knee arthroplasty in a single procedure	very low quality because allocation was based on clinical characteristics that would have resulted in differences in group demographics. potential confounders were not controlled for in the statistical analysis, resulting in very low quality

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			rating..not all patients had knee OA
Lombardi,A.V.; Mallory,T.H.; Fada,R.A.; Hartman,J.F.; Capps,S.G.; Kefauver,C.A.; Dodds,K.; Adams,J.B.	2001	Simultaneous bilateral total knee arthroplasties: Who decides?	only 5 patients had staged bilateral surgery
Mangaleshkar,S.R.; Prasad,P.S.; Chugh,S.; Thomas,A.P.	2001	Staged bilateral total knee replacement--a safer approach in older patients	unclear if 90% of patients had knee OA
Mantilla,C.B.; Horlocker,T.T.; Schroeder,D.R.; Berry,D.J.; Brown,D.L.	2003	Risk factors for clinically relevant pulmonary embolism and deep venous thrombosis in patients undergoing primary hip or knee arthroplasty	combines hip and knee arthroplast
March,L.M.; Cross,M.; Tribe,K.L.; Lapsley,H.M.; Courtenay,B.G.; Cross,M.J.; Brooks,P.M.; Cass,C.; Coolican,M.; Neil,M.; Pinczewski,L.; Quain,S.; Robertson,F.; Ruff,S.; Walter,W.; Zicat,B.	2004	Two knees or not two knees? Patient costs and outcomes following bilateral and unilateral total knee joint replacement surgery for OA	Compares unilat & bilat but not staged/simult bilat
McLaughlin,T.P.; Fisher,R.L.	1985	Bilateral total knee arthroplasties. Comparison of simultaneous (two-team), sequential, and staged knee replacements	very low quality due to being retrospective, and not adjusting for potential confounders in the analysis. .not all patients had knee OA
Miniaci,A.; Arneja,S.; Jones,M.	2011	Mid term clinical results of a novel knee resurfacing arthroplasty for focal medial compartment	n=5 for interventions of interest
Murray,A.; Brenkel,I.	2003	Bilateral total knee replacement	systematic review?
Parvizi,J.; Rasouli,M.R.	2012	Simultaneous-bilateral TKA: double trouble - affirms	Systematic review

Authors	Year	Title	Reason for Exclusion
Ritter,M.; Mamlin,L.A.; Melfi,C.A.; Katz,B.P.; Freund,D.A.; Arthur,D.S.	1997	Outcome implications for the timing of bilateral total knee arthroplasties	less than 90% oak. and would likely be very low quality due to not adjusting for potential confounding
Ritter,M.A.	1998	Simultaneous knee replacement is better for the patient	systematic review?
Rossi,M.D.; Brown,L.E.; Whitehurst,M.	2006	Knee extensor and flexor torque characteristics before and after unilateral total knee arthroplasty	Neither simult nor staged bilat TKA intervention
Sculco,T.P.; Sculco,P.K.	2012	Simultaneous-bilateral TKA: double trouble - opposes	Systematic review
Severson,E.P.; Mariani,E.M.; Bourne,M.H.	2009	Bilateral total knee arthroplasty in patients 70 years and older	does not answer the pico question. the unilateral groups did not have contralateral surgery.
Shah,K.; Smith,J.; Jones,B.; Hullin,M.	2007	Bilateral total knee replacement under a single anaesthetic, using a cementless implant is not unsafe	not all patients in control group had bilateral knee arthroplasty
Sliva,C.D.; Callaghan,J.J.; Goetz,D.D.; Taylor,S.G.	2005	Staggered bilateral total knee arthroplasty performed four to seven days apart during a single hospitalization	very low quality
Solak,A.S.; Kentel,B.; Ates,Y.	2005	Does bilateral total knee arthroplasty affect gait in women?: comparison of gait analyses before and after total knee arthroplasty compared with normal knees	does not compare simultaneous to staged tka
Song,E.K.; Seon,J.K.; Park,S.J.; Jung,W.B.; Park,H.W.; Lee,G.W.	2011	Simultaneous bilateral total knee arthroplasty with robotic and conventional techniques: a prospective, randomized study	does not compare simultaneous to staged tka
Soudry,M.; Binazzi,R.; Insall,J.N.; Nordstrom,T.J.; Pellicci,P.M.; Goulet,J.A.	1985	Successive bilateral total knee replacement	very low quality due confounding by indication. patients deemed too unhealthy to undergo anesthesia multiple times were given simultaneous surgery. there was no contol for this confounding factor. and not all patients have oa

Authors	Year	Title	Reason for Exclusion
Spicer,E.; Thomas,G.R.; Rumble,E.J.	2013	Comparison of the major intraoperative and postoperative complications between unilateral and sequential bilateral total knee arthroplasty in a high-volume community hospital	not all patients had bilateral oa knee
Stefansdottir,A.; Lidgren,L.; Robertsson,O.	2008	Higher early mortality with simultaneous rather than staged bilateral TKAs: results from the Swedish Knee Arthroplasty Register	unclear if all patients had bilateral arthroplasty. the author make the assumption that all patients in the registry who had another arthroplasty within the next hear had bilateral symptoms at baseline.
Walmsley,P.; Murray,A.; Brenkel,I.J.	2006	The practice of bilateral, simultaneous total knee replacement in Scotland over the last decade. Data from the Scottish Arthroplasty Project	uncelar if all patients in registry have osteoarthritis
Wohlrab,D.; HÃ¤dicke,E.; Radetzki,F.; Vasarhelyi,A.; Mendel,T.; Zeh,A.	2011	[Results of single stage vs. two-stage total knee arthroplasty]	foreign language
Zeni,J.A.,Jr.; Snyder-Mackler,L.	2010	Clinical outcomes after simultaneous bilateral total knee arthroplasty: comparison to unilateral total knee arthroplasty and healthy controls	simult compared to unilat not staged
Madsen,A.A.; Taylor,B.C.; Dimitris,C.; Hansen,D.C.; Steensen,R.A.; Gaines,S.T.	2014	Safety of bilateral total knee arthroplasty in morbidly obese patients	unclear if all patients had knee OA
Schairer,W.W.; Vail,T.P.; Bozic,K.J.	2014	What are the rates and causes of hospital readmission after total knee arthroplasty? Knee	unclear if all patients had knee OA
Seon,J.K.; Song,E.K.; Yoon,T.R.; Park,S.J.; Bae,B.H.; Cho,S.G.	2007	Comparison of functional results with navigation-assisted minimally invasive and conventional techniques in bilateral total knee arthroplasty	not relevant comparison. both patient groups get simultaneous tka.
BÃ¤this,H.; Perlick,L.; Tingart,M.; LÃ¼ring,C.; Grifka,J.	2004	CT-free computer-assisted total knee arthroplasty versus the conventional technique: radiographic results of 100 cases	no patient oriented outcomes
Bar,M.C.; Daubresse,F.; Hugon,S.	2011	The advantages of computer assistance in total knee arthroplasty	very low quality

Authors	Year	Title	Reason for Exclusion
Bathis,H.; Perlick,L.; Tingart,M.; Luring,C.; Perlick,C.; Grifka,J.	2004	Radiological results of image-based and non-image-based computer-assisted total knee arthroplasty	no patient oriented outcomes
Bathis,H.; Perlick,L.; Tingart,M.; Luring,C.; Zurakowski,D.; Grifka,J.	2004	Alignment in total knee arthroplasty. A comparison of computer-assisted surgery with the conventional technique	no patient oriented outcomes
Bejek,Z.; Paroczai,R.; Szendroi,M.; Kiss,R.M.	2011	Gait analysis following TKA: Comparison of conventional technique, computer-assisted navigation and minimally invasive technique combined with computer-assisted navigation	no patient oriented outcomes
Biasca,N.; Wirth,S.; Bungartz,M.	2009	Mechanical accuracy of navigated minimally invasive total knee arthroplasty (MIS TKA)	does not answer pico question. compares minmally invasive navigation to conventional navigation
Bonutti,P.M.; Dethmers,D.; Ulrich,S.D.; Seyler,T.M.; Mont,M.A.	2008	Computer navigation-assisted versus minimally invasive TKA: benefits and drawbacks	minimally invasive
Buckup,K.; Linke,L.-C.; Hahne,V.	2007	Minimally invasive implantation and computer navigation for a unicondylar knee system	minimally invasive
Chang,C.-W.; Wu,P.-T.; Yang,C.-Y.	2010	Blood loss after minimally invasive total knee arthroplasty: Effects of imageless navigation	very low quality
Chang,C.W.; Yang,C.Y.	2006	Kinematic navigation in total knee replacement--experience from the first 50 cases	very low quality.
Choi,W.C.; Lee,S.; An,J.H.; Kim,D.; Seong,S.C.; Lee,M.C.	2011	Plain radiograph fails to reflect the alignment and advantages of navigation in total knee arthroplasty	no patient oriented outcomes
Chotanaphuti,T.; Ongnamthip,P.; Teeraleekul,K.; Kraturerk,C.	2008	Comparative study between computer assisted-navigation and conventional technique in minimally invasive surgery total knee arthroplasty, prospective control study	minimally invasive
Chou,W.Y.; Ko,J.Y.; Wang,C.J.; Wang,F.S.; Wu,R.W.; Wong,T.	2008	Navigation-assisted total knee arthroplasty for a knee with malunion of the distal femur	case report
Chung,B.J.; Kang,Y.G.; Chang,C.B.; Kim,S.J.; Kim,T.K.	2009	Differences between sagittal femoral mechanical and distal reference axes should be considered in navigated TKA	no intervention

Authors	Year	Title	Reason for Exclusion
Chung,B.J.; Dileep,I.; Chang,C.B.; Kang,Y.G.; Park,Y.B.; Kim,T.K.	2010	Novel approach to reducing discrepancies in radiographic and navigational limb alignments in computer-assisted TKA	no patient oriented outcomes
Clemens,U.; Miehlke,R.K.	2003	Experience using the latest OrthoPilot TKA software: a comparative study	unclear if 90% of patientshad knee OA
Cobb,J.; Henckel,J.; Gomes,P.; Harris,S.; Jakopec,M.; Rodriguez,F.; Barrett,A.; Davies,B.	2006	Hands-on robotic unicompartmental knee replacement: a prospective, randomised controlled study of the acrobot system	unclear if all patients have osteoarthritis
Confalonieri,N.; Manzotti,A.; Pullen,C.; Ragone,V.	2005	Computer-assisted technique versus intramedullary and extramedullary alignment systems in total knee replacement: a radiological comparison	no patient oriented outcomes
Conteduca,F.; Massai,F.; Iorio,R.; Zanzotto,E.; Luzon,D.; Ferretti,A.	2009	Blood loss in computer-assisted mobile bearing total knee arthroplasty. A comparison of computer-assisted surgery with a conventional technique	unclear if all patients have osteoarthritis
Cossey,A.J.; Spriggins,A.J.	2005	The use of computer-assisted surgical navigation to prevent malalignment in unicompartmental knee arthroplasty	very low quality
Dunbar,N.J.; Roche,M.W.; Park,B.H.; Branch,S.H.; Conditt,M.A.; Banks,S.A.	2012	Accuracy of dynamic tactile-guided unicompartmental knee arthroplasty	unclear if all patients have osteoarthritis
Ee,G.; Pang,H.N.; Chong,H.C.; Tan,M.H.; Lo,N.N.; Yeo,S.J.	2013	Computer navigation is a useful intra-operative tool for joint line measurement in total knee arthroplasty	not relevant. looks at correlation between joint line changes and outcomes
Ensini,A.; Belvedere,C.; Feliciangeli,A.; Timoncini,A.; Dedda,V.; Leardini,A.; Giannini,S.	2012	Intra-operative quantification of patello-femoral joint kinematics in total knee arthroplasty and its correlation with femoral component position	not relevant. study of partial meniscectomy
Gothesen,O.; Espehaug,B.; Havelin,L.I.; Petursson,G.; Hallan,G.; Strom,E.; Dyrhovden,G.; Furnes,O.	2014	Functional outcome and alignment in computer-assisted and conventionally operated total knee replacements: a multicentre parallel-group randomised controlled trial	less than 90% of patients had knee OA
Han,H.S.; Seong,S.C.; Lee,S.; Lee,M.C.	2006	Rotational alignment of femoral components in total knee arthroplasty: nonimage-based	no patient oriented outcomes

Authors	Year	Title	Reason for Exclusion
		navigation system versus conventional technique	
Hart,R.; Janecek,M.; Chaker,A.; Bucek,P.	2003	Total knee arthroplasty implanted with and without kinematic navigation	no patient oriented outcomes
Harvie,P.; Sloan,K.; Beaver,R.J.	2012	Computer navigation vs conventional total knee arthroplasty: five-year functional results of a prospective randomized trial	unclear if all patients have osteoarthritis
Hasegawa,M.; Yoshida,K.; Wakabayashi,H.; Sudo,A.	2011	Minimally invasive total knee arthroplasty: comparison of jig-based technique versus computer navigation for clinical and alignment outcome	minimally invasive
Hetaimish,B.M.; Khan,M.M.; Simunovic,N.; Al-Harbi,H.H.; Bhandari,M.; Zalzal,P.K.	2012	Meta-Analysis of Navigation vs Conventional Total Knee Arthroplasty	meta-analysis (reviewed bib search)
Hiscox,C.M.; Bohm,E.R.; Turgeon,T.R.; Hedden,D.R.; Burnell,C.D.	2011	Randomized trial of computer-assisted knee arthroplasty: impact on clinical and radiographic outcomes	unclear if all patients have osteoarthritis
Hoppe,S.; Mainzer,J.D.; Frauchiger,L.; Ballmer,P.M.; Hess,R.; Zumstein,M.A.	2012	More accurate component alignment in navigated total knee arthroplasty has no clinical benefit at 5-year follow-up	
Iorio,R.; Mazza,D.; G.Bolle; Conteduca,J.; Redler,A.; Conteduca,F.; Ferretti,A.	2013	Computer-assisted surgery: A teacher of TKAs	no patient oriented outcomes
Jenny,J.-Y.; Ciobanu,E.; Boeri,C.	2007	The rationale for navigated minimally invasive unicompartmental knee replacement	very low quality
Johnson,D.R.; Dennis,D.A.; Kindsfater,K.A.; Kim,R.H.	2013	Evaluation of total knee arthroplasty performed with and without computer navigation: a bilateral total knee arthroplasty study	would be very low quality due to choosing the most symptomatic knee to get navigation. would confound results
Keun,Seon J.; Kyoo,Song E.; Jin,Park S.; Rim,Yoon T.; Bae,Lee K.; Taek,Jung S.	2009	Comparison of Minimally Invasive Unicompartmental Knee Arthroplasty With or Without a Navigation System	minimally invasive

Authors	Year	Title	Reason for Exclusion
Kim,S.J.; MacDonald,M.; Hernandez,J.; Wixson,R.L.	2005	Computer assisted navigation in total knee arthroplasty: Improved coronal alignment	no patient oriented outcomes
Klima,S.; Zeh,A.; Josten,C.	2008	Comparison of operative time and accuracy using conventional fixed navigation cutting blocks and adjustable Pivotal(trademark) cutting blocks	internvention is re cutting blocks not navigation
Konyves,A.; Willis-Owen,C.A.; Spriggins,A.J.	2010	The long-term benefit of computer-assisted surgical navigation in unicompartmental knee arthroplasty	very low quality
LÃ¼tzner,J.; GÃ¼nther,K.P.; Kirschner,S.	2010	Functional outcome after computer-assisted versus conventional total knee arthroplasty: a randomized controlled study	duplicate
Lampe,F.; Bohlen,K.; Dries,S.P.; Sufi-Siavach,A.; Hille,E.	2007	Accuracy of implant alignment and early results after minimally invasive vs conventional OrthoPilot-navigated Columbus TKA	minimally invasive
Lee,C.Y.; Lin,S.J.; Kuo,L.T.; Peng,K.T.; Huang,K.C.; Huang,T.W.; Lee,M.S.; Hsu,R.; Shen,W.J.	2014	The benefits of computer-assisted total knee arthroplasty on coronal alignment with marked femoral bowing in Asian patients	would be very low quality due to not adjusting for preoperative differences in weight and height and due to being retrospective
Lee,D.-H.; Lee,D.-K.; Shin,Y.-S.; Han,S.-B.	2013	Mid-term outcomes of floating platform mobile-bearing total knee arthroplasty under navigational guidance with a minimum 4-year follow-up	not relevant, does not compare surgical navigation to no navigation
Lee,H.J.; Lee,J.S.; Jung,H.J.; Song,K.S.; Yang,J.J.; Park,C.W.	2011	Comparison of joint line position changes after primary bilateral total knee arthroplasty performed using the navigation-assisted measured gap resection or gap balancing techniques	doesn answer pico question. compares different navigations techniques
Lindstrand,A.; Boegard,T.; Egund,N.; Thorngren,K.G.	1982	Use of a guide instrument for compartmental knee arthroplasty	not patient oriented otucomes
Lionberger,D.R.; Weise,J.; Ho,D.M.; Haddad,J.L.	2008	How does electromagnetic navigation stack up against infrared navigation in minimally invasive total knee arthroplasties?	does not answer pico question. compares two different types of navigation
Ma,B.; Rudan,J.; Chakravertty,R.; Grant,H.	2009	Computer-assisted FluoroGuide navigation of unicompartmental knee arthroplasty	very low quality

Authors	Year	Title	Reason for Exclusion
Manzotti,A.; Confalonieri,N.; Pullen,C.	2008	Intra-operative tibial fracture during computer assisted total knee replacement: A case report	case report
Manzotti,A.; Pullen,C.; Cerveri,P.; Chemello,C.; Confalonieri,N.	2012	Post traumatic knee arthritis: Navigated total knee replacement without hardware removal	unclear if all patients have osteoarthritis
Massai,F.; Conteduca,F.; Vadala,A.; Iorio,R.; Basiglini,L.; Ferretti,A.	2010	Tibial stress fracture after computer-navigated total knee arthroplasty	case report
Matsumoto,T.; Tsumura,N.; Kurosaka,M.; Muratsu,H.; Kuroda,R.; Ishimoto,K.; Tsujimoto,K.; Shiba,R.; Yoshiya,S.	2004	Prosthetic alignment and sizing in computer-assisted total knee arthroplasty	no patient oriented outcomes
Molli,R.G.; Anderson,K.C.; Buehler,K.C.; Markel,D.C.	2011	Computer-assisted navigation software advancements improve the accuracy of total knee arthroplasty	would be very low quality due to differences in severity at baseline between groups that were not statistically adjusted for
Nagamine,R.; Kondo,K.; Ikemura,S.; Shiranita,A.; Nakashima,S.; Hara,T.; Ihara,H.; Sugioka,Y.	2004	Distal femoral cut perpendicular to the mechanical axis may induce varus instability in flexion in medial osteoarthritic knees with varus deformity in total knee arthroplasty: a pitfall of the navigation system	narrative review
Nam,D.; Jerabek,S.A.; Haughom,B.; Cross,M.B.; Reinhardt,K.R.; Mayman,D.J.	2011	Radiographic analysis of a hand-held surgical navigation system for tibial resection in total knee arthroplasty	no patient oriented outcomes
Nam,D.; Cody,E.A.; Nguyen,J.T.; Figgie,M.P.; Mayman,D.J.	2014	Extramedullary guides versus portable, accelerometer-based navigation for tibial alignment in total knee arthroplasty: A randomized, controlled trial: Winner of the 2013 HAP PAUL award	no patient oriented outcomes
Pang,C.H.; Chan,W.L.; Yen,C.H.; Cheng,S.C.; Woo,S.B.; Choi,S.T.; Hui,W.K.; Mak,K.H.	2009	Comparison of total knee arthroplasty using computer-assisted navigation versus conventional guiding systems: a prospective study	no patient oriented outcomes

Authors	Year	Title	Reason for Exclusion
Prymka,M.; Hassenpflug,J.	2003	High Tibial Osteotomy with a Kinematic Navigation System	review of technology
Rosenberger,R.E.; Fink,C.; Quirbach,S.; Attal,R.; Tecklenburg,K.; Hoser,C.	2008	The immediate effect of navigation on implant accuracy in primary mini-invasive unicompartmental knee arthroplasty	minimally invasive
Saragaglia,D.; Chaussard,C.; Rubens-Duval,B.	2006	Navigation as a predictor of soft tissue release during 90 cases of computer-assisted total knee arthroplasty	study of hip arthroplasty
Sati,M.; De Guise,J.A.; Drouin,G.	1997	Computer assisted knee surgery: Diagnostics and planning of knee surgery	diagnostics and planning study
Schmitt,J.; Hauk,C.; Kienapfel,H.; Pfeiffer,M.; Efe,T.; Fuchs-Winkelmann,S.; Heyse,T.J.	2011	Navigation of total knee arthroplasty: rotation of components and clinical results in a prospectively randomized study	repeat
Seo,S.S.; Seo,J.H.; Sohn,M.W.; Kim,Y.J.	2012	Differences in measurement of lower limb alignment among different registration methods of navigation and radiographs in TKA using the OrthoPilot system	no patient oriented outcomes
Seon,J.K.; Song,E.K.; Park,S.J.; Yoon,T.R.; Lee,K.B.; Jung,S.T.	2009	Comparison of minimally invasive unicompartmental knee arthroplasty with or without a navigation system	minimally invasive
Shao,J.; Zhang,W.; Jiang,Y.; Wang,Q.; Chen,Y.; Shen,H.; Zhang,X.	2012	Computer-navigated TKA for the treatment of osteoarthritis associated with extra-articular femoral deformity	not relevant. does not compare uka to tka
Shetty,G.M.; Mullaji,A.; Bhayde,S.	2012	Computer guided restoration of joint line and femoral offset in cruciate substituting total knee arthroplasty	unclear if all patients have osteoarthritis
Shi,J.; Wei,Y.; Wang,S.; Chen,F.; Wu,J.; Huang,G.; Chen,J.; Wei,L.; Xia,J.	2014	Computer navigation and total knee arthroplasty	systematic review
Singh,V.K.; Varkey,R.; Trehan,R.; Kamat,Y.; Raghavan,R.; Adhikari,A.	2012	Functional outcome after computer-assisted total knee arthroplasty using measured resection versus gap balancing techniques: a randomised controlled study	not relevant. compares computer navigation techniques

Authors	Year	Title	Reason for Exclusion
Smith,J.R.; Rowe,P.J.; Blyth,M.; Jones,B.	2013	The effect of electromagnetic navigation in total knee arthroplasty on knee kinematics during functional activities using flexible electrogoniometry	unclear if 90% of patients had knee OA
Sparmann,M.; Wolke,B.; Czupalla,H.; Banzer,D.; Zink,A.	2003	Positioning of total knee arthroplasty with and without navigation support. A prospective, randomised study	less than 90% of patients had knee OA
Spencer,J.M.; Chauhan,S.K.; Sloan,K.; Taylor,A.; Beaver,R.J.	2007	Computer navigation versus conventional total knee replacement: no difference in functional results at two years	unclear if all patients have osteoarthritis
Tigani,D.; Rimondi,E.; Trentani,P.; Ansaloni,M.; Amendola,L.; Testi,D.	2011	Three-dimensional analysis of image-free navigation system for total knee arthroplasty	no patient oriented outcomes
Vadala,A.; Ciompi,A.; Lanzetti,R.M.; Rossi,C.; Fabbri,M.; Iorio,R.	2012	Tibial stress fracture after computer-navigated total knee arthroplasty	case report
van der Linden-van der Zwaag HM; Wolterbeek,R.; Nelissen,R.G.	2008	Computer assisted orthopedic surgery; its influence on prosthesis size in total knee replacement	no patient oriented outcomes
Wu,H.; Van,Driessche S.; Goutallier,D.	2009	Bone morphing system for rotational alignment in total knee arthroplasty	systematic review?
Yau,W.P.; Chiu,K.Y.; Zuo,J.L.; Tang,W.M.; Ng,T.P.	2008	Computer navigation did not improve alignment in a lower-volume total knee practice	no patient oriented outcomes
Zigo,P.; Ranke,T.P.; Ziegenbalg,A.; Pfeiffer,S.	2009	Axial deviation in total knee arthroplasty--is the navigation system necessary?	no patient oriented outcomes
Zorman,D.; Etuin,P.; Jennart,H.; Scipioni,D.; Devos,S.	2005	Computer-assisted total knee arthroplasty: comparative results in a preliminary series of 72 cases	no patient oriented outcomes
Zumstein,M.A.; Frauchiger,L.; Wyss,D.; Hess,R.; Ballmer,P.M.	2006	Is restricted femoral navigation sufficient for accuracy of total knee arthroplasty?	very low quality
Lee,D.H.; Padhy,D.; Park,J.H.; Jeong,W.K.; Park,J.H.; Han,S.B.	2011	The impact of a rectangular or trapezoidal flexion gap on the femoral component rotation in TKA	no patient oriented outcomes

Authors	Year	Title	Reason for Exclusion
Sampath,S.A.C.; Voon,S.H.; Sangster,M.; Davies,H.	2009	The statistical relationship between varus deformity, surgeon's experience, BMI and tourniquet time for computer assisted total knee replacements	no patient oriented outcomes
HernÃ¡ndez,Vaquero D.; Suarez,Vazquez A.; Iglesias,Fernandez S.	2011	Can computer assistance improve the clinical and functional scores in total knee arthroplasty?	Retrospective case series
Kuo,L.-T.; Huang,T.-W.; Peng,K.-T.; Hsu,R.W.-W.	2013	Computer-assisted navigation for cruciate-retaining total knee arthroplasty in patients with advanced valgus arthritic knees	retrospective review

APPENDIX XIII
LETTERS OF ENDORSEMENT FROM EXTERNAL ORGANIZATIONS

AANA | ARTHROSCOPY ASSOCIATION OF NORTH AMERICA

November 24, 2015

Kevin Shea, MD
American Academy of Orthopaedic Surgeons
9400 West Higgins Road
Rosemont, Illinois 60018

Dear Dr. Shea:

The Arthroscopy Association of North America has voted to endorse the AAOS Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. This endorsement implies permission for the AAOS to officially list our organization as an endorser of this guideline and reprint our logo in the introductory section of the guideline document.

Sincerely,

Jeffrey S. Abrams
Jeffrey S. Abrams, MD
President

** See Appendix XIII for details regarding support*

ACR AMERICAN COLLEGE OF RADIOLOGY
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November 24, 2015

Kevin Shea, MD
Clinical Practice Guidelines Section Leader
Committee on Evidence-Based Quality and Value
American Academy of Orthopaedic Surgeons
1900 West Higgins Road
Rosemont, Illinois 60018-4976

Dear Dr. Shea:

The American College of Radiology is pleased to endorse the AAOS Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. We appreciate having had the opportunity to participate in the review process of this document and look forward to future active involvement in the construction and review of AAOS Clinical Practice Guidelines that involve diagnostic imaging; image guided interventional procedures or radiation therapy.

This endorsement grants permission for the AAOS to officially list our organization as an endorser of this guideline and reprint our logo in the introductory section of the guideline document.

Sincerely,

William T. Thorwarth, Jr., MD, FACR
Chief Executive Officer
American College of Radiology

David C. Kushner, MD, FACR
President
American College of Radiology

cc: Bibb Allen, Jr., MD, FACR, Chair, ACR Board of Chancellors
William T. Herrington, MD, FACR, Speaker, ACR Council
Jacqueline A. Bello, MD, FACR, Chair, ACR Commission on Quality and Safety
Pamela Wilcox, RN, MBA, ACR Executive Vice President, Quality and Safety
David Kurth, MPH, MA, ACR Director, Quality and Safety
Jayson Murray, Manager, AAOS Evidence-Based Quality and Value Unit

SOMOS

Society of Military Orthopaedic Surgeons

20 November 2015

Kevin Shea, MD
AAOS Clinical Practice Guidelines Section Leader
9400 West Higgins Road
Rosemont, IL 60018

Dear Dr. Shea,

The Society of Military Orthopaedic Surgeons (SOMOS) Executive Committee has voted to endorse the AAOS Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. This endorsement implies permission for the AAOS to officially list our organization as an endorser of this guideline and reprint our logo in the introductory section of the guideline document.

Sincerely,

Anthony E. Johnson, MD
President

[redacted]

Promoting outstanding care to patients with knee disorders through innovative research and education.

THE KNEE SOCIETY

December 1, 2015

Kevin Shea, MD
AAOS Clinical Practice Guidelines Section Leader of the Committee on Evidence-Based Quality and Value
9400 West Higgins Road, Suite 500
Rosemont, IL 60018

Dear Dr. Shea,

With this letter, The Knee Society endorses the AAOS Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee (SMOAK). This endorsement implies permission for the AAOS to officially list our organization as an endorser of this guideline and reprint our logo in the introductory section of the guideline document.

We would like to thank AAOS CPG Section and the entire Committee on Evidence-Based Quality and Value for your diligent and thorough response to our comments on this CPG. While we endorse the SMOAK CPG, it is The Knee Society's request that our comments are also published. We view the SMOAK guidelines as a work-in-progress that are subject to the limitations of the methodology and need to be used as one tool in concert with clinical judgment by orthopaedic surgeons in practice.

We thank you, your colleagues, and the AAOS staff for your work on this important project and for allowing The Knee Society to be a part of it.

Sincerely,

Thomas Parker Vail, MD
President
The Knee Society

cc: The Executive Board of The Knee Society

9400 W. Higgins Road | Suite 500
Rosemont, Illinois | 60018-4976

Phone: (847) 698-1632
Email: knee@aaos.org

www.kneesociety.org

[redacted]

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December 1, 2015

Kevin Shea, MD
AAOS Clinical Practice Guidelines Section Leader
Committee on Evidence-Based Quality and Value
9400 West Higgins Road
Rosemont, IL 60018-4976

Dear Dr. Shea:

The American Geriatrics Society has voted to endorse the AAOS Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. This endorsement implies permission for the AAOS to officially list our organization as an endorser of this guideline and reprint our logo in the introductory section of the guideline document.

Sincerely,

Steven R. Counsell, MD, AGSF
President, American Geriatrics Society

American Society of Anesthesiologists®

1061 American Lane ▪ Schaumburg, IL 60173-4973 ▪ (847) 825-5586 ▪ asahq.org

March 28, 2016

Kevin Shea, M.D.
American Academy of Orthopaedic Surgeons
Clinical Practice Guidelines Section Leader
of the Committee on Evidence-Based Quality and Value
6300 North River Road
Rosemont, IL 60018

Dear Dr. Shea,

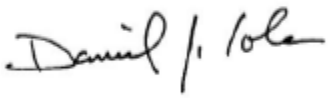
Thank you for providing the American Society of Anesthesiologists (ASA) the opportunity to review the 2015 American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. I am pleased to share that ASA's leadership has approved ASA's support of the Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. In alignment with ASA's governing documents, ASA is offering support of the Clinical Practice Guideline.

The following parties reviewed the document: ASA's Committee on Regional Anesthesia, Board Review Committee on Scientific Affairs Chair, Section on Subspecialties Chair, Division on Scientific Affairs Chair and Administrative Council.

If applicable, ASA can be listed as an organization that supports and participated in the development of the Clinical Practice Guideline on the Surgical Management of Osteoarthritis of the Knee. Please note that support does not indicate endorsement. However, the following disclaimer must be included: "Since the document has neither been presented to nor approved by either the ASA Board of Directors or House of Delegates, it is not an official or approved statement or policy of the Society. Variances from the recommendations contained in the document may be acceptable based on the judgment of the responsible anesthesiologist."

Thank you again for the opportunity to collaborate with AAOS and participate in the development of this Clinical Practice Guideline.

Sincerely,



Daniel J. Cole, M.D.
President
American Society of Anesthesiologists