PAPER NO. 1

Can Telephone Support During Post-TKR Rehabilitation Improve Post-op Function: A Randomized Controlled Trial

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INTRODUCTION: Improvement in physical function following total knee replacement (TKR) varies significantly. Despite technically successful surgery with pain relief, poorer emotional health and morbid obesity are associated with poorer functional gains. This NIH-funded RO1 developed and tested a telephone support program for patients undergoing post-TKR rehabilitation to evaluate the impact on six-month physical function.

METHODS: Following Institutional Review Board (IRB) approval, 180 patients scheduled for primary TKR, stratified by gender, body mass index (BMI) and emotional health (SF36/MCS), were randomized to receive telephone support or usual care. A trained behavioral counselor delivered a 12-session peri-operative program (three pre-op phone calls, one in-hospital visit, eight weekly post-op calls) to 90 patients. The intervention targeted self-efficacy for exercise and activity and self-management skills for rehabilitation. A total of 98% of patients completed the treatment and six-month data (SF36/PCS).

RESULTS: Patients were categorized as low risk (MCS>50 and BMI<35), moderate risk (BMI>35 or MCS<50), or high risk (MCS<50 and BMI>35) for PCS gain. Low risk treatment and control patients (n=79) reported median six-month post-op physical component score (PCS) at the national norm (50). However, high risk patients (n=21) reported significantly poorer median six-month PCS=38 (control) or 44 (treatment) (p<0.028; low vs high risk post-PCS). Moderate risk patients reported intermediate six-month PCS ranging from 40-48. Among high risk patients, the treatment group reported significantly higher post-op function than controls (median=38 vs. 44).

DISCUSSION AND CONCLUSION: Previous studies have shown the characteristics that place patients at high risk for less functional gain. This NIH-funded RO1 developed and tested a telephone support program for patients undergoing post-TKR rehabilitation to evaluate the impact on six-month physical function.

PAPER NO. 2

Patella Denervation in Primary TKR - A Double Blind Randomized Study

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INTRODUCTION: Worldwide primary total knee replacement (TKR) is often performed without resurfacing the patella. In this situation half of orthopaedic surgeons will denervate the patella in an attempt to reduce the incidence of patellofemoral pain. We have conducted a double blind randomized study to evaluate whether there is any evidence to support this practice.

METHODS: Between April 2009 and June 2010, we randomized 126 patients undergoing primary total knee replacement at our hospital into two groups: Group 1 - denervation group (n=63), group 2 - no denervation group (n=63). All patients had varus osteoarthritis and had a cruciate retaining implant. Randomization using sealed envelopes took place once the surgery was satisfied that the patella did not require resurfacing. All the operations were performed by two experienced surgeons or under their direct supervision. Patients and assessors were blinded with regards to denervation status for the duration of study. Assessment was performed preoperatively and at three and 12 months by three independent practitioners by means of questionnaires and physical assessment. Outcome measures included patient satisfaction, Oxford knee score, Knee Society score (KSS) and Knee Society function score, Bartlett score and activities of daily living (ADL) score. Routine demographic data including age, gender, side of surgery and body mass index (BMI) were recorded pre-operatively.

RESULTS: The demographics and pre-operative scores showed no difference between the groups. One patient in the no denervation group was lost to follow up at 12 months. Patient satisfaction was higher in the denervation group (47 excellent, nine good, seven fair/poor vs. 32 excellent, 16 good, 14 fair/poor), Chi square 8.1, p<0.05. Flexion at 12 months was higher in the denervation group (104 vs. 99 degrees), independent samples t-test, p<0.01. The anterior knee pain score within the Bartlett score was better in the denervation group at three months but not 12 months. There were however no statistically or clinically significant differences in Oxford scores, KSS scores, Bartlett scores and ADL scores during the follow up period. There were no complications of the procedure and no returns to theatre during the follow-up period.

DISCUSSION AND CONCLUSION: Circumferential denervation of patella during primary TKR without patellar resurfacing appears to be a safe procedure that may improve patient satisfaction and...
range of flexion at one year post-operatively. However, no clinically or statistically significant improvements in standard validated outcome measures are seen and the evidence is not strong enough to state that denervation should be performed when the patella is not resurfaced.

PAPER NO. 3

Factors Associated with Perioperative Complication Rates after Unilateral vs. Simultaneous TKA
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INTRODUCTION: There is limited and conflicting data comparing the severity of complications following simultaneous bilateral total knee arthroplasty (BTKA) and unilateral TKA. The purpose of this study was to compare complication rates following simultaneous BTKA and unilateral TKA and to determine factors associated with complication severity in a large cohort of patients identified from the nationwide inpatient sample (NIS).

METHODS: The 2004-2007 NIS dataset was used to identify 407,070 TKAs: 24,574 simultaneous and 382,496 unilateral TKAs. Complications, based on ICD-9 codes, were categorized as none, minor, major, and mortality. Covariates included comorbidities, demographics, payer type and hospital type. An ordinal logistic regression was used to calculate odds ratios and 95% confidence intervals.

RESULTS: Simultaneous BTKAs have significantly increased odds of having complications: minor (OR 1.35; CI 1.27-1.44), major (OR 1.18; CI 1.03-1.34), mortality (OR 2.05; CI 1.39-3.01). Greater numbers of comorbidities were significantly associated with complication rates: minor (OR 1.84; CI 1.41-2.39), major (OR 2.63; CI 1.67-4.13), mortality (OR 3.66; CI 1.01-13.3). Compared to Caucasians, African Americans and Native Americans had significantly higher odds of minor complications. Females have significantly higher odds of any complication type, while the youngest age group had 2.5 times the odds of a major complication. Compared to urban teaching hospitals, urban non-teaching hospitals have a reduced odds of major (OR .78; CI 1.72-8.84) and minor complications (OR .91; CI .88-.95) while rural non-teaching was associated with increased odds of mortality (OR 1.49; CI 1.04-2.14).

DISCUSSION AND CONCLUSION: Simultaneous BTKA have greater odds of any type of complication compared to unilateral TKA. Patient demographics, preoperative health status and hospital type are all significant factors in complication rates following BTKA. Such factors need to be considered by surgeons and patients during the decision-making process when bilateral TKA is indicated.

PAPER NO. 4

Temporal Trends in Knee Arthroplasty from 1990 To 2008: Data from a Regional Arthroplasty Register
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INTRODUCTION: The number of knee replacements performed continues to increase. The mean age at the time of surgery has reMed static. Satisfaction rates have also reMed unchanged. Knee replacement for rheumatoid arthritis has decreased. Knee arthroplasty remains the gold standard treatment for symptomatic knee osteoarthritis. There is a perception that more knee replacements are being performed in younger patients. Patient satisfaction is becoming an increasingly important aspect of measuring the success of knee arthroplasty together with more traditional outcome measures. A regional arthroplasty register helps provide data for the average orthopaedic surgeon working in a non-specialist hospital setting. It provides information on surgical practice, implant performance, outcome measures and demographic changes in a typical patient population.

METHODS: A regional arthroplasty register was established in 1990 and has provided outcome data on 25,521 knee arthroplasties over an 18-year period from 1990 to 2008. Self-administered questionnaires were mailed to these patients one year after their surgery. From this data, trends have been indentified to assess the demographics and satisfaction rates of patients at one year following total knee replacement surgery.

RESULTS: There has been a significant decrease in the number of knee replacements performed in patients with rheumatoid arthritis, both numerically and in percentage terms. In 1990, 281 out of 1330 (21%) were performed for rheumatoid arthritis; in 2008, this had declined to 107 out of 4051 (2.6%). The rates of primary knee arthroplasty were 22%, significantly higher for females than males (p < 0.001). The rates of primary knee arthroplasty were also significantly higher for osteoarthritis compared to rheumatoid arthritis and trauma (p < 0.001). The rate of primary knee arthroplasty for osteoarthritis was 95 per 100,000 persons compared to 10 and 1.2 per 100,000 persons for rheumatoid arthritis and trauma respectively. The rates for primary knee arthroplasty in the 75–85 year old age group were significantly higher than in those of other age groups (p < 0.001). The rate of surgery in the youngest age group (45–55 year age group) did not change significantly over time. A total of 62% (24,648) of knee arthroplasties were performed for osteoarthritis and 32% (1,233) for rheumatoid arthritis. Some 83.6% of osteoarthritic patients (20,244) were satisfied with their knee one year post surgery, 8.5% (2055) unsure and 7.9% dissatisfied. Comparable figures for patients with rheumatoid arthritis were 81.3% (1,028) satisfied, 10.3% (130) unsure and 8.4% dissatisfied. Overall, there was no significant difference in satisfaction rates between different diagnostic groups of patients. In osteoarthritic patients, satisfaction rates have reMed the same throughout the last 18 years, in different time periods. The satisfaction rate was 83.2% for the period 1990-1994, 80.9% for 1995-1999, 86.5% for 2000-2004 and 84.1% for 2005-2007. There was no statistically significant difference between the levels of satisfaction for these time periods. The age of the patient did not affect the satisfaction rate.

DISCUSSION AND CONCLUSION: This study challenges the perception that knee replacements are being performed in younger patients. Furthermore, patient satisfaction rates have reMed unchanged over an 18-year period, despite the evolution of newer implants. There continues to be an increase in the number of total knee replacements being performed and this trend looks set to continue.

PAPER NO. 5

Laboratory Testing Fails to Reproduce the Demanding Conditions Imposed on the Knee by Active Individuals
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INTRODUCTION: Knee prostheses retrieved at revision often show patterns and severity of damage neither seen nor predicted from standard testing using wear simulators. This suggests that we do not appreciate the severity of the mechanical conditions imposed on knee replacements, or that these implants are exposed to combinations of loads and motions that are more damaging than the simple loading profiles utilized in...
the laboratory. Using published data collected from these instrumented total knee prostheses, we examined the magnitude, direction and combination of forces and moments acting on the knee during various activities in order to guide the future development and testing of high-performance knee replacements.

METHODS: In vivo data from five patients with instrumented tibial implants were obtained from an open database (www.orthoload.com) to determine the direction and magnitude of forces and moments at given points during activities of daily living (stair descent, stair ascent, deep knee bend, one leg stance and level walking). The e-tibia data were also used to identify patterns and combinations of forces and moments at given points during each activity. These data were compared to the loading profiles used to evaluate the performance of new designs of knee prostheses through laboratory testing (ISO 14243-1: Standards for Wear of Total Knee-Joint Prostheses).

RESULTS: The vast majority of the maximum forces and moments measured during the five activities of daily living far exceeded those applied during laboratory testing, often by several-fold (Table 1). Analysis of the direction and magnitude of three component forces and moments showed considerable differences in loading patterns both between individuals and between activities. For example, at the point of peak axial force during level walking, there were four distinct loading patterns in the five patients; none of the in vivo loading patterns matched the laboratory testing pattern at the point of peak axial force. Comparison of the loading patterns at the point of peak axial force showed that different everyday activities generated more than three distinct loading patterns, which all differed substantially from the loading pattern applied during conventional knee testing.

DISCUSSION AND CONCLUSION: Current routines for laboratory testing of total knee joint prostheses fail to develop forces and moments measured during the five activities of daily living. Differences in loading patterns both between individuals and between activities. For example, at the point of peak axial force during level walking, there were four distinct loading patterns in the five patients; none of the in vivo loading patterns matched the laboratory testing pattern at the point of peak axial force. Comparison of the loading patterns at the point of peak axial force showed that different everyday activities generated more than three distinct loading patterns, which all differed substantially from the loading pattern applied during conventional knee testing.

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<td>358 (135%)</td>
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%ISO = percentage of the maximum ISO values ¹ ISO 14243-1 2009 ²Peak values from www.orthoload.com database
INTRODUCTION: The importance of individual anatomic variation in knee replacement prosthesis selection has gained popularity. Size differences can also occur between knees of the same patient. The purpose of this study is to evaluate the frequency of anatomic variation between knees within the same patient and to determine whether outcomes differ depending on the component size.

METHODS: From 2001-2009, 771 patients undergoing simultaneous bilateral knee replacements were identified. Staged procedures were excluded to eliminate possible bias when performing the second knee replacement based on clinical or radiographic outcomes of the first replacement.

RESULTS: Component sizes differed within the same patient in 17.1% (132/771). Femoral sizes differed in 37 patients (4.8%), the tibia 65 (8.4%), and the patella 46 (6.0%). In nine patients, the femur and tibia both differed in size from one knee to the other, and in seven cases the patellae varied in knees with femoral or tibial differences. Motion was not greater for smaller femoral sizes, with both groups achieving average 128 degrees flexion (p=0.6). Tibial size did not depend on depth of tibial resection as the tibial insert was not thicker for the smaller tibial sizes (p=0.8). Patellar thickness was similar before and after resurfacing for knees in which the patellar component differed (p=0.4). Knee and function scores were not different between the knees with larger versus smaller components. Patient satisfaction was similar for both knees.

DISCUSSION AND CONCLUSION: Total knee replacement component size can vary between knees of the same patient. The different sized components do not seem to affect outcome of the individual knees. Rather, the variability in prosthesis size is appropriate anatomically and leads to comparable outcomes compared to the contralateral knee.

Is Primary Total Knee Arthroplasty Safe and Efficacious in the Superobese Patient (BMI≥50)?

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INTRODUCTION: The purpose of this study was to compare the outcomes and complications of normal weight, class 1 obese (Body Mass Index (BMI)=30-34.9) and superobese (BMI≥50) primary total knee replacement (TKR) patients.

METHODS: Between January 1995 and December 2005, 4,104 consecutive primary TKR were performed and followed prospectively in our center. Patients were stratified for their obesity level according the World Health Organization (WHO) and current surgical literature classification. We identified 75 TKR, performed in 47 superobese patients (group 1). They were matched with normal weight (group 2) and class 1 obese (group 3) primary TKR for sex, age, side, presence of contralateral TKR, implants used, patella resurfacing, anaesthesia, time since surgery and preoperative SF-12 mental component summary score (MCS). Patient clinical outcomes (Western ON and McMaster Universities Arthritis Index (WOMAC), SF-12 and Knee Society scores (KSS)), radiographs, complications, readmissions, and revisions rates were compared for normal BMI, class 1 obese and superobese patients.

RESULTS: The mean BMI of our primary TKRs was 32.6. Using the WHO BMI classification, 0.3% were underweight, 10.4% normal weight, 30.1% overweight, 31.0% class 1 obesity, 16.5% class 2 obesity, 9.8% class 3 obesity and 1.9 % superobese. The superobese TKR population (n=75) had average age of 60.0±7.9, sex ratio of 7.3 (F=66;M=9), preoperative SF-12 MCS score of 50.5±11.2, with 79 % (59/75) receiving bilateral TKR and 84% (63/75) posterior stabilized TKR. The normal weight (n=75, mean age: 59.8±9.5, sex ratio: 7.3, SF-12 MCS: 51.5±10.9) and class 1 obese group (n=75, mean age: 60.1±7.6, sex ratio: 7.3, SF-12 MCS: 52.3±10.0) were similar for these five characteristics. Mean clinical and radiographic follow-up was 6.5 ±3.5 yrs (range 5 to 10 yrs). Twenty (26.7%) of superobese TKRs were diabetic, 84% had an ASA score ≥3, and 21.3% had sleep apnea. Seven (9.3%) had preoperative unsuccessful bariatric surgery. They had lower preoperative SF-12 physical component score (PCS; gp1=25.6±5.4; gp 2=30.8±8.3; gp 3=29.9±7.2; p<0.01), KSS (gp1=73.0±26.4; gp 2=83.9±24.2; gp 3=90.5±14.7; p<0.01) and WOMAC scores (gp 1=35.1±13.9 ; gp 2=42.8±20.4; gp 3=39.1±16.5; p=0.04). Surgical and tourniquet time were not significantly different. Surgical blood loss was similar between groups based on preoperative and 72 hours postoperative hemoglobin and hematocrit. A total of 10.6% (5/47) of superobese patients died during follow-up (p=0.02). Improvement in KSS was similar between groups (gp1=76.5±32.0; gp 2= 79.4±30.6; gp 3=86.5±28.4; p=0.17). Superobese and obese class 1 patients had more improvement of their SF-12 PCS (gp1=11.2±13.6; gp2= 5.9±10.1; gp3=12.6±11.2; p<0.01) and WOMAC scores (gp1=37.3±25.8; gp2=28.0±19.5; gp3=42.9±20; p<0.01). The superobese group had higher length of hospital stay (5.7±2.1 days; p=0.06), transfer to rehabilitation centers (13.3%;p=0.1), surgical complications (6.7%;p=0.25), deep infections (4.0%;p=0.6) and revision surgery rates (9.3%,p=0.6), but none of these differences were statistically significant.

DISCUSSION AND CONCLUSION: At five to 10 years follow up, superobese patients had similar improvement of their knee functional outcomes compared to patients in other weight classifications. The improvement of their quality of life was more significant than for patients with a normal BMI. However, these superobese patients are exposed to a higher mortality rate and possibly to an increased risk of surgical and postoperative complications.
INTRODUCTION: The success of total knee arthroplasty (TKA) depends on optimal soft tissue balancing among many other factors. The objective of this study was to evaluate the effects of antero-posterior (AP) laxity on the clinical outcome of cruciate-retaining (CR) TKA.

METHODS: A total of 100 consecutive patients were divided into three groups based on their AP laxity as measured by the KT-1000 arthrometer. Group 1 patients had AP translation <5 mm, Group 2 patients had AP translation 5-10 mm, and Group 3 patients had AP translation >10 mm. Outcome assessment was made at two years postoperatively by documenting knee range of motion (ROM), the presence of flexion contractures, hyperextension, clinical laxity, knee mechanical axes using postoperative radiological films, Knee Society Scores, Oxford Knee scores, and the SF-36 questionnaire.

RESULTS: Of 4,540 primary TKAs were performed between 2004-08. At six months, 254 knees resulted in GR, while 2,162 knees had a FFD. At two years, there were 889 GR knees and 1,629 with FFD. At six months, the degree of FFD ranged from 1 to 50 (mean 8.26, SD 3.89) while the degree of GR ranged from 1 to 20 (mean 4.85, SD 2.62). At two years, FFD ranged from 1 to 30 (mean 6.25, SD 3.41) while GR ranged from 1 to 30 (mean 5.00, SD 2.86). There was no statistical difference in mean KSC and Oxford Knee scores between the two groups at six months and two years. However, SF2 (role functioning - physical) and SF3 (bodily pain) scores were significantly better in FFD compared to GR at six months (p<0.001) and two years (p<0.001). Majority of our patients fall within the -10 degree (i.e., GR) to +10 degree (FFD) range: 89.1% and 94.5% at six months and two years respectively. For this subset of patients, KSC (knee and function) scores and Oxford knee scores at six months and two years were significantly better in FFD compared to GR at six months and two years. However, only 78 (35%) showed an improvement. At two years, knees with -4 degrees to +6 degrees have Oxford Knee scores that is not significantly different from that of patients who attain neutral (p>0.05).

DISCUSSION AND CONCLUSION: The best outcome for CR TKA was achieved in patients with antero-posterior laxity of 5-10 mm on a KT-1000 arthrometer.
tibial tray cruciate-retaining total knee arthroplasty design. METHODS: The first 101 posterior cruciate retaining modular tibial components of a single design performed by a single surgeon in 75 patients were evaluated at a minimum 20-year follow-up. All components were fixed with cement. These patients had been prospectively followed at five-year intervals and evaluated clinically using Knee Society ratings and documenting any need for reoperation. Serial radiographs were evaluated for radiolucencies, osteolysis and component migration until the time of patient death or at minimum 20-year follow-up. RESULTS: At minimum 20-year follow-up, five knees (5%) had required a revision operation. All revisions occurred greater than 10 years following the index procedures. Benefits of modularity (i.e., retention of the tibial tray) were utilized in three of five cases in this closely followed cohort. Survivorship from any revision was 90.8% at 20 years. For the 16 living patients with 22 knees, the average Knee Society clinical and functional scores were 91 and 59, respectively, and the average range of motion was 115 degrees. Osteolysis occurred around 10 knees (10%) during the follow-up interval. DISCUSSION AND CONCLUSION: When considering gamma irradiated in air polyethylene and a first generation locking mechanism were utilized, these results encourage the authors to continue to use modular tibial trays.

PAPER NO. 13
Comparison of Patient Reported Outcomes Following Total Knee Replacement with and without Patella Resurfacing
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INTRODUCTION: Patella resurfacing during total knee replacement (TKR) is controversial. Prior meta-analysis suggests resurfacing reduces the risk of reoperation and anterior knee pain. More recent randomized trials using “patella friendly” implants have, however, questioned this conclusion. Currently in the UK, only one third of primary TKRs have concomitant patella resurfacing. We aimed to determine whether patella resurfacing influences knee function, general health status and patient reported satisfaction using validated prospectively collected patient reported outcome measures (PROMs) for patients undergoing primary TKR with and without patella resurfacing. METHODS: PROMs data was collected using a combination of pre and post-op questionnaires. Assessment modalities used included patient demographics, a validated knee specific questionnaire (Oxford Knee Score (OKS), 0-48, 48=best), validated measure of general health status (EUROQOL-5D (EQ5D)) and patient reports of satisfaction/success with surgery using a five-point Likert scale. RESULTS: A total of 24,980 TKRs were analyzed. Of these, 8,515 of satisfaction/success with surgery using a five-point Likert scale. For the questions related specifically to anterior knee function the post-operative scores favored the non-resurfaced group (Q7:Kneeling mean post-op score, Resurfaced group=1.40 vs. Non resurfaced=1.35, p<0.01 and Q11:Standing from a chair mean post-op score, Resurfaced group=2.96 vs. Non resurfaced=2.97, p=0.37). There were no significant differences in any of the five EQ5D domains between the groups. Similarly the improvements in the EQ5D index (0.307 vs. 0.303, p=0.40) and EQ5D health scale (3.23 vs. 3.14, p=0.75) were comparable. Patient satisfaction was rated as either Excellent/Very good/Good in 83.9% of cases with resurfacing and 83.8% in those not resurfaced (p=0.73). Resurfaced patients quoted the operation to be a success in 89.2% of cases and the non-resurfaced patients in 88.3% (p=0.32). Wound problems were reported in 12.1% of resurfaced cases and 11.8% of non-resurfaced cases (p=0.38). DISCUSSION AND CONCLUSION: We found no clinically significant differences between TKRs with and without patella resurfacing for improvements in knee function, general health and patient reported satisfaction/success with surgery. Given the extra surgical time required to resurface the patella, as well as the extra bearing and hence potential for failure/complications, we question the efficacy of routine resurfacing in TKR for improving overall patient satisfaction and functional outcomes.

PAPER NO. 14
Tourniquet Use Only During Cement Fixation in Total Knee Arthroplasty: A Randomized Controlled Trial
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Justine M. Naylor, PhD, Liverpool, Australia
Jaykar Dave, FRACS, MBBS, Sydney, Australia
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INTRODUCTION: This study proposed to establish whether tourniquet application only during cement fixation and setting (short duration) was associated with better functional recovery compared to standard tourniquet (long duration) application during total knee arthroplasty (TKA). METHODS: We planned to randomize 230 patients to receive either short or long duration tourniquet. Short duration tourniquet was defined as tourniquet inflation during cement fixation only. Long duration was defined as tourniquet inflation during the operation: from skin incision to just prior to wound closure. Donor blood transfusion was according to the unit’s restrictive transfusion policy. Reviewers and statisticians were blinded to the treatment group. The primary outcomes were in-hospital donor transfusion rate and the Oxford Knee Score at 10 weeks post-surgery. Secondary outcomes included serial measures (pre-operative, day four and then two, 10, 26 and 52 weeks post-operation) of knee range and function. Pre- and post-operative Doppler ultrasounds were obtained. RESULTS: Baseline characteristics and comorbid conditions were similar across the two groups and represented a typical TKA population. The trial was discontinued after randomization of 65 patients. A total of 12 patients had transfusions; 10/31 and 2/34 in the short duration and long duration groups respectively. Interim analysis indicated the risk of transfusion (odds ratio 7.38, P = 0.015) was higher in the short duration group. At 10 weeks post-surgery, no significant difference was observed in Oxford Knee Score. There were no between-group differences in rate of recovery up to 26 weeks for any outcome. No patients were lost to follow up.
INTRODUCTION: Unicompartmental knee arthroplasty (UKA) as an alternative to total knee arthroplasty (TKA) in the treatment of knee arthrosis is a contentious topic. Assumptions have been made that UKA and TKA procedures result in equal improvements from baseline. We hypothesized TKA would demonstrate (1) better change in clinical outcome scores from preoperative to postoperative states and (2) better survivorship than UKA.

METHODS: We evaluated 4,087 patients with 5,606 TKAs and 219 patients with 279 UKAs performed between 1978 and 2009. We compared preoperative, latest postoperative and change in Knee Society Clinical Rating (KS), SF-12, and Western ON and McMaster Universities Arthritis Index (WOMAC) scores. The minimum followup required was two years for both groups.

RESULTS: The TKA group (67.65 ± 9.31 years) was older (p < 0.05) than that of the UKA group (66.02 ± 8.18 years). TKAs had a higher (p < 0.05) body mass index (BMI) than UKAs (mean, 31.8±6.55 vs. 29.3±4.69). All preoperative outcome measure scores (WOMAC, SF-12, KCSRS) were higher in (p < 0.05) the UKA group. UKA patients had significantly higher postoperative SF12 physical scores, KS scores and WOMAC function score (p<0.05). Change scores for all WOMAC domains (stiffness, pain, function, total) were similar between the groups. TKA total KS change scores were similar although UKA patients had higher knee scores (49 versus 43, p<0.0001) but lower function scores than UKA (21 versus 26, p<0.05). Cumulative revision rate was higher (p = 0.006) for UKAs than TKAs (36 revisions [12.9%] vs. 359 revisions [6.4%]). Kaplan Meier survivorship for UKA at five and 10 years was 94.6% (93.2 to 96) and 90.4% (88.4 to 92.4), respectively. Kaplan Meier survivorship for TKA at five and 10 years was 98.4% (98.2 to 98.6) and 94.9% (94.6 to 95.2) respectively.

DISCUSSION AND CONCLUSION: The assumption UKA provides better function than TKA for patients is based on greater improvements in raw clinical outcome scores. However, it is critical to evaluate change scores as a measurement of the effect of the intervention as TKA and UKA are equally successful. Survival analysis confirmed greater durability of TKAs.
receive prophylactic antibiotics either prior to the skin incision or after a minimum of three sets of intra-operative cultures were obtained. Preoperative and intra-operative cultures were then compared. Results between patients who did and did not receive antibiotics were compared using Chi-square analysis. RESULTS: Operative cultures were positive in 13 of 14 patients randomized to receive antibiotics prior to the skin incision compared to five of seven patients randomized to receive antibiotics after operative cultures were obtained (p-value = 0.247).

DISCUSSION AND CONCLUSION: In this prospective randomized trial, we found no effect on the results of cultures obtained during surgery when prophylactic antibiotics were administered prior to the skin incision. Given the known benefits of prophylactic antibiotics for preventing PJI, they should not be withheld out of fear of affecting the results of operative cultures.

PAPER NO. 123

Revision Rate is Influenced by Hospital and Surgeon Volume in Total Knee Arthroplasty
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INTRODUCTION: The volume of total knee replacements has increased significantly over the past 10 years. Several studies have indicated a correlation between high hospital and surgeon procedure volume and decreased morbidity and mortality in total knee arthroplasty (TKA). We wanted to study a possible correlation between risk of revision and procedure volume of TKA, both with respect to hospital volume and surgeon volume using data from the Norwegian Arthroplasty register (NAR).

METHODS: A total of 33,441 TKA reported to the NAR from 1994 to 2009 were used to examine the annual procedure volume per hospital. Hospital volume was divided into five categories: 1-24 (low volume), 25-49 and 50-99 (medium volume), 100-150 and 150+ (high volume) procedures annually. A questionnaire regarding surgeon procedure volume in 2000 and 2009 was sent to all 54 hospitals in Norway performing TKA, as this is not registered in the NAR. We received responses from 39 hospitals (72%). Low surgeon procedure volume was defined as the percentage of surgeons at the hospital who operated 1-10TKAs/year.

RESULTS: Hospital volume was associated with revision rate for subgroups of prosthesis brands provided similar results, with a lower risk of revision for hospitals with >66% low-volume surgeons performing less than 10 TKAs annually. Hospitals with >66% low-volume surgeons performed less than 10 TKAs compared to hospitals with <34% low-volume surgeons.

DISCUSSION AND CONCLUSION: Our study indicates lower revision rates for TKA both at higher hospital volume and at hospitals with a low percentage of low-volume surgeons.

PAPER NO. 124

A Nomogram to Predict Failure of Single-Stage Irrigation and Debridement with Polyethylene Exchange
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INTRODUCTION: Single-stage irrigation and debridement with polyethylene exchange offers advantages over two-stage revision procedures in managing prosthetic joint infections (PJI), including fewer surgeries resulting in a reduced potential of intraoperative complications to the patient and lower direct costs. While two-stage revision procedures with interim placement of antibiotic cement spacers are currently considered the gold standard, moderate success rates of infection eradication are reported in the literature for single-stage irrigation and debridement with polyethylene exchange procedures. The ability to preoperatively predict the probability that single-stage irrigation and debridement with polyethylene exchange will fail to eradicate a patient’s PJI may help identify patients most appropriately treated with this procedure.

METHODS: Between January 1, 1996 and October 19, 2010, 10,411 revision total joint arthroplasties were performed at a single institution. Charts were reviewed to identify instances of hip or knee PJI treated with a single-stage irrigation and debridement with polyethylene exchange. Clinical data (demographic, microbiological, clinical presentation, perioperative and medical comorbidity variables) and disease follow up on 309 patients (n=247 total knees; n=62 total hips) with PJI treated with single-stage irrigation and debridement with polyethylene exchange were collected from electronic and paper medical records. Average follow up was 1,021 ± 59 days (range, 8 to 4,641). Univariate analysis was performed to determine which variables were independently associated with failure of the procedure to eradicate the PJI. Kaplan-Meier survival analyses were also performed. Cox regression was used to construct a model predicting the probability of treatment failure and the results were used to generate a nomogram. The model was internally validated using bootstrapping.

RESULTS: A total of 149 (48.2%) cases experienced reinfection (n=122 total knees; n=27 total hips) at an average of 240 days (range, 2 to 1,545) following the single-stage irrigation and debridement with polyethylene exchange. Univariate analysis identified multiple variables independently associated with failure of the procedure to eradicate the PJI. Kaplan-Meier survival analyses were also performed. Cox regression was used to construct a model predicting the probability of treatment failure and the results were used to generate a nomogram. The model was internally validated using bootstrapping. A total of 149 (48.2%) cases experienced reinfection (n=122 total knees; n=27 total hips) at an average of 240 days (range, 2 to 1,545) following the single-stage irrigation and debridement with polyethylene exchange. Univariate analysis identified multiple variables independently associated with treatment failure including: a longer duration of symptoms (p=0.001), a higher erythrocyte sedimentation rate at presentation (0.02), a previous joint infection or previous infection in the same joint (0.009) and an infection by either methicillin resistant Staphylococcus aureus, methicillin resistant Staphylococcus epidermidis, vancomycin resistant Enterococcus, methicillin sensitive St. aureus or methicillin sensitive S. epidermidis (p=0.005). Kaplan-Meier survival analysis indicated that the recurrence-free survival rate of patients symptomatic for 21 days or more is significantly less (p<0.0001) than patients who were symptomatic for less than 21 days. The bootstrap corrected receiver operating characteristic (ROC) for the nomogram was 0.645.

CONCLUSION: This is the largest study investigating the single-stage irrigation and debridement with polyethylene exchange procedure for hip and knee PJI. The nomogram generated to estimate proportions without revision and relative differences was internally validated using bootstrapping.
preoperatively predict the probability of reinfection may be a useful tool in the management of patients with presumed PJI.

RESULTS: Fifty patients undergoing revision arthroplasty for infected total joints or major multiple revisions were analyzed. There were 33 knees (one bilateral), 16 hips, one elbow, one humerus and shoulder, and one hip, femur and elbow replacements. Two cases with hips had no exchange. Local post-op average levels were days 1-5: 265,172,146,146,104 for vancomycin, and 31.9,4.6,4.5, 5.3, 4.6 for tobramycin. Most of the cases assayed for greater than 400 on day 1 for vancomycin. This is at least 50 times greater MIC. Only six patients had detectable serum levels.

DISCUSSION AND CONCLUSION: This local delivery system provides an adequate means of administering high doses of vancomycin and tobramycin locally in infected total joints, without systemic levels and disappears in two weeks, without damaging the total joints.

PAPER NO. 126
Are there Discrepancies Between Frozen and Permanent Histopathologic Sections in Periprosthetic Knee Infections?
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Aaron J. Johnson, MD, Baltimore, MD
Alex A. Stroh, BS, Baltimore, MD
INTRODUCTION: Periprosthetic joint infections can be challenging to accurately diagnose and treat. One diagnostic method that has been used has been intra-operative pathology using freshly frozen tissue samples. A major concern is the intra- and inter-observer variability among pathologists, and the impact this has on the accurate diagnosis of continued infection. Some patients may present with continued infection following what should have been a definitive re-implantation procedure. The purpose of this study was to determine the discrepancy between diagnoses made from frozen sections, compared to the final permanent section diagnosis, and how this may have affected surgical treatment and patient outcomes.

METHODS: Between 2005 and 2008, there were 240 individual procedures performed at the senior author’s institution for staged revision for deep periprosthetic knee infection as confirmed by previously published criteria. During each staged procedure, from two to five tissue samples were sent for intra-operative histopathologic analysis, with samples saved for a later final histopathological. Frozen sections were evaluated from multiple slices from each sample with greater than 40 high-powered fields scanned per slice. A positive section was considered greater than five polymorphonucleocytes (PMN) per high powered field. Indeterminate sections contained an average of greater than one cell per high per field, but less than five. Negative sections averaged less than one cell per high per field, and contained no sections with five PMNs. A frozen section diagnosis was considered a false negative or positive if there was a discrepancy following what should have been a definitive re-implantation procedure. The purpose of this study was to determine the discrepancy between diagnoses made from frozen sections, compared to the final permanent section diagnosis, and how this may have affected surgical treatment and patient outcomes.

RESULTS: There were a total of seven discrepancies between diagnoses made from frozen sections, compared to the final permanent section diagnosis, and how this may have affected surgical treatment and patient outcomes.

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RESULTS: There were a total of seven discrepancies between diagnoses made from frozen sections, compared to the final permanent section diagnosis, and how this may have affected surgical treatment and patient outcomes.
DISCUSSION AND CONCLUSION: A false negative diagnosis can be a source for significant morbidity in total knee arthroplasty re-implantation procedures. Therefore, it is critical that these be minimized. The results of this study indicate that even with an experienced pathologist, discrepancies can occur between frozen and permanent section samples. Fortunately, in no instances out of 240 procedures did this appear to untowardly influence final outcome. To minimize the risk of a false negative interpretation, the senior authors emphasize the necessity of attaining multiple tissue sections intra-operatively if there is a high suspicion of infection.

PAPER NO. 127
Does the Reason for Knee Revision Surgery Influence the Patient Reported Outcomes?
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Simon Jameson, Middlesbrough, United Kingdom
Mike R. Reed, MBBS MD, Northumberland, United Kingdom
Paul J. Gregg. Cleveland, United Kingdom
David Deehan, MD FRCS, England, United Kingdom

INTRODUCTION: Total knee replacements (TKR) can fail for a variety of reasons. While a different clinical and surgical approach is often required to address assorted causes of failure, in many cases the final common pathway is revision surgery. Hypothesis: the reason for TKR revision does not affect short term patient reported outcomes measures (PROMs) and satisfaction. METHODS: We analyzed PROMs data collected on 1,066 patients who have undergone revision knee surgery since 1/4/2008. Of these revisions, 496 underwent a single-stage revision for an isolated mode of failure. Revisions for infection and revisions where the revising surgeon stated more than one reason for failure on the data collection form were excluded. The 496 revisions were allocated into groups based on the reason for revision surgery: Aseptic loosening (AS, n=194), pain (P, n=78), instability (I, n=56), stiffness (S, n=17) and other reasons (Oth, n=151). PROMs including the Oxford Knee Score (OKS) (rated 0-48, 48 best score), Euroqol-5D (EQ5D) questionnaire and patient satisfaction were collected prior to revision surgery, and again at a mean of 6.9 months post-operatively. RESULTS: The five groups were well matched for most of the background demographic variables, although the stiffness group had a higher proportion of males and a higher number of operations performed by a consultant than the other four groups. The groups differed in their pre and post-operative OKS with revision for stiffness reporting the lowest scores and only a modest improvement in knee function (Stiffness mean improvement 5.29 vs. 9.23 for whole group). Revisions for instability had a similarly small magnitude of improvement (5.96) (Table 1). All five groups demonstrated improvements on the EQ5D index scale (mean improvement = 0.207, best = “Others” 0.256, worst = “Stiffness” 0.063. Interestingly all five groups were worse postoperatively when assessed by the EQ5D health scale (mean improvement = -3.84). Improvements across all of the five EQ5D domains were noted for all groups. Overall rate of patient satisfaction (Outcome Excellent/Very Good/Good) was 61.6%. This varied between groups (AS=68.8% vs. P=55.4% vs. I=58.1% vs. S=58.8% vs. Oth=56.3%). Similarly the rate of success (patients much/a little better) differed between groups (AS=76.6% vs. P=60.0% vs. I=61.8% vs. S=52.9% vs. Oth=68.0%). DISCUSSION AND CONCLUSION: The outcome after single stage revision surgery varies depending upon the reason for revision. Patients revised for pain and stiffness have the poorest overall outcome and revisions for aseptic loosening tend to have the best improvements in knee function and general health status and the highest levels of patient satisfaction/success. To our knowledge, this is the first study to examine how the reason for revision affects patient-reported outcomes.

OKS total change pre to post operation.

<table>
<thead>
<tr>
<th></th>
<th>“Other” N=151</th>
<th>Aseptic N=194</th>
<th>Pain N=78</th>
<th>Instability N=56</th>
<th>Stiffness N=17</th>
<th>Total N=496</th>
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<tbody>
<tr>
<td>Mean Pre op Score</td>
<td>15.0 (95% CI 13.86 to 16.16)</td>
<td>16.57 (95% CI 15.39 to 17.74)</td>
<td>16.67 (95% CI 14.92 to 18.42)</td>
<td>18.58 (95% CI 16.01 to 21.15)</td>
<td>14.76 (95% CI 10.86 to 18.66)</td>
<td>16.28 (95% CI 15.56 to 17.00)</td>
</tr>
<tr>
<td>Mean Post op Score</td>
<td>25.35 (95% CI 23.57 to 27.13)</td>
<td>26.50 (95% CI 24.94 to 28.06)</td>
<td>25.29 (95% CI 22.35 to 28.23)</td>
<td>24.55 (95% CI 21.97 to 27.13)</td>
<td>20.06 (95% CI 13.50 to 26.62)</td>
<td>25.52 (95% CI 24.51 to 26.53)</td>
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<tr>
<td>Mean Score Change</td>
<td>10.34 (95% CI 8.68 to 12.00)</td>
<td>9.93 (95% CI 8.53 to 11.33)</td>
<td>8.82 (95% CI 6.38 to 10.86)</td>
<td>5.96 (95% CI 3.17 to 8.74)</td>
<td>to 26.62)</td>
<td>9.23 (95% CI 8.33 to 10.13)</td>
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PAPER NO. 128
Diagnosis of Periprosthetic Joint Infection: Abandon Serum White Blood Cell Count and Differential
Nader Toossi, MD. Philadelphia, PA
Bahar Adeli, BA. Philadelphia, PA
Ronald Huang, Philadelphia, PA
Javad Parvizi, MD, Philadelphia, PA

INTRODUCTION: Diagnosis of periprosthetic joint infection (PJI) remains a challenge. Serum white blood cell (WBC) counts and differentials have long been used during work up of a patient suspected for PJI. Although previous tests have shown a low sensitivity and specificity for this test, most surgeons still continue to utilize this test. The aim of this single institution study was to determine the utility of this serological test in diagnosis of PJI. METHODS: The retrospective cohort study comprised of 1,856 cases of revision hip or knee arthroplasty performed at our institution between January 2003 and August 2010. Among this cohort, 751 cases had a diagnosis of PJI based on our institutional criteria. Preoperative WBC counts and differentials (if available) were retrieved and receiver operating characteristic (ROC) curves were constructed to determine optimum sensitivity and specificity.

RESULTS: The area under the ROC curve for serum WBC count were constructed to determine optimum sensitivity and specificity. Preoperative WBC counts and differentials have long been used during work up of a patient (PJI) remains a challenge. Serum white blood cell (WBC) counts and differentials have long been used during work up of a patient suspected for PJI. Although previous tests have shown a low sensitivity and specificity for this test, most surgeons still continue to utilize this test. The aim of this single institution study was to determine the utility of this serological test in diagnosis of PJI. METHODS: The retrospective cohort study comprised of 1,856 cases of revision hip or knee arthroplasty performed at our institution between January 2003 and August 2010. Among this cohort, 751 cases had a diagnosis of PJI based on our institutional criteria. Preoperative WBC counts and differentials (if available) were retrieved and receiver operating characteristic (ROC) curves were constructed to determine optimum sensitivity and specificity. RESULTS: The area under the ROC curve for serum WBC count and neutrophil differential was 0.64 and 0.65, respectively. The diagnostic cut-off point determined by ROC curve analysis was 7,800 cells/µl with only 55.4% sensitivity and 66.1% specificity for WBC count in serum while the cut-off value for PMN percentage in serum was 68.8% with 52.7% sensitivity and 75.2% specificity. DISCUSSION AND CONCLUSION: Our study confirms the long held belief that serum white blood cell count and differential has minimal role in routine work up of patients with suspected PJI. This test should be abandoned for routine use and only utilized in patients with systemic infections.

PAPERS, POSTERS & SCIENTIFIC EXHIBITS
AR KNEE

*The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.*
**Repeat Two-stage Revision Knee Arthroplasty for Infection: Is Salvage Still Possible?**

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**Steve Kahane, MBBS BSc MRCS, London, United Kingdom**

**Vijai S. Ranawat, FRCS (Ortho), London, United Kingdom**

**Sabur A. Malek, FRCS (Ortho), Cardiff, United Kingdom**

**John Skinner, FRCS, London, United Kingdom**

**INTRODUCTION:** Infection after knee arthroplasty is a devastating complication. Our institution is a specialist tertiary hospital with significant experience in revision arthroplasty. Custom implants are routinely used to manage massive bone loss, beneficial in eradicating difficult to treat infections. Two-stage revision is the gold standard to eradicate deep infection in total knee arthroplasty. Published outcomes of a two-stage revision vary from 82-100%. There is very little published data where an initial two-stage revision fails and a repeat two-stage revision is performed. Our aim is to present the results of managing these challenging cases.

**METHODS:** We performed a consecutive, retrospective case series of revision knee arthroplasty for infection, between January 2006 and December 2008 allowing for a mean follow up of 43 months. Electronic theatre records were correlated with theatre log books to ensure a valid consecutive series was generated. Case notes were reviewed and data collated on the date and institution of primary arthroplasty, procedures undertaken at our institution, microbiology and bone loss following the first stage, serological markers (C reactive protein, Erythrocyte Sedimentation Rate) prior to second stage and outcome. **RESULTS:** During this three-year period we performed 430 knee revision operations. Fifty-one were in the presence of infection. A total of 90% (N=46) were referred from other hospitals. Overall infection was successfully eradicated in 35 out of 51 patients (69%). Of the remaining patients, seven are on long-term antibiotics at follow up, two are awaiting further surgery and seven have undergone above knee amputation (AKA). In our series of 19 patients who had a repeat two-stage, 42% (8/19) were infection free. Some 26% had a third two-stage procedure with the femoral component inserted after ligament balancing. The gap was measured by a tension device when 178 N of distraction force was applied. "A clinical gap" was defined as the distance calculated by subtracting the selected thickness of the tibial component including the polyethylene liner from the extension gap. The patients were divided into four groups with the clinical gap (tight: ≤ 0.0 mm, slightly tight: 0.0 mm < ≤ 1.0 mm, slightly loose: 1.0 mm < ≤ 2.0 mm, loose: > 2.0 mm). We compared the postoperative extension angle and the proportion of patients with a residual flexion contracture between each group (postoperative flexion contracture was defined as less than 0 degrees). At one month and one year after surgery, the knee extension angle was compared with the distal femoral axis and the proximal tibial axis, RESULTS: The mean extension angle was 1.0 degrees at one month and 5.9 degrees at one year postoperatively. The mean clinical gap was 1.0 mm at the medial compartment and 3.8 mm at the lateral compartment. A total of 13 patients (18.6%) had a residual flexion contracture one year after surgery. The proportion of patients with a residual flexion contracture one year after surgery was 6/13 (46.2%) in the tight group, 5/26 (19.2 %) in the slightly tight group, 1/20 (5%) in the slightly loose group, and 1/12 (9.1%) in the loose group. The rate in the tight group differed significantly from those in the slightly loose group (P = 0.00295) (Figure 1). **DISCUSSION AND CONCLUSION:** Custom constrained, rotating hinge prostheses enable aggressive soft tissue debridement including ligaments. Successful repeat two-stage requires a multidisciplinary approach including tissue viability nurses, microbiologists and plastic surgeons. In our series, there was a 58% (11/19) chance of eradicating infection with repeat two-stages. The risk of amputation increases with further procedures to 32% (6/19), particularly where the referring hospital has attempted revision prior.
formation. We believe that the clinical gap is a useful reference to select the proper thickness of the tibial component for the extension gap. At least more than 1mm of extension gap was necessary at the medial compartment to achieve full extension in the early postoperative course of total knee arthroplasty.

INTRODUCTION: Debate has raged over cruciate retaining (CR) or posterior stabilized (PS) total knee arthroplasty (TKA) having better motion. Frequently, CR designs are lumped together when comparing outcomes. Additionally, multiple factors have been proven to influence the rate of manipulation in TKA. The purpose of this study is to determine if different CR bearing insert designs provide better motion or different manipulation rates.

METHODS: All primary TKA performed by two surgeons between March 2006 and March 2009 were reviewed and 2,450 CR-TKA were identified. The same CR femoral component, instrumentation, and tibial design were used. In 1,334 TKA a CR insert with 3° posterior slope and no posterior lip was used (CR-S). In 804 an insert with no slope and a small posterior lip was used (CR-L) and in 312 the posterior cruciate ligament (PCL) was either resected or stabilized insert. Substitution for the PCL (PS design) may not be necessary even when the PCL is deficient.

RESULTS: More CR-AS were used in heavier patients (P<0.05) and in patients with less pre-operative range of motion (p<0.05). The average improvement in range of motion was highest for the CR-AS inserts (3.3° vs. 2.6°; p=0.03), although likely not clinically significant. There was a significantly higher manipulation rate with the CR-S and CR-L inserts than CR-AS (Pearson's 6.51; p=0.04).

DISCUSSION AND CONCLUSION: Despite sacrificing or not substituting for the PCL, motion improvement was highest, and manipulation rate was lowest in knees with a deep-dish, anterior-stabilized insert. Substitution for the PCL (PS design) may not be necessary even when the PCL is deficient.
Conversely, the addition of antibiotics may have an unintended negative impact on the mechanical properties of the cement, and in fact result in a higher revision rate. We sought to answer this question by examining data from both the Canadian Joint Replacement Registry (CJRR), and the hospital morbidity database (HMDB) which contains detailed information on all hospital stays in Canada.

METHODS: We identified 36,681 patients with the diagnosis of degenerative arthritis who had their cemented primary TKR appropriately recorded in both CJRR and the HMDB (linkage rate 77%). The HMDB was then queried to ascertain if a revision had been performed in the two years following the primary TKR. If a revision was identified, the CJRR was queried for further information on the exact reason for revision. In addition to the presence/absence of antibiotics in the cement, other variables considered in the analysis included age, gender, comorbidities (Charlson index), and the presence of diabetes.

RESULTS: A total of 16,665 patients had their TKR inserted using antibiotic containing cement, while 20,016 patients had their TKR inserted without antibiotics in the cement. Revision occurred in 532 patients, representing an overall two-year revision rate of 1.45%. This reflected a revision rate in the antibiotic group of 1.51%, and in the non-antibiotic group of 1.40%, p=0.41. CJRR data on the exact reason for revision was available for 206 of these 532 patients (38.7%). Twice as many patients were recorded as being revised for aseptic loosening in the non antibiotic group than the antibiotic group (p=0.02), however reported rates of revision for infection or pain of unknown origin did not differ between the groups. When controlling for the presence of diabetes, comorbidity index, age and gender, the hazard ratio of revision in the antibiotic cement group was 1.066 [95% CI 0.90 - 1.27, p=0.46] compared to the non antibiotic group.

DISCUSSION AND CONCLUSION: It appears that the addition of antibiotics to cement for TKR has no clinically important effect on the risk of revision within two years of surgery. Longer follow up, as well as confirmation of these findings with other national registries, is warranted.

PAPER NO. 134

◆ Removed Antibiotic-Impregnated Cement Spacers in Two-Stage Revision Joint Arthroplasty Do Not Show Biofilm In Vivo

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Stacey Guillot, Charlottesville, VA
Jan Redick, Charlottesville, VA
James A A. Browne, MD, Charlottesville, VA

INTRODUCTION: Although the use of antibiotic-impregnated cement spacers is common in the treatment of periprosthetic joint infection, surprisingly little is known about the properties of the spacer at the time of reimplantation. Antibiotic elution levels at the time of reimplantation are often below the minimum inhibitory concentration, raising concern that these foreign bodies may provide a potential attachment site for formation of biofilm. To our knowledge, no study has examined the antibiotic cement removed at the time of reimplantation to determine if spacers harbor biofilm.

METHODS: Advanced microscopy was used to evaluate the surface anatomy of representative samples of antibiotic-eluting spacers collected intraoperatively at the time of reimplantation from six patients (mean age 61) undergoing two-stage knee or hip revision for culture positive infection. Low and high power scanning electron and confocal microscopy examined cement for surface texture, cell type, extracellular matrix formation and evidence of bacteria and biofilm. Patients were followed clinically for evidence of recurrent or persistent infection.

RESULTS: The average in vivo time between cement spacer insertion and removal was 85 days. Pathogenic organisms at the time of spacer placement included Staphylococcus epidermidis, Streptococcus viridans, beta-hemolytic streptococci, Enterococcus faecalis, and Candida parapsilosis. Two of the patients had positive cultures at the time of spacer removal. One spacer was articulating (hip) and five were static (knee). The spacers contained an average total dose of 9.2 g of vancomycin (range, 2-15 g) and 5.0 g of tobramycin (range, 4.8-7.2 g). One spacer also contained gentamicin and amphotericin. Scanning electron microscopy of the removed spacers revealed modest fibrous matrix formation and inflammatory cells with no biofilm or bacteria detected (Figure 1). Confocal microscopy also demonstrated modest formation of fibrous matrix but no evidence of biofilm formation. Three of the six patients had evidence of recurrent infection following removal of the spacer.

DISCUSSION AND CONCLUSION: This prospective case series failed to demonstrate biofilm formation on antibiotic-impregnated cement spacers in vivo, even in patients that failed due to persistent or recurrent infection. While duration of effect of antibiotic elution is a concern, the lack of in vivo biofilm formation in this study lends support the current practice of using antibiotic-impregnated cement spacers in two stage revision for chronic infection. Microscopy does not appear to be an effective tool to screen for ongoing infection at the time of reimplantation.

PAPER NO. 135

Factors Associated with Deep Infections in 56,216 Primary Total Knee Arthroplasties

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Liz Paxton, MA, San Diego, CA

INTRODUCTION: Total knee arthroplasty (TKA) deep surgical site infections (SSI) are a devastating complication. Patient and surgical risk factors of TKA deep SSI have not been thoroughly examined. The purpose of this study was to examine patient and surgical factors associated with TKA deep SSI in a large, U.S. integrated healthcare system.

METHODS: A prospective cohort study of primary TKA procedures recorded in a Total Joint Replacement Registry (TJRR) between 2001 and 2009 was conducted. Deep SSIs were screened using a validated algorithm and adjudicated by chart review. Patient characteristics, surgical factors, and surgeon and site characteristics were identified using the TJRR. Cox regression models were used to assess univariate and multivariable associations of possible risk factors and deep SSI.

RESULTS: The study cohort consisted of 56,216 TKA procedures, where 63% were women, average age was 67 years (SD=10), and
BMI was 32 kg/m² (SD = 6). The incidence of deep SSI was 0.72% (95% CI 0.65-0.79). In a fully adjusted model, patient factors associated with deep SSI include: BMI > 35 (HR 1.47, 95% CI 1.17-1.85), diabetes mellitus (HR 1.28, 95% CI 1.03-1.60), male sex (HR 1.89, 95% CI 1.54-2.32), ASA > 3 (HR 1.65, 95% CI 1.33-2.04), diagnosis of osteonecrosis (HR 3.23, 95% CI 1.41-9.46), diagnosis of post-traumatic arthritis (HR 3.23, 95% CI 1.68-6.23), and Hispanic race (HR 0.69, 95% CI 0.49-0.98). Surgical factors associated with SSI include: use of antibiotic irrigation (HR 0.67, 95% CI 0.48-0.92), bilateral procedures (HR 0.51, 95% CI 0.31-0.83), quad-release exposures (HR 4.76, 95% CI 1.18-1.98), antibiotic laden cement (HR 1.53, 95% CI 1.18-1.98), annual site volume <100 cases as compared to >=200 cases (HR 0.33, 95% CI 0.12-0.90). In a subanalysis of a more limited dataset (N = 45181), operative time was also found to be a SSI risk factor with a 9% (95% CI 4%-13%) increased risk per 15 minutes increment.

DISCUSSION AND CONCLUSION: A comprehensive infection surveillance system, combined with a detailed TJR registry, identified patient and surgical factors associated with infection in a large population. High risk patients should be counseled and modifiable clinical conditions should be optimized. Use of antibiotic irrigation should be encouraged, but antibiotic laden cement may not help.

PAPER NO. 406

The Effect of Patient Specific Factors on Revision Rates for Unicompartmental Knee Arthroplasty
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Monti Khatod, MD, Santa Monica, CA
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Liz Paxton, MA, San Diego, CA

INTRODUCTION: In 1,746 primary, cemented unicompartmental knee arthroplasties (UKA), when adjusting for surgeon and implant factors, only age <55 and ASA category <3 were associated with lower revision rates and higher relative risk of revision. Cemented UKA revision rates (RR) have been linked to patient specific factors such as weight, age and gender. This paper aims to quantify the effect of patient specific factors on UKA survivorship and risk of revision in a large community based registry. METHODS: We identified all cemented primary UKA procedures performed between 2001 and 2009 in a large community based arthroplasty registry to assess the non infection related revision rate for cemented, primary UKAs relative to patient age (<55, 56-65, >65), gender, weight (> or <180lbs), body mass index (BMI) (<30, 31-34, >35) and ASA score (1-2 vs. 3). Using a Cox regression model, we calculated the relative rate of revision for these variables when adjusting for implant design as well as surgeon volume, hospital volume, surgeon experience and fellowship training. RESULTS: A total of 1,746 cemented UKAs were identified. The implant revision rate (RR) was highest in patients <55 years old (11.7%) and ASA category 3 (2.4%). BMI, weight and gender were not associated with a statistically higher RR in univariate analysis. The relative risk of revision when adjusting for other variables was 1.91 (P = 0.045) for ASA <3, and 4.50 (P <0.001) for age <55. Weight and gender differences did not lead to statistically increased risk.

DISCUSSION AND CONCLUSION: In our registry, higher revision rates for cemented UKAs are associated with younger patients (<55 years old) and with a lower ASA score (1 or 2) in both univariate and multivariate analysis. Of note, and in contrast to other studies, female gender, weight >180 lbs and BMI >35, are not risk factors for revision in this large cohort of patients.
Matched Comparison Between High Tibial Osteotomy and Unicompartmental Joint Replacement

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Gulraj Matharu, BSc, Walsall, United Kingdom
Jodi E. Dixon, West Midlands, United Kingdom
Laura Parker, Stockport, United Kingdom
Khalid Baloch, Birmingham, United Kingdom
Paul Pynsent, PhD

INTRODUCTION: In the young patient presenting with medial compartmental osteoarthritis the decision can be difficult whether to perform high tibial osteotomy (HTO) or unicompartmental joint arthroplasty (UKA). Our aim was to ascertain by matched comparison which form of treatment had the better survival and functional outcome.

METHODS: Forty-two patients undergoing closing wedge high tibial osteotomy for medial compartment osteoarthritis were matched for age and gender to a cohort of 329 patients who had undergone medial unicompartmental knee replacement over a similar time period. After matching, 42 patients were in each group. Kaplan Meier analysis evaluated survival. Arthroplasty was considered as the end-point. Oxford score evaluated the functional outcome.

RESULTS: There were eight females in the unicompartmental group and nine in the high tibial osteotomy group. Mean age for high tibial osteotomy was 44.1 (95% CI 42.6 to 45.7) and for unicompartmental arthroplasty 47.4 (95% CI 45.95 to 48.8). Kaplan Meier analysis showed 81% survival at seven years with eight failures in the high tibial osteotomy group. Mean failure occurred at 4.6 years. There were no failures in the unicompartmental replacement group. Mean Oxford score after HTO was 33 (95% CI 25 to 40), after UKA was 27 (95% CI 16 to 35).

DISCUSSION AND CONCLUSION: In this matched comparative study, we found better survival for unicompartmental joint replacement rather than high tibial osteotomy in the young patient with medial compartment osteoarthritis of the knee.

Medial Unicompartmental Knee Replacement: Survival and the Effect of Age and Gender

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INTRODUCTION: This large independent series demonstrates good medium-term survival and functional outcome can be achieved with unicompartmental knee replacement (UKR) in appropriately selected patients. Survival for unicompartmental knee replacement has been reported to be 97.1% at 10 years by the designing center. However, survival at independent centers is variable and may be as low as 84.7% at five years. This study aimed to determine the survival and functional outcome for UKR performed at an independent center and to assess whether age and gender affect survival.

METHODS: Between 2000 and 2008, 459 consecutive UKRs were implanted in 392 patients using a minimally invasive technique at one independent center. In addition to isolated medial knee compartment osteoarthritis, all patients had a functionally intact anterior cruciate ligament, a correctable varus deformity and a fixed flexion deformity of 10 degrees or less. Mean age at the time of UKR was 63.0 years (range 34.6 to 87.4 years) and 53% were female. All patients received clinical and radiological follow up. Mean follow up time was 4.4 years (range 0.5 to 11.2 years) with no patient lost to follow-up. The Kaplan-Meier method was used to determine survival and the end-point for survival was conversion to total knee replacement (TKR). Functional outcome was assessed using the Oxford knee score (OKS). A Cox proportional hazard model was used to determine the effect of age and sex on UKR survival.

RESULTS: Twenty knees (4.4%) have undergone revision to TKR at a mean time of 3.2 years (range 1.2 to 6.2 years). Aseptic component loosening (n=11) and unexplained pain (n=5) accounted for most failures. Cumulative survival was 94.4% at five years (95% confidence interval 90.9 to 97.0) and 93.0% at eight years (95% confidence interval 84.8 to 96.2). Mean age of patients undergoing revision to TKR (n=20) was 60.2 years (range 48.9 to 75.2 years) at the time of UKR, and 55% (n=11) were male. The median OKS for the entire cohort was 62.5% (interquartile range 50.0% to 74.9%) preoperatively and 31.2% (interquartile range 12.2% to 52.1%) at latest follow up. No cases of radiological failure without revision of the prosthesis were identified. Physiological radiolucent lines were seen in 32% (n=148) of knees around the tibial component. Both age and gender failed to have a statistically significant affect on UKR survival.

DISCUSSION AND CONCLUSION: The present study provides evidence from one of the largest independent cohorts that good medium-term survival and functional outcome can be achieved with UKR in appropriately selected patients. No failures occurred due to progression of osteoarthritis in the lateral compartment, a common mode of failure reported in other series. Age and gender did not affect prosthesis survival and therefore neither should be considered contraindications for performing UKR.

Comparing Patient Dissatisfaction Following Total and Unicompartmental Knee Replacement

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INTRODUCTION: Younger patients (aged 65 years or less) had higher dissatisfaction rates at one year following unicompartmental knee replacement (UKR). Unicompartmental knee replacement is a treatment option for patients presenting with isolated medial compartmental osteoarthritis. In many cases, such patients are aged 65 years or younger.

METHODS: A regional arthroplasty registry was established in 1990 collecting prospective data on knee arthroplasties performed in this region of the U.K. Self completed questionnaires were sent to 1,081 patients at one year, who had undergone a UKR. Completed questionnaires were received from 648 patients (60% return rate).

RESULTS: A total of 80.2% (451) reported being satisfied, 6.6% (37) unsure of their satisfaction and 13.2% (74) dissatisfied. Some 78% of those in the 55 or under group (n=92) were satisfied relative to 77.6% in 56-65 yr group (n=264), 90.6% for 66-75 yrs (n=202) and 87.6% for 75+ yrs (73). Increasing age appears to correlate with increased satisfaction rates. Of those who were dissatisfied, severe pain was the primary reason given as a cause for dissatisfaction. In comparison, patients undergoing total knee arthroplasty (TKA), who were sent identical questionnaires, demonstrated no difference in satisfaction rates in each of the different age groups. The overall satisfaction rate in such patients was 90%.

DISCUSSION AND CONCLUSION: Patients having a UKR appear to have similar satisfaction rates to patients undergoing TKA, but only in the older age group (age 66 years or older). In the younger patient (age 65 years or less), dissatisfaction rates remain a significant issue and the management of such patients continues to pose a challenging problem.
Outpatient Total Knee Arthroplasty: A Cost and Outcomes Analysis

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INTRODUCTION: There has been no previous study that has quantified and compared the costs and outcomes between knee arthroplasty patients who have differing lengths of stay after surgery. The purpose of the present study is to determine the differences in cost, complications and mortality between patients who stay the standard three to four nights in a hospital versus those that elect for either an outpatient procedure or a shortened stay.

METHODS: The Medicare 5% limited data sets (LDS) sample was used to identify patients with a total knee arthroplasty (TKA) procedure between 1997-2009 using ICD-9-CM (81.53) and CPT4 (27447) codes. TKA patients were separated into the groups treated in the following hospital settings: outpatient, one day inpatient, two days inpatient, three to four days inpatient or five-plus days inpatient. Results considered average annual payments adjusted to Jan-2011$, mortality, readmission, revision and common complications (Table 1). Differences in costs and risk ratios for each outcome were adjusted using logistic regression for age, sex, race, buy-in status, region and Charlson score. The results were compared at 90 days, one year and two years after surgery.

RESULTS: There were 23,534 five-plus day, 73,498 three to four day, 6,756 two day, 1,374 one day and 2,883 outpatient patients included in the study. Compared to the traditional three to four day stay, the incremental payments for osteoarthritis attributable costs at two years were -$6,964 (outpatient), -$3,327 (1 Day), -$1,681 (2 Day), and +$1,159 (5+ Day). At one year, the outpatient group had less pain (HR=0.86, p=0.0001) and stiffness (HR=0.82, p=0.0167) in comparison to the traditional stay group, but had higher 90-day readmission (HR=1.44, p=0.0397), dislocation (HR=1.77, p=0.0468) and mortality (HR=2.13, p=0.0005) risks (Table 1). The one day group had less pain (HR=0.83, p=0.0022), but a higher risk of mortality (HR=1.62, p=0.0198) and revision (HR=1.93, p=0.0018) at one year. The two day group had a higher risk for dislocation (HR=1.37, p=0.0436), implant loosening (HR=1.92, p=0.005), mortality (HR=1.26, p=0.0385) and revision (HR=1.31, p=0.0231) at one year.

DISCUSSION AND CONCLUSION: We estimated the costs, mortality and complications after TKA for differing lengths of stay in the U.S. Medicare population. Despite sizeable cost reductions, there was an increased revision and mortality risk for the outpatient and short stay TKA groups relative to the traditional stay group. The shorter stay groups did show an improvement in associated pain and stiffness. The five-plus stay group suffered the highest costs and hazard risks for mortality, revision and many of the complications analyzed.

Table 1: 1-year complications, mortality and revisions after TKA

<table>
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<tr>
<th>Number of Patients</th>
<th>Outpatient</th>
<th>1 Day</th>
<th>2 Days</th>
<th>3-4 Days</th>
<th>5+ Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate (%)</td>
<td>Hazard Ratio</td>
<td>Rate (%)</td>
<td>Hazard Ratio</td>
<td>Rate (%)</td>
<td>Hazard Ratio</td>
</tr>
<tr>
<td>DVT</td>
<td>6.12</td>
<td>0.90</td>
<td>6.85</td>
<td>1.04</td>
<td>7.36</td>
</tr>
<tr>
<td>Dislocation</td>
<td>0.72</td>
<td>1.24</td>
<td>0.59</td>
<td>1.01</td>
<td>0.83</td>
</tr>
</tbody>
</table>

For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
INTRODUCTION: Valgus high tibial osteotomy (HTO) and unicompartmental knee arthroplasty (UKA) for medial unicompartmental osteoarthritis have become subjects of debate. Information is lacking regarding return to recreational activities after valgus HTO or UKA. The hypothesis is that UKA can provide better outcomes in the recreational activity after surgery than HTO. The purpose of this study was to compare clinical outcomes, including return to recreational activities, after opening-wedge HTO and UKA.

METHODS: Patients that underwent HTO or UKA for medial unicompartmental OA with varus deformity (≥ K-L grade II OA) and with complete postoperative follow-up records for at least three years (range; three to four years) were included. Patients with ≥ K-L grade II OA of the lateral or patellofemoral compartments, knee flexion below 120° or flexion contracture exceeding 20°, and those with ligament instability or inflammatory arthropathy were excluded. One-hundred-eight patients were included for this study. Average age at time of surgery was 58.3 years in the HTO group (seven men and 51 women) and 60.3 years in the UKA group (two men and 48 women). Returns to recreational activities were compared after surgery for six different activities: cycling, swimming, exercise walking, dancing, jogging and mountain climbing. The Tegner activity scale was also used to evaluate activity levels. Clinical outcomes were assessed using ranges of motion and Lysholm knee scores. In addition, osteoarthritic changes of the tibiofemoral and patellofemoral joints were compared using the Kellgren-Laurence grading system.

RESULTS: In both groups, the number of patients that participated in recreational activities was significantly reduced after surgery (39 vs. 30 patients). However, no significant intergroup difference was evident (p=0.65). Patients participated in an average of 1.3 different recreational activities in the HTO group and in 1.6 activities in the UKA group, which showed no significant difference between two groups. Average Tegner activity scale scores and ranges of knee motion and Lysholm knee scores were not significantly different at final follow up. During follow up, five cases showed osteoarthritic of the patellofemoral joint (three in the HTO group and two in the UKA group). Lateral compartmental osteoarthritis (≥ Gr II) was observed in five cases in each group.

DISCUSSION AND CONCLUSION: This study identified no significant differences between HTO and UKA for medial unicompartmental osteoarthritis in terms of return to recreational activity and short-term clinical outcomes. Both techniques provided satisfactory outcomes in terms of return to sports activities and clinical and radiological results.
Cementless Unicompartmental Knee Arthroplasty is Safe and Improves Implant Fixation: A Multi-center Study

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INTRODUCTION: This study of 1,000 cementless unicompartmental knee arthroplasties (UKA) demonstrates that fixation without cement appears better than with cement as the incidence of radiolucency is much lower. Cementless fixation was shown to be safe as the incidence of complications is not higher than with cement.

METHODS: We studied 1,000 consecutive patients undergoing medial cementless UKA at three institutions in three countries. All patients had full thickness cartilage loss in the affected compartment with intact anterior cruciate ligament and correctable varus deformity. All underwent cementless Oxford UKA and were followed prospectively including radiological and clinical assessment. Radiographic views aligned with the bone cement interfaces were obtained. Post-operative complications were recorded.

RESULTS: In a preliminary analysis the mean follow up was two years (range: one year - six years). None of the patients died as a result of surgery. Less than 1% of patients required revision or had significant implant related complications. Radiographic analysis shows that the incidence of complete radiolucencies at the bone-implant interface is less than 0.5% which is significantly less than that reported with cemented UKA (32%).

DISCUSSION AND CONCLUSION: Cementless fixation is a safe and reproducible treatment option for managing end-stage medial compartment osteoarthritis. Cementless fixation appears to be more reliable than cemented fixation as the incidence of radiolucency is much lower. Common causes of early revision of UKA are aseptic loosening and pain. Surgeons commonly revise early for pain if radiolucencies are present as they suspect aseptic loosening. The incidence of these early revisions are likely to be lower with cementless than cemented fixation.

Minimally Invasive Total Knee Arthroplasty: Impact on Knee Strength and Functional Performance

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INTRODUCTION: Despite growing interest in minimally invasive surgery (MIS) technique for total knee arthroplasty (TKA), little data exist on muscle strength, knee range of motion and functional outcomes with this method. We hypothesized that improvements in strength and functional performance would be observed among patients undergoing minimally invasive TKA versus standard TKA.

METHODS: A prospective randomized controlled trial was conducted on patients undergoing primary TKA. Forty-four patients, aged 50-85 years (mean age: 64.3; 22 female, 22 male) blinded to group assignment, underwent TKA using standard parapatellar or quadriceps sparing approach (MIS). Identical skin incisions and post-operative rehabilitation were used for both groups. Assessment was performed pre-operatively and at one, three and six months post-operatively by a blinded evaluator.

Specific outcome measures included Western ON and McMaster Osteoarthritis Index (WOMAC), quadriceps strength, Knee Society Pain and Function score (KSS), timed up and go test (TUG), knee active range of motion (AROM) and 100 foot walk test (100FWT).

RESULTS: No significant differences in the measured outcomes were observed between groups pre-operatively. No significant differences in blood loss (p=0.36) or tourniquet time (p=0.78) were observed between groups intra-operatively. At one month postoperatively, no differences in WOMAC (p=0.66), quadriceps strength (p=0.09), TUG (p=0.90), KSS pain and function (p=0.75, 0.46), flexion and extension AROM (p=0.53, 0.28), or 100FWT (p=0.56) were observed between groups. At three months, improvements were noted in MIS WOMAC (p=0.03) versus standard; however, no significant differences were observed between groups for TUG (p=0.31), KSS pain and function (p=0.55, 0.16), flexion and extension AROM (p=0.44, 0.27), and 100FWT (p=0.15). At six months, no significant differences between groups were noted for WOMAC (p=0.33), TUG (p=0.48), KSS pain and function (p=0.95, 0.32) flexion and extension AROM (p=0.34, 0.42) and 100FWT (p=0.32).

DISCUSSION AND CONCLUSION: Although patients undergoing TKA using MIS trended towards more favorable quadriceps strength at one month and demonstrated more favorable total WOMAC scores at three months compared to those with standard approach, overall, there were no differences between groups. Therefore, these results do not support an advantage of MIS over standard technique in TKA surgery.

Funding: National Institutes of Health (R03 AR054538, UL1 RR025780, T32 AG000279), Arthritis Foundation.

Outcome Following Revision Surgery for Failed Unicompartmental Knee Replacement

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INTRODUCTION: Most revisions were technically straightforward, however patients failed to achieve the better functional outcomes reported following primary unicompartmental knee replacement (UKR) and total knee replacement (TKR). Revision of a failed UKR may be achieved with standard TKR implants or may require stemmed implants, augmentation and/or bone grafting. The outcome following revision is variable with a number of studies reporting different surgical interventions are frequently needed. This study aimed to determine the complexity of the revision surgery required for a failed UKR and the clinical outcome following revision.

METHODS: Details of consecutive patients undergoing revision of UKR to TKR at a single independent center between 2000 and 2009 were collected prospectively. Data was collected on patient demographics, indication for UKR failure and details of the revision surgery performed. All patients underwent clinical and radiological follow up. Functional outcome was assessed using the Oxford knee score (OKS) with a healthy joint scoring 0% and the worst possible joint 100%. The OKS was compared to the hospitals standards following primary UKR and primary TKR.

RESULTS: During the study period 494 UKRs were implanted, of
which 20 knees (4.0%) were revised to TKR. Mean age at revision surgery was 63.5 years (52.3 to 77.3 years) and 55% (n=11) were male. Mean time to revision surgery from UKR was 3.2 yr (range 1.2 to 6.2 years). Aseptic component loosening (n=11) and unexplained pain (n=5) accounted for most failures. All patients were revised to a cemented TKR. Stemed implants were used in 35% (n=7) of the revised knees (four knees with tibial only stems and three knees with both components stemmed). Three of these knees (15%) also required a tibial augment and one knee had a bone allograft. During a median follow-up of 2.9 years (range 0.5 to 5.8 years), one knee has been re-revised for instability 1.5 years later. No other patient underwent further surgical intervention and there were no cases of radiological failure. The median post-revision OKS at latest follow-up was 45.0% (range 6.3% to 70.8%). Median postoperative OKS for patients undergoing a primary UKR (n=494) and primary TKR (n=4781) at our center are 31.2% and 29.2% respectively.

DISCUSSION AND CONCLUSION: The present study demonstrates revision of failed UKR can be achieved with standard TKR implants in most cases. There was a low need for further surgical intervention during follow up. However, following revision surgery patients failed to achieve the better functional outcomes reported after primary UKR and primary TKR performed at our center.

PAPER NO. 418

Does Patellofemoral Arthritis Change the Indication for Unicompartmental Knee Arthroplasty?

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INTRODUCTION: The presence of radiographic or clinical symptoms of patellofemoral osteoarthritis is often considered a contraindication to medial unicompartmental knee arthroplasty (UKA). However, little information is available on complications related to the patellofemoral articulation in UKA. The purpose of the present study was to compare outcomes after UKA in patients with patellofemoral osteoarthritis, and to evaluate the effect on functional outcomes of patellofemoral osteoarthritis with respect to grade, size and magnetic resonance imaging (MRI) determined chondral lesion location. METHOD: In this study, the outcomes of 48 patients without patellofemoral arthritis that underwent medial UKA (the Non-PF OA group) were compared with the outcomes of 57 patients with patellofemoral arthritis that underwent medial UKA (the PF OA group) after a mean follow up of three years. All patients received the fixed bearing UKA. Clinical outcomes, such as, anterior knee pain (VAS) and Hospital for Special Surgery (HSS) scores, ranges of motion and radiological parameters, such as lower extremity alignment and the progression of patellofemoral osteoarthritis, were compared. MRI patterns of chondral lesions on patellofemoral joints were analyzed, and their effects on functional outcomes were evaluated. RESULTS: At final follow-up visits, no significant inter-group difference was found in terms of anterior knee pain, average HSS score or range of motion (p>0.05 for all values). Five patients (10.4%) in the non-PF OA group and six patients (10.5%) in PF OA group progressed by more than two grades according to the Kellgren-Lawrence classification (p=0.872). Furthermore, mean femorotibial angles and mechanical axes were no different in the two groups, and chondral lesion grades, sizes and locations were not found to be significantly associated with outcome (p>0.05 for all values). No complication requiring revision surgery occurred in either group. DISCUSSION AND CONCLUSION: Preoperative anterior knee pain and patellofemoral joint degeneration were found to be unrelated to a poorer outcome in patients with or without patellofemoral arthritis that underwent medial UKA. Furthermore, no correlation was found between any functional outcome variable and chondral lesion pattern type. The study shows that medial unicompartmental knee osteoarthritis with mild to moderate patellofemoral arthritis is a good indication for UKA.

PAPER NO. 419

The Role of Pre-operative Self-efficacy in Predicting Outcome after Total Knee Replacement

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INTRODUCTION: For the majority of patients, total knee replacement (TKR) is a successful procedure for providing relief from chronic pain. However, there are some patients who continue to experience chronic pain after TKR. There is now evidence emerging to suggest that psychological factors are important risk factors for chronic pain after surgery. The aim of this study was to determine if self-efficacy is a significant and independent pre-operative predictor of patient-reported pain and function at one-year after TKR.

METHODS: Patients listed for a primary TKR because of osteoarthritis were recruited from pre-operative assessment clinics at one regional orthopaedic center. Before surgery, patients completed a questionnaire which included the WOAMC Pain and Function Scale, Pain Self-Efficacy Scale, the Hospital Anxiety and Depression Scale (HADS) and questions about other painful joints. Patients then completed the WOMAC Pain and Function Scales at one-year post-operative. Regression analysis was performed to determine if pre-operative self-efficacy was a significant and independent predictor of outcome after TKR.

RESULTS: Overall, 251 patients were recruited into this observational cohort study, and one-year questionnaire data was available for 220 patients. At one-year post-operative, 7% of patients reported severe pain in their replaced knee and 9% reported severe functional limitations. Self-efficacy was found to be a significant pre-operative predictor of functional ability (p=0.024), but not pain (p=0.675) at one-year post-operative, after controlling for age, gender, depression and anxiety, pre-operative pain intensity and painful joints elsewhere. Other significant pre-operative predictors of post-operative pain and function were baseline pain and function, worse HADS and more painful joints elsewhere. DISCUSSION AND CONCLUSION: This study demonstrates that pre-operative pain self-efficacy is a significant and independent predictor of patient-reported functional ability at one-year after TKR. Future research is needed to assess the impact of interventions for enhancing pre-operative self-efficacy on patient-reported outcomes after TKR.

PAPER NO. 420

Determining Minimum Clinically Important Difference and Targeted Clinical Improvement Values for the Oxford 12

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INTRODUCTION: The Oxford 12 hip and knee scores have gained significant popularity worldwide in evaluating the outcomes of arthroplasty. However, little has been published...
on a minimum clinically important difference value (MCID), or on the ideal amount of improvement in Oxford 12 score that should result from arthroplasty, i.e. the targeted clinical improvement (TCI). An MCID represents the smallest difference in scores that is clinically apparent to the patient, while the TCI represents the amount of improvement required to satisfy the patient's expectation of the intervention. The TCI is necessarily influenced by patient perceptions of costs (such as surgical risks) and benefits (pain relief, improved function). MCID values allow for robust comparisons of the functional status of groups of patients, in addition to providing important information required for study design. The TCI provides guidance on the amount of improvement that should be targeted as the result of total hip and knee arthroplasty and on candidacy for total joint replacement, and accordingly can be used to assess the outcome of care in ongoing quality initiatives that utilize patient reported outcomes. These values facilitate the translation of research and clinical outcomes beyond the limits of methodology and statistical methods, we have determined both MCID and TCI values for the Oxford 12 hip and knee scales for total knee arthroplasties (TKAs) and primary total hip arthroplasties (THAs) performed between January 2005 and December 2009. In addition to Oxford 12 scores, the dataset contained responses to a five-level satisfaction question that ranged from "very unsatisfied" to "very satisfied." Values for the MCID and TCI were determined using anchor based techniques that compared change in Oxford 12 score to satisfaction level. The slope of the line of best fit across mean improvements in Oxford 12 score stratified by satisfaction level provided an estimate of the MCID. The TCI was calculated using ROC analysis to find the improvement in Oxford 12 score that best discriminated between patients who were satisfied with surgery and those who were not.

RESULTS: An MCID for the Oxford 12 knee score is 5.2 points (Figure 1) and for the hip is 4.9 points. The TCI for TKA is an improvement of 11.5 points and for THA an improvement of 19.1 points (Figure 4). ROC statistics were very good with the area under the curve of 0.86 and 0.84 respectively.

DISCUSSION AND CONCLUSION: Using a robust data set, we have determined both MCID and TCI values for the Oxford 12 hip and knee scales for their use with TKA and THA patients. The MCID values facilitate comparisons of functional status for groups of patients, in addition to providing important information required for study design. The TCI provides guidance on the amount of improvement that should be targeted as the result of TKA and TKA, and accordingly can be used to assess the outcome of care in ongoing quality initiatives that utilize patient reported outcomes. These values facilitate the translation of research and clinical outcomes beyond the limits of statistical significance alone.

Figure 1 - Linear increase in mean Oxford 12 improvement across satisfaction ratings at one year post-operation for TKA. Slope of the line of best fit indicates that the difference in Oxford 12 improvements between groups is 5.2 points, which we have defined as the MCID.

**PAPER NO. 481**

**Leukocyte Esterase Reagent Strips for the Rapid Diagnosis of Periprosthetic Joint Infection**

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Adolph V. Lombardi, Jr, MD, New Albany, OH
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INTRODUCTION: Leukocyte esterase reagent (LER) strips are commonly used for the diagnosis of urinary tract infection and have also been used for the diagnosis of peritonitis and chorioamnionitis with recent data suggesting a potential role for the rapid diagnosis of periprosthetic joint infection (PJI). The purpose of this study is to determine the utility of a LER strip test for rapid diagnosis of PJI.

METHODS: We prospectively studied 158 patients with suspected PJI following a total knee (127 patients) or total hip arthroplasty (31 patients); 117 strips were performed in the office and 41 in the operating room. The LER strip was considered positive for infection only when graded + or ++ using Chemstrip 7 Urine test strip (Roche Diagnostics) and moderate or large when using the Multistix 7 reagent strip (Siemens Medical Solutions); trace and small leukocyte esterase results were considered negative. The LER results were compared with cultures and correlated with the synovial fluid white blood cell count (WBC).

RESULTS: Thirty-six strips were read as positive, 63 as negative and 53 strips were unable to be read secondary to debris of blood or metal in the aspiration. Using a synovial fluid WBC > 3,000 WBC/ul (the cut-off we use for diagnosing PJI) the LER strips had a sensitivity of 85.7% and specificity of 88.3%. When using positive cultures or the presence of a draining sinus tract as the gold standard, these values were 90.0% and 77.5%, respectively. For the 41 cases where a re-operation was performed the sensitivity was 100% and specificity of 88.2%.

DISCUSSION AND CONCLUSION: LER strips represent a rapid, inexpensive and sensitive tool for the diagnosis of PJI that seems to correlate well with the synovial fluid WBC count. Their utility is limited however, by blood or debris in the synovial fluid rendering them unreadable in one third of cases.

Figure 1 - ROC Curve for change in Oxford 12 score that discriminates between those THA patients who were satisfied one year after surgery from those who were not satisfied. The value with the best sensitivity and specificity is indicated by 1 and is equal to 59.1 points improvement.

*The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.*
A Nomogram to Predict Success of Two-stage Revisions for Treating Knee Prosthetic Joint Infections
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INTRODUCTION: Two-stage revision, with the interim placement of an antibiotic-laden cement spacer, is considered the gold standard for treatment of knee prosthetic joint infections (PJIs). Current guidelines for selecting the most appropriate procedure to eradicate a knee PJI are based upon the duration of symptoms, the condition of the implant and soft tissue evaluated during surgery and, if known, the infecting organism. A more robust tool to identify those patients with presumed knee PJIs that are considered candidates for two-stage revision and who are at high risk for treatment failure may improve preoperative risk assessment and increase a surgeon’s index of suspicion, resulting in closer monitoring and more aggressive management of those patients predicted to fail.

METHODS: Between January 1, 1996 and October 19, 2010, 10,411 revision total joint arthroplasties were performed at a single institution. Charts were reviewed to identify instances of knee PJI treated with a two-stage revision. Demographic and clinical data (microbiological, clinical presentation, preoperative and medical comorbidity variables) and disease follow up on 314 patients with infected total knee arthroplasty treated with two-stage revision were collected from electronic and paper medical records. Univariate analysis was performed to determine which variables were independently associated with failure of the procedure to eradicate the PJI. Cox regression was used to construct a model predicting the probability of treatment failure and the results were used to generate a nomogram. The model was internally validated using bootstrapping.

RESULTS: A total of 209 (66.6%) cases experienced reinfection at an average of 429 days (range: 9 to 3,886) following the two-stage revision. Univariate analysis identified multiple variables independently associated with reinfection including: a longer duration of symptoms (p<0.001), a longer time from the index total knee arthroplasty (p=0.003), a higher number of previous surgeries in the same joint (p<0.001), an elevated C-reactive protein (p=0.005), an elevated erythrocyte sedimentation rate (p=0.006), a low hemoglobin (p=0.001), a previous infection in the same joint (p<0.001), diabetes (p<0.001) and heart disease (p=0.006). Among 1,000 bootstrap samples, the bias corrected receiver operating characteristic (ROC) for the nomogram was 0.77.

DISCUSSION AND Conclusion: This is one of the largest studies instigating the two-stage revision procedure for knee PJIs. The results of this study identified variables independently associated with treatment failure that had not been previously described in the literature. The nomogram generated in this study has a very good ROC. This nomogram may become a useful tool in the preoperative assessment of patients with presumed knee PJIs, which may result in fewer surgeries, reducing the potential for intraoperative complications to the patient and lower direct costs.

Articulating Versus Static Spacers for Two-Stage Revision of Infected Total Knee Arthroplasty
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David Backstein, MD, Toronto, ON, Canada

INTRODUCTION: Infection following total knee arthroplasty is a devastating complication, requiring considerable effort on the part of the surgeon to eradicate the infection and restore joint function. Two-stage revision is the standard of care in the treatment of peri-prosthetic infection, using a temporary antibiotic-impregnated spacer between procedures. However, controversy remains concerning the use of static versus dynamic spacers, as well as the spacer material. The purpose of this study was to evaluate the clinical outcomes and complications of two-stage revision total knee arthroplasty in patients treated with a metal-on-polyethylene articulating spacer, as compared to those treated with a static antibiotic-impregnated cement spacer at the same center.

METHODS: Twenty-seven knees in patients with a mean age of 65 years (range, 40 to 80 years) were treated with two-stage revision of an infected total knee arthroplasty using a metal-on-polyethylene spacer.
dynamic prosthetic spacer fixed with antibiotic-impregnated cement. Clinical outcomes were evaluated using maximum active knee range of motion, as well as modified Knee Society knee scores and incidence of re-infection at a minimum one-year follow up. The results were compared to those achieved at similar follow up in 10 patients treated with a static cement spacer. Demographic profile as measured by age and gender, and pre-operative Knee Society scores and range of motion were similar between the two groups.

RESULTS: At a mean of 25 months following re-implantation (range, 12 to 50 months), the patients treated with dynamic spacers had significantly higher Knee Society scores (mean 77 to 100 points) as compared to the group treated with static spacers (mean 76 points, range 59 to 89 points; p=0.039). Additionally, mean range of motion at final follow up was substantially higher in the patients treated with dynamic spacers (mean 102 degrees, range 60 to 120 degrees versus mean 92 degrees, range 40 to 120 degrees). There was one re-infection in the dynamic spacer group (3.7%), in a patient whose clinical course was previously complicated by subluxation of the dynamic spacer between procedures. Otherwise, no gross loosening or fractures of the dynamic spacers were noted.

DISCUSSION AND CONCLUSION: The results of this study suggest that the use of a cemented metal-on-polyethylene dynamic prosthetic spacer at the time of two-stage revision knee arthroplasty is similarly effective in eradicating peri-prosthetic infections when compared to the use of a cemented static spacer, while providing better clinical outcomes at short-term follow up. Additionally, this spacer design provides a degree of mobility and knee function between procedures that is unachievable with a static construct, and appears to eliminate the potential complication of spacer fracture associated with pre-formed cement implants. The authors await further data to confirm these findings at longer-term follow up.

PAPER NO. 484

**No Difference in 90 Day Complications Between Bilateral Unicompartmental and Total Knee Arthroplasty**

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Robert T. Trousdale, MD, Rochester, MN
Rafael J. Sierra, MD, Rochester, MN

INTRODUCTION: Simultaneous bilateral unicompartmental knee arthroplasty (UKA) had a similar 90 day complication rate when compared to 2 to 1 bilateral total knee arthroplasty (TKA) matched controls. UKA has been shown to be less invasive than TKA but there has been conflicting evidence whether bilateral UKA is a safe practice and its performance is highly surgeon dependent. The purpose of this study was to compare the 90 day complication rates in a select group of patients undergoing simultaneous bilateral UKA when compared to aged matched controls undergoing bilateral simultaneous TKA.

METHODS: A total of 487 UKA (415 patients) were performed at one institution between 2003 and 2009. Of these, 28 bilateral UKA (56 knees) were performed in 16 males and 12 females with a mean age of 64 ± 9 years. The cases were matched 2:1 to a cohort of 56 bilateral TKA (112 knees) according to age, gender, and American Society of Anesthesiologist (ASA) score. The medical records of these patients were reviewed to identify complications, reoperations and hospital readmission during the first 90 days after surgery.

RESULTS: The median operative time was 150 (114, 206) minutes for bilateral UKA and 171 (127, 269) minutes for bilateral TKA and this difference was not significant (p=0.06). The mean length of stay was 3.9±1.2 days for bilateral UKA and 5.2±2.1 days for bilateral TKA (p<0.001). Ninety day complications in the UKA group included one wound infection and one deep vein thrombosis (DVT) (3.57%). There were two complications in the 112 TKA knees and included one superficial wound infection and one pulmonary embolism (1.79%). One knee in each group required irrigation and debridement for wound infection. These were the only two patients that required readmission within 90 days.

DISCUSSION AND CONCLUSION: Unilateral UKA provides a faster recovery and less risk of perioperative complications when compared to unilateral TKA. Despite its lower isolated morbidity, bilateral UKA was found to have similar complications to a group of bilateral TKA patients. Surgeons should use this data to counsel patients undergoing bilateral simultaneous UKA.

PAPER NO. 485

**The Effect of an Operating Room Air Purification System on the Contamination of Opened Sterile Operating Room Trays**

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Wayne E. Moschetti, MD, Lebanon, NH
Justin S. Cummins, MD, Duluth, MN

INTRODUCTION: This study investigates the potential for a self-contained atmospheric plasma air purification system to decrease surface contamination within the operating room environment.

METHODS: Twenty-seven sterile instrument trays were opened each day in an operating room divided between three locations: inside the laminar flow air-curtain (Location 1); directly under the laminar flow air-curtain (Location 2); outside of the laminar flow air-curtain (Location 3). Cultures of the sterile trays were obtained at 30-minute intervals. Following collection of the Day 1 samples, two self-contained air purification systems were placed into the same operating room. On Day 2, nine sterile trays were placed into each of the three locations described for Day 1. The same procedure was followed for obtaining cultures of each of the trays.

RESULTS: The total contamination rate for Day 1 was 28% and for Day 2 was 13.6% (p=0.021). Comparison of Day 1 and Day 2 by location demonstrated no statistical difference at Location 1 (p = 0.087) and 2 (p = 0.72). At Location 3 there was a decrease in the contamination rate on Day 2 compared to Day 1 (p = 0.0047). Kaplan-Meier analysis showed a difference (p=0.014) between time-dependent contamination rates for Day 1 and Day 2.

DISCUSSION AND CONCLUSION: The use of an air purification system can decrease the rate of surface bacterial contamination of sterile operating room trays. Further study of this technology is needed to see if it can have an effect on infection rates.
INTRODUCTION: As many patients warranting total knee arthroplasty (TKA) are frail elderly, they can frequently have medical comorbidities and take many related medicines. In addition, it was our anecdotal experience that previously undetected medical comorbidities were frequently discovered during the medical clearance process before TKA. However, little information is currently available regarding these issues. First, we aimed to document the prevalence and types of comorbidities and related medicines in patients undergoing TKA and to compare the prevalence of comorbidities and medications in the patients with that in the age and gender-matched community-based subjects. Second, we aimed to examine the rate of new diagnoses of the comorbidities which were discovered during the medical prescreening. Finally, we aimed to determine whether comorbidities in the TKA patients would be associated with postoperative complications. METHODS: With a prospective manner, 459 patients scheduled for primary TKA (TKA group) were evaluated using a systematic medical clearance program two weeks before TKA. We compared comorbidities and medications in the study cohort with those in age and gender-matched 459 community-based subjects (control group). The Chi-square tests and Fisher's exact tests were conducted for comparison of the study variables between the TKA and the control groups. Multivariate analyses were carried out to determine the association between the comorbidities and postoperative complications in the TKA group. RESULTS: In the TKA group, 409 patients (89%) had at least one medical comorbidity, and 129 patients (28%) had three or more medical comorbidities. Most prevalent comorbidity was hypertension (70%), followed by Diabetes mellitus (DM) in 22% and dyslipidemia in 20%. New diagnoses were discovered in 84 patients (18.3%). Hypertension and DM were more prevalent in the TKA group than in the control group (70% vs. 48% and 22% vs. 12%, respectively; p < 0.03 in both). The prevalence of coronary artery disease and dyslipidemia also tends to be higher in the TKA group (9% vs. 3% and 20% vs. 13%, respectively; p = 0.052, p = 0.092). In the TKA group, 410 patients (89%) had taken at least one kind of medicine. Frequency of medication related to hypertension and dyslipidemia was higher in the TKA group than the control group (67% vs. 43%, 18% vs. 9%, respectively; p < 0.02 in both). We found that the number of comorbidities was associated with higher incidence of postoperative acute renal failure and transfusion rate (p = 0.045, p = 0.022). In addition, among the comorbidities, DM was associated with higher incidence of postoperative delirium (odds ratio = 6.4, p = 0.007). DISCUSSION AND CONCLUSION: This study revealed that the prevalence of medical comorbidities and medications in the patients with advanced knee osteoarthritis warranting TKA would be extremely high, and multiple comorbidities and DM per se would be associated with higher complications after TKA. We also found that considerable patients had previously undetected comorbidities which could be discovered by the systematic medical clearance program. Our results suggest that a knee surgeon should recognize highly prevalent medical comorbidities in TKA patients and establish a systematic medical clearance program to discover undetected comorbidities to minimize complications after TKA.

Medical comorbidities and medications in the TKA group

<table>
<thead>
<tr>
<th>Disease</th>
<th>TKA (%)</th>
<th>Control (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM (+)</td>
<td>99 (21.6%)</td>
<td>36 (7.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Controlled DM + (%)</td>
<td>64 (13.9%)</td>
<td>35 (7.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DM (-)</td>
<td>409 (89%)</td>
<td>324 (72%)</td>
<td></td>
</tr>
<tr>
<td>DM (+)</td>
<td>11 (2.3%)</td>
<td>3 (0.6%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension (+)</td>
<td>138 (30.1%)</td>
<td>105 (23%)</td>
<td>0.018</td>
</tr>
<tr>
<td>Controlled hypertension +</td>
<td>13 (2.8%)</td>
<td>7 (1.5%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension (-)</td>
<td>395 (86.9%)</td>
<td>319 (70%)</td>
<td></td>
</tr>
<tr>
<td>Cardiac disease (+)</td>
<td>114 (24.7%)</td>
<td>53 (11.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiac disease (-)</td>
<td>345 (75.3%)</td>
<td>306 (68.5%)</td>
<td></td>
</tr>
<tr>
<td>Respiratory disease (+)</td>
<td>41 (9.1%)</td>
<td>20 (4.3%)</td>
<td>0.026</td>
</tr>
<tr>
<td>Respiratory disease (-)</td>
<td>418 (90.9%)</td>
<td>490 (95.7%)</td>
<td></td>
</tr>
<tr>
<td>Urologic disease (+)</td>
<td>113 (24.8%)</td>
<td>71 (15.6%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Urologic disease (-)</td>
<td>346 (75.2%)</td>
<td>458 (94.4%)</td>
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<tr>
<td>Neurologic disease (+)</td>
<td>102 (22.2%)</td>
<td>55 (11.9%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Neurologic disease (-)</td>
<td>357 (77.8%)</td>
<td>394 (88.1%)</td>
<td></td>
</tr>
</tbody>
</table>

*The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
Dae K. Bae

DISCUSSION AND CONCLUSION: A modified protocol such as five-day fondaparinux prophylaxis can be considered as an effective chemoprophylaxis in reducing DVT prevalence in this low incidence population. However despite use of short duration, minor bleeding should be closely monitored.

PAPER NO. 487

Modified Protocol for Deep-Vein Thrombosis Prophylaxis after Total Knee Arthroplasty in a Low Incidence Population

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INTRODUCTION: Standard thromboprophylaxis guidelines have not been applied universally in regions with low incidence of deep-vein thrombosis (DVT) in view of the risks associated with the use of the chemoprophylaxis drugs. We prospectively evaluated the recent prevalence of DVT, the efficacy and safety of a modified, five-day in hospital fondaparinux protocol following total knee arthroplasty (TKA) and the necessity of pharmacological thromboprophylaxis use in a low DVT incidence population.

METHODS: A total of 148 patients undergoing unilateral TKA were randomized to receive either a subcutaneous dose of a placebo or 2.5 mg of fondaparinux once daily for five days. Colour doppler ultrasonography was performed preoperatively and seven days after surgery. The primary efficacy outcome was the prevalence of DVT up to day 7. Secondary efficacy outcome was the prevalence of symptomatic DVT up to day 90. The primary and secondary safety outcomes were the incidence of major bleeding and minor bleeding respectively.

RESULTS: The prevalence of DVT was 25.7% in placebo group and 6.8% in fondaparinux group (p = 0.002; odds ratio, 4.767; 95% confidence interval, 1.673 to 13.581; relative risk reduction, -0.255). There was no symptomatic DVT or pulmonary embolism in both groups. Although there was a significant increase in the incidence of minor bleeding events in the fondaparinux group (p < 0.001), no major bleeding developed.

DISCUSSION AND CONCLUSION: A modified protocol such as five-day fondaparinux prophylaxis can be considered as an effective chemoprophylaxis in reducing DVT prevalence in this low incidence population. However despite use of short duration protocol, minor bleeding should be closely monitored.
The purpose of this study was to report the results of a novel screening and management protocol to identify and optimize risk of renal, pulmonary and mental complications. METHODS: Retrospective case-control study comparing incidence of perioperative complications before and after initiation of a novel screening and management protocol. The study cohort was evaluated preoperatively with an algorithm to preoperatively identify risk factors for delirium, pulmonary complications and renal failure. Patients who were deemed at risk were managed differently in the perioperative period to reduce the incidence of complications. The control population was consecutive patients who underwent total knee arthroplasty (TKA) prior to development of the screening protocol. Administrative records were reviewed for pulmonary, renal, cardiac and mental perioperative complications during the hospital stay. The incidence of complications was compared between groups using Fisher’s Exact test. RESULTS: There were 357 patients in the study cohort and 768 patients in the control population. There was a significant decrease in the screened patients in the incidence of delirium (screening 1.4% vs. control 5.6%, p=0.001), renal failure (screening 0.28% vs. control 2.5%, p=0.007) and pulmonary complications (screening 2.2% vs. control 7.6%, p=0.0005). There was a significant decrease in the screened patients in the incidence of total complications (screening 5.6% vs. control 24%, p=0.0001) between groups. There was also a significant decrease in the incidence of cardiac complications in the screened patients (screening 1.7% vs. control 12.2%, p=0.0001). DISCUSSION AND CONCLUSION: Preoperative screening and management for non-cardiac, medical complications resulted in a significant decrease in renal, pulmonary, delirium, cardiac and total complications. Further studies are indicated to identify and further reduce preventable causes of perioperative medical complications.

PAPER NO. 490
Identifying the High Risk Total Knee Arthroplasty Patient
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Kevin Ong, PhD, PE, Philadelphia, PA
Steven M. Kurtz, PhD, Philadelphia, PA
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INTRODUCTION: Although individual patient risk factors have been identified for periprosthetic joint infection (PJI) and postoperative mortality in total knee arthroplasty (TKA) patients, the interactions between those risk factors are poorly understood. The purpose of this study was to evaluate which combinations of risk factors are associated with the highest risk of PJI and mortality, and to develop an electronic risk calculator for PJI and mortality in Medicare TKA patients. METHODS: The Medicare 5% sample claims database was used to calculate the relative risk of PJI and mortality within 180 days as a function of clinical and demographic characteristics in 110,322 primary TKA patients between 1998 and 2009. Logistic regression using 29 comorbid conditions, age, gender, race and socioeconomic status (SES) were used as inputs to estimate the probability of PJI and mortality. RESULTS: The overall risk of PJI and mortality within 180-days post-operatively was 1.13% and 0.79%, respectively. White, female, low SES patients with cardiopulmonary and cerebrovascular comorbidities, renal disease, and diabetes were at highest risk for PJI. White men with cardiovascular and cerebrovascular comorbidities, renal disease and dementia were at highest risk for mortality. An electronic risk calculator was developed to estimate the risk of PJI and mortality in Medicare TKA patients based on their individual demographic and clinical characteristics, compared with the rates for the entire Medicare TKA population and patients with similar demographics. DISCUSSION AND CONCLUSION: This information is important when counseling elderly patients regarding the risks of PJI and mortality following TKA and for risk-adjusting publicly reported TKA outcomes.

PAPER NO. 491
Early Failure of a Modern Total Knee Arthroplasty Design. Reason for Concern?
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INTRODUCTION: The authors report an unusually high failure rate of a modern total knee arthroplasty (TKA) design. METHODS: Our total joint registry was queried for all primary total knee arthroplasties performed between 01/01/2000 and 10/01/2011. A total of 1,373 of these were performed with a Zimmer Nexgen Cemented metal backed modular tibial component with a degree sloped tray. The TKAs were performed by eight surgeons all specialized in adult reconstruction. Of these 1,373 knees, 54 in 53 patients subsequently failed for various reasons (3.9%). RESULTS: Major mechanisms for failure included aseptic loosening (50%), deep infection (30%), postoperative instability (5%) and other (15%). Isolated debonding of the tibial component from the cement accounted for more than 80% of the aseptic failures seen with this tray (1.6% of 1373). All cases of aseptic tibial component loosening were revised with a mean time to revision of 46.4 months (range 13-95 months). Mean Knee Society Scores preoperatively were 99 and improved to 146 after revision surgery. The mean follow-up period post revision was 18.2 months (range from 1 to 65 months). DISCUSSION AND CONCLUSION: Isolated tibial debonding from the cement was seen in several cases in this series, a failure mechanism that has not been seen before with other tibial designs used at our institution. The reasons for failure remain unclear. The degree sloped design is not the typical 7 degree design that is used in other centers for primary TKA. Implant design, surface finish and the changes in slope design warrant further investigation as to whether it contributes to this particular failure mechanism.

PAPER NO. 492
Thrombosis Incidence in Unilateral vs. Simultaneous Bilateral Total Knee Arthroplasty with Compression Device
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Steven Copp, MD, La Jolla, CA
Adam Rosen, DO, La Jolla, CA
Clifford W. Colwell, Jr, MD, La Jolla, CA

INTRODUCTION: Higher rates of venous thromboembolic events (VTE) are reported following simultaneous bilateral total knee arthroplasty (TKA), though the relative risk may not be higher than in unilateral or staged bilateral TKAs. Prophylaxis can reduce the rate of VTEs, which includes deep vein thrombosis (DVT) and/or
pulmonary emboli (PE). The purpose of this study was to provide an early report of VTE incidence in patients undergoing simultaneous bilateral TKA in comparison to patients undergoing unilateral TKA using only a mobile compression device as prophylaxis. METHODS: Following prior consent from Institutional Review Board and strict selection criteria, we studied the rates of VTEs on 255 patients (255 knees) undergoing unilateral TKA and compared their VTE rates to 50 patients (100 knees) undergoing simultaneous bilateral TKA. Patients in both groups used a mobile compression device as a monotherapy for VTE prophylaxis. Patients with clinical suspicion of DVT underwent duplex ultrasonography of both legs. Patients with clinical suspicion of PE were evaluated with spiral CT. All patients were clinically evaluated three months after surgery documenting any VTE events as an endpoint. Each event was recorded separately. Chi-square analysis was used to compare the VTE incidence rates between the bilateral and unilateral groups. When comparing the statistical power between the two groups, per patients and per knees the power found to be 93% and 56% respectively. RESULTS: In order to prevent bias, we decided to report the results of VTE events per patient number and per knees. In the simultaneous bilateral TKA group, seven patients had at least one VTE; two patients had PE following DVT. The rates of total VTEs were documented in 18% of the patients (nine events) and in 9% of the knees, DVTs documented in 12% of the patients (six events) and in 6% of the knees. Two patients (4%) had proximal DVT (2% of the knees) and four patients (8%) had distal DVT (4% of the knees). Three cases of PE (6%) were recorded (3% of the knees). In the unilateral TKA group, the rate of VTEs was 3.1% (eight events) per patients and knees; all the events were distal DVT, no proximal DVT or PE was documented. The VTE rates between the bilateral and unilateral groups (per patient, 18% and 3.1%, per knees 9% and 3.1% respectively) was statistically significant (p<0.001, p=0.02 respectively). DISCUSSION AND CONCLUSION: Mobile compression devices used as the sole thromboprophylactic modality in the bilateral group TKA yielded statistically higher rates of VTE compared with patients undergoing unilateral TKA. The authors believe that patients undergoing simultaneous bilateral TKA are at high risk for development of VTE.

PAPER NO. 493

Readmission Following TKA: Is the Wrong “Never Event” Being Targeted?

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Muhibat A. Adelani, MD, Saint Louis, MO
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INTRODUCTION: Measures to improve quality of care and control costs are continually being introduced. One such initiative is the identification of “never events” whereby reimbursement for readmissions for complications considered to be largely avoidable may be decreased or eliminated in the future. One such complication is that of VTE (venous thromboembolism: DVT or PE) following total knee arthroplasty (TKA). A study was undertaken to examine the relative incidence and cost of VTE following TKA compared to other major causes of early readmission. METHODS: A five-year retrospective study was performed of all knee arthroplasty patients using an administrative data base of a large teaching hospital. Although over 700 readmissions occurred in that patient group, when readmissions were excluded that were not clearly related to the index procedure and/or occurred >90 days after the index procedure, 79 readmissions in 60 patients reMED for analysis. RESULTS: The most common reasons for readmission by far was persistent drainage or noninfectious wound complication (44.3%), followed by bleeding complications (12.7%), infection (11.4%) and limited motion (7.6%). VTE was the fifth most common cause for readmission (5.1%) with a highly significantly lower incidence than wound complications (p < .001). All patients were treated with some form of DVT prophylaxis accepted under SCIP Guidelines at this institution during this time period. The total cost of treating bleeding complications was eight times greater and the cost per episode of care was twice as great for bleeding related complications than for VTE. DISCUSSION AND CONCLUSION: The most common cause of readmission following TKA was related to wound drainage and bleeding, far exceeding that of VTE in both volume and cost. Focusing on further decreasing VTE complications with more aggressive prophylaxis regimens is more likely to increase wound drainage and bleeding complications that are already the leading cause of readmission at this institution.

PAPER NO. 494

Clinical Features and Prognosis of Unusual Periprosthetic Joint Infection: Fungus and Mycobacterium

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Su-Chan Lee, MD, Seoul, Republic of Korea
Kwang Am Jung, MD, Seoul, Republic of Korea
Chang-Hyun Nam, MD, PhD, Yangcheon-G, Republic of Korea

INTRODUCTION: Periprosthetic joint infection (PJI) due to fungus or mycobacterium, although well-recognized, is very rare, has similar clinical features and is generally associated with an immunosuppressive environment. To our knowledge, few large-scale studies for these unusual PJIs have been conducted. The current study was performed for assessment of clinical features and surgical outcomes following two-stage reimplantation for these PJIs. METHODS: We conducted a retrospective review of collected data from our database on 33 two-stage reimplantations (30 fungus and three mycobacterium) in 31 patients performed following primary total knee arthroplasty (TKA) for fungal or mycobacterial PJIs. Patients were followed for at least two years or until development of recurrent infection. The mean follow-up duration of patients who reMED free of infection was 4.3 years (range, 2 to 6.3 years). RESULTS: Twenty patients (64.5%) belonged to the American Society of Anesthesiologists’ grade 3 or 4. Surgical protocol included resection arthroplasty and cement spacer insertion with vigorous debridement of bone and soft tissues. This was followed by a minimum of six weeks of intravenous antibiotics and then delayed reimplantation in all patients. The median duration from resection arthroplasty to reimplantation was 2.2 months (range, 1.5 to 6.2 months) in fungal PJI and 3.5 months (range, 2 to 6.5 months) in mycobacterial PJI. Two patients with tuberculous PJI received an anti-tuberculous regimen as soon as the isolation of Mycobacterium tuberculosis for 12 months. Two knees with fungal PJI had become re-infected, and one of these subsequently required arthrodesis as a result of uncontrolled infection. At the most recent follow up, the mean Knee Society and WOMAC scores were 146 and 71 points, respectively. Overall satisfaction revealed that 29% of the patients expressed dissatisfaction with their reimplanted prosthesis. DISCUSSION AND CONCLUSION: Fungal or mycobacterial PJIs can be successfully treated with resection arthroplasty and...
delayed reimplantation combined with proper antimicrobial agents. Suspicious infection or loosening after primary TKA, particularly in an immunosuppressive environment, should alert the orthopaedic surgeon to consider the possibility of these PJs.

PAPER NO. 495
Patient Reported Activity Levels Following Successful Treatment of Infected Total Knee Arthroplasty
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Amun Makani, MD, Philadelphia, PA
Atul F. Kamath, MD, Philadelphia, PA
Rashikh Choudhury, BA
Gwo-Chin Lee, MD, Philadelphia, PA
INTRODUCTION: The morbidity of infection after total knee arthroplasty (TKA) remains difficult to quantify. While the impact of failed treatment and persistent infection is easier to define, the sequelae of infection even when successfully treated can still cause significant pain and dysfunction. Therefore, the purpose of this study is to quantify patient-reported activity levels the morbidity associated with successfully treated infected TKA.

METHODS: We identified 183 consecutive patients who underwent revision total knee arthroplasty secondary to infection between 2003 and 2010. There were 97 men and 86 women with a mean age of 63.9 years. All patients were treated with resection and placement of an antibiotic spacer followed by reimplantation. At one-year minimum follow up, 135 patients had no recurrence of infection. These patients were evaluated clinically with Knee Society Score (KSS) and the UCLA activity score.

RESULTS: The average follow up was 3.0 years (range 1-7). Fifteen patients died and 26 were lost to follow up. The mean KSS was 39 (range 2-88) for pain and 41 (range 0-100) for function, respectively. The average self reported University of CA at Los Angeles (UCLA) activity level rating was 3.4 (range 1-7). Overall, patient satisfaction was poor. All patients reported significant residual pain and limitations with activities.

DISCUSSION AND CONCLUSION: Even when infection after total knee arthroplasty is successfully controlled, patients continue to suffer from significant residual pain and limitations in activity.

PAPER NO. 815
Protective Role of IL-1β Against Post-Arthroplasty Staphylococcus Aureus Infection
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Lloyd Miller, MD, PhD, Los Angeles, CA
INTRODUCTION: As the number of total joint arthroplasty surgeries in the United States will exceed 3.8 million surgeries per year by 2030, the number of post-arthroplasty infections is projected to increase to over 266,000 infections annually. While much attention is focused on improving treatment for post-arthroplasty infections, little is known about the innate immune response responsible for preventing infection. Using a mouse model of post-arthroplasty infection published in previous work, we evaluate the role of IL-1β, a pro-inflammatory cytokine, as well as Toll-like receptor 2 (TLR2), a pattern recognition receptor that recognizes S. aureus lipopeptides and lipoteichoic acid.

METHODS: Using a previously-established mouse model of post-arthroplasty S. aureus infection, we compare the bacterial burden, biofilm formation and neutrophil recruitment in IL-1β-deficient, TLR2-deficient and wildtype mice using in vivo bioluminescence and fluorescence imaging, histology and variable-pressure scanning electron microscopy (VP-SEM).

RESULTS: Bacterial burden in IL-1β-deficient mice was 26-fold higher than at day after infection and reMed three- to 10-fold greater than wildtype mice through day 42. In contrast, the bacterial burden in TLR2-deficient mice did not differ from wildtype mice. In addition, implants harvested from IL-1β-deficient mice had substantially more biofilm formation compared with those from wildtype mice. Finally, IL-1β-deficient mice had ~50% decreased neutrophil recruitment to the infected postoperative joints than wildtype mice.

CONCLUSION: These findings suggest a mechanism by which IL-1β induces neutrophil recruitment to help control the bacterial burden and the ensuing biofilm formation in a post-surgical joint.

PAPER NO. 586
◆Postoperative Emesis in Multimodal Analgesic Protocol and Role of New Antiemetic Drug after Total Knee Arthroplasty
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Eun Seok Seo, MD, Seoul, Republic of Korea
Byung June Cho, MD, Yangsan, Republic of Korea
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Sang Cheol Seong, MD, Seoul, Republic of Korea
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INTRODUCTION: Pain after surgery is one of the most distressing concerns in patients undergoing total knee arthroplasty (TKA), and the use of preemptive and multimodal measures has been documented to be effective to reduce postoperative pain. Emetic events associated with the use of potent analgesic drugs used in current multimodal pain control protocols have emerged as another challenging issue both for patients and healthcare providers. This study was conducted to investigate the incidence of emetic events in TKA patients managed with a contemporary multimodal pain control protocol and to explore the role of a new antiemetic drug, ramosetron, in reducing emetic events after surgery.

METHODS: The incidence of emetic events, frequency of a need for rescue antiemetics and its effect, opioid consumption via IV-PCA and patient satisfaction were compared between a ramosetron group of 109 patients treated with ramosetron and a control group of 60 patients not treated with the drug. Patient allocation was done randomly using a computer generated randomization table. Emetic events (nausea and vomiting) were evaluated using a multilevel grading system (none, mild, moderate, and severe) and 0-10 visual analog scale during multiple time-periods (0-6, 6-24, 24-48 hours). All patients were covered with a multimodal pain control protocol involving preemptive analgesic medication, continuous femoral nerve block, periarticular injection, and fentanyl based IV-PCA. Metoclopramide was given as a rescue antiemetics.

RESULTS: A substantial number of patients in the control group experienced nausea (54.2%) and vomiting (33.9%) during the evaluation period. The ramosetron group had a lower incidence of nausea during the period of 6-24 hours (23.3% vs. 44.1%, p=0.017) and tended to experience less severe nausea during the same period (VAS score: 1.0 vs. 1.7, p=0.079). The use of rescue antiemetics was less frequent during the period of 6-24 hours in the ramosetron group (20.0% vs. 39.0%, p=0.023), and the
response to rescue antiemetics was complete more frequently in the ramosetron group (76.7% vs. 55.9%, p=0.017). However, there were no significant differences in pain level, opioid consumption via IV-PCA, and patient satisfaction (p>0.05).

DISCUSSION AND CONCLUSION: This study demonstrates that a substantial number of TKA patients managed with a contemporary multimodal pain control experienced emetic events after surgery and that reduction of emetic events by the new antiemetic drug was not complete and limited only to the period of 6-24 hours. More efficient and comprehensive measures to reduce emetic events after TKA should be explored. A substantial number of TKA patients managed with multimodal protocol experienced emesis after surgery, and more efficient and comprehensive measures to reduce emesis after TKA should be explored.

PAPER NO. 587
Upsizing Femoral Component Increases Patellofemoral Contact Force in Total Knee Arthroplasty

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INTRODUCTION: In posterior stabilized total knee arthroplasty (TKA), larger femoral component is sometimes selected to manage increased flexion gap due to resection of the posterior cruciate ligament. However, concerns remain regarding the adverse effect of increased anteroposterior (AP) dimension of the femoral component on patellofemoral (PF) joint. On the other hand, recently, gender specific knee prostheses have been introduced to have narrower and thinner anterior flange of the femoral component. It is expected that contact force at the PF joint would decrease with the ‘Gender’ component. This study evaluated the effect of the size and the shape of the femoral component on PF contact force.

METHODS: Contact forces at the PF joint were evaluated during posterior stabilized TKA in 16 patients. The forces were measured with the load cell embedded in the patellar component from 90 to 140 degrees of flexion with the AP size-matched standard component, and the one-size larger component, and with the AP size-matched Gender component.

DISCUSSION AND CONCLUSION: The results of this study revealed that the over-size femoral component significantly increased PF contact forces in deep knee flexion. These findings suggest that selection of the larger femoral component would increase PF complications or decrease postoperative knee flexion. The effect of the Gender knee prosthesis was not proven in decreasing PF forces in the setting of this study.
Early Onset Failure of Porous Tantalum Monoblock Tibial Component

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INTRODUCTION: Concern regarding backside wear has led rapid increase in use of porous tantalum monoblock (PTM) components for total knee arthroplasty (TKA) in recent time with good short and mid-term outcomes. With added advantage of faster surgery, good biologic properties and lesser stress shielding of bone, monoblock tibial components offer a certain alternative to “gold standard” cemented TKA. The purpose of this study was to study the early onset failures in monoblock tibial components.

METHODS: From 2004 through 2008, we identified six patients with failure of ingrowth and/or collapse of uncemented PTM tibial components. There were four women and two men with average age of 58 and average body mass index (BMI) of 38.7. Preoperative diagnosis was osteoarthritis. All knees were evaluated clinically by knee society scores (KSS) and assessing stability of the knee in full extension and at 90 degrees flexion.

RESULTS: All failed cases showed well aligned tibial and femoral components on six weeks postoperative films. Two of six patients showed radiolucency under medial tibial plateau at three months postoperative which progressed and the patients presented with medial collapse of tibial plateau/metaphysis at one year from index surgery. Four of six patients showed excellent osteointegration, however medial tibial plateau gradually collapsed at average of 16 (range 13 to 19) months postoperative. The KSS declined from average 94 after primary TKA to 54.8 by the time of final follow up after tibial collapse.

DISCUSSION AND CONCLUSION: Contrary to reported literature regarding monoblock porous tibial components with excellent survivorship at mid-term, we present a case series of early onset failures which show strikingly similar pattern. Further studies are needed to correlate use of porous tibial components with patient demographics like smoking, avascular necrosis, bone density, and severity of osteoporosis.

Early Post-operative Predictors of Satisfaction Following Total Knee Arthroplasty

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Emer Doran, SR, Northern Ireland, United Kingdom
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David W. Murray, MD, Oxford, United Kingdom
David Beverland, MD, Belfast, Ireland

INTRODUCTION: Despite the excellent total knee arthroplasty (TKA) results reported using traditional outcome measures, this is often not reflected in measures of patient satisfaction, with up to 30% remaining dissatisfied following surgery. The causes of dissatisfaction are poorly understood, with both pre and post-operative factors considered important. There is, however, very little evidence as to how early in the postoperative period, dissatisfied patients can be identified. This study examines the three-month post-operative TKA outcomes in relation to 12-month satisfaction, and aims to identify potential predictors of dissatisfaction.

METHODS: We analyzed a cohort of 486 primary TKA patients, under the care of a single surgeon, following introduction of a 12-month patient satisfaction assessment. Additional outcome data (pain score, Oxford Knee score (OKS), SF-12, and range of movement) was prospectively collected pre-operatively, and at three- and 12-months postoperatively. Outcome measures were compared between satisfied and dissatisfied groups at all time-points, with calculation of mean scores, as well as change in scores post-operatively. Further analysis of three-month outcomes was performed with calculation of Spearman correlation coefficients, and a multivariate logistic regression model to identify potential predictors of dissatisfaction.

RESULTS: At 12 months postoperatively, 374 (77.0%) patients were satisfied with their TKA, with the dissatisfied group scoring worse on all outcome measures (p<0.02). No significant differences in demographics or pre-operative outcome measures were seen between groups. At three months post-operatively, all outcome measures except SF-12 Physical score (p=0.052) were significantly better in the satisfied compared to the dissatisfied group (p<0.03). Dissatisfied patients exhibited minimal further improvement or even worsening of outcome scores between three and 12 months postoperatively (p<0.015). Correlation coefficients were significant between satisfaction and all outcome measures at three months (p<0.03). Multivariate logistic regression modelling demonstrated that both the OKS and knee flexion at three months follow up were significant predictors of dissatisfaction at 12 months (p<0.02).

DISCUSSION AND CONCLUSION: The 12-month satisfaction rate of 77% is comparable to previously reported studies. This study demonstrates that dissatisfied patients show signs of poor progression as early as three months post-operatively, with significant differences in outcome measures evident. Additionally these patients fail to gain further improvement over time. This suggests that early follow up following TKA is important, and that post op assessment of knee flexion and OKS may help to identify those patients at risk of dissatisfaction.
Tranexamic Acid Reduces Blood Loss in Simultaneous Bilateral Total Knee Arthroplasty

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INTRODUCTION: Total knee arthroplasty (TKA) is a common procedure; bilateral TKA ensures cost efficiency. Bilateral TKA is associated with increased requirement of blood transfusion (BT). BT is associated with hazards therefore is avoided. Tranexamic acid (TXA) has been suggested to reduce the BT, the use of TXA in bilateral TKA appears sparse in literature. This study aimed at assessing the effect of TXA in such patients.

METHODS: This prospective randomized controlled trial evaluated the use of TXA in bilateral TKA. Pre and postoperative hemoglobin (Hb) and packed cell volume (PCV), blood loss and BT, hospital stay, and the cost of TXA compared to blood transfusion were the measured variables.

RESULTS: A total of 175 patients (n = 88 TXA, n = 87 CTRL) completed the study. The patients in the control (CTRL) group on an average received 0.3 units and 0.07 in TXA group. The average blood loss in the TXA group was significantly less than the CTRL (p < 0.0001). There was no significant difference in the perioperative complications, hospital stay in the two groups.

DISCUSSION AND CONCLUSION: The use of TXA reduces the postoperative blood loss. The allogenic BT requirement in patients undergoing bilateral TKA is significantly decreased. The routine use of this drug is cost effective and reduces post-operative blood loss.

Table 1

<table>
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<th>Variable</th>
<th>Control Group</th>
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</tbody>
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Manipulation After Total Knee Arthroplasty: Prognosis and Range of Motion

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INTRODUCTION: Knee stiffness following total knee arthroplasty may compromise the outcome of the procedure. Manipulation under anesthesia usually results in improvement of range of motion but the outcome depends on various factors. The purpose of this study was to evaluate the effectiveness of manipulation following total knee arthroplasty and identify prognostic factors predictive of post manipulation range of motion.

METHODS: A retrospective review of prospectively collected epidemiological, medical, and surgical data over an eight-year period was conducted on 119 knees in 96 patients who underwent manipulation after total knee arthroplasty. These patients were compared to 137 matched control cases not requiring manipulation after total knee arthroplasty.

RESULTS: The mean rate of manipulation was 3.7%. The mean pre-operative range of motion (p = 0.004) and final range of motion (p < 0.001) was significantly lower in the manipulation group versus the non-manipulation group. The average increase in range of motion following manipulation was 34° (p = 0.001). Caucasians had a higher final range of motion following manipulation compared to non-Caucasians (p = 0.003). In both groups, the number of comorbidities per patient had a summative effect with significantly lower final range of motion with each additional comorbidity (all p < 0.05). In the manipulation group final range of motion was significantly higher in posterior stabilized knees versus cruciate retaining knees (p = 0.02). Within the manipulation group, general anesthesia alone during the index case was associated with significantly lower final range of motion (p = 0.04). The interval between total knee arthroplasty and manipulation inversely correlated with final range of motion (r = -0.20, p = 0.04) with a significant decrease in final standardized criteria. Secondary outcome measures included the total calculated blood loss, daily postoperative hemoglobin levels, pain scores, and narcotic requirements during the hospital stay. Function was measured at the preoperative and four- and 12-week postoperative time-points by range of motion, Short Form-12, and Knee Injury and Osteoarthritis Outcome Scores.

RESULTS: Fifty patients were randomized to each arm. There was one cross-over in each group, and the results were analyzed according to the intention-to-treat principle. Transfusion requirements were significantly lower in the treatment group (no blood transfusions) compared to the control group (five transfusions; p = 0.007). There was a trend toward higher hemoglobin levels in the treatment arm starting on the second postoperative day which became statistically significant by the fourth day (10.2 ± 1.0 vs. 8.8 ± 1.1; p = 0.01). Aside from a difference in the Short Form-12 physical component summary score at 12 weeks postoperative, no other significant differences in secondary outcome measures were detected between the two groups.

DISCUSSION AND CONCLUSION: These data support the addition of a collagen/thrombin and autologous platelet product to standard surgical hemostasis for preventing blood transfusions following primary total knee arthroplasty.

Prospective Randomized Trial of a Collagen/Thrombin and Autologous Platelet Hemostat During TKA

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INTRODUCTION: Considerable attention is being paid to blood conservation following elective arthroplasty surgery. The purpose of this study was to evaluate the effectiveness of an FDA-approved collagen/thrombin and autologous platelet hemostatic agent in preventing blood loss during primary unilateral total knee arthroplasty.

METHODS: This prospective, double-blinded, randomized study was designed to enroll a total of 100 patients. The average age was 64 (±8.7) years; 57% were female. Patients were randomized 1:1 to either the treatment arm (standard intra-operative hemostasis plus study product) or the control arm (standard hemostasis alone). The primary outcome measure was blood transfusion requirement, as determined by a blinded investigator using standardized criteria. Secondary outcome measures included the total calculated blood loss, daily postoperative hemoglobin levels, pain scores, and narcotic requirements during the hospital stay. Function was measured at the preoperative and four- and 12-week postoperative time-points by range of motion, Short Form-12, and Knee Injury and Osteoarthritis Outcome Scores.

RESULTS: Fifty patients were randomized to each arm. There was one cross-over in each group, and the results were analyzed according to the intention-to-treat principle. Transfusion requirements were significantly lower in the treatment group (no blood transfusions) compared to the control group (five transfusions; p = 0.007). There was a trend toward higher hemoglobin levels in the treatment arm starting on the second postoperative day which became statistically significant by the fourth day (10.2 ± 1.0 vs. 8.8 ± 1.1; p = 0.01). Aside from a difference in the Short Form-12 physical component summary score at 12 weeks postoperative, no other significant differences in secondary outcome measures were detected between the two groups.

DISCUSSION AND CONCLUSION: These data support the addition of a collagen/thrombin and autologous platelet product to standard surgical hemostasis for preventing blood transfusions following primary total knee arthroplasty.
All patients were diagnosed with osteoarthritis. Utilization rates, over two years from 2009-2010 in a large hospital network setting.

**METHODS:** Blood utilization after TKA was retrospectively studied network and to evaluate hospital charges and length of stay. For individual surgeons after primary TKA within a large hospital network, the goals of this study were to determine the blood utilization rate associated with transfusions has not been well delineated. The allocation of blood transfusions after primary TKA and the costs blood transfusion after total knee arthroplasty (TKA). The but few studies have been performed that specifically examine detail blood utilization rates after total joint arthroplasties, introduced.

**INTRODUCTION:** Meta-analyses have been conducted that blood utilization after primary TKA differs greatly among orthopaedic surgeons. There is a huge variability of perioperative blood use between providers that suggests that resources may be misallocated. Patients who received transfusions had longer hospital stays and higher hospital costs. Thus, establishing criteria to reduce blood transfusions may decrease hospital length of stay and minimize costs.

**PAPER NO. 593**

**Blood Utilization After Total Knee Arthroplasty in a Large Hospital Network**

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**Mark Yazer, MD, Pittsburgh, PA**  
**Jonathan Waters, MD, Pittsburgh, PA**

**INTRODUCTION:** Meta-analyses have been conducted that detail blood utilization rates after total joint arthroplasties, but few studies have been performed that specifically examine blood transfusion after total knee arthroplasty (TKA). The allocation of blood transfusions after primary TKA and the costs associated with transfusions has not been well delineated. The goals of this study were to determine the blood utilization rate for individual surgeons after primary TKA within a large hospital network and to evaluate hospital charges and length of stay. METHODS: Blood utilization after TKA was retrospectively studied over two years from 2009-2010 in a large hospital network setting. All patients were diagnosed with osteoarthritis. Utilization rates, hospital charges, and hospital length of stay (LOS) were compiled using our regional hospital network’s electronic database. The Student’s t-test was performed to determine the significance of continuous variables. A p<0.05 was considered statistically significant.

**RESULTS:** During the study period, there were 50 surgeons who performed at least 10 TKAs per year. During this time, there were 3,750 patients who underwent TKA, of which 19.3% (723/3,750) required an allogeneic or autologous red blood cells (RBC) unit in the peri-operative period. Within our system, transfusion rates after TKAs varied from 4.8% for one surgeon to 63.8% for another surgeon. An average of 1.65 units of packed red blood cells were administered peri-operatively, and 21.6% (156/723) of the transfusions were autologous blood. The hospital charge for patients who received blood transfusions was significantly higher than those that did not receive blood transfusions ($70,893.60 ± $3,399.09, $56,568.40 ± $1,346.84, respectively) (p=0.001). The average length of stay was significantly lower for those who did not have a transfusion (3.34 days ± 0.05) versus those who did have a transfusion (4.2 days ± 0.1) (p<0.001).

**DISCUSSION AND CONCLUSION:** Our study demonstrated that blood utilization after primary TKA differs greatly among orthopaedic surgeons. There is a huge variability of perioperative blood use between providers that suggests that resources may be misallocated. Patients who received transfusions had longer hospital stays and higher hospital costs. Thus, establishing criteria to reduce blood transfusions may decrease hospital length of stay and minimize costs.

**PAPER NO. 594**

**Tranexamic Acid Results in Decreased Blood Loss and Transfusions in Patients Undergoing Staged Bilateral TKR**

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**Mary Jo Adams, BSN, Towson, MD**

**INTRODUCTION:** Tranexamic acid (TEA) is an antifibrinolytic that reduces blood loss and transfusion rate in total joint arthroplasty. Blood loss and allogenic transfusion rate in patients receiving TEA has not been well studied in patients undergoing bilateral staged total knee arthroplasty. The purpose of our study is to evaluate the benefits of using TEA in a group of patients undergoing staged bilateral TKA, in particular looking at blood loss via drain, changes in post-op hemoglobin (Hgb), and transfusion.

**METHODS:** This case control study compared the effect of TEA on drain output, hemoglobin, and number of allogenic blood units transfused in 51 patients undergoing bilateral staged TKA three days apart, and compared it with 70 patients who did not receive TEA. There were no significant differences between groups in terms of demographics or preoperative hemoglobin. One gram of TEA was administered intravenously at the start of each case and one gram intravenously at tourniquet release in all patients. All knees were treated with suction drains which were pulled in all cases within 24 hours.

**RESULTS:** Among patients receiving TEA, mean total drain output (373.8 mL, SD 264.6 mL) was significantly (p<0.001) lower than the mean total drain output of the controls (871.6 mL, SD 457.7 mL), and post operative hemoglobin levels were significantly (p<0.005) higher among those receiving TEA on POD #1 and POD #2 for both staged TKRs. The mean number of allogenic blood units transfused was significantly (p<0.001) lower in the TEA group (0.60 units, SD 0.84) compared with the control group (1.53 units, SD 1.30).

**DISCUSSION AND CONCLUSION:** Tranexamic acid reduces drain output (373.8 mL, SD 264.6 mL) was significantly (p<0.001) lower than the mean total drain output of the controls (871.6 mL, SD 457.7 mL), and post operative hemoglobin levels were significantly (p<0.005) higher among those receiving TEA on POD #1 and POD #2 for both staged TKRs. The mean number of allogenic blood units transfused was significantly (p<0.001) lower in the TEA group (0.60 units, SD 0.84) compared with the control group (1.53 units, SD 1.30).

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output, improves postoperative Hgb, and decreases the allogenic blood transfusion requirements for patients undergoing bilateral staged TKA. TEA is an option for patients choosing bilateral staged TKA to decrease the risks associated with blood transfusion or when autologous blood is not available.

PAPER NO. 595
Superficial Anterior Vasculature and Surgical Approaches to the Knee
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Bryn Jones, MD, Glasgow, United Kingdom

INTRODUCTION: The superficial anterior vasculature of the knee is variably described; most of our information comes from anatomical literature. Descriptions commonly emphasise medial-dominant genicular branches of the popliteal artery. Quantifying the relative contribution of medial and lateral vessels to the anastomotic network of the anterior knee may help provide grounds for selecting one of a number of popular incisions for arthrotomy. The aim was to describe the relative contribution of vessels to anastomoses supplying the anterior knee.

METHODS: Cadaveric knees (n = 16) were injected at the popliteal artery with a single color of latex; then processed through a modified diaphanisation technique (chemical tissue clearance) before final dissection and analysis. The dominant sources were determined in each specimen. Specimens were reconstructed using 3D microscribe technology for further quantification.

RESULTS: The majority of the specimens (n = 13/16; 81%) demonstrated that an intramuscular branch through the vastus medialis muscle was the dominant vessel, giving rise to 65% of all vessels seen on the medial side of specimens. Mean gauge of source vessel seen over the superior medial aspect of the knee (2.4mm) was greater than that of the lateral side (1.0mm; p<0.05). Medial-medial anastomoses (n=13/16; 81%) were seen more frequently than lateral to lateral (n=4/16; 25%; p<0.05).

DISCUSSION AND CONCLUSION: The networks of vessels found in the anterior knee are thought to be the main supply to the patella, extensor apparatus, anterior joint capsule and skin. Our results suggest that anterior vasculature of the knee is predominately medial in origin, but not from the genicular branches as previously described. While medial dominance of blood supply is widely stated, little quantitative data and several conflicting opinions are present in the literature. Optimum placement of incision for arthrotomy remains a subject of debate. Considering the blood supply to the anterior knee may help in choosing a particular surgical approach, especially in the presence of microvascular disease, or cases where further surgery in the future is highly likely. We have confirmed with reproducible, quantitative methods the apparent medial and superior dominance in anterior knee blood supply.

PAPER NO. 596
Revision Total Knee Arthroplasty in the Young Patient
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Javad Parvizi, MD, Philadelphia, PA
William J. Hozack, MD, Philadelphia, PA

INTRODUCTION: While majority of patients experience excellent clinical outcome and function following total joint arthroplasty (TJA), some patients may not do well following this otherwise successful surgery. Clinicians often identify patients who are receiving Workers’ Compensation as a subset of the patients that are unlikely to benefit fully from TJA and may not be able to return to work in a timely manner, if at all. The objective of our study is to determine the influence of Workers’ Compensation on return to work after TJA.

METHODS: Using our institutional database, we identified and collected perioperative data on all patients between January 2000 and December 2008 who underwent a unilateral primary TJA while receiving Workers’ Compensation. A total of 291 patients were identified that met the inclusion criteria. All patients were contacted and inquiry was made regarding the type of preoperative work, and postoperative work status and time frame of returning to work.

RESULTS: Out of the entire cohort, 104 patients have completed the two-year follow up. At the latest follow up of 4.1 years (range, 2 to 9.7 years), 67% (70 of 104) of patients have been able to return to work, with nearly equivalent return to work in the TKA and THA groups (68% and 67%, respectively). When patients did return to work, the average time to return was 3.5 months overall (range, 0.5 to 9, TKA mean 3.2 months, THA mean 3.7 months). In patients who performed manual labor preoperatively, only 56% (37 of 66) returned to work, while patients working sedentary jobs returned more reliably (87%, 33 of 38).

DISCUSSION AND CONCLUSION: Although patient characteristics and motivation play a significant role, return to work after arthroplasty in Workers’ Compensation patients is an
intake is an important measure of our ability to return these patients to a high level of function in physically demanding jobs. It appears that nearly one-third of patients with Workman’s Compensation are not able to return to work following TKA.

PAPER NO. 598
Clinical Values of Tranexamic Acid in Contemporary Extensive Blood-Saving Protocols for Total Knee Arthroplasty
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In Jun Koh, MD, Gyeonggi-Do, Republic of Korea
Chong Bum Chang, MD, Seongnamsi, Republic of Korea
Byung June Chung, MD, Seoul, Republic of Korea
Sae Kwang Kwon, MD, Bucheon-Si, Republic of Korea
Moon Jong Chang, MD, Kyonggi-Do, Republic of Korea
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INTRODUCTION: Total knee arthroplasty (TKA) involves great blood loss, which can require blood transfusion. Currently, extensive blood-saving protocols are being applied to reduce blood loss. One of the many protocols is to administer tranexamic acid (TNA), and many studies reported its blood saving effects. However, it remains to be answered whether TNA has additional transfusion reducing effect in patients covered already with extensive blood-saving protocols. In particular, no previous studies looked into whether potential blood-saving effects of TNA are greater in bilateral TKAs than unilateral ones. Thus, this prospective randomized study was purposed to explore the potential blood-saving effect of TNA after TKAs that are already covered with extensive blood-saving protocols, particularly in bilateral TKAs. RESULTS: TNA reduced drained volume via the vacuum drainage of 178.4 ml, p=0.023. Hb drop was smaller in the TNA group in both unilateral (2.8 g/dL vs. 3.6 g/dL, p=0.001) and bilateral TKAs (4.5 g/dL vs. 5.2 g/dL, p=0.001). The use of TNA reduced transfusion rate in both unilateral and bilateral TKAs, but a meaningful reduction was observed only in the bilateral TKAs (20% vs. 31%, p=0.081). In unilateral TKA, the difference did not reach statistical significance. No symptomatic VTE were observed in both groups. DISCUSSION AND CONCLUSION: This study demonstrates that the use of TNA reduced blood loss and Hb drop in TKAs with no increase of thromboembolic complications even when we already applied extensive blood-saving protocol. But transfusion rate was reduced by TNA only in simultaneous bilateral TKA patients. The clinical value of the TNA was more distinct in simultaneous bilateral TKAs. The authors recommend a routine use of TNA in TKAs, especially in simultaneous bilateral TKAs to reduce postoperative blood loss and transfusion rate.

PAPER NO. 599
Tranexamic Acid Reduces Blood Loss in Primary Cemented Unilateral Total Knee Arthroplasty
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INTRODUCTION: Tranexamic acid is an inhibitor of fibrinolysis that blocks the lysine-binding site of plasminogen to fibrin, and thereby decreases blood loss in patients undergoing surgery. A prospective, randomized, double-blind study was done on 100 patients undergoing primary cemented unilateral total knee arthroplasty to determine the effect of tranexamic acid on intra- and postoperative blood losses and on the transfusions requirements. METHODS: One-hundred patients undergoing unilateral cemented total knee Arthroplasty for osteoarthritis were enrolled for the study. All total knee replacement was done under combined spinal epidural anaesthesia with the use of tourniquet. One-hundred patients were randomized to tranexamic acid (15 mg/kg) given as a bolus intravenous injection or placebo (normal saline) given intravenously, 15 minutes before the release of tourniquet. The blood loss (at removal of the drain 24 hours after the operation) and the number of blood transfusions required were recorded. The patients were screened for deep venous thrombosis with bilateral compression Ultrasonography using color doppler imaging on the tenth postoperative day. The hemoglobin level was measured preoperatively and on the third postoperative day. The D-dimer levels were measured preoperatively and 24 hrs postoperatively. RESULTS: Patients receiving tranexamic acid had a mean postoperative blood loss of 175 ml (range,130-310ml) versus 330 ml (range,210-460ml) (p value<0.05), and a total need for three blood transfusions versus 15. Only three out 50 patients in tranexamic acid group required blood transfusion whereas 12 out of 50 patients in the placebo group required transfusion. In the group receiving placebo the mean fall in hemoglobin was 2.1g/dl (range, 1.5-3.2) and in the group treated with tranexamic acid 1.3 g/dl (0.9-2) (p<0.05). At 24 hours postoperatively, mean plasma D-dimer concentration in the tranexamic group was half of that in the control group. No patient in either group had any evidence of deep vein thrombosis on bilateral compression ultrasonography using color doppler imaging done on the tenth postoperative day. DISCUSSION AND CONCLUSION: Tranexamic acid 15 mg/kg given as a single bolus dose reduces blood loss and transfusion requirements in unilateral primary cemented total knee arthroplasty without any increased risk of thrombus formation.
The Effect of Femoral Implant Malrotation and Material on Patellofemoral Contact Mechanics and Wear During Gait

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INTRODUCTION: Malrotation of the femoral component is a cause of patellofemoral maltracking after total knee arthroplasty (TKA). Its precise effect on patellofemoral (PF) contact mechanics and wear has not been well quantified. The aim of this study was to investigate the effect of malrotation of the femoral component on PF contact area and pressure - and particularly on wear - in TKA by in vitro simulation of a full gait cycle in a knee simulator. Moreover, the influence of the counterface material - Cobalt Chrome (CoCr) or Oxidized Zirconium (OxZr) - on PF wear was investigated during a wear simulation of 4 million cycles.

METHODS: Femoral components were cemented onto metal fixtures, specially designed to be able to position the components in different angles of axial rotation. Patellar buttons and femoral components were then mounted in a knee simulator. In order to investigate PF contact mechanics, seven axial rotation configurations were tested: neutral (femoral component parallel to the epicondylar axis), 2.5° endo- and exorotation, 5° endo- and exorotation and 7.5° endo- and exorotation. Patellar contact location, contact area and contact pressure were measured dynamically with a sensor covering the patella during 20 gait cycles at a rate of 100 frames per cycle. This was measured for each alignment with mediolateral movement either blocked or constrained with linear springs (k = 8 N/mm). Maximum contact area was determined as the total area over the entire patella where pressure was recorded during peak load. The contact pressure was defined as the average pressure recorded on the entire patella at peak load. For three alignments (neutral, 5° endo- and exorotation), a PF wear test of 4 million cycles in bovine serum (diluted to 40%) was done with three CoCr and three OxZr components on conventional ultra-high molecular weight polyethylene (UHMWPE). Every 0.5 million cycles the test lubricant was replaced, the patellar samples were cleaned and polyethylene wear was measured gravimetrically. A linear regression model was used to calculate the wear rate of each patellar sample. Aggregate wear rates were determined for each test condition by pooling the measurements of all three patellar samples.

RESULTS: For all six endorotation and exorotation configurations, the contact area was significantly lower and the contact pressure significantly higher than in the neutral position (p < 0.001, Fig 1). In the patellofemoral wear test, the highest average wear rate was found in the group of endorotated CoCr femoral components (0.54 mm³/Mcycle), but this is still only 11% of a typical tibiofemoral wear rate with the same CoCr component (5 mm³/Mcycle). No significant differences were found between materials or between rotational alignments, but a trend in the average wear rates could be observed. The average wear rate for CoCr tends to be higher than for OxZr and the average wear rate for 5° endorotation tends to be higher than for 5° exorotation and neutral alignment. DISCUSSION AND CONCLUSION: Our results indicate that both internally and externally malrotated femoral components significantly decrease contact areas and significantly increase contact pressures in the patellofemoral joint. These significant changes in contact pressure didn’t translate in significant changes in wear. Overall, patellofemoral wear is very small compared to tibiofemoral wear.

Figure 1: Total contact area and average contact pressure at the different angles of malrotation (ML = mediolateral movement).

The Anatomic Graduated Component (AGC) Primary Total Knee Arthroplasty at 20-26.5 Year Follow Up

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INTRODUCTION: More than one million total joint arthroplasties (TJA) are performed annually in the United States, and primary total knee arthroplasty (TKA) is among the most effective medical procedures in improving quality of life. Twenty-five years ago, it was not evident from available data what combination of implant factors would contribute to long-term survival. One contemporary design from the mid-1980s is evaluated for longevity. METHODS: Between January 1985 and May 1991, a consecutive series of 441 primary TKA was performed in a dedicated arthroplasty practice by one of two surgeons. The series were prospectively followed in a practice-based registry. Clinical, radiographic, and survivorship (life-table analysis) data were analyzed. RESULTS: At 20 to 26.5 year follow up, 43% of patients had died. Fifty-eight (13%) of the original 441 knees had been revised. The most common modes of failure were as such: 21 knees (4.8%) had been revised for failure of a single-peg patella, 15 knees (3.4%) had failed for polyethylene wear and/or osteolysis, six knees (1.4%) were revised for infection, and four knees (0.9%) failed with tibial subsidence. Interestingly, the knees which failed for infection (mean 2.0 yr) or tibial subsidence (mean 2.2 yr) failed early; those which failed for patella loosening (mean 8 yr) failed at midterm, and those which failed for polyethylene wear (mean 14 yr) failed later and over a broader time frame. There was a preponderance of a certain tibial design (“Modular 1”) which suffered failure from polyethylene wear. Mean KS Scores were 81 and Functional Scores were 77 at latest follow up for group. Survivorship was 84.3% at 25 years.
DISCUSSION AND CONCLUSION: This study demonstrates the long-term survivorship of the anatomic graduated component (AGC) total knee arthroplasty in a non-designing surgical practice, and highlights the advantages of unconstrained articular geometry and compression-molded polyethylene.

PAPER NO. 707

**New High Flexion Design Does Not Improve Maximal Flexion in Total Knee Arthroplasty: A Randomized Controlled Trial**

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**INTRODUCTION:** An important factor in the functional results after total knee arthroplasty (TKA) is the achieved maximal flexion. To date, a TKA still provides dissimilar flexion capabilities compared to the healthy knee, which could be due to the mismatch between the normal knee geometry and the implant geometry. The implant design of a new bi-cruciate stabilized knee system aims to replicate the normal knee function and intends to accommodate high flexion. This study investigated maximal knee flexion one year after surgery of the high flexion system compared to its conventional predecessor. In addition, clinical and functional outcomes were evaluated.

**METHODS:** A total of 124 patients presenting with noninflammatory osteoarthritis received the high flexion or the conventional prosthesis, by randomization. The primary outcome was the maximum flexion angle on a lateral X-ray performed with the patient supine and using manual force on bending the knee. Secondary outcomes were: active flexion (lying and standing), Knee Society System score (KSS), Patella Scoring System (PSS), number of adverse events (AEs) and satisfaction until two years post-operative. The changes in KSS and PSS were calculated as: $\Delta$KSS = KSS year - KSS pre-op, and $\Delta$PSS = PSS year - PSS pre-op. Two-sided t-tests and non-parametric alternatives were performed to test for differences between the implants.

**RESULTS:** Demographic and flexion characteristics were comparable between the two groups at baseline. No significant differences were observed at one year in maximal flexion and active flexion between both groups (Figure). Median maximal flexion on X-ray was 127° (range 83°-150°) for the high flexion system and 125° (range 81°-145°) for its predecessor. Active flexion was lower ($p<0.001$) than flexion on X-ray at one year (both lying and standing, median 120°). The $\Delta$KSS and $\Delta$PSS scores improved significantly more for the conventional group ($p=0.018$ and $p=0.005$, respectively). In the high flexion group, 40 AEs in 27 patients were reported, including 14 manipulations under anaesthesia (MUA), 10 patients with persistent pain, three insert exchanges, and two total system revisions. In the conventional group, 13 AEs were observed in 12 patients, including six MUAs, three patients with persistent pain, and one insert exchange. Patients were equally satisfied in both groups. The two-year follow up will be complete at the time of the meeting.

**DISCUSSION AND CONCLUSION:** The new high flexion design did not increase the maximal flexion. In both groups, patients did not use the maximum of their flexion ability. Less improvement in clinical and functional outcomes and a higher number of AEs were observed in the high flexion group. The functional problems of the new implant design could be due to an increased lateral roll-back as compared to the native knee. The new design does not result in the desired increased flexion and better clinical and functional outcome.

PAPER NO. 708

**Comparison Of Osteoarthritis and Cruciate Retaining TKA Mechanoreceptor Content in the PCL**

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**INTRODUCTION:** The presence of mechanoceptors in the cruciate ligaments of the knee has been long reported. No one has compared posterior cruciate ligaments that have been retrieved from well-performing, cruciate-retaining (CR) total knee arthroplasty (TKA) specimens to those from osteoarthritic (OA) knees. In this study we determine if mechanoreceptors in the human posterior cruciate ligament (PCL) from patients that have had total knee arthroplasty with retention of the PCL and from OA knees are similar in quantity.

![Graph](image-url)

For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
METHODS: Five cruciate retaining TKA specimens were identified from a retrieval program and five PCLs were obtained during TKA from OA patients after consent. The whole en bloc PCL specimens were harvested for the study. These specimens were then sectioned to a thickness of 8 microns and mounted on microscope slides. The sections were then subjected to immunohistochemistry with neurofilament protein (NFP), and S-100 protein. RESULTS: All five PCL specimens in each group revealed evidence of positive stained elements with both S100 protein and NFP immunohistochemical staining. Morphologically, these elements appear to correspond to pacini, golgi and lamellar types of mechanoreceptors. No difference in positive staining mechanoreceptor elements as a percentage of area investigated between the OA and TKA group was found (p = 0.18 to 0.86).

DISCUSSION AND CONCLUSION: This study is the first to show that when the PCL is retained that it can maintain mechanoreceptors with innervations that may aid in function after a TKA. If mechanoreceptors continue to function after CR TKA then it may continue to participate in proprioception of the knee after TKA.

PAPER NO. 709

Long Term Follow-Up of Fresh Osteochondral Allografting of the Femoral Condyle

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INTRODUCTION: Articular cartilage injuries of the distal femur are a challenging clinical entity. Fresh osteochondral allografting (OCA) is an increasingly popular option for articular cartilage restoration. Many short-term follow up studies demonstrate promising clinical results, but there are few long-term follow up studies that provide information about graft survivorship and durability. The purpose of this study was to assess the long-term outcomes of patients undergoing fresh OCA transplantation due to various pathologies of the femoral condyles.

METHODS: Since 1983, our IRB-approved OCA outcomes program has collected data on 614 OCA transplantation procedures of the knee performed in 536 patients. Of those, we identified 137 patients (144 knees) who underwent OCA transplantation of the femoral condyle and were at least 10 years out from surgery. Nine patients (10 knees) were deceased and 16 patients (16 knees) did not have a minimum of two-year follow up and were excluded; the remaining 112 patients (119 knees) were included in the present analysis. Mean age was 31 years (range, 15-61 years), 57% were male. Diagnoses included osteochondritis dissecans (45%), traumatic cartilage injury (24%), degenerative chondral lesion (17%), avascular necrosis (10%), and other (6%). The medial femoral condyle was involved in 60%, lateral femoral condyle in 33% and both condyles in 7%. Average total graft area was 8.1 cm² (range, 0.7-28.5 cm²).

Clinical evaluation included the modified D’Aubigne and Postel (18-point) scale, International Knee Documentation Committee (IKDC) pain and function scores, Knee Society (KS) function scores, and measures of subjective satisfaction. Reoperations occurred in 54 of the knees (45%), 27 (23%) of which were not directly related to OCA. Reoperations for clinical failure occurred in 27 knees (23%) at a mean of 6.6 years (range, 1-19.7 years): 13 revision OCA (48%), 12 total knee arthroplasties (45%), and two unicompartmental knee arthroplasties (7%). Kaplan Meier survivorship analysis showed survival rates of 81% at 10 years, 76% at 15 years, and 65% at 20 years.

DISCUSSION AND CONCLUSION: Osteochondral allografting appears useful in treating wide spectrum articular cartilage pathology. OCA resulted in significant improvement in pain, function and high patient satisfaction in the majority of patients with acceptable graft survivorship.

PAPER NO. 710

Measurement of the Knee Flexion Angle with a Smartphone Application is Precise and Accurate

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INTRODUCTION: The magnitude of knee flexion angle is relevant information during clinical examination of the knee, and this item is a significant part of every knee scoring system. It is generally performed by visual analysis or with manual goniometers, but these techniques may be neither precise nor accurate. More sophisticated techniques are only possible in experimental studies. Smartphone technology might offer a new way to perform this measurement with increased accuracy.

METHODS: Twenty patients operated on for unicompartmental or total knee replacement with help of a navigation system participated to the study. There were 13 women and seven men with a mean age of 72.1 years. All patients were operated on for unicompartmental or total knee replacement. All patients were operated on with help of a non-image based navigation system. The navigation system is able to measure very accurately the knee flexion angle. The Smartphone application allows measuring this angle in two steps 1) recording the reference position by putting the Smartphone on the operating table, 2) recording the knee flexion angle by putting the Smartphone against the tibial crest. Two observers participated the study. The first observer performed three independent navigated measurements followed by three independent Smartphone measurements while positioning the knee under visual control in full extension, at 0°, 30°, 60°, 90° of knee flexion and at maximal flexion; the second observer performed only one set of measurements. The intra- and inter-observer variability was assessed by calculation of the intra-class correlation coefficient. Navigated and Smartphone data were compared by a paired Wilcoxon test and calculation of the Spearman coefficient of correlation at a 5% level of significance.

RESULTS: There was no significant difference between paired navigated and Smartphone measurements at any degree of knee flexion. There was a strong correlation between the two data sets. The intra- and inter-observer reproducibility was high.

DISCUSSION AND CONCLUSION: There was a high agreement between the navigated measurements considered as the reference and the Smartphone measurements. This new technology is easy to use and extensively available. It allows significant improvement in the precision and the accuracy of the measurement of the knee flexion angle without technical difficulties. This technique might allow self-control by the patient of the progression of the post-operative rehabilitation. The Smartphone application allows significant improvement in the precision and the accuracy of the measurement of the knee flexion angle without technical difficulties.
**INTRODUCTION:** A study was undertaken to assess the association between objective rating of pre-operative degree of osteoarthritis (OA) and occurrence of pain and dissatisfaction following total knee arthroplasty (TKA).

**METHODS:** Patients referred for TKA of unknown etiology were included. Cases included for study had pain rated moderate or worse and knees that were otherwise clinically and radiographically normal. Advanced imaging was used to fully characterize knees. Pre-operative radiographs were obtained for all patients. Pre-operative radiographs were successfully obtained in 38 of 49 knees (78%). The degree of OA was graded on the Kellgren and Lawrence classification in which grades 1 and 2 are early stage OA with possible joint space narrowing. Three other matched cohorts of TKAs from the same center with radiographically normal TKAs had their pre-operative radiographs graded - Group 1 (n = 100) a consecutive series of primary TKAs performed for OA during the same year, Group 2 (n = 80) were asymptomatic at 1-4 years, while Group 3 (n = 80) had some degree of pain at 1-4 years. RESULTS: The study group had a statistically significant higher incidence of early grade OA pre-operatively compared to any of the control groups (19/38, 49% vs. 5.5%, 6.25%, and 10% respectively, p < 0.0001). Among TKAs performed at the study center, patients who were asymptomatic at 1 year were more likely to have had Grade 4 OA pre-operatively than those who had some degree of pain at follow up (69% vs 53%, p = 0.09).

**DISCUSSION AND CONCLUSION:** An extraordinarily high percentage of patients referred for unexplained pain following TKA had early stage OA pre-operatively compared to any of the control groups. Patients undergoing TKA for less than Grade 4 OA should be informed that they are at higher risk for persistent pain and dissatisfaction.

**PAPER NO. 712**

**Long-Term Comparison of Fixed- and Mobile-Bearing TKAs in Patients Younger Than 50 Years of Age**

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**INTRODUCTION:** The prospective randomized comparison of fixed- and mobile-bearing total knee arthroplasties in patients with osteoarthritis younger than 50 years of age is limited. The purpose of this study was to compare the long-term clinical and radiographic results of fixed- and mobile-bearing total knee arthroplasties in patients with osteoarthritis younger than 50 years of age.

**METHODS:** We prospectively compared the results of 108 patients with osteoarthritis younger than 50 years of age who received a fixed-bearing prosthesis in one knee and a mobile-bearing knee prosthesis in the other. There were 83 women and 25 men with a mean age of 45.2 ± 6.1 years (range, 29 to 50 years). The mean follow-up was 16.8 years (range, 15 to 18 years). The patients were assessed clinically and radiographically using the rating systems of the Knee Society and the Hospital for Special Surgery at three months, one year, and annually thereafter. In addition, each patient recorded the Western ON and McMaster Universities Osteoarthritis (WOMAC) questionnaire and University of CA, Los Angeles (UCLA) activity score.

**RESULTS:** At the last follow up, the mean Knee Society knee scores (95 points vs. 94 points), WOMAC scores (35.1 points vs. 34.9 points), and ranges of knee motion (126° vs. 128°) were similar in both groups. UCLA activity score was 8.4 points. In the fixed-bearing group, one knee was revised because of infection and two for aseptic loosening of the tibial component. Another two knees were revised because of wear of tibial polyethylene insert.

In the mobile-bearing group, two knees were revised because of instability and the other one was revised because of infection. The Kaplan-Meier survivorship for revision at 16.8 years was 95% (95% CI, 91 to 100) for the fixed-bearing prosthesis and 97% (95% CI, 93 to 100) for the mobile-bearing knee prosthesis.

**DISCUSSION AND CONCLUSION:** Long-term results of both fixed- and mobile-bearing total knee arthroplasties were encouraging in patients with osteoarthritis younger than 50 years of age. However, we found no evidence to prove the superiority of the mobile-bearing over the fixed-bearing total knee arthroplasty.

**PAPER NO. 713**

**Mechanical Axis Alignment did not Predict Dynamic Knee Joint Loading after Modern TKA**

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**INTRODUCTION:** One long-held tenet in total knee arthroplasty (TKA) is to obtain neutral mechanical-axis alignment in an effort to produce balanced knee joint loading and maximize implant longevity. The precise relationship between static mechanical-axis alignment and the loads experienced at the knee during dynamic activities of daily living has not been examined closely after TKA. We sought to test the hypothesis that a neutral post-operative mechanical axis would routinely result in balanced knee joint loading during level walking and stair climbing activities.

**METHODS:** As part of a randomized clinical trial to assess outcomes after TKA, 40 patients were enrolled in a protocol that included comprehensive gait analysis, strength testing and patient derived outcomes measures done preoperatively, at two months postoperatively and at two years postoperatively. The patient group was representative of a contemporary TKA group with a mean age of 66 years, a mean BMI of 31, and a slight predominance of females over males. Gait kinematic parameters were acquired with a state-of-the-art computerized video motion analysis system during level walking trials. Mechanical axis alignment was calculated from digital full-leg hip-knee-ankle radiographs performed per protocol and a validated, computational model was utilized to calculate medial tibial plateau loading experienced during static standing and during the stance phase of the gait cycle. The relationship between mechanical axis alignment and the loads experienced at the knee was assessed preoperatively and postoperatively at two years.

**RESULTS:** Pre-operatively, the mean static medial load was 54% ± 3% (reflecting the predominance of varus degenerative arthritis) and two months and two years post-operatively; the mean static medial loads were, 50% ± 1% and 50% ± 2% respectively. However, both pre-operatively and at two months and two years post-operatively, the dynamic medial load percentage did not correlate closely with mechanical-axis alignment. While the overall mean values for the group approached balanced 50/50 loading of the tibia there were substantial individual differences. Pre-operatively, the mean dynamic medial load was
61% ± 22% and two months and two years post-operatively, the mean dynamic medial loads were, 51% ± 11% and 44% ± 19% respectively. The two month data was not predictive of the two year data. At two years post-operatively, 89% of patients achieved the surgical mechanical axis alignment goal (0°±3°), but only 56% of patients had a dynamic medial load distribution of 50 ± 10%. Additionally, at two years 22% of subjects experienced pain, but these subjects achieved both the alignment and loading targets.

RESULTS AND CONCLUSION: A neutral mechanical axis remains a useful goal in TKA but for substantial numbers of patients that does not result in balanced knee loading. This data may provide insight to why some well-aligned knees fail and some outliers prove durable.

PAPER NO. 714

Errors in Knee Alignment Using Fixed Resection Angles

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INTRODUCTION: Instrumentation for total knee arthroplasty (TKA) has been stable over the last 20 years relying on intramedullary guides for proper femoral resection. These guides come in varying angles and the surgeon must select an appropriate angle for each patient. By definition this is variable, however, the standard of care at many institutions is to select a set angle for a given deformity. Selecting a predetermined angle of 5° or 6° may result in a number of outliers and malalignment in the coronal plane. This study describes the variance within a given population and provides guidance in improving coronal alignment in TKA.

METHODS: A review of 250 full-length templated radiographs was performed. Each radiograph was templated using trauma-CAD software. The actual degree required to make a femoral resection perpendicular to the mechanical axis was compared to the technique of using short films only and making a fixed 5 or 6 degree resection.

RESULTS: The median resection angle was 5.5° while the mode was 6°. There was considerable variation within the data set with a range of 2° to 10°. Varus femoral bows were found in 11% of patients while valgus femoral bows were found in 16%. Using a fixed 5° angle to make all distal femoral resections, an error of at least 2° would be made 9.3% of the time. Using a fixed 6° angle to make all distal femoral resections, an error of at least 2° would be made 9.3% of the time.

DISCUSSION AND CONCLUSION: Proper alignment is a critical aspect of TKA. Significant errors in coronal alignment will occur 10% of the time if fixed femoral resection angles are chosen without considering the variance in patient anatomy. Full length films should be used to identify abnormal anatomy and ensure proper alignment in TKA.

PAPER NO. 715

Total Joint Arthroplasty Outcome based on Day of Week

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INTRODUCTION: Total joint arthroplasty (TJA) is the gold standard treatment for end stage arthritis unresponsive to conservative treatment. Variables affecting outcomes of TJA have been identified extensively in the literature. However, the effect of the time of week surgery is performed on the outcome of elective TJA is unknown.

The day of week could theoretically have an impact on patient care due to the availability of physical therapy, rehabilitation services, medical staff, and operating room staff. This study attempted to identify the influence of day of surgery on length of stay (LOS) and complications following primary total joint arthroplasty.

METHODS: A total of 3,143 patients underwent consecutive primary TJA at a single institution by two surgeons between 2006 and 2011. One surgeon operated on Monday and Friday while the other operated on Tuesday and Thursday. Patients were grouped into have surgery early (Monday, Tuesday) or late (Thursday, Friday). Data obtained and analyzed included: age, body mass index, gender, Charlson Index, day of admission, time to discharge, and complications of indexed surgery.

RESULTS: The mean LOS was significantly longer for patients undergoing surgery late (Mean = 3.9 days) vs. early (Mean = 3.6 days) in the week (p=0.002). Univariate analysis identified significant associations of end of week surgery, increased Charlson index, age, and female gender with increased LOS. BMI was not statistically significant. Multiple regression analysis identified day of week as an independent predictor of length of stay. Patients that had surgery on Thursday and Friday also had increased rate of postoperative pulmonary complications (p=0.006) and hematoma/seroma (p=0.067).

DISCUSSION AND CONCLUSION: It appears that hospital length of stay is affected by the day on which patient receives surgery. This is likely due to a combination of factors including the availability of ancillary services (physical therapy and social services) and availability of family members. This delay in discharge creates economic and clinical disparity between the early and late week operative groups.

PAPER NO. 716

Comparison of Total Knee Arthroplasty Using Patient Specific Instruments versus Conventional Instruments

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INTRODUCTION: Component alignment is an important factor affecting the long-term outcome of total knee arthroplasty (TKA). A patient specific instrument was developed to improve the accuracy of implant placement without negative aspects of navigated total knee arthroplasty. The purpose of this study was to compare the alignment of TKA using patient specific instruments (PSI) to TKA using conventional instruments.

METHODS: Fifty primary osteoarthritis knees were prospectively randomized to undergo total knee arthroplasty with patient specific instruments (PSI group; 25 knees) or conventional instruments (Conventional group; 25 knees). Patient specific guides for PSI group were generated from CT scan. We analyzed postoperative mechanical axis, coronal and sagittal alignment with plain radiographs and 3-dimensional CT scan. Outliers in coronal alignment were defined as >3°.

RESULTS: There was no difference in preoperative demographics, CT scan. We analyzed postoperative mechanical axis, coronal and sagittal alignment with plain radiographs and 3-dimensional CT scan. Outliers in coronal alignment were defined as >3°. There were grouped into have surgery early (Monday, Tuesday) or late (Thursday, Friday). Data obtained and analyzed included: age, body mass index, gender, Charlson Index, day of admission, time to discharge, and complications of indexed surgery.

The mean LOS was significantly longer for patients undergoing surgery late (Mean = 3.9 days) vs. early (Mean = 3.6 days) in the week (p=0.002). Univariate analysis identified significant associations of end of week surgery, increased Charlson index, age, and female gender with increased LOS. BMI was not statistically significant. Multiple regression analysis identified day of week as an independent predictor of length of stay. Patients that had surgery on Thursday and Friday also had increased rate of postoperative pulmonary complications (p=0.006) and hematoma/seroma (p=0.067).

DISCUSSION AND CONCLUSION: It appears that hospital length of stay is affected by the day on which patient receives surgery. This is likely due to a combination of factors including the availability of ancillary services (physical therapy and social services) and availability of family members. This delay in discharge creates economic and clinical disparity between the early and late week operative groups.
alignment (varus 0.5° versus valgus 0.2°; p>0.05) were similar between two groups. Femoral sagittal alignment (3.5° flexion versus 3.1° flexion; p>0.05) and tibial sagittal alignment (3.1° posterior slope versus 3.6° posterior slope; p>0.05) were also similar between the groups. The prevalence of outliers in the mechanical axis of the leg was 16% in PSI group and 12% in conventional group (p>0.05). The percentage of outliers in the femoral (4% versus 4%; p>0.05) and tibial coronal alignment (0% versus 0%; p>0.05) was also similar between the groups.

DISCUSSION AND CONCLUSION: Total knee arthroplasty with patient-specific instruments provide accurate implant positioning and alignment without breaching the intramedullary canal.

PAPER NO. 717
The All-Polyethylene Tibial Component in Octogenarians
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INTRODUCTION: The all-polyethylene tibial component (APT) has proven durable in many clinical studies and has demonstrated survivability equivalence to metal-backed tibial (MBT) components. Despite this evidence and known cost savings, critics continue to question its utility. We hypothesized that in the octogenarian, the APT has a survivability that usually exceeds the patient’s lifetime.

METHODS: This is a retrospective consecutive case series from a single surgeon. All patients were a minimum of 80 years of age when they underwent total knee arthroplasty with an APT. We attempted to contact all patients or their next of kin by a mailed or telephoned survey. From 1994 to 2008, 166 knees in 132 patients over 80 years of age received an APT. At the time of operation, average age was 84 years (80 to 97) with 82 patients (98 knees) still living at the time of the analysis. Seventy-five percent of the patients were female and the average body mass index was 27.9 kg/m2.

RESULTS: There were no failures of the APT at the time of most recent follow up. There was a minimum follow up of two years or death in 87.9 percent of patients (mean 5.7 years, range 2 to 15.5 years) and contact with the next of kin in 64 percent of those deceased. There were no failures of the APT at the time of most recent follow up. One patient developed hemarthrotic septic arthritis which was successfully treated with irrigation, debridement and retained components. Knee Society clinical and function scores improved from 30 and 48 respectively preoperatively to 94 and 93 respectively. Preoperative function scores were 57 and 56 in the minimal OA group and severe OA groups. Postoperative knee scores were 89 and 93 respectively. Preoperative function scores were 57 and 56 in the minimal OA group and severe OA groups. Postoperative function scores increased to 79 and 72 respectively. Twenty-seven out of 32 patients (84%) in the minimal OA group had mild or no pain at the time of last follow up, while five (16%) had moderate or severe pain. Twenty-six out of 32 patients (81%) in the severe OA group had mild or no pain at the time of last follow up, while six (19%) had moderate or severe pain. Six of 32 knees in the minimal OA group (18.9%) experienced a complication. They included three manipulations under anesthesia, one deep infection, one superficial infection, and one saphenous nerve neumora. Only one of 32 knees (3.1%) in the matched cohort experienced a complication.

DISCUSSION AND CONCLUSION: Patients with minimal preoperative radiographic arthritis constituted less than 1% of the patients undergoing TKA at our institution and had a higher risk of complications but similar pain relief, function and satisfaction compared to a matched group with severe arthritis.

PAPER NO. 718
Is Minimal Preoperative Degenerative Arthritis a Predictor of Poorer Outcomes After TKA?
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INTRODUCTION: Though most surgeons presuppose that patients with more severe degenerative osteoarthritis (OA) are better candidates for total knee arthroplasty (TKA) there is little data comparing outcomes based on the extent of radiographic OA. We sought to test the hypothesis that patients with minimal radiographic OA would have inferior outcomes to a matched cohort with severe OA.

METHODS: Our total joint registry identified 29 patients (32 knees) with minimal degenerative changes (Kellgren and Lawrence Grades 0-2) who had a TKA between 2000 and 2004. We then identified a matched cohort with severe OA (age, sex, surgeon, BMI, and side of surgery). The mean followup was five years (2-10 years).

RESULTS: Preoperative knee scores were 63 and 59 in the minimal OA group and severe OA groups. Postoperative knee scores were 89 and 93 respectively. Preoperative function scores were 57 and 56 in the minimal OA group and severe OA groups. Postoperative function scores increased to 79 and 72 respectively. Twenty-seven out of 32 patients (84%) in the minimal OA group had mild or no pain at the time of last follow up, while five (16%) had moderate or severe pain. Twenty-six out of 32 patients (81%) in the severe OA group had mild or no pain at the time of last follow up, while six (19%) had moderate or severe pain. Six of 32 knees in the minimal OA group (18.9%) experienced a complication. They included three manipulations under anesthesia, one deep infection, one superficial infection, and one saphenous nerve neumora. Only one of 32 knees (3.1%) in the matched cohort experienced a complication.

DISCUSSION AND CONCLUSION: Patients with minimal preoperative radiographic arthritis constituted less than 1% of the patients undergoing TKA at our institution and had a higher risk of complications but similar pain relief, function and satisfaction compared to a matched group with severe arthritis.

PAPER NO. 719
Comparison of Asymmetric and Symmetric Femoral Condyles in Posterior Stabilized TKR
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INTRODUCTION: Total knee replacement (TKR) designs are continually changing. Designs incorporating symmetric femoral condyles with conforming tibial surfaces may decrease implant-bone interface forces and reduce wear; whereas, asymmetric condyle designs may enhance rotation. We hypothesize that posterior stabilized (PS) TKRs with symmetric femoral condyles have comparable clinical outcomes to PS TKRs with asymmetric femoral condyles.

METHODS: We compared the first 100 consecutive primary PS TKRs with asymmetric femoral condyles (Group A) to the first 100 consecutive PS TKRs with symmetric femoral condyles (Group B) by the same manufacturer for osteoarthrisis. Patient demographics (age, weight, height, BMI, gender, side) were not significantly different. Outcome measures included failure rates (revision), Knee Society knee scores (KSKS) and function scores (KSFNS), knee ROM, and incidence of radiographic radioluencies.

RESULTS: Average follow up was 102 months (Group A) and
94 months (Group B) \(p=0.29\). Two revisions were performed in Group A (infections) and two in Group B (infection, lysis of adhesions) (Fisher Exact \(p=0.67\)). Three manipulations were performed in Group A and two in Group B (Fisher Exact \(p=0.52\)). The average KSFS significantly improved in both groups (56 to 93; \(p<0.01\); Group A) (58 to 94; \(p<0.01\); Group B) as well as the average KSFXNS (42 to 69; \(p<0.01\); Group A) (47 to 74; \(p<0.01\); Group B) and knee ROM (103 to 114; \(p<0.01\); Group A) (111 to 115; \(p<0.01\); Group B). When comparing Group A and Group B; the average change in KSFS \(p=0.90\) and KSFXNS \(p=0.91\) were not significantly different, however, the average change of knee ROM \(p<0.01\) was significantly greater in Group A. Implant radiolucencies were only evident at the patellar interface in one patient from Group A (Fisher Exact \(p=0.51\)).

**DISCUSSION AND CONCLUSION:** Our results indicate that primary TKRs with symmetric femoral condyles have a comparable failure rate, clinical outcome, and incidence of radiographic radiolucencies when compared to primary TKRs with asymmetric femoral condyles.

**PAPER NO. 720**

**Long-Term Results of Cemented and Cementless TKA Using Identical Prosthetic Design in Same Patients**

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**INTRODUCTION:** There is considerable debate regarding the possible benefits of using cementless fixation in TKA. The purpose of this prospective, randomized study was to evaluate the clinical and radiographic results in the same patients associated with identical cemented or cementless total knee prosthesis.

**METHODS:** Sequential simultaneous bilateral TKA was performed for 50 patients (100 knees). Thirty-nine women and 11 men (mean age, 58.4 years) received a cemented total knee prosthesis in one knee and a cementless total knee prosthesis in the contralateral knee. The mean duration of follow up was 13.1 years (range, 13 to 14 years). At each follow up, the Knee Society knee score, the Hospital for Special Surgery knee score, the Western ON and McMaster Universities Osteoarthritis (WOMAC) score, patient satisfaction score, the University of CA, Los Angeles (UCLA) activity score and radiographs were evaluated.

**RESULTS:** The mean postoperative Knee Society knee scores (96.2 vs. 97.7 points) and Hospital for Special Surgery knee scores (92.8 vs. 93.1 points) were similar in both groups. The mean postoperative WOMAC scores (34.5 vs. 35.6 points) were similar in both groups. At final follow up, the mean ranges of knee motion in the supine position (124º vs. 128º), patient satisfaction (8.1 vs. 8.3 points), and radiographic results were similar in both groups. The UCLA activity score at final follow up was 7.9 points. The Kaplan-Meier survivorship analysis revealed that the rate of survival of the femoral components was 100% (95% CI, 0.93 to 1.0) in both groups at 14 years. The rate of survival of the tibial component was 100% (95% CI, 0.93 to 1.0) in the cemented group but 98% (95% CI, 0.91 to 1.0) in the cementless group at 14 years. No osteolysis was identified in either group.

**DISCUSSION AND CONCLUSION:** Although cementless total knee prostheses are justified under this most optimistic view, it should be appreciated that our data have shown no evidence of benefit for cementless total knee prosthesis over cemented ones.

**PAPER NO. 796**

**G-CSF Enhances Chondrocyte Outgrowth from Human Cartilage Fragments: A New Perspective for One-stage Repair?**

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**INTRODUCTION:** Minced cartilage fragments provide a viable cell source for one stage cartilage repair. Human in vitro explant cultures show some limitations (i.e. reduced cell migration and outgrowth from cartilage fragments, compared to animal models). Aim of the study is to verify if G-CSF exposure could enhance chondrocyte outgrowth into a HA/fibrin/PRP scaffold and evaluate its effects on chondrocyte behavior, compared to TGF-beta exposure.

**METHODS:** Platelet rich plasma (PRP) preparation: from an original vein concentration of 234,6 x 103 platelets/mm3 (range 194 - 280), the mean platelet concentration in the final volume of PRP was 1015,2 x 103 platelets/mm3. Cartilage fragments construct preparation: Articular cartilage from 23 human knees (> 35y) was harvested and minced into small fragments. A non-woven esterified HA derivative felt was cut to pieces of 0.7 cm2. Two sheets were put in a culture dish one atop the other and homogeneously hydrated with 100 ul of PRP. 10-15 mg of cartilage fragments were evenly seeded atop the membrane and retained with a coating of approximately 200 ul of commercial fibrin glue. Constructs were cultured for one month both in standard culture medium and under exposure to G-CSF (10ng/ml) and/or to TGF-beta (10ng/ml). Expant cultures were evaluated histologically and with immunofluorescence. Cell counting: at 20x magnification, the number of migrating cells per area was counted, for each H/E section, in the two areas close to cartilage fragments, where migrating cells were more represented. Two different sections per construct were examined and a mean value of migrating cells was determined. For each patient, a “patient migration ratio” was determined at one month as the ratio between the number of migrating cells under G-CSF and/or TGF-beta stimulation compared with the number of migrating cells of unstimulated constructs. Mean migration ratio under the different culture conditions was finally calculated.

**RESULTS** (Fig 1): Compared to unstimulated cultures \(p<0.05\), chondrocyte outgrowth at one month increased in a mean ratio of 1.7:1 with exposure to TGF-beta, in a mean ratio of 1.9:1 with exposure to G-CSF and in a mean ratio of 1.8:1 with exposure to both factors. No statistical differences were observed between exposure to G-CSF or TGF-beta or both factors \(p>0.05\). Immunofluorescence of migrating cells was positive for sox9, CD151, CD49c and negative for CD105, consistent with a predominant chondrogenic phenotype; G-CSF Receptor was detected on migrating cells with immunofluorescence; exposure to G-CSF slightly decreased SOX-9 expression and increased PCNA and beta-catenin expression in migrating cells.

**DISCUSSION AND CONCLUSION:** G-CSF exposure improves chondrocyte outgrowth from human cartilage fragments loaded into a HA/fibrin/PRP scaffold. Efficiency of migration is not increased if TGF-beta is added to G-CSF during construct culture. The changes in expression of Sox-9 (slightly decreased) and PCNA and beta-catenin (increased) under G-CSF exposure suggest a
proliferative phenotype of cells. This supports a possible role of G-CSF in increasing chondrocyte outgrowth during in-vivo one stage cartilage repair with minced human cartilage fragments. Further studies are required to better ascertain the effects of G-CSF on migrating chondrocytes.

PAPER NO. 797

How Many Americans are Currently Living with Total Knee Replacement?

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INTRODUCTION: In the last decade, the number of total knee replacements (TKRs) performed in the U.S. doubled, exceeding 600,000 in 2009. The vast majority are done for osteoarthritis (OA). The growth in TKR use has been greatest among younger individuals, and as a result the average age at which patients receive TKR has decreased over time. The rapid growth in TKR utilization among younger individuals, coupled with increased life expectancy, may lead to increased healthcare costs due to periprosthetic fractures, prosthetic infections, and symptomatic loosening, with the need for revision TKR. While changes in annual rates of TKR over time have been described, estimates of the number of persons in the U.S. living with knee implants have not been reported. METHODS: We used the OAPol Model, a state-transition, computer-simulation model, to estimate the prevalence of primary TKR stratified by age and sex. We combined these prevalence estimates with 2009 U.S. Census data to calculate the number of Americans currently living with an intact primary TKR. The incidence and prevalence of symptomatic knee OA were derived using data from the National Health Interview Survey. The annual incidence of TKR among persons with advanced knee OA (Kellgren-Lawrence grade 3 or 4) was derived using the data from two national longitudinal studies of persons with knee OA (Multicenter Osteoarthritis Study and Osteoarthritis Initiative). Input parameters related to mortality, obesity, comorbidities, non-surgical OA treatments, and prosthesis failure were obtained from national survey data and published literature. RESULTS: Over 4.5 million Americans currently have an intact primary TKR, representing 4.7% of the population aged 50 years or older. The prevalence of TKR is higher in females (5.3%) than males (4.1%). Among persons 60-69 years of age, 4.1% of men and 4.9% of women have had at least one knee replaced. Among those 70-79 years of age, 7.1% of men and 8.2% of women have had at least one knee replaced. Approximately 10% of those older than 80 years have had at least one knee replaced. DISCUSSION AND CONCLUSION: Five percent (5%) of females and 4% of males older than 50 years are living with TKR. Among persons older than 50 years of age, TKR has become considerably more prevalent than rheumatoid arthritis or congestive heart failure. Knowledge of TKR prevalence is useful in planning health services specific to the population living with TKR. This includes the prevention and management of periprosthetic fractures and infections, as well as planning for adequate capacity for revision TKR.

PAPER NO. 798

Wear in Total Knee Arthroplasty - Just a Question of Polyethylene?

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INTRODUCTION: Failure of total knee arthroplasty (TKA) is mainly caused by biological reactions against wear particles generated at the implant. Chronic inflammation following the generation of wear particles has been realized as the main biological mechanism leading to implant failure. So far, wear has been mainly attributed to polyethylene (PE) and much effort has been put into understanding and optimizing the wear mechanism of PE in recent years. However, evaluation of metal wear particles and ion release in TKR has been neglected so far although the implants present large metal surface areas. In the present study we aimed to analyze the wear performance of TKA and to study the kinetics of metal ion and particle release. We hypothesized that due to abrasion and corrosion TKA will release relevant levels of Cobalt (Co), Chromium (Cr), Molybdenum (Mo) and Titanium (Ti).
METHODS: Implants were subjected to an in-vitro simulation applying physiological loadings and motions for 5 million walking cycles in a knee wear simulator. Wear processes were determined gravimetrically and by measuring the release of Co, Cr, Mo and Ti ions using high resolution-inductively coupled plasma-mass spectrometry. Surface alterations were determined through surface roughness measurements. RESULTS: An average PE wear rate of 7.28 mg/10^6 cycles (R=0.995; p<0.001) was determined. After 5 million cycles the cumulative release of metals measured 1.63 ± 0.28 mg for Co, 0.47 ± 0.06 mg for Cr, 0.42 ± 0.06 mg for Mo and 1.28 ± 0.14 mg for Ti. The metal release progressed linearly and the rate of sole surface corrosion was 0.06 mg/10^6 cycles (R=0.993; p<0.001), whereas the rate of articulation induced metal release was found to be 0.80 mg/10^6 cycles (R=0.996; p<0.001), (Fig. 1). DISCUSSION AND CONCLUSION: For other metallic implant devices it is well known that metal wear products are able to interact with the immune system potentially leading to immunotoxic effects like hypersensitivities or the formation of pseudotumors. To our knowledge, this is the first study that analyzed the release of metallic wear products in TKA in vitro. We found that approx. 10% of the whole wear products are metallic and we believe that these particles and ions may become clinically relevant. Their effect regarding the clinical outcome of TKR will be analyzed in further studies.

PAPER NO. 799

Comparison of TKAs with Oxidized Zirconium and Cobalt-Chromium Femoral Components in Same Patients

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INTRODUCTION: Although it has been claimed that TKAs with an oxidized zirconium (OxZr) femoral knee component had beneficial wear properties in vitro, there are conflicting clinical results. The purpose of the present study was to compare the clinical, subjective, and radiographic results as well as the weight, size and shape of polyethylene wear particles of the aspirated synovial fluid in the 331 consecutive patients with an OxZr and a cobalt-chromium (Co-Cr) femoral knee component. METHODS: Three hundred thirty-one patients received an OxZr and a cobalt-chromium (Co-Cr) femoral knee component. Patients who had total knee arthroplasty at our institute from 2000 to 2009. The mean age at surgery was 71.3, and the mean follow up period was 5.0 years. A questionnaire of the Knee Scoring system was sent to the patients by mail. RESULTS: An average PE wear rate of 7.28 mg/10^6 cycles (R=0.995; p<0.001) was determined. After 5 million cycles the cumulative release of metals measured 1.63 ± 0.28 mg for Co, 0.47 ± 0.06 mg for Cr, 0.42 ± 0.06 mg for Mo and 1.28 ± 0.14 mg for Ti. The metal release progressed linearly and the rate of sole surface corrosion was 0.06 mg/10^6 cycles (R=0.993; p<0.001), whereas the rate of articulation induced metal release was found to be 0.80 mg/10^6 cycles (R=0.996; p<0.001), (Fig. 1). DISCUSSION AND CONCLUSION: For other metallic implant devices it is well known that metal wear products are able to interact with the immune system potentially leading to immunotoxic effects like hypersensitivities or the formation of pseudotumors. To our knowledge, this is the first study that analyzed the release of metallic wear products in TKA in vitro. We found that approx. 10% of the whole wear products are metallic and we believe that these particles and ions may become clinically relevant. Their effect regarding the clinical outcome of TKR will be analyzed in further studies.

PAPER NO. 800

Patient Satisfaction Survey After Total Knee Arthroplasty

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INTRODUCTION: Total knee arthroplasty (TKA) is an effective procedure for relieving pain and restoring function. Increasingly, patient satisfaction is being recognized as an important measure of healthcare quality. This study evaluated patient satisfaction after total knee arthroplasty using the new Knee Society scoring system. METHODS: This study evaluated 438 knees in 319 patients who had total knee arthroplasty at our institute from 2000 to 2009. The mean age at surgery was 71.3, and the mean follow up period was 5.0 years. A questionnaire of the Knee Scoring system was sent to the patients by mail. RESULTS: The mean score of each category was 18.6/25 (walking and standing), 19.9/30 (standard activities), 9.2/25 (symptoms), 23.3/40 (satisfaction), 9.6/20 (expectation), 17.3/30 (Advanced Activity), and 6.8/15 (Dicretionary Knee Activities). The mean score of the global rating of change was 5.0 (-7 to 7). The highest score was found in the question of pain with level walking in the symptoms category (8.3/10), and the lowest score was found in kneeling (1.5/5.0) in the advanced activity. The patients with PS knees were more satisfied than the patients with CR knees in the satisfaction (24.6 (PS) and 22.1 (CR), p = 0.0250) and in the expectation (10.4 (PS) and 9.4 (CR), p = 0.0011). The male patients and the patients with osteoarthriti showed higher score than the female patients and than the patients with rheumatoid arthritis, respectively in the Advanced Activity (12.1 (male) and 8.3 (female), p = 0.0006), (9.8 (OA) and 7.9 (RA), p = 0.0249). DISCUSSION AND CONCLUSION: The results of this study showed that the patients after TKA were satisfied with pain relief, but felt difficulty in advanced activities, such as kneeling, squatting, or running. The patients with PS prosthesis tended to have higher satisfaction, and male and osteoarthritis patients showed higher postoperative activities.

The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use).

For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
The Effects of Age on Knee Arthroplasty Outcomes

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INTRODUCTION: Total knee arthroplasty (TKA) is increasingly performed across a wider age spectrum. Although early concerns about TKA at the extremes of age have been dismissed, some recognized differences in outcome remain. Traditional survival analyses demonstrate higher revision rates in the younger patient, while the elderly have higher incidence of morbidity and mortality. Objective clinical measures show that the elderly gain less functional improvement, although overall outcome is comparable. However, the focus has recently shifted towards patient reported outcome measures (PROMs) as the preferred tool to define arthroplasty results. Currently, there is very little information as to how PROMs are influenced by age, and whether consistent results are provided across age groups when using different PROM tools. This study examines knee arthroplasty outcomes using PROMs, to identify any variations according to patient age.

METHODS: We analyzed prospectively collected outcome data (OKS, EQ-5D, satisfaction, and revision) on 2,456 primary knee arthroplasty patients. Patients were stratified into defined age groups (<55, 55-64, 65-74, 75-84, and ≥85 years). Oxford Knee Score and EQ5D were analyzed preoperatively, and postoperatively at six months and two years. Both absolute scores and postoperative change in scores were calculated and compared between age groups. Satisfaction scores (0-100) were analyzed at six months postoperatively. Linear, logistic, and ordinal regression modeling was used to describe the association between age and outcomes, for continuous, binary, and ordinal outcomes, respectively. Kaplan-Meier analysis was performed to describe revision rates at two years.

RESULTS: Patients aged 65-85 years demonstrated better preoperative status than those aged under 65 (OKS and EQ5D, p<0.05), and over 85 years (OKS, p<0.05). Postoperatively, no significant difference in OKS or EQ5D was observed between age groups. Postoperative change in score showed a linear trend for a greater post-operative change in younger patients at six months and two years (p<0.04). The overall satisfaction score was 84.9, but patient satisfaction was significantly lower in those aged <55 years (78.1) compared to all other age groups (p<0.031). The highest two-year revision rate was seen in those aged <55 years (2.9%), with the lowest in those ≥85 years (0%), although these were not statistically significant.

DISCUSSION AND CONCLUSION: The overall damage score was 77 ± 22 for MB and 58 ± 21 for FB (p<0.001). The topside score was 38 ± 10 for MB and 45 ± 16 for FB (p<0.042). The backside score was 40 ± 14 in MB and 13 ± 8 in the FB (p<0.001). Regional analysis showed that the MB post had less damage than the remainder of the insert (P < 0.001). The post in the FB sustained more damage than the post in the MB (p<0.001). The overall damage score was significantly higher in the MB group. As expected, topside damage was less in the MB group, while backside damage was dramatically increased. Interestingly, the post in the MB group had less damage than the post in the FB group. Overall, this study does not support the theoretical superiority of the MB TKA design. However, MB inserts sustained less post damage than FB.

The Key to Satisfaction Following TKA: Results from the New Knee Society Scoring System

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INTRODUCTION: Mobile-bearing total knee arthroplasties (MB TKA) were designed to allow for a conforming articular surface while reducing stress at the bone-implant interface. However, MB TKA has not outperformed fixed-bearing TKA (FB TKA) clinically. Even so, a possible benefit of MB TKA is a reduction in polyethylene surface damage. To investigate this, retrieved inserts from both MB and FB TKAs were analyzed.

METHODS: Twenty-five MB and 33 FB inserts from failed TKAs with the same tibiofemoral condylar geometry were obtained from an IRB-approved, institutional retrieval registry. Hood grading was used to score polyethylene damage.

RESULTS: The overall average damage score was 77 ± 22 for MB and 58 ± 21 for FB (p<0.001). The topside score was 38 ± 10 for MB and 45 ± 16 for FB (p<0.042). The backside score was 40 ± 14 in MB and 13 ± 8 in the FB (p<0.001). Regional analysis showed that the MB post had less damage than the remainder of the insert (P < 0.001). The post in the FB sustained more damage than the post in the MB (p<0.001).

DISCUSSION AND CONCLUSION: The overall damage score was significantly higher in the MB group. As expected, topside damage was less in the MB group, while backside damage was dramatically increased. Interestingly, the post in the MB group had less damage than the post in the FB group. Overall, this study does not support the theoretical superiority of the MB TKA design. However, MB inserts sustained less post damage than FB.
of male and female and as younger (<65) and older (>65). RESULTS: Post-TKA, knee function met or exceeded 84% of patient expectations, with 49% of patients reporting that their knee always feels normal. While performing standard activities (e.g., turning, climbing stairs), the majority of patients (78%) experienced few symptoms referable to the knee. Fewer (47%) report that they remain asymptomatic while performing more demanding (‘advanced’) activities (e.g., squatting, running). Distance walking (52%), swimming (28%) and stationary biking (25%) were among activities that were most commonly selected as personally important. Activities such as golf (Male 39%; Female 6%; p<0.001) and road cycling (Male 19%; Female 4%; p<0.001) were important to more men than women, whereas for gardening (Female 44%; Male 32%; p=0.001) and stretching (Female 44%; Male 16%; p<0.001) the gender preference was reversed. Overall, 24% of patients experienced severe symptoms when performing at least one of their most important activities. Older patients experienced symptoms more than younger patients (26% vs 21%; p<0.01). As a whole, 93% of patients reported that they were satisfied with their knee post-operatively. However, satisfaction with TKA decreased significantly among patients who experienced severe or debilitating symptoms during their most important activities, (at least one activity: 78% satisfied; p<0.001; during all three activities: 50%; p<0.001). DISCUSSION AND CONCLUSION: The new Knee Society Scoring System provides sufficient flexibility and scope to capture the diverse lifestyles and activities of contemporary TKR patients. Data collected by this assessment tool allow surgeons and affiliated personnel to appreciate differences in the priorities of individual patients and the interplay between function, expectation, symptoms, and satisfaction after TKA. A resounding conclusion of this new multi-dimensional analysis is that a critical factor in many patients’ assessment of the value of this procedure is their restored ability to perform activities that they personally consider important.

PAPER NO. 804

Does High-Flexion TKA Provide Benefit in Patients with Well Preserved Preoperative Knee Flexion?

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INTRODUCTION: Reports on early results and postoperative knee range of motion (ROM) following high-flexion TKA exhibited favorable outcomes. However, all studies had a mean preoperative maximum knee flexion ranging from 111-127 degrees. As full-range passive knee flexion is not uncommon in the advanced stage of knee arthritis among the Asians, and there has been no study focusing the benefit of high-flexion TKA on patients who have a preoperative well preserved knee ROM, we hypothesized that high-flexion TKA improved maximum knee flexion, postoperatively. METHODS: A consecutive series of 165 patients (189 knees) who had late-stage osteoarthritis with well-preserved knee ROM (≥120 degrees) were prospectively evaluated for a mean FU of 77 months. Patients were divided into 2 groups according to their preoperative ability to perform a full-range (heel-to-buttock) knee flexion (group A) and the inability to do so (group B). Patients were evaluated for clinical and functional outcomes using the KSS clinical & function scores, the ROM, specific deep knee-bending activities and radiographic results. The mean values of non-weight-bearing passive knee ROM with the patient in the supine position were evaluated by two evaluators (AT and SN), pre-operatively and at the latest FU, were recorded. Changes of knee ROM after TKA were compared between patients in group A and patients in group B. RESULTS: The patient’s average age was 70 years, and the average body mass index (BMI) was 24.2 kg/m². At the latest follow-up, there were 156 patients (178 knees) available evaluation. There were 51 patients (60 knees) in group A and 105 patients (118 knees) in group B. The mean KSS clinical and function scores of group A and B improved from 37.3 to 96.2 and 31.1 to 87.8, respectively, with no difference between the groups. The overall mean maximum knee flexion decreased from 137.9° to 134.8°, with no statistical difference between pre- and postoperative knee flexion. Regarding ROM according to patient’s group, patients in group A had significantly decreased knee flexion (146.2° vs. 135.0°, p< 0.001), whereas patients in group B exhibited no change in knee flexion (133.7° vs. 134.7°, p=0.14). In addition, 14.7%, 36.5% and 43.0% of the studied patients could engage in kneeing, Thai polite style sitting and cross-legged sitting, respectively, with no significant differences between groups A and B. The survival rates for any reoperation and prosthesis-related problem at 6 years were 98.3% and 100%, respectively. DISCUSSION AND CONCLUSION: At 6-year follow-up in patients with well preserved preoperative knee flexion, the high-flexion knee prosthesis provided favorable outcomes in terms of KSS clinical and functional scores; however, maximum passive knee flexion has not been improved. The mean postoperative maximum knee flexion in the present study was similar to the values obtained in previous reports, while the selection criterion for preoperative knee ROM was much greater than other series. Regarding overall result of ROM, a mean 3.1-degree loss of knee flexion was found in this series. Patients in group A was significantly decreased by 11.2 degrees from levels observed during preoperative evaluation, whereas patients in group B exhibited similar maximum knee flexion pre- and post-operatively. In conclusion, TKA in knees with advanced arthritic and well-preserved ROM did not improve knee ROM after surgery.

PAPER NO. 805

Improved Recovery Following Fixed-bearing Total Knee Arthroplasty: An Ambulatory Gait Analysis

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INTRODUCTION: The goal of this study was to assess total knee arthroplasty (TKA) recovery outcome between adult patients with fixed- and mobile-bearing during the first postoperative year, and at five years follow up, providing gait parameters in real life conditions as a new objective method. METHODS: This randomized controlled double-blinded study included 56 patients with mobile- and fixed-bearing of the same design who were evaluated pre- and post-operatively at six weeks, three months, six months, one year and five years. Each participant completed an EQ-5D questionnaire, and a WOMAC and Knee Society Score were calculated. Gait analysis was also carried out where lower limb movement and rotation was measured by five miniature angular rate sensors mounted respectively on the sacrum and each shank and thigh connected to a small ambulatory gait-recording device. The patients then

◆ The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
RESULTS: There was no statistically significant difference between age-matched groups at baseline, on any subjective, semi-objective or objective parameter. The results of the traditional scoring systems (EQ-5D, VAS pain, KSS) did not show any clinically meaningful differences between the groups of patients with fixed- and mobile-bearing replacements. Our results show that age is strongly correlated with objective recovery. There was no significant difference between groups at any time in objective gait parameters when the whole population was considered. A secondary analysis after separating the population according to their age (less than 71 years old, versus more than or equal to 71 years old) shows that the bearing type can lead to opposite results in different age groups. Most of the recorded gait parameters (stride length, knee max rotation speed, shank and thigh range of motion, and limp) show better results for mobile bearing in younger patients, while better gait performances were found systematically in older patients with fixed-bearing TKA at five years follow up. DISCUSSION AND CONCLUSION: To our knowledge, this is the first study where the gait performance of fixed- and mobile-bearing of otherwise similarly designed posterior-stabilized knee replacements have been compared in real-life conditions. We observed statistically significant effects and differences between mobile versus fixed-bearing groups even if we lose statistical power in dividing our population, which are confirmed by multivariate analysis. Our results suggest that older patients might not benefit from a mobile-bearing TKA and that extended age controlled study should be performed to identify an age, above which fixed bearing should not be the recommended choice. Meanwhile surgeons should take into account the age of the patient before choosing the bearing type.

PAPER NO. 806
Cost Effectiveness Analysis of Waiting for a Total Knee Arthroplasty
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INTRODUCTION: The projected demand for total knee arthroplasty (TKA) is staggering. At its root, the solution to the problem involves increasing supply or decreasing demand. Other developed nations have used rationing and wait times to distribute this service. However, the economic impact and cost effectiveness of waiting for total knee arthroplasty is unknown. METHODS: A Markov decision model was constructed for a cost-utility analysis of three treatment strategies for end-stage knee osteoarthritis: 1) immediate TKA, 2) a waiting period with no non-operative treatment and 3) a non-operative treatment bridge during that waiting period in a cohort of 64 year-old patients. Outcome probabilities and effectiveness were derived from the literature or estimated by expert opinion where necessary. Costs were estimated from the societal perspective with use of the national average Medicare reimbursement for the procedures in 2011 U.S. dollars. Costs and utilities were discounted in accord with the United States Panel on Cost-Effectiveness in Health and Medicine. Effectiveness was expressed in quality-adjusted life years gained. Principal outcome measures were average incremental costs, incremental effectiveness, incremental quality-adjusted life years, and net health benefits.

RESULTS: In the base case, a two-year wait-time both with and without a non-operative treatment bridge resulted in a lower number of average quality-adjusted life-years gained (11.57 QALY (no bridge) and 11.95 QALY (bridge) vs. 12.14 QALY (no delay)). The average cost to society was $1,660 higher for immediate TKA than a wait-time with no bridge, but $1,810 less than a wait-time with a non-operative treatment bridge. The incremental cost effectiveness ratio comparing wait-time with no bridge to immediate TKA was $2,901/QALY. When comparing immediate TKA to waiting with a non-operative bridge, immediate TKA produced greater utility for the patient at a lower cost to society, therefore dominating the waiting with nonoperative bridge for the treatment of knee osteoarthritis.

DISCUSSION AND CONCLUSION: Immediate TKA is the preferred cost effective treatment strategy when compared to a waiting for TKA without nonoperative treatment bridge. Immediate TKA is cost saving when a non-operative treatment bridge is used during the waiting period. It is unlikely that patients waiting for TKA would not receive any non-operative treatment, and, as such, immediate TKA may be an overall cost-saving healthcare delivery strategy when compared to waiting for a TKA. Policies aimed at increasing the supply of TKA should be considered as savings exist that could indirectly fund those strategies.

PAPER NO. 807
Manipulation Under Anaesthetic for a ‘Stiff Knee’ after Total Knee Arthroplasty
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INTRODUCTION: A poor range of movement (ROM) following total knee arthroplasty (TKA) can be a disabling problem which is often very difficult to manage and for the patient it compromises the ability to perform everyday tasks. Manipulation under anaesthetic (MUA) is one method of trying to improve a patient’s poor ROM after total knee arthroplasty. We describe our indications and criteria for an MUA knee following TKA and present the results at six weeks and at one year for 49 consecutive patients. METHODS: The Primary Joint Unit in our hospital has a dedicated outcomes team responsible for collection of pre and post-op data to assess the outcome of surgery. All TKA patients are seen prior to surgery and then again at three months, one year and 10 years post-op for collection of outcome scores, complication rates, and assessment of knee ROM and function. Between January 1996 to December 2009, 5,600 consecutive TKAs were performed under the care of a single surgeon using an unconstrained, cruciate-sacrificing, mobile bearing prosthesis. The orthopaedic outcomes information system was used to identify which patients had a further procedure subsequent to their TKA. Forty-nine patients were identified as being boarded for MUA knee subsequent to a TKA. Practice in the Primary Joint Unit is to offer an MUA knee to those patients who at three months post-op have less than 75° of flexion, provided they had at least 30° more flexion prior to TKA. This criteria is based on our previous work which has shown that pre-op ROM is one of the major predictors of post-op ROM. MUA involves a general anaesthetic in combination with a femoral nerve block and the manipulation pushing the ROM to achieve maximum flexion. Post-MUA the patients are treated with a Continuous- Passive-Motion machine and receive intensive inpatient physiotherapy for up to 48 hours. ROM was recorded in these patients prior to...
their initial TKA procedure, at their three-month post-op review, in theatre at the time of MUA, six weeks post-MUA and one year post MUA. Measurements were recorded in theatre by the surgeon and in clinics by the outcomes research nurses using a goniometer. RESULTS: Forty-nine patients (16 male and 33 female) were boarded for MUA out of 5,600 TKA patients. This gives a male to female ratio of 1:2.06 which is in keeping with our male to female ratio of 1:2 seen in our overall TKA population. The rate of patients requiring MUA post-TKA was 0.88%. The mean flexion values in these patients for pre-TKA flexion was 108.9° (range 45° - 140°), three month post-TKA was 55.6° (range 20° - 75°), in theatre with forced flexion was 105.4° (range 45° - 120°), six week post-MUA was 78.92° (range 40° - 100°) and one year post-MUA was 86.4° (range 45° - 115°). Of the 49 patients boarded for surgery one patient having a ROM pre-TKA of 0° - 130° and a three-month post-op ROM of 25° - 70° refused MUA at the time of surgery and despite this their one year ROM was 5° - 120°. One patient was also lost to follow up leaving 47 patients with complete six week and one year data post-MUA. Forty-two patients (89.3%) had improved ROM at six weeks with mean improvement in flexion 25.8° (range 5-50°). In these 42 patients who had improved at six weeks 40 of them had maintained or improved their ROM at one year post MUA. Two patients failed to maintain their improved six week ROM at one year. No patients had greater than 75° prior to MUA and at one year post-MUA 48.9% (23 patients) had greater than 90° flexion. DISCUSSION AND CONCLUSION: Results reinforce the view that there is a role of MUA knee to improve ROM for certain TKA patients. Patients who improve their ROM at six weeks post-MUA are likely to maintain this improved ROM at one year. It should be remembered that not all patients improve with MUA and that some people with poor ROM at three-months post-op TKA can still greatly improve even without intervention.

PAPER NO. 808
Periprosthetic Supracondylar Femoral Fracture Following Total Knee Arthroplasty
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INTRODUCTION: Periprosthetic supracondylar femur fractures (PSF) are an uncommon complication of total knee arthroplasty (TKA). Management of these fractures presents a significant challenge because most orthopedic surgeons do not have a good clinical experience with this problem. There are only a few clinical studies reported about the result of treatment of PSF. This is likely due to lack of sufficient evidence regarding adequate care of PSF. The purpose of this study is to analyze the clinical results and related complications between the Less Invasive Stabilization System (LISS) and the Retrograde-inserted supracondylar nail (RISN).

METHODS: We had 42 PSF proximal to posterior stabilized total knee arthroplasty from 2005 to 2009. Twenty-four fractures were treated with the LISS and the other 18 fractures with RISN. All patients had type II fractures according to Lewis-Rorabeck classification. This cohort was subgrouped with AO classification. For the cases without complication we retrospectively compared the clinical results between LISS group and RISN group, and also compared them with each of three subgroups to see differences in those subgroups. For complicated cases, demographic, surgical, radiological factors and instrumental factors were surveyed to know their affect on complications following fracture fixation.

RESULTS: There were 40 female and two male patients. The mean age at the time of TKA was 67.2 years old and it was 69.9 years old at fixation of fracture. The mean interval from TKA to fracture was 25.5 month. All fractures were immobilized for 6.1 weeks on average in the LISS group and 4.2 weeks in the RISN group. At the latest follow-up visit of uncomplicated cases, the mean range of motion (ROM) were 95.76° (extension to flexion in LISS; 1.92° to 96.33°) and 100.71° (extension to flexion in RISN; 0.7° to 100.71°) and the average Knee scores were 77.22 and 81.81, the average knee Function scores were 76.75 and 80.63, respectively. There were no significant differences between two groups (p>0.05). In subgroup analysis, the mean operation time present significant differences in group A1 only (129min. in LISS, 102.14min. in RISN, p=0.03). Complications showed 29.2% (7/24) in LISS group, which included five cases of nonunion with broken screws, two cases of nonunion with varus deformity (mean 5.86°) due to broken distal screw were found (27.8%, 5/18). The age during index TKA and fracture fixation were a significant risk factor for complication (Odds ratio =1.150, 95% CI 1.01-1.30, Odds ratio = 1.195, 95% CI 1.02-1.39). For other factors (such as fracture type, instrument type, BMI, BMD, HTN, DM), no significant differences between two groups were found. DISCUSSION AND CONCLUSION: Treatment methods did not show differences in clinical result. Although both showed significant clinical improvement following PSF, complication rates were significant (30%). Fixation method and fracture type did not contribute to increasing complication rate but, there was a trend toward higher non-union rates with LISS method and higher re-fracture with RISN. Noting the fact that only increasing age correlates with increased complication rate, more careful attention should be paid on elderly patients in terms of both prevention and surgical care.

PAPER NO. 809
Efficacy of Postoperative Intraarticular Analgesia Following Total Knee Arthroplasty
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INTRODUCTION: There is no consensus on the optimal postoperative analgesia protocol for patients undergoing total knee arthroplasty (TKA). The objective of this study was to determine the analgesic efficacy of an intraarticular catheter delivering a local anesthetic agent following TKA.

METHODS: Patients undergoing primary, unilateral TKA were consented for this study. Participating patients were randomized to receive an intraarticular catheter filled with 0.5% bupivacaine or 0.9% normal saline placebo solution, with patients, surgeons, and study personnel blinded as to which solution was used. All patients consented for this study. Participating patients were randomized to receive an intraarticular catheter filled with 0.5% bupivacaine or 0.9% normal saline placebo solution, with patients, surgeons, and study personnel blinded as to which solution was used. All patients received spinal anesthesia with Duramorph, and a standardized perioperative anti-inflammatory schedule. Catheters were prepared under sterile conditions and placed intraperoperatively. The catheters released fluid continuously at 5mL/hour over two postoperative days (POD). Patients were asked to complete Visual Analog Scale (VAS) questionnaires at 5PM on the day of surgery, and 8AM and 5PM each day until discharge, as well as at the four-week follow-up visit. All narcotic consumption during the hospital stay was recorded and converted to morphine equivalent units for data comparison.
RESULTS: A total of 150 patients were enrolled and randomized. There was a significant difference in mean POD 1 VAS levels (p=0.015), highest POD 1 (p=0.013) and POD 2 (p=0.048) VAS levels, as well as POD 2 (p=0.021) and POD 3 (p=0.038) narcotic consumption with the patients receiving bupivacaine having the least pain and narcotic consumption. There was no significant difference (p>0.05) in postoperative complications. DISCUSSION AND CONCLUSION: TKA patients may positively benefit from the use of postoperative intraarticular catheter in decreasing overall pain levels and reducing the need for opioids. With no noted increase in infection risk from the study population, intraarticular analgesia may provide an effective alternative for pain relief in the immediate postoperative time period without the disadvantages encountered with epidural anesthesia, regional nerve blockade, and patient controlled analgesia (PCA) pumps.

PAPER NO. 810

Objective Sagittal Instability of CR-TKA by Functional EMG During Normal Walking

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INTRODUCTION: Predictable and consistent functional results from total knee arthroplasty (TKA) have eluded our surgical ability. Sagittal stability is challenged during normal walking in loading phase. Quadriceps muscle hyperactivity was used to measure sagittal instability TKA during normal gait. METHODS: Dynamic electromyography (EMG) recorded quadriceps activity during a 200-meter walk recorded by IDEEA. Paired t-test compared operated to non-operated knees for seven satisfied patients (four male and three female) more than one year after unilateral "cruciate retaining" (CR)-TKA. RESULTS: There was nearly 3x greater (see figure 4) EMG activity for operated knee, both in amplitude (43.08 ± 26.47 vs 16.02 ± 5.38, p=0.0355, N=7), and the area-under-the-curve (2547.3 ± 1007.9 vs 7231.1 ± 3869.8, p=0.0267, N=7). The onset and duration of muscle activity was similar for both knees (205.32 ± 56.43 ms for operated knee vs. 213.20 ± 33.66 ms for non-operated knee, p=0.74, N=7). DISCUSSION AND CONCLUSION: CR-TKA demonstrated threefold greater EMG activity and muscle effort during normal walking. The study suggested that implant modifications to enhance stability may reduce quadriceps effort and improve function after TKA and a method is described.

POSTERS

POSTER NO. P111

Early Survivorship of Fixed versus Mobile Bearing Unicompartmental Knee Arthroplasty

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INTRODUCTION: Unicompartmental knee arthroplasty (UKA) is successful for the treatment of medial compartment arthritis of the knee. This study examines a consecutive series of fixed (FB) and mobile bearing (MB) UKAs at one tertiary care center. METHODS: A consecutive series of 178 UKAs (103 MB and 75 FB) in 156 patients that were a minimum two years postoperative were reviewed. Minimum two year follow-up data was available for 110 knees (94 patients) with an average follow up of 39 months (21-85 months). Range of motion, radiographs, and mode of failure were examined. Failure was defined as conversion to TKA for any reason. RESULTS: The average range of motion was 127 degrees for the FB group and 123 degrees for the MB group (p=0.09). There were three (2.7%) revisions in the FB group, one for late ACL rupture and two for advancement of patellofemoral arthritis. There were eight (7.2%) revisions in the MB group, three for aseptic loosening, three for unexplained pain, and one each for polyethylene impingement, and severe motion limitation. DISCUSSION AND CONCLUSION: In this series, the early failure rate was over two times higher for the MB UKA versus the FB UKA cohort. There was no difference between groups with regards to radiolucent lines and range of motion at two-year follow up.

Figure 1: Gait cycle measured by the sensors from the Right Foot

Figure 2: Patient 1: EMG activity of left and right quadriceps. Graph shows a relative comparison between quadriceps muscle activity of the right and left leg.

*The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
Diagnosis of Periprosthetic Joint Infection Following Unicompartmental Knee Arthroplasty

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INTRODUCTION: The erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and synovial fluid white blood cell (WBC) count with differential are commonly used for diagnosing periprosthetic joint infection (PJI); however their utility in patients with unicompartmental knee arthroplasty (UKA) is unknown and the optimal cut off values may be different given that native cartilage from the unresurfaced compartments is present. The purpose of this study is to determine the utility of these commonly used tests for evaluating PJI in patients with a failed UKA.

METHODS: One-hundred-forty consecutive patients undergoing revision of UKA at six different centers were prospectively evaluated for PJI using the ESR, CRP, synovial fluid WBC count and differential. Receiver operating characteristic curves were used to establish optimal cutoff values for diagnosis of PJI, and the area under the curves (AUC) were calculated to determine overall accuracy of these tests in each population.

RESULTS: Twenty-four UKA (17.1%) met the criteria for PJI. The optimal cutoffs were 27mm/hr for the ESR; 14mg/L for the CRP; 3,537/uL for the synovial fluid WBC count; and 60% for the differential. The AUC were 82.3% for the ESR, 85.7% for the CRP, 98.7% for the synovial fluid WBC count, and 95.0% for differential. Forty-six patients (28.6%) did not receive preoperative inflammatory screening for PJI by serum ESR and CRP. An additional four (2.9%) patients had elevated inflammatory markers and were not aspirated preoperatively.

DISCUSSION AND CONCLUSION: The ESR, CRP, synovial fluid WBC count and differential are useful in diagnosing PJI following UKA at optimal cutoff values that are similar to those used for total hip and knee arthroplasty. The synovial fluid WBC count and differential were the best tests for diagnosis of PJI. Approximately 20% of patients undergoing revision surgery for a failed UKA in our series had a suboptimal evaluation for PJI.

The Use of 2-Octyl Cyanoacrylate (CA) as an Adjunct to Wound Closure After Total Knee Arthroplasty (TKA)

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INTRODUCTION: Wound drainage after total knee arthroplasty (TKA) is a complication that can be detrimental to surgical outcome. Post-operative course may be negatively affected resulting in increased hospital length of stay, patient dissatisfaction, discontinued deep venous thrombosis (DVT) chemoprophylaxis, delayed mobility, increased risk of infection, and/or delayed epithelization of surgical wound. The purpose of this study was to examine the usage of 2-octyl cyanoacrylate (CA) as an adjunct to wound closure after TKA.

METHODS: This is an IRB approved, prospective, randomized, controlled trial. Forty-four patients undergoing primary total knee arthroplasties were enrolled. Exclusion criteria included: history of previous surgery, infection, or trauma to the operative knee; history of hypocoaguable / hypercoaguable states; need for therapeutic DVT / pulmonary embolism (PE) treatment pre-or post-surgery; and any co-morbidity that may delay wound healing (e.g. ESRD). Each patient received a standardized closure following TKA. After skin staples were placed, each patient was then randomized into the experimental or control groups. The experimental group received CA as a supplement to the closure. The standardized gauze dressings placed were evaluated on post-op days two and three.

RESULTS: The mean total drainage for the control and experimental groups were compared utilizing a Mann-Whitney U Test. The decrease in drainage was statistically significant post-op days two and three as well as the combined total.

DISCUSSION AND CONCLUSION: The use of CA as an adjunct to wound closure in TKA results in a statistically significant decrease in wound drainage in the immediate post-operative period.
INTRODUCTION: The morphology of the trochlea is highly variable and impacts trochlear component position in “inlay” style designs in patellofemoral arthroplasty (PFA). This study characterizes the patellofemoral trochlear inclination angle and highlights the reason for patellar maltracking that is common with inlay style PFA designs.

METHODS: Magnetic resonance images of 329 consecutive knees (146 male, 183 female) were evaluated in normal (n=279) and dysplastic (n=50) patients. A standardized trochlear inclination angle (TIA) was measured by two independent (orthopedic and radiology) reviewers. Two angles were measured for each knee: one measurement included articular cartilage, and the other was an angle subtended from the subchondral bone (i.e. excluded cartilage surface). Numbers of patients in subgroups met pre-study power analysis requirements. Student’s t-test was used for statistical analysis.

RESULTS: The average TIA in normal knees was 11.4 degrees internal rotation (range, 6 to 20), while the average angle in dysplastic knees was 9.4 degrees (range, 4 to 15). These differences between normal and dysplastic knees was significant, (p<0.0001); however, regardless of morphotype, the mean TIA was internally rotated. Patients with dysplastic knees were significantly younger than controls (36.9 vs. 50.5 years, p<0.001). The average angles in male patients (11.3 deg) and female patients (10.9 deg) did not differ significantly (p=0.14). The average angles in patients less than 50 years of age (n=164) did not differ significantly from patients greater than 50 years (n=165) (10.9 deg vs. 11.3 deg; p=0.15); when excluding cartilage, however, a significant difference arose (p=0.01).

DISCUSSION AND CONCLUSION: The trochlear inclination angle is different for dysplastic and normal knees; however, most tend to be internally rotated relative to the femoral anteroposterior axis. Positioning a trochlear component in PFA parallel to the articular surface of the native trochlea would result in internal rotation malposition, predisposing to patellar subluxation after PFA.

Serial Radiographic Analysis of Tibial Polyethylene Bearing Thickness Losses In Vivo

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INTRODUCTION: Total knee “wear” (condylar penetration) has historically been measured by comparing the initial polyethylene thickness to the current thickness. This assumes wear is constant over time (linear). However, polyethylene properties, patient activity and other variables known to influence wear can change with time. These changes could be large enough that the wear rate would also change over time. Our purpose is to challenge the assumption that total knee wear is linear by making multiple measurements in individual patients over a 10 year follow up.

METHODS: Medial compartment thickness was measured at multiple follow-up periods on 251 total knee arthroplasties (TKAs). For each TKA, the multiple data points were graphed as wear versus time. Using regression techniques, the best fit of a line and a curve was determined. By comparing the goodness of fit for a line and curve, we could determine which one fit better. A best-fit line implied constant wear and a best-fit curve implied either increasing or decreasing wear with time.

RESULTS: A line was determined to be the best way to characterize the penetration over 10 years for 221 (88%) of the cases. In these cases the mean wear rate was 0.11±0.13 mm/year. Twenty-three TKAs had data that was better fit by a curve with increasing wear rates; each was sterilized with gamma radiation in air and revision retrieval of many of these bearings suggested late mechanical failure.

DISCUSSION AND CONCLUSION: Although assuming the wear rate to be constant was reasonable for most of our TKAs, 9% of the cases demonstrated increasing wear rates over time. Serial radiographic measurements of individual patients are a better way to evaluate TKA wear over time. An increasing wear rate may evidence mechanical failure of the polyethylene bearing.

Aspirin was Effective to Prevent Proximal DVT and PE in TKA and THA - Analysis of 1,500 Cases

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INTRODUCTION: Warfarin and low molecular weight heparin (LMWH) has been recommended to prevent deep venous thrombosis (DVT) and pulmonary embolism (PE) in total knee arthroplasty (TKA) and total hip arthroplasty (THA) patients because of its great anticoagulation effect, although such anticoagulants may increase hemorrhage and infection. Contrarily, aspirin is thought to be safer, although the sole usage is thought to be not so effective to prevent DVT. The purpose of this study is to determine the incidence and risk factors of DVT and PE in TKA and THA patients with aspirin and mechanical prophylaxis.

METHODS: Preoperative and 10-day postoperative ascending venographies were performed prospectively in 1,500 patients, including 750 primary TKA and 750 primary THA patients. In all the patients, use of the foot pump and elastic stocking was started immediately after surgery, followed by initiation of 162mg/day aspirin dosage two days postoperatively. Multivariate analysis identified risk factors including age, BMI, ROM, lab data, and preoperative venogram findings.

RESULTS: The incidence of DVT was 19.2% (32.7% in TKA and 5.6% in THA), which was lower than the incidence in the distal veins (tibial and peroneal veins) and no DVT occurred in the proximal veins (femoral and iliac veins). There was no fatal PE, nor PE with severe symptoms except one case of PE with mild symptoms in a THA patient. There were no complications induced by aspirin, including brain, abdominal, spinal and joint hemorrhage. Among the risk factors, age, BMI, limitation of preoperative ROM, and preoperative venogram findings statistically correlated with the occurrence of DVT.

DISCUSSION AND CONCLUSION: Aspirin and mechanical prophylaxis is thought to be safe and sufficient to prevent proximal DVT and PE in most TKA and THA patients, except some cases with very high risk of coagulation tendency.
Knee Arthrodesis: The Fate of the Contralateral Knee

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INTRODUCTION: Knee arthrodesis remains an option for a variety of end-stage knee disorders. However, little is known of the morbidity within the contralateral knee for patients undergoing this procedure. The objective of this study was to identify and report on any contralateral knee morbidity in patients treated with intramedullary knee arthrodesis. METHODS: We retrospectively reviewed a consecutive series of 16 patients of one surgeon, at one institution, who underwent knee arthrodesis over a 12-year period (1994-2006). Knee arthrodesis was performed for treatment of failed septic total knee arthroplasty, post-traumatic arthritis, and extensor mechanism disruption. Data collection points included: age at time of arthrodesis, time to fusion, and complications. Radiographs were reviewed for evidence of progressive osteoarthritis in the contralateral knee. RESULTS: The average age of the 16 patients was 61.94 years (range: 34-80 years). There was an overall fusion rate of 94%, with 67% of these fusing within six-months of arthrodesis. Patients undergoing arthrodesis for infectious etiology were found to achieve fusion at two and four months longer than those with extensor mechanism disruption and post-traumatic etiology, respectively. Contralateral knee pain was found in 56.25% of all patients. Sixty-six percent of these patients experienced pain within one year of the procedure and 33% of these patients underwent total knee arthroplasty (TKA) of the contralateral knee. TKA was performed at 13 months in two patients and 48 months in the other. Identified complications included leg length discrepancy, delayed union and infected non-union. DISCUSSION AND CONCLUSION: These results support the use of knee arthrodesis as a viable surgical option in a salvage situation when TKA is not a viable option. Post-operative radiographic review of the contralateral knee did not demonstrate accelerated progress of osteoarthritis in this small cohort of patients. Although 56.25% of patients complained of contralateral knee pain, these patients showed pre-existing radiographic changes likely to cause such symptoms. Based on this small case series, it appears that contralateral knee deterioration is directly correlated to surgical arthrodesis of the knee and is related to the increased stresses, e.g., stair climbing, rising from a chair, relegated to the contralateral extremity.

Disposable Cutting Blocks and Trials Decrease Contamination and Lower Costs in Primary TKA

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INTRODUCTION: Total knee arthroplasty (TKA) is one of the most common orthopaedic procedures. As such, it is important to minimize costs, increase efficiency, and maintain patient safety though emphasis on reducing contamination. This prospective controlled study, designed to determine if replacing traditional saws and cutting blocks with specialized saws and disposable cutting blocks and trials could increase efficiency, decrease contamination, and lower costs in both non-navigated and navigated total knee arthroplasty procedures. METHODS: Four hundred procedures were prospectively analyzed from six surgical centers with traditional and specialized instrumentation compared against navigated and non-navigated total knee arthroplasties. Reprocessing costs and times were assessed by an independent observer. Results: The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
surgical episode time decreases at all six centers. A decrease in contamination was found with 59% (non-navigated) and 32% (navigated) fewer compromises of tray sterility indicators, pans, and instruments. Costs were lowered by $140 to $220 per surgery due to fewer instrument trays being reprocessed and $75 to $330 per instrument case due to tray rewrapping.

DISCUSSION AND CONCLUSION: The use of single use instrumentation was associated with a reduction in the combination of instrument set-up and clean-up times across both navigated and non-navigated protocols at all participating sites. The results of the study identified where disposable instruments promoted time savings within the total knee arthroplasty surgery cycle and how these time savings can provide an opportunity for improved operating room efficiencies along with identifying reprocessing savings and decreasing the incidences of compromised instruments.

POSTER NO. P121
Thrombosis Prevention Using a Portable Compression Device as Monotherapy in Hip and Knee Arthroplasty
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INTRODUCTION: Thromboembolic event is a common complication in patients undergoing total knee arthroplasty (TKA) or total hip arthroplasty (THA). The purpose of this study was to evaluate the effectiveness of a portable compression device with or without ASA as the sole means of venous thromboemobilism (VTE) prophylaxis, including both deep vein thrombosis (DVT) and/or pulmonary embolism (PE) in patients undergoing primary total joint arthroplasty. METHODS: A multicenter registry was established to capture the rate of VTE occurring following elective primary unilateral lower extremity arthroplasty. 2,513 patients from eight sites were included in the registry after undergoing primary TKA (1,379) or THA (1,134). All patients were older than 18 years without known history of prior VTE, coagulation disorder, or major operation in the previous three months. The use of the compression device began intraoperatively and continued for a minimum of 10 days. Patients with clinical suspicion of DVT underwent duplex ultrasonography of both legs. Patients with clinical suspicion of PE were evaluated with spiral CT of the lungs. All patients were clinically evaluated three months after surgery documenting whether there was any evidence that a DVT or PE event had occurred postoperatively. RESULTS: Of 2,513 patients, 24 (1%) had VTE (15 distal DVT, five proximal DVT, and four PE). DISCUSSION AND CONCLUSION: When compared to current pharmacologic protocols, the use of a portable compression device as monotherapy for patients undergoing primary total joint arthroplasty provides a non-inferior risk for developing VTE without the risk of bleeding.

POSTER NO. P122
ALTERNATE PAPER: ADULT RECONSTRUCTION KNEE II
Patella-Plateau Angle in Evaluation of Patellar Height after Total Knee Arthroplasty
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INTRODUCTION: The patella-plateau angle (PPA) was recently introduced as a new and simpler method of measuring patellar height. This method involves a single angular measurement without calculations. This method was described using normal knees, however, and has not been validated in knees following total knee arthroplasty (TKA). The purpose of this study was to describe the method and assess the applicability of the PPA in knees following arthroplasty as a measurement for patellar height. METHODS: Two-hundred-ninety-one patients who underwent total knee arthroplasty at our institution in 2010 were identified and the postoperative radiographs from at least six weeks post operative were reviewed. Three observers, with different levels of orthopedic training, measured the PPA, Insall-Salvati, modified Caton-Deschamps, and modified Blackburne-Peele indices on a subset of 50 consecutive patients. The PPA was measured both from the tibial base plate and the joint line (modified PPA). Two observers evaluated the entire cohort. Intraobserver agreement for the PPA and interobserver agreement between all ratios were calculated. RESULTS: The mean PPA for the entire cohort was 22.61 and 23.06 for the two observers using the tibial base plate and the joint line (modified PPA). The mean PPA for the entire cohort was 20.49 and 21.12 for the two observers using the modified PPA. The intraobserver reliability concordance coefficient (CCC) was 0.98 and 0.99 for the two observers in both the tibial base plate group and the modified PPA group. The CCC for the interobserver reliability was the highest for the PPA compared to the other ratios. The level of training did not correlate with intraobserver reliability with respect to the PPA.

DISCUSSION AND CONCLUSION: The patella-plateau angle is a rapid and reliable way to evaluate patellar height in patients who have undergone total knee arthroplasty. The measurement demonstrated a higher interobserver reliability in comparison to the previously described methods.
INTRODUCTION: This study evaluated whether the patients with high flexion total knee arthroplasty can do high-flexion activity and higher satisfaction?

POSTER NO. P124
Patient-Specific Instrumentation in TKA Required Frequent Surgeon Directed Intraoperative Changes
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INTRODUCTION: Patient specific instrumentation (PSI) is touted as a method to improve surgical precision, efficiency and safety in primary total knee arthroplasty (TKA). MRI, along with computer based surgeon input, is used to create a preoperative plan that is assumed to be an accurate tool for intraoperative use. We hypothesized that frequent intraoperative surgeon directed changes would be required despite the use of PSI.

METHODS: We prospectively evaluated 66 knees in 60 consecutive patients undergoing primary total knee arthroplasty with the use of PSI. A preoperative plan with component alignment, position and size was provided to the surgeon and the default settings were kept when possible. Intraoperative changes to femoral and tibial sizing and alignment were recorded. A subset of radiographically measurable changes was analyzed to determine if surgeon intervention resulted in improved component positioning.

RESULTS: The PSI femoral guide poorly fit 5% of knees. The PSI proposed tibial resection was unacceptable in five knees and was abandoned in favor of an extramedullary guide. The plan was able to predict the implanted tibial size 48% of the time. Frequent upsizing of the tibial component was required (36%) with no resultant radiographic overhang. A total of 161 intraoperative changes were made. Only three knees were implanted with no intraoperative changes while 11 knees (17%) required four or more. The most frequent changes included increasing femoral resection (30%), internally rotating the femoral cutting block (18%), increasing the tibial resection (24%) and valgus angle (14%). Of the 161 total changes, 21 were made to sagittal and coronal tibial and femoral alignment and were radiographically measurable. Alignment was improved in 17 of these.

DISCUSSION AND CONCLUSION: In this series, PSI required frequent surgeon directed intraoperative changes to improve component placement. Surgical experience was necessary to recognize and change PSI default surgical plans in a high percentage of cases. Measurable surgeon directed changes were associated with improved alignment. We would caution surgeons against blind acceptance of PSI generated surgical plans.

POSTER NO. P125
Does High Flexion after High-flexion TKA Guarantee High-flexion Activity and Higher Satisfaction?
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INTRODUCTION: This study evaluated whether the patients with high flexion total knee arthroplasty can do high-
flexion activity and analyzed correlations between active flexion, the ability to perform the high-flexion activity, and patient’s satisfaction after high flexion total knee arthroplasty. METHODS: Two-hundred-fifty-two patients were followed up for at least two years after high flexion posterior stabilized total knee arthroplasty. The clinical assessment was based on the active maximal flexion, Knee Society score, Hospital for Special Surgery (HSS) score, and Western ON and McMaster University Osteoarthritis Index. The functional assessment was used to estimate the ability to perform high-flexion activities including kneeling, squatting, sitting cross-legged and standing from the floor. RESULTS: Mean final active flexion was 132.8º (range, 75º to 155º). Eighty-two percent and 28.4% of patients showed active flexion ≥125º and ≥140º. The mean final Knee Society knee score, function score, HSS score and WOMAC index were 94.7, 85.9, 89.9, and 18.6, respectively. Eighty-nine percent of patients satisfied or very satisfied with the results. The 9.5%, 11.1%, 25.4% and 39.3% of patients could kneel, squat, sit cross-legged and stand from the floor easily, respectively. Patient’s satisfaction had moderate to strong correlation with the ability to perform the high-flexion activity and weak correlation with active flexion, which was weakly correlated with the ability to perform the high-flexion activity. DISCUSSION AND CONCLUSION: The active high flexion after high flexion total knee arthroplasty did not always guarantee the high-flexion activity in daily life and was weakly related with patients’ satisfaction. High-flexion activity rather than maximal active flexion was more closely related with patient’s satisfaction after high-flexion total knee arthroplasty.

POSTER NO. P126
Persistence of MSSA and MRSA Among Arthroplasty Patients After Use of a Decolonization Protocol
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INTRODUCTION: Decolonization protocols in orthopaedic surgery have recently become a growing trend for the preoperative treatment of nasal colonization of MRSA/MSSA in an effort to decrease post-operative surgical site infection. There is little information about the persistence of MRSA/MSSA after decolonization in the arthroplasty population. The purpose of this pilot study is to quantify long-term S. aureus persistence in decolonized total joint arthroplasty (TJA) patients. METHODS: Over a two-year period from 2008-2010, all patients having hip or knee arthroplasty by one surgeon were preoperatively screened for nasal MSSA/MRSA and decolonized as part of an infection reduction protocol. Our institutional database was used to retrospectively identify those patients who tested positive. Of 634 patients screened, 139 were identified to have MSSA (15.3%) or MRSA (6.6%) colonization before TJA. Fifty-eight of these positive patients were asked to be retested for persistence of MSSA/MRSA colonization as part of a pilot study. Data collection included age at time of TJA, type of TJA, and time from TJA to repeat nasal swab testing. RESULTS: Of 18 patients originally testing positive for MRSA, four (22%) were persistently positive for S. aureus on repeat testing at an average of 549 days (range: 176-949 days) after TJA. Of 37 patients originally testing positive for MSSA, 15 (37.5%) were persistently positive for S. aureus on repeat testing at an average of 473 days (range: 103-885 days) after TJA. The MSSA cohort had an average age of 67.28 years (range: 57.35-85.27 years). There were 37 primary total joint arthroplasties and three revisions. One patient converted from MSSA to MRSA while another converted from MRSA to MSSA at repeat testing. DISCUSSION AND CONCLUSION: This study demonstrates that although the majority of patients decolonized of MSSA/MRSA before surgery remain negative over several years, about 33% of patients have persistent colonization. Interestingly, patients with continued colonization almost invariably demonstrated the same antibiotic sensitivity, suggesting a model of persistent colonization instead of a model of eradication and repeat colonization. It is unknown whether these patients are at an elevated risk of hematogenous infection years after surgery, or whether there is any benefit to identifying and retreating these patients to establish eradication. Given the relatively high rate of patients with persistent MSSA/MRSA colonization even years after a decolonization protocol, there is a great importance in understanding the true risks in this patient population.

POSTER NO. P127
The Use of Gelatin Hemostatic Matrix to Reduce Post-operative Bleeding after Total Knee Arthroplasty
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INTRODUCTION: Total knee arthroplasty places patients at risk for significant blood loss and hematoma formation. Surgeons may choose to utilize an intra-articular drain to diminish hematoma in the knee. Control of post-operative bleeding is an important aspect of patient care and outcomes. One appropriate solution is to reduce the loss of blood during and after the operation. The present study was designed to evaluate the hemostatic efficacy of the use of gelatin hemostatic matrix (Floseal) in patients managed with total knee arthroplasty. METHODS: In this study of primary total knee arthroplasty, 83 consecutive patients received 10mL Floseal and these patients were compared with 100 consecutive patients who received no Floseal. In both groups, the standard means of hemostasis were applied. In the treatment group, a gelatin hemostatic matrix (Floseal) was applied to the internal aspects of the operative field before skin closure. All operations were performed in a bloodless field with use of a pneumatic tourniquet. All patients received coumadin as thromboprophylaxis starting the day after the operation. Blood loss during the operation was evaluated by measuring the volume in the suction apparatus and by estimating the amount of lost blood in the swabs at the end of the operation. The apparent postoperative lost blood was determined by measuring the volume in the suction drain canisters. All blood transfusions, preoperative and postoperative hemoglobin levels were recorded. RESULTS: There were no statistically significant differences between the groups for age, gender, operative side, estimated intra-operative blood loss, type of anestheisa, inpatient days, or preoperative hemoglobin. No adverse events occurred related to the use of Floseal. Patients receiving Floseal had a lower probability of getting a transfusion (p = 0.004). The probability of a blood transfusion was 5.5% in the control group and 0.5% in the treatment group. The volume of blood in the intra-articular drains was significantly reduced in the Floseal group (p < 0.00001). The mean value in the control group was 430.83mL and in the treatment group 120.54mL. DISCUSSION AND CONCLUSION: The use of a gelatin hemostatic matrix is an effective and safe means with which to reduce blood loss and blood-transfusion requirements after total knee arthroplasty.
MRI Following Unicondylar Knee Arthroplasty: The Preserved Compartments

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INTRODUCTION: The aim of this study was to assess the reproducibility of using magnetic resonance imaging (MRI) to analyze the preserved anatomic knee compartments following unicondylar knee arthroplasty (UKA) with zirconium femoral components. It was hypothesized that evaluation of the cartilage, ligaments, meniscus, and tendons would result in a high rate of inter-observer reliability.

METHODS: Ten patients underwent MRI of the knee tailored to reduce metallic artifact following medial UKA with zirconium femoral implants. Cartilage, external meniscus, collateral and cruciate ligaments, the quadriceps and patellar tendons, and the presence of joint effusion were evaluated by two independent investigators. The reviewers provided degrees of confidence with their evaluation of each parameter through the use of a five-point scale. Inter-observer agreement was calculated and inter-observer reliability was determined by use of Cohen's Kappa.

RESULTS: Artifacts originating from the implants was rarely observed. There was excellent inter-observer reliability (i.e., high Cohen's Kappa) for all assessed structures, and a high level of observer confidence for the evaluation of the cartilage, meniscus, tendons, ligaments, and joint effusion.

DISCUSSION AND CONCLUSION: Tailored MRI allows for reproducible analysis of the preserved knee joint compartment after UKA. This technique might prove helpful in the assessment of painful knee joints after UKA.

The Medial Wall of the Intercondylar Notch is Useful Rotational Reference in UKA

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INTRODUCTION: Relatively little attention has been given to the correct rotational orientation of the femoral and tibial component in unicompartamental knee arthroplasty (UKA). We investigated whether the medial wall of the intercondylar notch can be used for the tibial rotational reference as an alternative to the anteroposterior (AP) axis in UKA.

METHODS: Forty-five normal knees at a flexion angle of 90° were scanned using an open MRI. The angle between the AP axis of the tibia and the line on the medial wall of the intercondylar notch was measured. The femoral condyle plane was selected as the plane dividing the posterior femoral condylar surface and the center of the intercondylar notch in half (Fig. 1). A line was drawn from the anterior edge of the wall to the posterior edge of the wall on the femoral condyle plane (Fig. 2). The medial border of the patellar tendon and the middle of the PCL were projected into the femoral condyle plane and the angle between the AP axis and the line on the medial wall of the notch was measured. The relationship between the origins of the ACL and PCL and the medial wall of the intercondylar notch was evaluated. The medial borders of the ACL and PCL at the tibial attachment were identified. The line on the medial wall of the notch was projected to the tibial plateau, which was defined as the tibial sagittal cut line. Whether this line intersects the medial borders of the ACL and PCL at the tibial attachment was examined.

RESULTS: The line on the medial wall of the intercondylar notch was 0.1° ± 4.4° externally-rotated relative to the AP axis of the tibia. The line on the medial wall of the notch was within 5 degrees internally or externally rotated relative to the AP axis in 33 of 45 knees. The line on the medial wall of the intercondylar notch was projected to the tibial plateau, and the projected line did not intersect the medial borders of the ACL and PCL in all of the knees.

DISCUSSION AND CONCLUSION: The results of this study suggest that the medial wall of the intercondylar notch is one of the candidates for the tibial rotational reference as an alternative to the AP axis of the tibia. The line on the medial wall was almost parallel to the AP axis and the origins of the ACL and PCL stayed intact when the sagittal cut of the tibia was done parallel to the wall. The tibial medial plateau was covered sufficiently with the tibial component when the tibia was cut at the medial wall of the intercondylar notch.

Fig. 1

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Simultaneous Versus Staged Bilateral Total Knee Arthroplasty: A Meta-Analysis

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INTRODUCTION: An important debate in many orthopaedic practices is the choice of performing simultaneous or staged bilateral total knee arthroplasty. The objective of this meta-analysis is to determine the effect of simultaneous bilateral and staged bilateral total knee arthroplasty on perioperative complication rates, revision rates and mortality.

METHODS: A search strategy was developed to identify all relevant citations from the MEDLINE, EMBASE and Cochrane databases and the unpublished literature. Assessment of the studies for methodological quality and content was conducted independently by two reviewers, who extracted all relevant information from the included studies. The data was categorized into subgroups and pooled using the DerSimonian and Laird's random effects model.

RESULTS: A total of 18 articles were identified from 873 potentially relevant titles and selected for inclusion in the primary meta-analyses. The incidence of mortality was significantly higher in the simultaneous group at 30 days (Risk Ratio (RR) 3.31, 95% Confidence Interval (CI) 1.76-6.23, p = 0.001, I² = 33%, sample size (n) = 67,784 patients), three months (RR 2.45, 95% CI 2.15 - 2.79, p < 0.001, I² = 0%, n = 66,474 patients) and one year (RR 1.85, 95% CI 1.66 - 2.06, p<0.001, I² = 0%, n = 65,322 patients) post-surgery. The rate of revision surgery was significantly lower in the simultaneous group (RR 0.36, 95% CI 0.16 - 0.81, p<0.05, n = 752 patients) two years post-surgery. There was no increased risk of deep vein thrombosis, cardiac complication, pulmonary embolism, or infection rates in either comparison group.

DISCUSSION AND CONCLUSION: The results of the analysis suggest that simultaneous bilateral total knee arthroplasty has a significantly higher rate of mortality at 30 days, three months and one year post-surgery, and a significantly lower rate of revision surgery two years post surgery. These results should be interpreted with caution due to the inclusion of nonrandomized studies in the primary meta-analyses.

Simultaneous Bilateral vs. Unilateral TKR: Complications and Analysis of the Patient's Perspective

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INTRODUCTION: Patients with bilateral osteoarthritis and their surgeons face the choice between simultaneous or staged surgery. Despite extensive research, the risks associated with simultaneous bilateral total knee replacement (SBTKR) remain a controversial topic. The aim of this study was to compare patients who had undergone SBTKR to those who had undergone unilateral knee replacement (UTKR) and staged bilateral knee replacements (STKR), in order to evaluate patient satisfaction and post-operative complications.

METHODS: A continuous series of 205 patients who had undergone elective TKR for primary OA under the care of one surgeon from July 2006 to February 2009 were enrolled. Patients were grouped as simultaneous bilateral total knee replacement (n=89), unilateral knee replacement (n=81) staged bilateral knee replacements (n=35). Routine antibiotics and thromboprophylaxis were used for all patients. A clinical case audit was performed using their medical records during hospital admission and data was collected on the length of their hospital stay (LOS) and postoperative complications. Prospectively collected outcome scores (Oxford, KSRRS, WOMAC, and SF-36) were analyzed and compared between groups. The patient’s satisfaction of their knee replacement were administered and scored via a questionnaire.

RESULTS: Complication rates did not differ significantly (P>0.05) between any groups for any post-operative complications. The groups did not exhibit a significant difference in LOS in an acute setting. There were no recorded episodes of major complications such as myocardial infarction or mortality in either group. Significant higher preoperative mental and physical score was found (P<0.05) in the SBTKR groups compared to the other groups. In addition, the SBTKR group reported a significantly higher (P<0.05) satisfaction score compared to the other two groups.

Patient-Specific Instrumentation in Total Knee Arthroplasty Provides No Improvement in Component Alignment

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INTRODUCTION: Improved implant positioning and alignment in total knee arthroplasty (TKA) remains a commonly cited benefit of patient-specific instrumentation (PSI) but has not yet been thoroughly evaluated. We hypothesized that PSI would lead to improved accuracy in component alignment when compared to traditional instrumentation (TI) during primary TKA.

METHODS: Sixty-five knees in 59 prospectively enrolled patients who underwent TKA with the use of PSI were compared to a cohort of 62 consecutive patients who had previously undergone TKA with TI. Anteroposterior (AP), lateral, and AP long-standing post-operative radiographs were evaluated for mechanical axis, femoral notching and coronal and sagittal alignment of the femoral and tibial components. Goal alignment was within +/- 2° of planned femoral flexion of 3°, posterior tibial slope of 3°, mechanical axis of 0°, femoral valgus of 5°, and tibial varus of 0°.

RESULTS: There was no difference with respect to age, gender, BMI or operative blood loss between the two groups. The implanted femoral, tibial and polyethylene insert sizes were also similar. There was no statistically significant difference in component alignment including femoral flexion, femoral valgus angle, tibial varus angle, and overall alignment between the two groups. PSI demonstrated greater mean posterior tibial slope (6.3° PSI vs 5.1° TI, p=0.017) and decreased accuracy with only 36% of PSI knees implanted within the target range of posterior slope compared to 61% within the target range with TI (p = 0.004).

DISCUSSION AND CONCLUSION: We found no improvement in component alignment with decreased accuracy in tibial slope with the use of patient-specific instrumentation compared to traditional instrumentation during primary TKA. We cannot currently recommend the use of this technology due to no appreciable alignment benefit with an associated additional cost and resource utilization.

For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
DISCUSSION AND CONCLUSION: The aim of this study was to compare between the postoperative medical complications and patient's satisfaction after undergoing SBTKR with those undergoing UTKR. The results suggest that performing a simultaneous bilateral procedure does not increase the risk of complication or the length of hospital stay. However, increased patient satisfaction scores indicate that simultaneous replacement may be a more attractive alternative from the perspective of the patient.

POSTER NO. P134
ALTERNATE PAPER: ADULT RECONSTRUCTION KNEE I
What We Can and What We Can't Learn from Minimum Twenty-Year Follow-Up Studies of Total Knee Replacement
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INTRODUCTION: There are very few studies of total knee replacement where cohorts of patients have been followed for a minimum of 20 years. The purpose of this study was to examine the minimum 20-year follow up of two prospectively followed cohorts of total knee replacement patients to determine what pertinent findings would be helpful for performing and designing total knee replacements today as well as to potentially provide insight into the future study of total knee replacement procedures and designs. METHODS: Two consecutive series of total knee replacement cohorts were performed sequentially in a single orthopaedic practice and were prospectively followed for a minimum of 20 years both clinically and with serial radiographs. One cohort received a rotating platform knee design and the second a modular tibial tray design. In the first cohort, 119 knees were performed in 86 patients, average age 70 at the time of surgery with two-thirds of the patients male. The second cohort consisted of 101 knees performed in 75 patients, average age 70 with two-thirds of the patients female. Survival curves of the patients themselves were performed for the various age groups. RESULTS: In the first cohort, 20 patients with 26 of the 119 knees were still alive and in the second, 16 patients with 22 of 101 knees were still alive at 20-year follow up. Revision rates for aseptic loosening were 0 and 5% respectively and osteolysis rates were 5% and 9% respectively. In both groups the survivorship at 20 years for patients over 65 at surgery was 19% and for patients under 60 was 50%.

DISCUSSION AND CONCLUSION: At 20-year follow up these studies demonstrate the durability of total knee replacement, the small differences and results of elderly patient cohorts and the need to follow large cohorts of younger patients in the future to have adequate numbers of patients surviving at 20 years to make pertinent observations.

POSTER NO. P134
Cemented Stems in Two-Stage Revision for Infected Total Knee Arthroplasty
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INTRODUCTION: Controversy exists concerning the optimal method of stem fixation during reimplantation for periprosthetic knee sepsis. Cemented fixation can provide an antibiotic delivery system and in contrast to canal filling cementless fixations, it does not affect alignment at the joint line. The purpose of this study was to review the results of cemented stems in two-stage reimplantation for infection. METHODS: This was a retrospective review using the modified Knee Society Radiographic score which classifies stems as stable, follow closely, or loose. Stems were classified into metaphyseal, less than 4 cm. diaphyseal engagement, and greater than 4 cm. of diaphyseal engagement. A regression analysis was used to determine the association of the level of constraint, bearing type (fixed vs. mobile), radiographic loosening as well as cortical engagement of dowels placed between stages. RESULTS: Only six of 97 stems (6.2%) were categorized as loose at an average follow up of 3.9 years (2-8.5 years). None of the covariates in the model were significantly associated with loosening or need to follow closely with the numbers available. As compared to unconstrained implants, constrained implants had a reduced odds (OR .58; 95% CI: 0.23-1.51) of loosening or need to follow closely. Fixed bearing implants had a reduced odds (OR .88; 95% CI .33-2.36) of loosening or need to follow closely compared to mobile bearings. While stems with greater than 4 cm of diaphyseal engagement had 2.5 times the odds of loosening or need to follow closely compared to stems that had less than 4 cm. Dowel placement that engaged ≤ 2 cortices has 1.8 times the odds (95% CI: 0.56-6.02) of loosening or need to follow closely compared to dowels engaging > 2 cortices.

DISCUSSION AND CONCLUSION: Cemented stems provided acceptable results in 93.8% of two-stage reimplantations. Surprisingly constrained fixed bearing implants with intermediate length stems did not negatively affect results.

POSTER NO. P135
Effect of Patellar Resurfacing or Not on Quadriceps Recovery in Total Knee Arthroplasty with Objective Dynameter
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INTRODUCTION: There were still debates about the advantages and disadvantages of patellar resurfacing during total knee arthroplasty (TKA). However the clues for pros and cons of patellar resurfacing were relatively subjective data such as ability of straight leg raising, range of movement, walking up or down the stairs or anterior knee pain. We investigate the difference of clinical result according to patellar resurfacing or non-resurfacing by quadriceps recovery using an objective dynamometer. METHODS: Fifty-nine knees for TKA in only female with primary osteoarthritis were prospectively randomized into two groups. Thirty knees underwent TKA using patellar resurfacing and 29 knees underwent TKA with patellar non-resurfacing. They were
evaluated for range of movement (ROM), Knee Society Scores (KSS) and SF-36 questionnaire. Quadriceps force was evaluated using dynamometer. Data were collected preoperatively and at postoperative six weeks, three months, six months and one year.

RESULTS: The postoperative KSS, SF-36 and ROM improved in all patients with no significant difference between the groups (p>0.05). There were no significant differences between the groups with the mean of quadriceps force throughout preoperative and postoperative follow-up periods (p>0.05).

DISCUSSION AND CONCLUSION: We found no significant difference between the two groups throughout follow-up periods in terms of quadriceps force using a dynamometer as well as clinical results. Therefore, the quadriceps recovery after a total knee arthroplasty may not be affected by patellar resurfacing.

POSTER NO. P136
ALTERNATE PAPER: ADULT RECONSTRUCTION KNEE III

Satisfaction in Patients after Primary Total Knee and Unicompartmental Arthroplasty

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INTRODUCTION: Knee replacement studies traditionally have focused on surgeon-reported outcomes such as loosening rates. More recently, patient-related outcomes have become the focus of increased attention. However, few studies have investigated patient satisfaction with certain aspects of knee replacement, such as pain, motion, recreational activity and kneeling, specifically differences in these parameters in different age groups undergoing total versus partial knee replacement.

METHODS: We contacted patients at a minimum of three years after primary unicompartmental (n=200) and total knee replacement (n=373) to rate their satisfaction regarding pain, range of motion (ROM), daily living function (DLF), return to recreational activity (RRA) and ability to kneel (ATK) on a scale of 0 (worst) to 10 (best). We further collected data on pain level and modified Cincinnati rating scale. Range of motion was documented pre- and postoperatively at a minimum of six months. The cohort was subdivided into four age groups and compared with each other (Group 1= less than 55, Group 2= between 55 and 65, Group 3= between 66 and 75, Group 4= greater than 76 years). To be regarded clinically significant, the difference in the satisfaction score needed to exceed one point (>10%).

RESULTS: Patients in Group 1 with total knee arthroplasty (TKA) were significantly less satisfied in comparison to Group 3 with TKA in all subscores (see table) and in comparison to Group 4 in the subgroup pain and ROM. Group 1 with TKA also had significantly higher scores on the VAS compared to Group 3 with TKA (0.67±0.5, p<0.05) and lower scores on modified Cincinnati (1.3±0.29, p<0.001). There were no significant differences in the comparison between the TKA and UKA patients in all subset scores. However, significantly greater range of motion was documented postoperatively in all groups with UKA compared to patients with TKA patients, ranging from 5.6° to 10.2° (p<0.01).

DISCUSSION AND CONCLUSION: We found that overall, younger patients demonstrated lower satisfaction scores and higher pain levels with TKA in comparison to older patients with TKA. Even though there was better motion in UKA patients, surprisingly, there were no consistent differences in satisfaction scores between UKA and TKA patients.

### Table: Patient satisfaction between different age groups who underwent TKA

<table>
<thead>
<tr>
<th>Group 1 versus Group 2</th>
<th>Group 1 versus Group 3</th>
<th>Group 1 versus Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>D1.57±0.3 (p&lt;0.001)</td>
<td>D1.25±0.5 (p&lt;0.05)</td>
</tr>
<tr>
<td>NS</td>
<td>D1.21±0.5 (p&lt;0.001)</td>
<td>D1.14±0.37 (p&lt;0.01)</td>
</tr>
<tr>
<td>NS</td>
<td>D1.14±0.4 (p&lt;0.001)</td>
<td>D1.21±0.6 (p&lt;0.05)</td>
</tr>
<tr>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

POSTER NO. P137

Chronic Lumbo-sacral Disease May Impair Function Following Total Knee Arthroplasty

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INTRODUCTION: Lumbo-sacral spine diseases, including lumbar canal stenosis, are a common cause of lower back and leg pain in older adults. Non-operative treatment is generally recommended in the absence of signs of acute nerve compression. Symptomatic chronic canal stenosis is not considered a contraindication for total knee arthroplasty, however, it is not clear whether this condition is associated with changes in post-operative outcomes. The purpose of this study was to compare the clinical outcomes of total knee arthroplasty in patients with symptomatic lumbar canal stenosis to those who did not have symptomatic disease.

METHODS: A review of all total knee arthroplasties performed by two surgeons in patients who had a diagnosis of symptomatic lumbar spine disease, with or without prior spinal surgery, was performed. A total of 137 knees were identified in 118 patients who had a mean age of 68 years (range, 47 to 83 years) and a minimum of two years follow up (mean, 46 months; range, 24 to 70 months). These patients were matched by age, gender, body mass index, and type of procedure (unilateral or bilateral) to patients operated by the same surgeons over the same time period who did not have symptomatic lumbar disease. Clinical outcomes as measured using the Knee Society pain and function scores, and range of motion, were compared between the two groups. The demographic factors and pre-operative clinical scores were similar between the two groups.

RESULTS: At a mean final follow up of 49 months (range, 29 to 100 months), the Knee Society function scores were significantly lower in the spinal stenosis patients, with a mean of 84 points (range, 29 to 100 points) as compared to 95 points (range, 90 to 100 points) in the asymptomatic patients (p<0.001). The mean pain scores were also lower in the patients with canal stenosis (91 points, range 65 to 99 points as compared to 97 points, range 90 to 100 points; p=0.044), although the differences were much smaller. The mean range of motion was similar in both groups (117 degrees, range 110 to 128 degrees compared to 118 degrees, range 110 to 137 degrees; p=0.429). There were eight revisions for aseptic reasons in the lumbar disease cohort (6%), compared to three revisions in the matched group (25; p=0.2).

DISCUSSION AND CONCLUSION: The results of this study suggest that patients with lumbar spine disease have significantly worse function following total knee arthroplasty when compared to those who do not have symptomatic disease. Surgeons should consider these factors in their decision making.
consider cautioning patients with chronic lumbar spinal disease that although they can expect excellent relief of arthritic knee pain following arthroplasty, they may continue to experience limitations in post-operative function.

POSTER NO. P138

**Tranexamic Acid Decreases Postoperative Blood Loss Associated with Total Knee Arthroplasty**

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INTRODUCTION: Tranexamic acid (TXA) reduces blood loss in patients undergoing total knee arthroplasty (TKA). However, there is not much literature regarding the protocols for administration of TXA.

METHODS: Between September 2009 and April 2011, we enrolled 73 patients with primary osteoarthritis undergoing a cemented TKA. Patients were randomized into one of three groups: the control group (n=29), the 1-TXA group (n=20) received tranexamic acid intravenously (1000 mg) 10 minutes before deflation of the tourniquet and 2-TXA group (n=24) received tranexamic acid intravenously (1000 mg) 10 minutes before deflation of the tourniquet and three hours postoperatively. We measured volume of drained blood postoperatively. Venous thromboembolic (VTE) events included symptomatic VTE or asymptomatic deep vein thrombosis (DVT) screened by compression ultrasonography at enrollment, one day follow up and one week follow up.

RESULTS: Mean postoperative volume of drained blood was lower in the 2-TXA group (228 mL) than in the 1-TXA group (408 mL) and control group (980 mL). Results showed no transfusion requirements in the TXA group and control group. The amount of autologous blood donation and number of patients requiring autologous blood donation were lower in patients receiving tranexamic acid than in control group. The incidence of DVT was 21% (6/29) in the control group, 25% (5/20) in the 1-TXA group, 25% (6/24) in the 2-TXA group. There were no significant differences between these groups. The incidence of pulmonary emboli (PE) was 3% (1/29) in the control group, and PE was not observed in the TXA group.

DISCUSSION AND CONCLUSION: Tranexamic acid reduced postoperative blood loss after TKA, and it was not associated with the risk of DVT and PE.

POSTER NO. P139

**Is the Outcome of Knee Arthroplasty Different for Rheumatoid Arthritis Compared to Osteoarthritis?**

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INTRODUCTION: Comparative studies of knee arthroplasty outcome for different disease processes show variation in both revision rates and objective clinical outcome measures. However, the focus has recently shifted towards patient reported outcome measures (PROMs) as the preferred tool to define arthroplasty results. Currently there is very little information as to the variation in PROMs between different disease processes (and implant types), and whether consistent results are reported when using different PROM tools. This study compares knee arthroplasty outcomes using PROMs, to identify variations between osteoarthritis (OA) and rheumatoid arthritis (RA). It also examines how the use of different outcome variables affects the interpretation of outcomes.

METHODS: We analyzed prospectively collected outcome data (OKS, EQ5D, satisfaction score, and revision) on 2,540 primary knee arthroplasty patients. Patients were categorized according to their disease process (inflammatory arthritis [RA] or osteoarthritis [OA]). The type of implant used (total knee replacement [TKA], or unicompartmental [UKA]) was also recorded for sub analysis in the OA group. Oxford Knee Scores and EQ5D were analyzed preoperatively, and postoperatively at six months and two years. Both absolute scores and post-operative change in scores were calculated and compared between groups. Satisfaction scores (0-100) were analyzed at six months. Parametric data was analyzed using ANOVA, and Kruskall-Wallis/Mann-Whitney for non-parametric data. Kaplan-Meier analysis was performed to describe revision rates at two years.

RESULTS: Post operatively, no differences in OKS or EQ5D were observed between OA and RA groups at two years, but the RA group had a lower EQ5D at six months (p<0.001). Preoperative OKS and EQ5D were significantly lower for the RA compared to the OA group (p<0.01), and consequently post-operative change in OKS and EQ5D were significantly greater in the RA group (p<0.01). No difference in satisfaction was seen between the groups. Within the OA group, post-operative OKS was significantly better in the UKA compared to TKA group at both six months and two years (p<0.05). However, post-operative change in scores demonstrated no significant benefit for UKA over TKA. Two year revision rate was highest for UKA (2.7%), which was significant compared to TKA (0.8%, p=0.03).

DISCUSSION AND CONCLUSION: This study demonstrates that RA patients achieve an excellent early outcome following knee arthroplasty, with high levels of satisfaction, and postoperative PROMs comparable to those seen in the OA group. Furthermore, the change in scores shows that the postoperative improvements are significantly superior to the OA group. Within the OA group, postoperative scores in isolation suggest superior outcome of UKA over TKA. However, this is not supported by the change in scores, which show no differences between implants at six months or two years. This highlights the complexities of measuring and interpreting arthroplasty outcomes, and the potential to reach misleading conclusions when using postoperative scores in isolation.

POSTER NO. P140

ALTERNATE PAPER: ADULT RECONSTRUCTION KNEE V

**Prospective Use of AAOS Guideline on the Prevention of Symptomatic VTE in 3,289 Patients Undergoing THA or TKA**

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INTRODUCTION: The optimal management of deep venous thrombosis and pulmonary embolism in patients undergoing total hip and total knee arthroplasty remains controversial. Depending upon endpoints chosen (all DVT vs. proximal DVT plus pulmonary embolism), the literature supports more than one approach. From June 1, 2009 through April 30, 2011 we prospectively managed 3,289 patients undergoing primary or revision arthroplasty using risk stratification and one of two risk-based prophylaxis protocols.
METHODS: Beginning on June 1, 2009, all patients undergoing arthroplasty in our dedicated total joint unit were questioned by the pre-operative screening staff for personal history or family history of blood clots requiring long-term (> 1 month) warfarin use or a personal history of malignancy (active or in remission). Patients were also screened for prior history of bleeding dyscrasia, GI bleed or hemorrhagic CVA. All patients were mobilized on POD #1 and all used pneumatic foot pump compression; patients were assigned to “standard” vs “high” risk for VTE and treated with enteric-coated aspirin for TKA/10 day enoxaparin course for THA or 28 day enoxaparin program respectively. Chi square tests with Pearson’s R for parametric or Spearman Rank Correlation for categorical data were used to analyze relationship to development of proximal DVT or pulmonary embolism. Patients were contacted by phone at 60 days post-discharge to confirm late diagnoses of VTE.

RESULTS: A total of 3,289 patients underwent hip or knee arthroplasty. These were 57% female; average age was 65.8 years old; average BMI 30.8. 58.4% underwent primary or revision total knee, the remainder primary or revision total hip arthroplasty. A total of 1,966 (59.8%) patients were “standard” risk and 610 (18.5%) “high” risk. Surgeon protocol selection was incomplete in 12.3% and the remainder were excluded from the protocol for one reason or another (3.7% on warfarin preoperatively, 2.6% per medical physician, 3.1% other). There were 37 major VTE events documented by Doppler ultrasound or CT angiogram (18 proximal limb DVT and 19 pulmonary embolism) for a prevalence of 1.12%. In our series, total knee patients were more likely to develop a VTE complication (1.53% vs. 0.70%, p = .036). Personal history of blood clots was associated with complications (yes 3.4% vs. no 0.98%, p = .004) but family history and history of malignancy did not show a statistically significant relationship.

DISCUSSION AND CONCLUSION: In this large, prospective series, the prevalence of VTE was 1.12% using the AAOS Guideline on the Prevention of Symptomatic Pulmonary Embolism in Patients Undergoing Total Hip or Knee Arthroplasty. This report is consistent with the trend toward lowered reported prevalence of thromboembolic disease in this patient population using early mobilization, multi-modal pain management and risk stratification for arthroplasty patients.

POSTER NO. P141

Limitations of the Knee Society Clinical Rating System in Comparison with the SF-12 and WOMAC for UKA

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INTRODUCTION: The Knee Society Score (KSCRS) is commonly used to evaluate unicompartmental knee arthroplasty (UKA), but the correlation between the KSCRS and patient driven scores, such as the Short Form Health Survey (SF-12) and Western ON and McMaster Universities Osteoarthritis Index (WOMAC), is not known for patients with UKAs. The aim of this study was to examine the degree of correlation between the KSCRS (knee and function scores), SF-12, and WOMAC scores in patients who underwent UKA after a minimum follow up of two years.

METHODS: Eighty-two UKAs were performed at our institution between 2005 and 2009 and prospectively followed for a minimum of two years postoperatively. The KSCRS, SF-12, WOMAC scores were calculated pre-operatively and at two year follow up for each patient. Correlation analyses were done using Spearman coefficients to determine the degree of correlation for each outcome and among subsets within each rating scale.

RESULTS: Analysis of the subsets within the KSCRS demonstrated a low (r<0.2) to negative correlation in pre-operative and post-operative analysis for the clinical subset of the scale. The functional subset of the KSCRS demonstrated a low correlation coefficient pre-operatively, which improved to moderate (r<0.6) correlation post-operatively. There was low to mild (r<0.4) correlation between the WOMAC and SF-12, and the KSCRS. KSCRS pain subset scores had a correlation of 0.23 to WOMAC pain subset when examined pre-operatively. Correlation did improve post-operatively with KSCRS and WOMAC pain subsets demonstrating a marked correlation of 0.63. The SF-12 Physical subset was correlated to the KSCRS functional subset and demonstrated a moderate correlation (0.42) pre-operatively and mild (0.23) post-operatively. The highest correlations were found within subset correlations of the KSCRS and WOMAC scales themselves. A correlation coefficient of 0.9 was found between the post-operative pain and clinical subsets of the KSCRS. Similarly, high correlation coefficients were observed between the WOMAC pain and function subsets pre-operatively (0.76) and post-operatively (0.78).

DISCUSSION AND CONCLUSION: Our results suggest that neither patient nor surgeon derived rating scales have strong correlation in either pre-operative or post-operative settings in patients undergoing UKA. The KSCRS and WOMAC do offer strong correlation intrinsically, when pain and function or clinical outcomes are examined, both pre- and post-operatively. Further research will be required to examine whether or not the new Knee Society Score will demonstrate an improved correlation in determining the outcomes of UKA.

POSTER NO. P142

Can Nanohydroxyapatite Improve Bone Healing After Open Wedge High Tibial Osteotomy? A CT Study

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INTRODUCTION: Open wedge high tibial osteotomy (OWHTO) is an established technique to treat symptomatic varus malaligned knees. The purpose of our study was to compare the radiological CT results of 18 patients (19 knees) treated with computer-assisted open wedge high tibial osteotomy. In order to fill the osteotomy gap, we only used heterologous bone graft in nine patients (Group A, 10 knees), while in the other nine patients (Group B, nine knees) we used both heterologous bone graft and nano-hydroxyapatite.

METHODS: All 18 patients (19 knees) were radiologically evaluated eight weeks after the operation with a CT multivision study. Density values in the osteotomy site were calculated using Hounsfield Unit (HU). To make repeated measurements, we selected specific areas identified on three planes (axial, sagittal-oblique and coronal-oblique). The density measurements in the three planes were then summed and divided by three to obtain an additional average sample size for each patient, so as to be less influenced by the space plan of reconstruction on the measure.

RESULTS: The mean bone density of patients treated only with dehydrated equine bone-substitute (group A) was 129.9±15.4 HU, while in group B bone density was 213.2±45.2 HU (p=0.0001). CT multislices exams showed significantly better results in patients in which we used also nanohydroxyapatite.
We did not observe any post-operative complication as infections or allergic reaction to nanohydroxyapatite. DISCUSSION AND CONCLUSION: To our knowledge this is the first study to evaluate bone density after OWHTO with multislice CT method. The success of surgery is closely linked to the healing of the graft. Delayed or nonunion of the graft may result in loss of correction. In OWHTO the gap can be left or filled with autologous, homologous, heterologous or synthetic graft. It has been suggested that these nanohydroxyapatite can accelerate growth and bone remodeling, allowing the patient early full weight bearing after OWHTO. The nanohydroxyapatite consisting of highly pure microscopic crystals in aqueous dispersion called nanocrystals provides a supporting structure for new bone formation, aiding bone healing in places where voids or gaps exist in the bone. It’s a full synthetic bone substitute material and highly compatible, basically its chemical composition and crystalline character are identical to natural bone mineral structure. This is a preliminary study whose aim was to observe a possible difference between two groups of patients to assess the possibility of a faster lower limb weight-bearing. Data obtained with CT examination showed significantly better results in group B in terms of bone density. The use of nanohydroxyapatite seems to promote the osteointegration process.

INTRODUCTION: Remelted highly crosslinked polyethylenes (HXLPEs) were introduced in total knee replacement (TKR) starting in 2001 to reduce wear and particle-induced lysis. Few studies have reported on the clinical performance of HXLPE knees. Now one decade following its introduction, knowledge regarding the in vivo damage mechanisms and oxidative stability of first generation HXLPE in total knee replacement. Remelted HXLPE inserts exhibited lower oxidation indices as compared with conventional inserts. However, we were able to detect slight regional differences within the HXLPE cohort, specifically at the bearing surface. Additional long-term HXLPE retrievals are necessary to ascertain the long term in vivo stability of these materials in total knee replacement.

POSTER NO. P143
Surface Damage and Oxidative Properties of Remelted Highly Crosslinked Polyethylenes in Total Knee Arthroplasty
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INTRODUCTION: Remelted highly crosslinked polyethylenes (HXLPEs) were introduced in total knee replacement (TKR) starting in 2001 to reduce wear and particle-induced lysis. Few studies have reported on the clinical performance of HXLPE knees. Now one decade following its introduction, knowledge regarding the in vivo damage mechanisms and oxidative stability of remelted HXLPEs in the knee remains incomplete. We hypothesized that due to the reduced free radicals, remelted HXLPE would have lower oxidation levels than gamma inert-sterilized controls. METHODS: A total of 186 posteriorly stabilized tibial components were retrieved at consecutive revision surgeries at seven different surgical centers. Sixty-nine components were identified as remelted HXLPE while the remainder (n=117) were conventional gamma inert sterilized polyethylene. The sterilization method was confirmed by tracing the lot numbers by the manufacturer. The conventional inserts were implanted for 3.4±2.7 years (Range: 0.0 - 10.1 years), while the remelted components were implanted 1.4±1.2 years (Range: 0.0 - 4.2 years). Surface damage was assessed using the Hood method. For oxidation analysis, implants were evaluated in accordance with ASTM 2102 following submersion in boiling heptane for six hours to remove absorbed lipids. Only 41 of the conventional implants were available for oxidation analysis.

RESULTS: The predominant reasons for revision were loosening, instability, and infection. None of the highly crosslinked tibial inserts were revised for osteolysis or component fracture. Pitting, scratching, and burnishing were the predominant damage mechanisms within both material groups. Delamination was only present on one gamma inert insert, but was not present within the highly crosslinked group. Oxidation was lower in the HXLPE group when compared to the gamma inert group at all locations (p<0.001). In the HXLPE group, the bearing surface had higher oxidation indices than the backside (p = 0.001), post (p < 0.001), and AP Face (p = 0.008). In the gamma inert inserts oxidation indices were positively correlated with implantation at the bearing surface, AP face, and the post (Rho = 0.38-0.48; p ≤ 0.02). In the HXLPE cohort, only the bearing surface was positively correlated with implantation time (Rho = 0.36; p = 0.004).

DISCUSSION AND CONCLUSION: This study evaluated the surface damage mechanisms and oxidative stability of first generation HXLPE in total knee replacement. Remelted HXLPE inserts exhibited lower oxidation indices as compared with conventional inserts. However, we were able to detect slight regional differences within the HXLPE cohort, specifically at the bearing surface. Additional long-term HXLPE retrievals are necessary to ascertain the long term in vivo stability of these materials in total knee replacement.

POSTER NO. P144
Surgeon Experience is Not Predictive of Implant Survivorship in 1,784 Unicompartmental Knees
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INTRODUCTION: Cemented unicompartmental knee arthroplasty (UKA) revision rates reported in total joint registries tend to be higher than those reported in single surgeon series. We postulate that experienced, high volume surgeons may have better outcomes than less experienced peers. Our aim is to quantify the effect of surgeon experience and surgeon volume on revision rates and the relative risk of UKA revision. METHODS: We identified all cemented primary UKA procedures performed between 2001 and 2009 in a large community...
based registry. We assessed the non infection related rate of revision for cemented, primary UKAs relative to surgeon volume (> or <=12UKAs/year), hospital volume (> or <=24UKAs/ year), surgeon experience (first 10 UKAs vs. rest of UKAs) and fellowship training. Using a Cox regression model, we calculated the relative risk of revision after adjusting for implant design, patient age, gender, weight, BMI, and ASA score.

RESULTS: A total of 1,746 cemented UKAs were identified. There were 87 revisions. Some 71.5% of UKAs were performed in low volume hospitals and 55.4% by low volume surgeons. A total of 38.3% of all UKAs were performed within the first 10 years of a surgeon's experience. In univariate analysis, high hospital volume (P=0.0084), high surgeon (P=0.0023), and greater surgeon experience (P=0.0002) were all strongly correlated with a lower revision rate. However, when adjusting for other variables in a Cox regression model, none of these variables reached statistical significance (P=0.249, 0.181, 0.902 respectively).

DISCUSSION AND CONCLUSION: There was a strong correlation in univariate analysis between UKA aseptic revision and 1) hospital volume 2) surgeon volume and 3) surgeon experience. However, in multivariable analysis the risk of revision was not statistically different between the groups studied thus refuting our hypothesis. We conclude that in our registry neither surgeon experience nor volume is driving differences in aseptic revision rates.

POSTER NO. P145

A Comparison of Different Prosthetic Spacers in Two-Stage Treatment for Infected TKA

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INTRODUCTION: Various spacers are used between stages in treating infected total knee arthroplasty (TKA), including re-implanting sterilized infected prostheses and static or articulating cement. Articulating spacers may improve interim and ultimate function compared to static spacers. There are concerns about re-implanting metallic and polyethylene components in an infected bed, cost of cement spacer molds and potential bone loss with cement spacers. This study compares the use of prosthetic components to all-cement static spacers in controlling infected TKAs.

METHODS: Forty-seven patients with infected TKA were managed with a static antibiotic cement; 33 patients (static cement) were managed with a static antibiotic cement spacer. This study compares the use of prosthetic components to all-cement static spacers in controlling infected TKAs.

RESULTS: There were 2 revisions for infection (one), and periprosthetic fracture (one). Average pain score was 38/44 Standard and 40/44 High-Flexion, function score was 73/100 Standard and 70/100 High Flexion and Knee Society scores were 85/100 Standard and 87 High-Flexion. Average postoperative ROM was 124 for each femoral component.

DISCUSSION AND CONCLUSION: The finding of no difference in average flexion of 124 degrees at one year was at first surprising. It indicates that the importance of the posterior condylar cleanout which the additional 2mm of resection of the posterior femoral condyles to accommodate the high flexion femur. All other cuts were the same.

POSTER NO. P146

Comparison of Outcomes in Standard versus High-Flexion Condylar CR MB Femurs in Total Knee Arthroplasty

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INTRODUCTION: The use of a posterior condylar cleanout has been shown in a previous published study to increase the flexion in a cruciate retaining knee with a fixed and mobile bearing tibia. This allowed removal of osteophytes and freeing the contracted soft tissue adhering to the resected posterior condyles. Due to this rationale, the curve of the posterior condyle in a high-flexion femur was continued an additional 2mm to provide metal articulation for increased flexion.

METHODS: We queried our database for primary total knee arthroplasty (TKA) with both femurs in patients between 1/2009 to 12/2009 to compare outcomes related to this femoral component. The only difference in technique was the additional 2mm of resection of the posterior femoral condyles to accommodate the high flexion femur. All other cuts were the same.

RESULTS: A total of 508 primary cruciate-retaining TKAs were performed using each prosthesis during this time period: 432 with the Standard and 76 with the High-Flexion femurs. Some 494 patients with an average age of 65 in the Standard group and 66 in the High-Flexion group and BMI of 31 in each group returned to the clinic for a follow-up visit between 6-24 months, average 10 months. There were two revisions for infection (one), and periprosthetic fracture (one). Average pain score was 38/44 Standard and 40/44 High-Flexion, function score was 73/100 Standard and 70/100 High Flexion and Knee Society scores were 85/100 Standard and 87 High-Flexion. Average postoperative ROM was 124 for each femoral component.

DISCUSSION AND CONCLUSION: The finding of no difference in average flexion of 124 degrees at one year was at first surprising. It indicates that the importance of the posterior condylar cleanout which the additional 2mm of bone resection forces the surgeon to perform. The additional metal at the extremes of flexion might keep the bone-implant interface away from possible articulation with the polyethylene.

POSTER NO. P147

Hyaluronic Acid (Hyalgan) Enhances Viability of Human Chondrocytes in Cold-Stored Allografts

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INTRODUCTION: Maintenance of chondrocyte viability in cold-stored allografts is a concern for tissue banks. Several investigators have reported that following four weeks of cold storage, approximately only 65%-70% have cell viability. Several authors have hypothesized that loss of viability may be responsible for the failure of about 25-30% of allograft transplantation surgery. Recently, a growing number of studies have attempted to create different conditions with varying agents in an attempt to improve cell viability. Previous published
work in our laboratory has demonstrated that hyaluronic acid (HA) is improving chondrocyte viability through the preservation of mitochondrial function in monolayer cultures. We hypothesized that we would observe similar effects in cold-stored chondrocytes exposed to HA during preservation.

METHODS: Cartilage specimens were obtained from 16 normal donors (LifeLink Tissue bank). The ages of specimens ranged from 18-36 (avg= 27 years). Cartilage pieces were cut and placed on 6-well plates. Harvested specimens were refrigerated and stored in DMEM/F12 media containing antibiotics and 10% fetal bovine serum for up to 45 days. Half of the specimens (Group A) underwent standard preservation while eight specimens (Group H) had Hyalgan [200 µg/ml] added to the media. Media was replaced every three to four days, with new HA added to the media of Group B. Chondrocyte viability was evaluated by Live/Dead assay and flow cytometry. Mitochondrial dysfunction was evaluated by mitochondrial DNA damage using quantitative Southern blot technique and ATP production by bioluminescence kits.

RESULTS: After storage day 1, chondrocyte viability in Group A was 94%, dropping to 66% after day 28. In Group H, storage day 1 chondrocyte viability was 95%, dropping to 92% at day 28. This difference between Groups A and H at day 28 was significant (p<0.05). Mitochondrial dysfunction was observed in chondrocytes during cold storage. MtDNA damage progressively accumulated after two weeks of cold storage. Increased mitochondrial DNA damage accumulated after longer storage time. In cells in Group H, mtDNA damage did not accumulate with prolonged storage. There were no differences between mtDNA break frequencies after one and 28 days of storage. In Group A, ATP levels dropped significantly after 28 days of storage (Day 1 = 8.3 pmol/1000 cells versus Day 28 = 3.5 pmol/1000 cells). In Group H chondrocytes stored with HA, ATP levels were not significantly different after 28 days (Day 1 = 9.1 pmol/1000 cells versus Day 28 = 8.9 pmol/1000 cells) (p=NS).

DISCUSSION AND CONCLUSION: The current study demonstrated that hyaluronic acid added to storage media significantly improved chondrocyte viability in cold-stored allografts. In addition, preservation of mtDNA integrity and ATP levels were also noted in HA stored grafts. The use of hyaluronic acid appears to be beneficial during cold storage of osteochondral allografts.

<table>
<thead>
<tr>
<th>Evaluation test</th>
<th>Day 1</th>
<th>Day 28</th>
<th>P value</th>
</tr>
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<tbody>
<tr>
<td>Chondrocyte Viability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A (control)</td>
<td>94</td>
<td>66</td>
<td>P=NS</td>
</tr>
<tr>
<td>Group H (HA)</td>
<td>95</td>
<td>92</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>ATP Levels</td>
<td></td>
<td></td>
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<tr>
<td>Group A (control)</td>
<td>8.3</td>
<td>3.5</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Group H (HA)</td>
<td>9.1</td>
<td>8.9</td>
<td>P=NS</td>
</tr>
</tbody>
</table>

POSTER NO. P148

Can Blood Culture be Used to Diagnose Periprosthetic Joint Infection?

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Matthew Austin, MD, Philadelphia, PA

INTRODUCTION: Diagnosis of periprosthetic joint infection (PJI) presents a real challenge in some patients. A battery of tests are available to reach this diagnosis. It is not known if blood cultures have any role in diagnosis of PJI. The objective of this study was to evaluate whether blood cultures, taken in a group of patients with PJI, were useful in identifying the infecting pathogen.

METHODS: The prospective institutional database was used to identify all patients treated at our institution between 2000 and 2010 for PJI. There were a total of 978 patients with mean age of 66 years. Synovial fluid sample and/or deep tissue samples were analyzed and cultured in all of these patients. In 96 patients with PJI, blood cultures were also taken. Statistical analyses were performed for correlation purposes.

RESULTS: Results of blood cultures and those from joint tissue/fluid culture were identical in 67 patients. The pathogen identified from blood was the same infecting organism isolated from joint tissue/fluid in 59 cases (concordance of 100%). Interestingly one infection that was fungal in nature showed no growth on tissue/fluid culture, yet the same organism was isolated in blood culture. In 29 patients in whom an organism was isolated from joint fluid, blood cultures were negative for any pathogen.

DISCUSSION AND CONCLUSION: Although this study does not advocate the use of blood culture for diagnosis of PJI, the finding that blood culture is successful in isolating the infecting organism as the joint in majority of cases is compelling. Thus, the result of blood culture when performed should be considered as representative of the infecting organism in PJI cases.

POSTER NO. P149

Cost and Disease Outcomes of Total Knee Arthroplasty Patients in the Medicare Population

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INTRODUCTION: Despite the prevalence and projected increase in osteoarthritis (OA) in the elderly, there are little data that quantify the risks and benefits of cost and quality of life for knee arthroplasty treatments. The purpose of this study is to compare differences in cost and health outcomes between osteoarthritic patients who undergo joint replacement therapy and those who do not.

METHODS: The Medicare 5% sample was used to identify patients with OA using the ICD-9 codes within the 715.X6 family during 1997-2009. All OA patients were separated into non-arthroplasty and arthroplasty (indicated by ICD-9 code 81.54) groups. Outcomes of interest included average annual payments adjusted to Jan-2011$, mortality, and new diagnoses of congestive heart failure, diabetes, and depression. Differences in costs and risk ratios for each outcome were adjusted using logistic regression for age, sex, race, income status, region, and Charlson score. The results were compared at fixed periods of one year, three years, five years, and seven years after surgery.

RESULTS: There were 80,629 non-TKA patients and 53,829 TKA patients with one-year follow-up data. These numbers dropped to 39,183 non-TKA and 25,904 TKA patients at seven years. The seven-year cumulative average Medicare payments for all treatments for all medical care were $63,940 for the non-TKA group and $83,783 for the TKA group, an incremental seven-year cost of $19,843. The mortality hazard ratio of the TKA group ranged from 0.48 to 0.54 through seven years (all p<0.001) (Table 1). The risk of congestive heart failure of the TKA group was 21.1% at three years (HR=0.89, p<0.001) and 40.9% at seven years (HR=0.93, p<0.001). The risk of depression was higher for the TKA group at one year (rate=9.37%,
HR=1.28, p<0.0001) and three years (rate=17.1%, HR=1.05, p<0.0093), but there were no long-term significant differences. There was a slightly higher risk for diabetes in the TKA group at one year (rate=24.8%, HR=1.05, p=0.013) and seven years (rate=45.5%, HR=1.05, p=0.017), but not at three and five years.

DISCUSSION AND CONCLUSION: We estimated the costs, mortality and diagnoses of new diseases for OA patients who either did or did not receive a TKA in the U.S. Medicare population. The incremental seven-year cost of TKA was $19,843. This cost does not consider the cost of prescription drugs, which have been reported to be much higher in OA patients who do not undergo TKA. The mortality risk for the TKA patient cohort was approximately half that of the non-TKA group. TKA patients were more likely to be depressed in the first three years after surgery, a finding that suggests the mental health of these patients should be monitored and treated if necessary. This study demonstrates the potential benefit of TKA in reducing mortality, at a relatively minimal long-term incremental cost.

Table 1: Hazard ratios for mortality and new disease diagnoses after TKA. * indicates significance to p<0.05.

<table>
<thead>
<tr>
<th>Years After Surgery</th>
<th>Rate (%)</th>
<th>Hazard Ratio</th>
<th>Rate (%)</th>
<th>Hazard Ratio</th>
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<tr>
<td>1 Year</td>
<td></td>
<td></td>
<td>3 Years</td>
<td></td>
<td>5 Years</td>
<td></td>
<td>7 Years</td>
<td></td>
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<tr>
<td>Congestive Heart Failure</td>
<td>10.6</td>
<td>1.00</td>
<td>21.1</td>
<td>0.89*</td>
<td>31.0</td>
<td>0.91*</td>
<td>40.9</td>
<td>0.93*</td>
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<tr>
<td>Diabetes</td>
<td>24.8</td>
<td>1.05*</td>
<td>33.5</td>
<td>0.98</td>
<td>40.1</td>
<td>1.00</td>
<td>45.5</td>
<td>1.05*</td>
</tr>
<tr>
<td>Depression</td>
<td>9.37</td>
<td>1.28*</td>
<td>17.1</td>
<td>1.05*</td>
<td>23.4</td>
<td>1.00</td>
<td>29.5</td>
<td>1.03</td>
</tr>
<tr>
<td>Mortality</td>
<td>0.99</td>
<td>0.49*</td>
<td>4.43</td>
<td>0.48*</td>
<td>9.62</td>
<td>0.50*</td>
<td>17.1</td>
<td>0.54*</td>
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</tbody>
</table>

POSTER NO. P150

Comparison of In Vivo Coronal Plane Patella Tracking Following Knee Arthroplasty Using the MAUS Technique

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INTRODUCTION: Previous attempts to measure coronal plane patellofemoral kinematics following knee replacement have suffered from methodological drawbacks; the patella being obscured by the components, metal artefact and technical inaccuracies. The aim of this study was to assess whether there was any significant difference in the patellofemoral kinematics between normal, total knee replacement (TKR) and patellofemoral joint replacement (PFJR) patients using the validated MAUS™ technique (combining Motion Analysis with UltraSound).

METHODS: Sixty patients were recruited into three groups; normal healthy volunteers (Normal), TKR, and PFJR patients. The MAUS technique incorporates a 12 camera motion analysis system (measuring bony landmarks on tibial and femoral segments) and an ultrasound probe (providing coordinates for the patella) during a squat exercise. From the measurements at 15° increments between 0 and 90° of knee flexion, patellofemoral kinematics were described relative to both the femur and tibia with 6 degrees of freedom.

RESULTS: The accuracy of the MAUS technique registering the ultrasound images within the motion capture system is 1.84 mm (2 x SD). The three groups showed very different patella tracking patterns (Figure 1). The sine wave pattern of coronal plane patella motion displayed by the Normal group was not recreated in the TKR or PFJR groups. Movements of the Normal group were significantly different from the TKR group (p=0.03) and the PFJR group (p<0.01), while there was no significant difference between the TKR and PFJR groups (p=0.27).

DISCUSSION AND CONCLUSION: We present a new, accurate, reliable in vivo technique for measuring 3D patellofemoral kinematics in native and replaced knees. Our data suggest that many aspects of patellofemoral kinematics are absent following TKR and PFJR, which could be addressed in future designs of knee arthroplasty.
POSTER NO. P151

Tantalum Cones in Revision Total Knee Arthroplasty: A Promising Short-term Result with 29 Cones in 21 Patients

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Antonio Rios-Luna, MD, PhD, El Ejido, Almeria, Spain
Francisco Chana Rodriguez, MD, Madrid, Spain
Jose M. Rojo-manaute, MD, PhD, Madrid, Spain
Pablo S. sanz ruiz, MD, Madrid, Spain
Felipe Benito Del Carmen, MD, Madrid, Spain
Rodrigo Jimenez Garcia, MD, Madrid, Spain
Javier Vaquero Martin, MD, PhD, Madrid, Spain

INTRODUCTION: In the setting of severe bone loss following total knee arthroplasty (TKA), the best method of treatment has not been established. The mechanical and osteoconductive capacity of trabecular metal may provide early mechanical support and an adequate environment to facilitate biological fixation and restoration of bone mass. METHODS: Twenty-nine porous tantalum metaphyseal cones were implanted during 21 revision TKA in 14 women and seven men who had an average age of 73.3 years at the time of the procedure. Sixteen revisions were considered aseptic and five septic. In 10 patients a femoral cone was inserted, in eight cases a double cone, femur and tibia was inserted and in three cases a cone was implanted just in the tibia. Pre-op 13 patients had a primary design and eight a stemmed revision one. According to the Anderson Institute bone defect classification, 14 knees had an F3 defect and three knees had an F2B defect. Tibia defects were rated as T2A in three cases, T2B in four cases and T3 defect in five knees. A rotating hinge knee design (RHK, Zimmer) was inserted in 12 patients and a condylar T2B in four cases and T3 defect in five knees. A rotating hinge knee was used in 11 cases and a condylar constrained design (LCCK, Zimmer) in nine cases. In 10 cases the diaphysis was cemented and in 11 cases just the metaphysis. RESULTS: At an average of 32 months all metaphyseal cones showed evidence of stable osseointegration. According to the Knee Society Score the results were rated as excellent in 12 cases, good in six cases, fair in two and poor in one case. All excellent results had a primary implant pre-op (p: 0.002). Other factors like septic or aseptic revision, type of cementation or use of one or two cones were not significant in terms of function or complications but there were more excellent results in the group of RHK prosthesis than in the group of LCCK ones. Complications included five fractures of the distal femoral epicondyles uneventfully healed, two cases of recurrent sepsis (one requiring removal of a well-fixed cone and the other successfully treated with debridement and retention of the implant) and two cases with a partial patellar tendon avulsion. One patient with metaphyseal cementation of the femur over a previously failed diaphyseal hinge cemented implant suffered an early displacement of the femoral reconstruction but became stable after a non-ambulant period. Her result was fair.

DISCUSSION AND CONCLUSION: In this series, despite a high rate of complications in the presence of severe bone loss the potential for biologic fixation of the tantalum metaphyseal cones provide good results and structural support in the short term and may provide durability of the reconstructions in the long term. The tantalum cones provide the environment for bone graft osseointegration, repair of femoral fractures and effective interdigitation of cement mantle into the trabecular metal cone. Diaphyseal cementation seems to be necessary in cases with previous revision designs, ectatic and atrophy femoral diaphysis unless weight bearing is protected until tantalum cone is osseointegrated.

POSTER NO. P152

Is Socio-Economic Status a Risk Factor for Stiffness after Total Knee Arthroplasty? Multicenter Case-control Study

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Douglas A. Dennis, MD, Denver, CO

INTRODUCTION: Stiffness requiring manipulation after total knee arthroplasty (TKA) is a common complication with most outcomes reporting only modest improvement in ROM (average 30 degrees). Preoperative range of motion has always been thought to be the sole determinate of postoperative ROM. However, evidence suggests that there is a disparity in functional outcomes among minority and economically disadvantaged individuals after total knee arthroplasty. The purpose of our study was to determine if socio-economic status is a risk factor for manipulation following total knee arthroplasty. METHODS: A multicenter case-control study was conducted. Cases requiring manipulation following total knee arthroplasty were identified (n=521). Controls (no manipulation) were randomly selected using a 2:1 ratio within site and physician (n=1036). Multiple logistic regression analysis was used to determine the effects of race, gender, BMI, age, and insurance type. RESULTS: Compared to Caucasians, African Americans have a two-fold increase in the odds of undergoing manipulation (OR 2.13, 95% CI 1.46-3.11). Compared to patients >75 years old, patients <45 years old also had a two-fold increase in the odds of undergoing a manipulation (OR 2.12, 95% CI 1.004-4.48). As compared to patients with private insurance, patients with Medicare have decreased odds of manipulation (OR .485, 95% CI .341-.689). Medicaid was not associated with an increased risk of manipulation. No other factors were significantly associated with the utilization of manipulations. DISCUSSION AND CONCLUSION: Socio-economic factors appear to influence the need for manipulation following TKA. Both young and minority patients may require closer supervision following TKA. Further research is needed to elucidate the role that socio-economic factors have on the disparity and poor outcomes after
Pre-operative Recurvatum Deformity with Knee Osteoarthritis: Is a Hinge Prosthesis Always Necessary?

INTRODUCTION: The only predictable method of correcting a recurvatum knee deformity is by using a hinge knee prosthesis (HKP). The disadvantages of a HKP are excessive bone resection and constraint. The aim of this study is to assess the functional outcome of patients with pre-operative recurvatum deformity treated with a primary conventional total knee arthroplasty (TKA).

METHODS: This is a prospective study. Inclusion criteria was patients who underwent primary TKA from 2004 to 2008 in our hospital joint registry, treated by multiple surgeons, with idiopathic and physiological pre-operative recurvatum deformity with knee osteoarthritis. Patients without a two-year follow up and those with HKP were excluded. Patient demographics, pre-operative range of motion (ROM), post-operative ROM and functional outcome and quality of life scores were noted. Risk factors for post-operative recurvatum in patients with pre-operative recurvatum were analyzed among group 1 and 2 patients. Patients with zero degrees of extension at two years after a conventional total knee arthroplasty during that same time period from the joint registry were used as a control group. Comparison of functional outcome between patients in group 1 and 2 were made against the control group.

RESULTS: A total of 297 patients with pre-operative hyperextension (mean -5.7 degrees SD 3.7) were included in the study. Two patients with a hinge prosthesis were excluded. We classified our patients into two groups, pre-op recurvatum of less than 5 degrees (group 1) and more than 5 degrees (group 2). There were 198 patients (66.7%) in group 1 and 99 patients (33.3%) in group 2. At two years, patients in group 2 were more likely to have recurvatum (55.6%) than those in group 1 (39.6%) (p=0.01). When analyzing the functional outcome between patients with pre-operative recurvatum against those with the control group, there was no significant difference in Knee function, Oxford and SF 36 scores. When analyzing Group 1 against control group, there was no difference in functional scores except for Oxford knee score (group 1 mean 19.2 SD 6.4, Control group mean 18.2 SD 5.1, p<0.01). There was also a statistical difference (p=0.03) in the mean Oxford knee score between group 2 (mean 17.9 SD 3.9) and control (mean 18.2, SD 5.1). When analyzing Group 1 against group 2, there was also a statistical difference in the mean Oxford knee score (p<0.01). There was no difference in SF-36 scores between the groups 1 and 2. There was a significant difference (p<0.01) in the mean recurvatum postoperatively between group 1 (mean 1 degree SD 6.5 degrees) and group 2 (mean 3 degrees SD 5 degrees). There was no increased risk of post-operative recurvatum with age, gender, body mass index or CR or PS knee in patients with pre-operative recurvatum. Recurvatum at six months did not predict recurvatum at two years (p=0.12).

DISCUSSION AND CONCLUSION: Patients with pre-operative recurvatum deformity can be treated with a conventional knee arthroplasty to achieve good functional results. Although there is a risk of post-operative recurvatum in patients with more than 5 degrees of pre-operative hyperextension, there is minimal clinical significant difference in the functional scores between the two groups. At short-term follow up, a HKP is not necessary for treating preoperative idiopathic or physiologic recurvatum deformity with knee osteoarthritis.

Bariatric Orthopaedics: Total Knee Replacement with a Body mass Index Greater than 50 kg/m^2

INTRODUCTION: Obesity may be associated with an increased risk for osteoarthritis of the knee requiring eventual total knee arthroplasty. Although all patients in our practice are advised to lose weight, either with non-operative methods or through bariatric surgery, some patients have difficulty losing weight, and do not want to undergo gastric bypass or banding procedures. Because of their extreme obesity and added soft tissue, there is concern for an increased risk of complications. The purpose of this study was to assess the clinical and radiographic outcomes of total knee arthroplasty in
patients who had body mass indices (BMI) greater than 50 kg/m². METHODS: Twenty total knee arthroplasties in 17 patients who had a body mass index of 50 kg/m² or greater (mean 52, maximum 65 kg/m²) who were operated by two surgeons, and who had a mean age of 57 years (range, 50 to 65 years), were reviewed. Outcomes were evaluated using the Knee Society pain and function scores, x-ray evaluation for radiolucencies, and the incidence of revision procedures. The outcomes were compared to a matched group of patients operated by the same surgeon over the same time period, matched by age, gender, and type of procedure (unilateral or bilateral). The pre-operative clinical scores and length of follow up were similar for both groups. RESULTS: At a mean final follow up of 50 months (range, 26 to 67 months), the overall implant survivorship in the extreme obesity cohort was 95% (19/20). Survival rates were similar for the high BMI and low BMI groups (95% versus 100%; p=1.0). The mean Knee Society objective and functional scores in the extreme obesity cohort were 87 points (range, 58 to 97 points) and 82 points (range, 65 to 100 points), respectively, compared to 95 points (range 64 to 100 points) and 96 points (range, 68 to 99 points) in the matched cohort. Additionally, there were six patients (30%) in the extreme obesity cohort who had either Knee Society functional or objective scores of 80 points or less. Excluding the one revision, there was no evidence of tibial or femoral component progressive radiolucencies or component loosening on serial post-operative radiographs. DISCUSSION AND CONCLUSION: The results of this study suggest that although survivorship may be similar between the two cohorts, patients who have a BMI greater than 50 kg/m² have the potential for lower post-operative functional scores. Additionally, there did not appear to be an increased number of post-operative wound problems with this patient cohort. Overall, although the authors encourage patients to decrease their weight as much as possible prior to total knee arthroplasty, it is encouraging that even in these extremely obese patients, total knee arthroplasty can have acceptable results. Longer term follow up is needed to evaluate whether wear-related revisions are higher in this extreme patient population.

POSTER NO. P156

Is Simultaneous Bilateral Total Knee Arthroplasty (BTKA) as Safe as Staged BTKA?
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INTRODUCTION: Simultaneous bilateral total knee arthroplasty (BTKA) continues to be a highly debated topic. Most studies compare the relative safety of BTKA to unilateral TKA, however we do not think this is the most accurate estimate of the risks. We feel the most useful comparison is between simultaneous bilateral TKA and staged procedures within six months. These patients fall within the critical post-operative period when increased morbidity and mortality would likely be present. Any period of time longer than six months between surgeries is effectively two separate surgeries. METHODS: A retrospective study of prospective collected data from 2005 - 2009, 371 patients who underwent simultaneous BTKA where compared to 67 patients who underwent staged < 6 months BTKA. Patient's demographics (gender, age, BMI), clinical variables (American Society of Anesthesiologists (ASA) score, anesthesia, antibiotics), and in hospital outcomes (complications, length of stay and transfusion requirements) were recorded and analyzed. Complications included death, pulmonary embolism (PE), and deep surgical site infection (SSIs). The two groups were compared using Student's t-test for continuous variables and Chi-Square tests for categorical variables. Statistical significance set at p<0.05. RESULTS: There were 371 patients who underwent 742 simultaneous BTKA procedures while 67 patients underwent 134 staged < 6 months BTKA procedures. The two groups were well matched for demographic and clinical variables. There was not a significant difference in complication rate between the two cohorts (p=0.01). However there was one death in the simultaneous BTKA group, and seven pulmonary embolism. The mean transfusion rate was 1.39 units/patient for BTKA versus 0.66 units/patient during both staged TKA hospitalizations (p=0.04). When considered in aggregate the mean length of stay for both staged TKA hospitalizations was 8.93 days/pt while the mean simultaneous BTKA length of stay was significantly less at 4.94 days/pt (p=0.001). DISCUSSION AND CONCLUSION: To our knowledge this is the first direct comparison between simultaneous BTKA and staged < 6 months BTKA. The increased transfusion requirements for simultaneous bilateral procedures are not surprising given a higher single intraoperative blood loss. Additionally it is intuitive that two hospitalizations would exceed the length of stay of one hospitalization and incur an increased healthcare cost. Our experience demonstrates that simultaneous BTKA is as safe as staged BTKA within six months in terms of overall complications but there were trends towards increased PE in the simultaneous BTKA group. Larger patient populations from a multi-center study is needed to more accurately determine the difference between simultaneous and staged < 6 months BTKA.

POSTER NO. P157

In Vitro Chondrocyte Viability in Response to Exposure of Metallic Wear Debris Particulate
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Tristan Maerz, BS, Royal Oak, MI
Kevin Baker, MS, Royal Oak, MI

INTRODUCTION: Unicompartmental knee arthroplasty (UKA) has been used in the past decades to treat progressive cartilage degeneration in a single compartment. Concern has been raised over the rate of revision procedures for polyethylene wear and osteoarthritic progression into the adjacent compartment. Few studies have examined the pathology of cartilage degeneration in the setting of UKA. This study aims to investigate the viability of knee chondrocytes introduced to high and low concentrations of orthopaedic wear debris particulate. METHODS: Unicompartmental knee arthroplasty has been used in the past decades to treat progressive cartilage degeneration in a single compartment. Concern has been raised over the rate of revision procedures for polyethylene wear and osteoarthritic progression into the adjacent compartment. Few studies have examined the pathology of cartilage degeneration in the setting of UKA. This study aims to investigate the viability of knee chondrocytes introduced to high and low concentrations of orthopaedic wear debris particulate. RESULTS: All groups displayed a minor decrease in cell viability after 24 hours of exposure to particles. Similarly, a second distinct decrease in viability occurred at the day 3 timepoint. Days 5 and 7 yielded little change in cell viability. Results are displayed in Figure 1. Observations of light microscopy revealed cells may actively engulf particles over time. Images show specific tissue concentrations at the same locations as chondrocytes with few particles present between cells. DISCUSSION AND CONCLUSION: Wear debris has been implicated as a contributing factor to osteolysis and component loosening. A potential effect on the cellular level can ultimate
lead to effects on the entire tissue and complications on the clinical level. A decrease in chondrocyte viability has been shown in response to the presence of particulate wear debris. Our results showed decreases in cell viability were most noticeable between 24 and 72 hours after introduction to particles. Chondrocyte death may contribute to progression of cartilage degeneration into healthy compartments of the knee.

**POSTER NO. P158**

**Antibiotic-loaded Cement Spacer in the Treatment of the Infected Knee Replacement**

Lih Wang, MD, PhD, Busan, Republic of Korea

Kyung Taek Kim, Busan, Republic of Korea

**INTRODUCTION:** The treatment results of two-stage exchange arthroplasty of the infected knee replacement with the functional or non-functional types of antibiotic-loaded cement spacers were compared and analyzed.

**METHODS:** Between March 2000 and October 2007, we reviewed 30 patients who underwent two-stage exchange arthroplasty of the infected knee replacement and were followed up at least three years. Of the 30 cases, 12 cases used the functional type (articulating type) and 18 cases used the non-functional type (static type).

**RESULTS:** Ten cases (33.3%) showed bacterial growth in the preoperative bacterial culture, and 20 cases (66.7%) showed no bacterial growth. All of 27 cases showed no evidence of reinfection until the last follow up after two-stage exchange arthroplasty. One out of the 12 cases (8.3%) in the functional group and two out of the 18 cases (11.1%) in the non-functional group had a reinfection. The range of motion (ROM) of the knee joint and HSS knee rating scale increased more significantly in the functional group than in the non-functional group.

**DISCUSSION AND CONCLUSION:** The functional group showed better results in the knee ROM and HSS knee rating score as well as easier exposure than the non-functional group even though there was no statistical difference in the period and successful rate of treatment between the two groups.

**Figure 1: Cell viability of human articular chondrocytes determined by MTT assay over a 7 day period.**

**POSTER NO. P159**

**Which Surgical Technique Reduces Rotational Mismatch of the Tibial Component on the Femoral Component?**

Stephen M. Howell, MD, Sacramento, CA

Maury L. Hull, PhD, Davis, CA

**INTRODUCTION:** Variability in femoral and tibial component internal-external (I-E) rotational alignment can lead to improper joint kinematics, pain, and patellofemoral complications. Tibial component rotational malalignment in the transverse plane has reported errors ranging from 44 degrees of internal rotation to 46 degrees of external rotation. Computed-tomography scans have shown 30° of I-E rotational mismatch between the anteroposterior axes of the tibial and femoral components with a mismatch of >10° compromising function and contact kinematics. Ideally implanted femoral and tibial components should have no I-E rotational mismatch. We determined which of four alignment techniques reduce rotational mismatch: 1) kinematic alignment with patient-specific guides (KA-PSG), 2) kinematic alignment of the femoral component and alignment of the tibial component parallel to the medial tibial spine (KA-MTS), 3) kinematic alignment of the femoral component and alignment of the tibial component with conventional instruments (KA-CI), 4) mechanical alignment of the femoral and tibial components to the surgeons preferred anatomic landmarks with conventional instruments. In the MA group, the I-E rotation of the femoral component was aligned to the posterior condylar line after correcting for wear and the tibial component alignment was either with patient-specific guides, parallel to the medial tibial spine, or to accepted anatomic landmarks with conventional instruments. In the MA group, the femoral and tibial components were aligned with CI to the femoral and tibial rotational landmarks preferred by the surgeon.

**METHODS:** Rotational mismatch was measured with computed-tomography scans in 84 KA-PSG TKAs, 115 KA-MTS TKAs, 184 KA-CI TKAs, and 58 MA-CI TKAs. In the three KA groups, the I-E rotation of the femoral component was aligned to the posterior condylar line after correcting for wear and the tibial component alignment was either with patient-specific guides, parallel to the medial tibial spine, or to accepted anatomic landmarks with conventional instruments. In the MA group, the femoral and tibial components were aligned with CI to the femoral and tibial rotational landmarks preferred by the surgeon.

**RESULTS:** Rotational mismatch was different between surgical techniques (p < 0.0001). The least rotational mismatch was the 13° range (5 to 8°) of the KA-PSG technique and the 14° range (6 to 8°) of the KA-MTS technique (NS). The 20° range (11 to 9°) of the MA-CI technique was higher and the 21° (9 to 13°) of the KA-CI technique was the highest rotational mismatch of all four techniques (p < 0.05).

**DISCUSSION AND CONCLUSION:** The techniques of kinematically aligned TKA with patient-specific guides and alignment of the AP axis of the tibial component parallel to the medial tibial spine had the least rotational mismatch of the tibial component on the femoral component. These results suggest that the increased rotational mismatch is from the imprecision (or variability) from aligning the internal-external rotation of the tibial component to accepted anatomic tibial rotational landmarks with conventional instruments.
**Micromotion Analysis of Lavage Techniques for Unicompartmental Knee Arthroplasty (UKA)**

**Sebastian Jaeger, MSc, Heidelberg, Germany**

**Johannes S. Riegler, MSc, Heidelberg, Germany**

**Christian Schuld, MSc, Heidelberg, Germany**

**Philippe P. Kretzer, PhD, Heidelberg, Germany**

**Michael Clarius, MD, Bad Rappenau, Germany**

**Rudi Bitsch, MD, Heidelberg, Germany**

**INTRODUCTION:** The comparison between jet lavage and conventional lavage for unicompartmental knee arthroplasty (UKA) showed a significant reduction of implant subsidence, micromotion and the risk of fractures using jet lavage.

**METHODS:** In a randomized experimental study UKA was performed in 12 paired whole human cadaver legs without any injury of bone and ligamental structures. Donor data: t/m = 3/9, mean age 74.42 years, mean weight 73.52kg and mean height 1.71m. Before cementing one side of the paired knees was cleaned using pulsed jet lavage (Group A), contra lateral cleaning was done with conventional syringe lavage (Group B). The same amount of bone cement was used for all knees. In order to adapt the tibiae to the experimental setup they were shortened to a uniform length. To fix the tibiae in a standardized way they were fixed to a frame with a casting resin consisting of two components. The fixed tibiae were integrated into a hydraulic testing machine. The dynamic axial load was applied using a femoral component of the required sizes and a custom made fixture frame to eliminate shear forces. The tibia implant pre-load was 50N. A load of 980N was applied using a sinusoidal waveform at 1Hz for 10,000 cycles. After reaching 10,000 cycles the applied load was increased for 200N every 200 cycles until periprosthetic tibial fractures. The micro movement of the implant was measured in three planes and six degrees of freedom by six linearly variable differential transducers with a resolution of 0.1µm. The implant subsidence, micromotion, fracture load and bone mineral density (BMD) were measured. Statistical analyses were performed with SPSS 18.0 for Windows using the Wilcoxon-Test and the Spearman rank correlation. The tests were two-sided and a p value of 0.05 was considered significant.

**RESULTS:** The BMD of group A (jet lavage) and B (conventional syringe lavage) did not differ significantly (p=0.622). The jet lavage group showed a reduced mean implant subsidence of 29.61µm (range: 7.03-44.78µm) and group B of 36.46µm (range: 19.45-1945.69µm) of the lavage group. The difference was statistically significant p=0.034. Group A showed a mean relative micromotion of 23.20µm (range: 7.03-44.78µm) and group B of 36.46µm (range: 8.38-71.65µm). This difference was statistically significant between the two groups (p=0.005). The fracture load between group A 4.6kN (range: 2.4-6.6kN) and group B 3.7kN (range: 1.6-5.6kN) was statistically significant p<0.001. A correlation between the BMD and the implant subsidence of the lavage group could be found with a correlation coefficient of r=-0.790 (p=0.002). For the jet lavage group was no significant correlation found r=-0.392 (p=0.208).

**DISCUSSION AND CONCLUSION:** The results of this experimental study showed that the use of the jet lavage reduces significantly implant subsidence, micromotion and the risk of fractures for UKAs. The correlation between BMD and implant subsidence was significant for the conventional syringe lavage group. Therefore the use of jet lavage reduces implant subsidence for specimens with low bone quality.

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**Evaluation of Tranexamic Acid for Reducing Blood Loss After TKA**

**Timothy Diiorio, MD**

**Andrea Irizarry, BS, Philadelphia, PA**

**Peter Sharkey, MD, Media, PA**

**INTRODUCTION:** Numerous studies have suggested that the use of tranexamic acid (TA) during or prior to total knee arthroplasty (TKA) significantly reduces perioperative blood loss and allogenic transfusion requirements. One notable weakness in most of these studies is the collection of autologous blood prior to surgery which could be described as a confounding factor in determining blood loss based on hemoglobin drop, especially if protocol for blood collection is not standardized. The aim of the study was to determine the efficacy of TA in reducing blood loss and transfusion.

**METHODS:** We retrospectively identified 80 consecutive patients who underwent bilateral total knee arthroplasty by a single surgeon. None of these patients donated autologous blood prior to surgery. The first 40 patients did not receive TA while the second group of 40 patients received a single dose (20mg/kg) of TA approximately 10 minutes prior to deflation of tourniquet of the first knee. Patients’ charts were reviewed to identify detailed data including the hemoglobin level, hematocrit, transfusions, postoperative narcotic use and length of hospital stay.

**RESULTS:** Both groups of patients were largely similar based on demographic data. Blood loss, as determined by the hemoglobin drop on postoperative day 2, among patients who received TA was less than that of patients who did not receive TA (4.55 vs 5.37 g/dl). In addition, 52% of control patients versus 8% of study patients required allogenic blood transfusion. Finally, study patients had significantly higher postoperative hemoglobin, shorter LOS, less analgesic requirements and better discharge ROM.

**DISCUSSION AND CONCLUSION:** It appears that use of TA with TKA does reduce postoperative bleeding and improve certain outcome parameters without a demonstrated increased risk of thromboembolic disease.

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**Is Polyethylene Exchange Only Ever Appropriate for Periprosthetic Knee Instability?**

**Thomas K. Fehring, MD, Charlotte, NC**

**Robert C. Baird, III, MD, Mobile, AL**

**Anne C. Dennos, BS, Charlotte, NC**

**INTRODUCTION:** Prosthetic knee instability is a common cause of patient dissatisfaction and early failure following total knee arthroplasty (TKA). Technical considerations account for the majority of these problems. Whether polyethylene exchange only is ever appropriate in the management of such patients remains controversial. Intuitively its use should be dictated by the type of instability pattern present, however no instability classification system exists that would guide its appropriate use. The purpose of this study was to classify a series of patients revised for knee instability and describe treatment categories where polyethylene exchange only was successful.

**METHODS:** This is a retrospective series of 174 total knees revised for prosthetic knee instability. Each case was classified into five distinct categories: global instability, flexion instability, extension instability or recurvatum, coronal instability with competent ligaments, coronal instability with incompetent ligaments. The number of patients treated with polyethylene exchange in each category was documented. Success of polyethylene exchange only was defined...
as a Knee Society score > 80 and a Knee Society Stability score ≥ 20.

RESULTS: Of the 174 patients revised for periprosthetic knee instability, 74 had polyethylene exchange only to manage this problem. Twenty-seven patients with global instability were treated with polyethylene exchange only. Six patients with flexion instability and five patients with extension instability were treated with polyethylene exchange only. Thirty-six patients with coronal instability with competent ligaments were treated by polyethylene exchange only. No patients with coronal instability with incompetent ligaments were treated with polyethylene exchange only.

DISCUSSION AND CONCLUSION: Polyethylene exchange only is a viable treatment option for those patients with global instability or coronal instability with competent ligaments. Flexion instability caused by posterior cruciate incompetence can be successfully managed with an anterior lipped liner; however, this treatment option is inappropriate if flexion instability caused by flexion extension mismatch occurs.

POSTER NO. P163
Comparison of Intrathecal Morphine and Periarticular Multimodal Drug Injection for 1st Total Knee Arthroplasty
Nattapol Tammachote, MD, Bangkok, Thailand
Supakit Kanitnate, MD, Prathumthani, Thailand
Sudsayam Manuwong, MD, Pathumthani, Thailand

INTRODUCTION: Postoperative pain after total knee arthroplasty has been a patient's top concern. It influences the overall outcome. There is no study comparing the efficacy of spinal anesthesia combined with intrathecal morphine and periarticular multimodal drug injection.

METHODS: Sixty osteoarthritic knees who underwent total knee arthroplasty in 2010 were randomized into two groups. The spinal anesthesia with 200 µg intrathecal morphine was used in the first group while periarticular multimodal drug injection used in the second group. The infiltration comprised of morphine 5 mg, epinephrine 1:1000 0.6 ml, Ketorolac 30mg and 0.5% Bupivacaine 25 ml. The average age of patient is 68 years old. The outcomes were pain levels and patient satisfaction measured by using VAS score. Post-operative pain was managed with Ketorolac by patient controlled analgesia (PCA) for 48 hours. One surgeon who did not recognize the allocation until the bone cut was finished operated on all knees using conventional technique with posterior stabilized implants. Patients and evaluators were blinded. All patients were followed up to three months.

RESULTS: No significant difference in postoperative pain level, patient satisfaction level, PCA drug consumption, blood loss collected in drain, knee function were observed. However there was a significant difference (p<0.05) in the percentage of patients who vomited and needed anti-vomiting drugs: 89% in the intrathecal morphine group and 35% in the periarticular infiltration group. Thirty-five percent of patients in the first group while periarticular multimodal drug injection used in the second group. Thirty-five percent of patients in the first group also experienced puritus severe enough to ask for anti-puritic drug injection, compared to 13% in the second group.

DISCUSSION AND CONCLUSION: In conclusion, the two techniques provide no differences in pain control ability. The periarticular multimodal drug injection is advantageous due to lower rate of vomiting and puritus.

POSTER NO. P164
Five to Nine Year Results of High Flexion Fixed Bearing Total Knee Arthroplasty: How Many Knees Survived?
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Jjak Jang, MD, Seoul, Republic of Korea
Joon Kyu Lee, MD
Sae Hyung Chun, MD, Seoul, Republic of Korea
Yoon Whan Roh, MD, Seoul, Republic of Korea
Sahnghoon Lee, MD, Seoul, Republic of Korea
Sang Cheol Cheol Seong, MD, Seoul, Republic of Korea
Myung Chul C. Lee, MD, Seoul, Republic of Korea

INTRODUCTION: There is concern whether deep flexion will increase early loosening. The aim of this study was to evaluate the mid and long term survival rate, clinical and radiological results of a fixed bearing high flexion posterior stabilized (PS) total knee arthroplasty (TKA).

METHODS: Between July 2001 and February 2006, 399 high flexion PS TKAs (335 patients) were performed and 339 knees (284 patients, 84.8%) had been followed up for mean 6.1 years (range, 5 to 9.2 years) clinically and radiographically. We evaluated degree of knee flexion, Knee rating system of the Hospital for Special Surgery (HSS) and Knee Society (KS) scoring system, and survival rate.

RESULTS: The mean flexion improved from 125.0° preoperatively to 130.6° at the latest follow up. Two-hundred-seventy-four knees (80.8 %) and 96 knees (28.3 %) showed more than 125° and 140° of flexion. The mean KS clinical and function score improved from 39 to 93 points (p<0.01) and from 40 to 85.4 points (p<0.01). The estimated survival rate at nine years with revision for any reason and for aseptic loosening was 89.4% and 91.1%.

DISCUSSION AND CONCLUSION: The high flexion PS TKA showed satisfactory clinical results with high degree of knee flexion. The relatively long term survival was about 90% in this series.

POSTER NO. P165
Cross-linked Polyethylene and Polished Trays: Effective Weapons Against Knee Wear?
Douglas Van Citters, PhD, Hanover, NH
John H. Currier, MS, Hanover, NH
Meagan E. Tibbo, BA, Hanover, NH
Barbara H. Currier, MChE, Hanover, NH
Michael B. Mayor, MD, Hanover, NH

INTRODUCTION: Highly crosslinked polyethylene has been introduced in total knee arthroplasty (TKA) to combat wear. Polished tibial trays have replaced matte-finished trays in some modular TKAs also to address bearing backside wear. To date there have been no retrieval studies distinguishing and comparing the respective impacts on clinical wear.

METHODS: An IRB approved retrieval library was queried to generate a matrix of study components as shown below (n=2 manufacturers)

<table>
<thead>
<tr>
<th>Crosslinked UHMWPE</th>
<th>Gamma-Barrier UHMWPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matte Tray</td>
<td></td>
</tr>
<tr>
<td>n=14</td>
<td>Avg. 28 mos, 1-48 mos.</td>
</tr>
<tr>
<td>Polished Tray</td>
<td></td>
</tr>
<tr>
<td>n=30</td>
<td>Avg. 20 mos, 2-69 mos.</td>
</tr>
</tbody>
</table>

Through-thickness wear of each insert was measured by comparing retrieval thickness to as-manufactured dimensions.
at multiple locations or by comparing thicknesses to the short-duration or never-implanted cohort of each size. A stepwise linear regression was performed, controlling for duration. RESULTS: Average wear rates for each cohort of devices ranged from -0.001 mm/month to 0.014 mm/month. The stepwise linear regression shows that duration and a polished tray are significant predictors of wear. Crosslinked material was not significant at the 0.05 level.

DISCUSSION AND CONCLUSION: Unlike hips, knees have been shown to have significant backside wear. It is unclear whether crosslinking has significant clinical advantage. This study shows that the finish of the tibial tray is significant predictor of wear, and crosslinking might not be. Tibial construct designs and material choices should account for unintentional backside motion to minimize wear.

POSTER NO. P166
Can Cementing Technique Reduce the Cost of a Primary Total Knee Arthroplasty?
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Mayank Agrawal, Smithtown, NY
Vera L. Whalen, NP, Forest Hills, NY
Hebah El-Gendi, MS
Vijay J. Rasquinha, MD, New Hyde Park, NY

INTRODUCTION: With the recent trends in healthcare reforms, cost saving has emerged as one of the most important aspects of healthcare. More than 500,000 total knee arthroplasties (TKA) are done in the U.S. annually, costing more than $11 billion. Although extensive research has been conducted evaluating the cost effectiveness of TKA, the role of cementing technique in cost saving has not yet been investigated. Literature review indicates that two packets of bone cement are usually used for a primary TKA. The senior surgeon has been using only one packet of bone cement for primary TKA for the last 10 years without any increase in complications. The hypothesis of this study was that almost all primary TKA could be successfully done using just one packet of bone cement, irrespective of the size of the knee.

METHODS: A retrospective review of the total joints database for a single surgeon at a teaching hospital revealed 767 cases of primary TKA (Current Procedural Terminology Code: 27447) between 2000-2009. Data collection included patient demographics and indications, the amount of bone cement and the implant type and size used in each case. The Knee Society functional and radiological scores, as well as any complications that occurred were also recorded. A cost analysis was done for the use of bone cement.

RESULTS: The patient demographics were usual for a TKA population. All TKA cases were done with a single packet of cement irrespective of the implant size and type used. No case was revised for aseptic loosening. No case had progressive radiolucent lines on radiographs. There was one case of acute infection requiring incision and drainage. Four other cases were revised for other reasons (two stiffness, one instability and one periprosthetic fracture).

DISCUSSION AND CONCLUSION: During the current era of cost containment and cost accountability in healthcare, hospitals and joint replacement surgeons have been targeted for cost control. Although the standardization of TKA clinical pathways and TKA implants has taken priority in many hospitals for cost containment, one costly aspect of orthopedic surgery that remains overlooked is the use of bone cement. Our study indicates that almost all TKA can be done successfully using just one packet of bone cement, irrespective of the size of the knee, and without any increase in the rate of aseptic loosening or other complications. Considering the cost of one antibiotic laden cement packet to be $300-$500, this would mean considerable cost saving (about $300,000-$500,000 for every 1000 TKA).

POSTER NO. P167
Should Preoperative Deformity Determine Femoral Component Rotation in Total Knee Arthroplasty?
Patel'Anay R. Rajendra, MD, Chicago, IL
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Mark A. Yaffe, MD, Chicago, IL
Raju S. Ghate, MD, Chicago, IL
S. D. Stulberg, MD, Chicago, IL

INTRODUCTION: Most surgeons utilize one of three axis options in conventional total knee arthroplasty (TKA), the transepicondylar axis (TEA), Whiteside’s line (WSL) and the posterior condylar axis (PCA) with an external rotation correction factor. Each option has limitations and no clear algorithm has been determined for which option to use and when. Many surgeons believe the TEA to be the gold standard for determining rotation however it can be difficult to access intraoperatively. WSL and PCA have been used as surrogates for determining axial rotation in conventional TKA but may also be prone to error. MRI based preoperative planning systems overcome intraoperative limitations while accounting for the individual anatomy of each patient, thus helping optimize femoral component rotation. The goal of this study was to examine if coronal plane deformity had any effect on the relationship of conventional referencing options such as WSL and PCA to the TEA.

METHODS: Utilizing a preoperative planning software based on MRI, we compared the preoperative posterior femoral condyle resections for three different axis options in 176 TKA. The difference in bone resection amount was used to determine the rotational differences between the axis options in all knees. Assuming that the TEA was the ideal rotational axis, we compared the TEA to both WSL and PCA. A 1-sample t-test and paired t-test were then used to determine if there was a significant rotational difference between the various axis options when accounting for degree and direction of preoperative deformity in the coronal plane.

RESULTS: Of the 176 knees in 164 patients, 42 patients had preoperative valgus deformity and 134 patients had preoperative varus deformity. The table below indicates how WSL and PCA approximated TEA for given subgroups of patients.

<table>
<thead>
<tr>
<th>Population</th>
<th>Does WSL approximate TEA?</th>
<th>Does PCA approximate TEA?</th>
</tr>
</thead>
<tbody>
<tr>
<td>All knees (N=176)</td>
<td>No (p=0.016)</td>
<td>No (p=0.001)</td>
</tr>
<tr>
<td>All Varus knees (N=134)</td>
<td>No (p=0.0065)</td>
<td>No (p=0.001)</td>
</tr>
<tr>
<td>Varus Deformity 0-3 degrees (N=29)</td>
<td>No (p=0.018)</td>
<td>Yes (p=0.53)</td>
</tr>
<tr>
<td>Varus Deformity 3-6 degrees (N=57)</td>
<td>Yes (p=0.76)</td>
<td>No (p=0.0008)</td>
</tr>
<tr>
<td>Varus Deformity &gt; 6 degrees (N=48)</td>
<td>No (p=0.036)</td>
<td>No (p&lt;0.0001)</td>
</tr>
</tbody>
</table>

* The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use). For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
**DISCUSSION AND CONCLUSION:** Based on MRI data, our study indicates that preoperative coronal plane deformity should help determine the specific referencing option utilized for femoral component rotation in TKA. Broad application of either WSL or the PCA to all patients regardless of preoperative deformity did not accurately approximate TEA in femoral component rotation. Rather, analysis of the degree and direction of preoperative coronal plane deformity indicates that WSL and PCA should be used in specific scenarios to approximate the TEA. When WSL or PCA either both approximate or do not approximate the TEA, we recommend using the option with a lower standard deviation, and thus less variability. Although this MRI based technology is not in widespread use, we believe the graphic below can assist the majority of surgeons determine when to use WSL or the PCA based on preoperative coronal plane deformity.

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**POSTER NO. P168**

**Sagittal Component Alignment Comparing Instrumentation with a Rigid IM Rod to a Flex IM Rod**

**Kirby Hitt, MD, Temple, TX**

**INTRODUCTION:** There is a paucity of data related to the sagittal alignment of the knee following total knee arthroplasty (TKA). Traditional TKA instrumentation relies on the use of a rigid IM rod to determine the valgus angle of the distal femoral cut with little consideration for sagittal alignment. The purpose of this study was to measure the sagittal alignment of the femoral component using two different techniques: Rigid IM rod versus flexible IM rod.

**METHODS:** A prospective, randomized, controlled study compared sagittal component alignment in TKA with preop alignment. Sagittal alignment was measured from long-view radiographs in 25 patients utilizing a rigid IM rod and 25 patients a flexible IM rod. Preop and postop sagittal alignment was assessed to determine the percentage of patients that were within ±3 degrees from the preop anterior sagittal femoral bow.

**RESULTS:** Rigid IM rod utilization resulted in 46% of patients outside ±3 degrees of preop sagittal alignment compared to the flex IM rod of 21% (0.019). DISCUSSION AND CONCLUSION: The use of a flexible IM rod more accurately reproduces the preop sagittal alignment of the femur compared to conventional rigid IM femoral instrumentation.

**POSTER NO. P169**

**What Do Negative Cultures Tell Us in Periprosthetic Joint Infection?**

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**Harry E. Rubash, MD, Boston, MA**

**Andrew A. Freiberg, MD, Boston, MA**

**Hany Bedair, MD, Newton, MA**

**Sandra B. Nelson, MD, Boston, MA**

**Henrik Malchau, MD, Boston, MA**

**INTRODUCTION:** Identification of a causative pathogen from joint aspirate or operative tissue sample is the standard for diagnosis of periprosthetic joint infection (PJI). However, lack of growth in routine aerobic and anaerobic cultures is not uncommon even in patients with strong evidence for infection by other measures. Regardless treatment options, this negative culture result have been reported in most infection studies. However, the clinical characteristics and outcome of culture negative infection have not been well studied. We therefore retrospectively analyzed our negative culture experience in PJI to evaluate the clinical characteristics and treatment results of culture negative PJI.

**METHODS:** There were 175 PJI (97 THA and 78 TKA) surgically treated and followed up 24 months minimum at our institution from January 2000 to January 2009. The study patients were divided into two groups; (1) 40 joints that showed negative results (culture negative group), and (2) 135 joints that showed positive results (culture positive group) at perioperative cultures from preoperative joint aspirate or intraoperative periprosthetic tissues. The purpose of our study was to measure the sagittal alignment of the femoral component. Placing the femoral component in a more anatomic flexed position may decrease the chance of over-sizing and subsequent overhang of the femoral component.

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For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
antimicrobial coverage for possible resistant organisms in the culture negative cases. However, given that overuse of broad spectrum antimicrobials contributes to the development of multi-drug resistant pathogens and increased cost burden, focus should still be on trying to identify organisms in culture negative PJI. Our results suggest that culture negativity is not necessarily a negative prognostic factor for infection control.

POSTER NO. P170
Mortality Risk Assessment of Patients Undergoing Total Knee Arthroplasty After Stent Placement
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Jeffrey N. Katz, MD, Brookline, MA
Thomas S. Thornhill, MD, Boston, MA
Elena Losina, MD, Boston, MA

INTRODUCTION: The number of patients treated with coronary stents, who subsequently undergo non-cardiac surgery has risen dramatically over the past decade. Clopidogrel and aspirin are essential for the prevention of stent thrombosis. However, the optimal use of clopidogrel in non-cardiac surgery, such as total knee arthroplasty (TKA) remains unknown. The balance between the risk of bleeding due to TKA and stent thrombosis has not been examined rigorously.

METHODS: We developed a decision analysis model to examine the impact of alternative strategies for clopidogrel use pre-TKA on 30-day mortality. In the model, we assumed that TKA was performed within the first 30 days following bare metal or drug-eluting stent placement. Hematoma, infection, and cardiac complications were identified as being the dominant variables associated with mortality risk. The model input parameters were derived from published literature and included a mean risk of infection after hematomat of 13.6%; risk of death after cardiac complications of 18.44% (4.85-45%) and risk of death after an infected total knee of 4.65%. To examine variability of results to uncertainty in parameter estimates we conducted a wide set of sensitivity analyses.

RESULTS: Discontinuation of clopidogrel after PCI for non-cardiac surgery within 30 days of stent placement was associated with 2.38% (0.24-4.4%) risk of bleeding and 29% (10.5-85%) risk of cardiac complications. In comparison, continuation of the clopidogrel throughout non-cardiac surgery resulted in 18.5% (7.2-27.5%) risk of bleeding and 4.85% risk of cardiac complications. Overall 30-day post TKA mortality risk in a strategy in which clopidogrel was discontinued led to an estimated 5.3% mortality compared to 1.0% mortality in a strategy without clopidogrel discontinuation. Sensitivity analysis demonstrated that if the risk of cardiac complications when clopidogrel is discontinued were equal to 5.4%, discontinuation and continuation of the drug would have equal mortality risks. If the risk of cardiac complications with clopidogrel discontinuation were lower than 5.4%, discontinuation would lead to lower postoperative mortality compared to continuing use of clopidogrel.

DISCUSSION AND CONCLUSION: Clopidogrel discontinuation in patients undergoing TKA shortly after major cardiac surgery may lead to greater mortality. The higher risk of hematoma in patients undergoing TKA while on clopidogrel does not offset the impact of increased risk of death due to cardiac complications in patients discontinuing clopidogrel. Further studies are needed to establish more accurate estimates of cardiac risk in patients on clopidogrel undergoing elective surgery. Our study suggest that continuing clopidogrel in patients undergoing TKA 30 days after stent placement leads to lower 30-day mortality. Clinicians should consider delaying TKA for at least 90 days, if they wish to discontinue clopidogrel.

POSTER NO. P171
Total Knee Arthroplasty with or without Patellar Resurfacing with Grade IV Osteoarthritis in Patellofemoral Joint
Kyung-Do Kang, Hwasun, Republic of Korea
Jong-Keun Seon, MD, Hwasun, Republic of Korea
Chan-Hee Park, Jeonnam, Republic of Korea
Eun-Kyoo K. Song, MD, Hwasungun, Republic of Korea

INTRODUCTION: Despite the excellent clinical success of total knee arthroplasty (TKA), controversy remains concerning whether or not to resurface the patella. This has led to a number of randomized controlled trials. Randomized controlled trials constitute the most reliable source of evidence for the evaluation of the efficacy of a potential intervention. But most of these studies include all degrees of osteoarthritis of the patellofemoral joint. So we did this prospective study to compare clinical and radiological outcomes after TKA with or without patellar resurfacing in patients with grade IV osteoarthritis on patellofemoral joint.

METHODS: A total of 123 cases (93 patients) with Kellgren-Lawrence grade IV osteoarthritis on patellofemoral joint were enrolled for this study. At the operating room, they were randomly assigned to undergo patella resurfacing (62 cases) or patella retention (61 cases). Among them, 114 cases that could be followed for more than two years were included in this study (resurfacing group; 59 cases, retention group; 55 cases). When patellar retention was performed, osteophytes of the patella were removed and marginal electrocauterization was carried out. Preoperative and postoperative clinical outcomes were evaluated and compared regarding the Hospital for Special Surgery Patellar (HSSP) score (total 100 point; anterior knee pain, functional limitation, tenderness, crepitus, Q-strength). We also compared Hospital for Special Surgery (HSS) and WOMAC scores, and range of motion (ROM). We also compared radiological outcomes at the final follow up, with regards to mechanical axis of the lower limb, patella tilt and patella congruence angle between two groups.

RESULTS: Average HSSP score was 85 in resurfacing group, 83 in retention group, which were showing no significant differences between groups (p=.75). Anterior knee pain subscale also showed no significant differences between groups (40 in resurfacing group, 36 in retention group, p = 0.52). HSS score improved to 94 points in resurfacing group and 95 points in retention group showing no significant difference (p=.92). While WOMAC score and range of motion was 32 point and 128°±10.5° in resurfacing group, respectively, they were 29 point and 126°±11.5° in retention group, without significant inter-group difference (p>.05). There were no differences between two groups in mechanical axis of the lower limb and patella tilt, patella congruence (p>0.05).

DISCUSSION AND CONCLUSION: Clinical and radiological outcomes were ‘good’ after TKA with or without patellar resurfacing in patients with high grade osteoarthritis of the patellofemoral joint without significant intergroup difference. Thus, this study suggested that TKA without patellar resurfacing is a good treatment option in patients with high grade osteoarthritis of the patellofemoral joint.

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Patellofemoral Tracking and Anterior Knee Pain after Closing- and Open-Wedge Valgus High Tibial Osteotomy

Jong-Keun Seon, MD, Hwasun, Republic of Korea
Chan-Hee Park, Jeonnam, Republic of Korea
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INTRODUCTION: Patellofemoral complications, such as, patella infera and patellofemoral maltracking, may still be common complications of valgus high tibial osteotomy. Although an experimental study reported that closing-wedge osteotomy has some advantages over open-wedge osteotomy in terms of patellofemoral joint pressure and tracking, no in-vivo comparative study has been performed to study patellofemoral tracking or anterior knee pain after closing- or open-wedge valgus high tibial osteotomy (HTO). The purpose of this study was to compare the clinical and radiographic outcomes of open- and closing-wedge HTO for the treatment of medial unicompartmental knee osteoarthritis with a minimum follow up of three years, particular with respect to patellofemoral tracking and anterior knee pain.

METHODS: Patients that underwent valgus HTO for medial unicompartmental OA (K-L grade I, II or III) with an age of less than 65 years old and with complete postoperative follow-up records for at least three years (range: 3 to 4 years) were included. Patients with OA of more than grade I OA in the lateral or patellofemoral compartment, and those that underwent another ligament surgery at the time of osteotomy were excluded. Fifty patients that underwent closing-wedge HTO (the closing-wedge group) and the same number of patients that underwent open-wedge HTO (the open-wedge group) with a minimum follow up of three years met the inclusion criteria. All patients were evaluated and the two study groups were compared in terms of patellofemoral tracking, patellofemoral osteoarthritis, and anterior knee pain based on the VAS during climbing stairs.

RESULTS: Patellar tracking (patellar tilt and lateral patellar displacement) was not significantly different in the two groups either preoperatively or at final follow up, and degrees of patellofemoral osteoarthritis were not significantly different at final follow up. Patellar height, measured using the Blackburne-Peel method, was significantly lower in the open-wedge group postoperatively (0.8 ± 0.1 vs. 0.7 ± 0.08; P<0.001), but was not significantly altered in the closing-wedge group (0.8 ± 0.1 preoperatively to 0.7 ± 0.2 postoperatively; P=0.38). However, no significant inter-group differences were found in terms of the incidence of anterior knee pain (28% in the closing-wedge group and 32% in the open-wedge group at final follow up).

DISCUSSION AND CONCLUSION: Closing- and open-wedge valgus high tibial osteotomies were not found to be significantly different with respect to patellar tracking, osteoarthritis of the patellofemoral joint, or anterior knee pain. However, some patients in both groups experienced postoperative anterior knee pain or patellofemoral osteoarthritis progression.
INTRODUCTION: Controversy remains regarding the optimal treatment for iatrogenic injury to the medial collateral ligament (MCL) during primary total knee arthroplasty (TKA). Some authors have recommended converting to a prosthesis that provides varus/valgus constraint while others have recommended primary repair. In this study we report the results of a 45 patients who sustained intraoperative MCL injuries during primary TKA that were treated with primary repair.

METHODS: A retrospective review of consecutive primary TKA performed between June of 1991 and February of 2009 was performed to identify intra-operative lacerations or avulsions of the MCL treated with primary repair. End to end suture repair was performed for midsubstance lacerations while a screw/washer construct or suture anchor was used to reattach avulsions from the proximal tibia or distal femur. All patients were instructed to wear a hinged knee brace set for full range of motion for six weeks postoperatively.

RESULTS: Of 3,922 consecutive primary TKA there were 48 (1.2%) intra-operative MCL lacerations or avulsions. One patient was lost and one died before 24 months follow up. All but one patient underwent primary repair with placement of components without varus/valgus constraint. This left 45 knees with a mean follow up of 89 months (range, 24-200). The mean HSS knee scores increased from 46.8 to 84.8 points (p<.001). No patients had subjective complaints of instability. No patients had excessive varus/valgus laxity when tested in full extension and 30 degrees of flexion. The range of motion at the time of final follow up averaged 110° (range, 85° to 130°). Five knees required treatment for stiffness with four knees undergoing manipulation under anesthesia and one knee undergoing open lysis of adhesions with polyethylene articular surface exchange. Two knees underwent revision for aseptic loosening of the tibial component. In the three knees that underwent open revision, the MCL was noted to be in continuity and without laxity.

DISCUSSION AND CONCLUSION: Primary repair with six to end suture repair was successful at preventing instability although stiffness was seen in approximately 10% of patients. The increased morbidity associated with implantation of a semiconstrained or constrained implant may be unwarranted in this situation.
So as not to allow mean results to diminish the impact outliers of alignment on the overall results, we also asked: 3.Is there a higher risk of having a fair or poor Knee Society Score in the MIS group than the “traditional” group at intermediate-term? METHODS: This series is a follow up at four years minimum follow up on a cohort of patients previously reported on in The Journal of Bone and Joint Surgery, and involved a comparison between the same surgeon’s last 50 traditional medial parapatellar approach TKAs and his first 100 MIS TKAs. The MIS approach was performed as described by Coon and Tria (CORR 416: 185-90, 2003); key elements were the avoidance of dissection into the quadriceps tendon or more than 2 cm into the mid- or sub- vastus planes, patellar subluxation rather than dislocation, and no tibiofemoral dislocation or hyperflexion during the procedure. The same surgeon performed all of the procedures, using the same indications, the same condylar knee design, and the same aftercare for all patients; regional anesthesia was preferred and used in all cases unless the patient refused or unless it was not technically possible to achieve adequate analgesia with that approach. Patients completed a Knee Society Score at a minimum of four year follow up; complications, reoperations, revisions and the risk of fair/poor knee scores were compared between groups. RESULTS: Pre-operatively, there were no significant differences in KSS between the MIS and traditional TKA patients (35.6 vs. 34.2 points out of 100, p=n.s.). At a mean of four years (MIS) and five years (traditional), the average Knee Society Score was excellent in both groups, but not different between the MIS and traditional TKA cohorts (85.6 vs. 85.6, respectively, p=n.s.). There have been three reoperations in 100 patients among the MIS TKAs and two of 50 in the traditional TKA cohort (p=n.s.). There was no difference in the likelihood of a patient having a fair or poor knee score between the two groups (two of 50 in the traditional TKA group, one fair, one poor; four of 100 in the MIS group, two fair, two poor, p=n.s.). DISCUSSION AND CONCLUSION: Excellent knee scores and a low risk of reoperation and revision were observed both in MIS and traditional-approach TKA patients in this controlled series. The risk of a fair or poor outcome was not different between approaches. The MIS approach did not improve outcomes compared to the traditional approach at intermediate-term follow up.

POSTER NO. P177

A Randomized Clinical Trial of Minimally Invasive TKA: Comprehensive Gait and Strength Testing Outcomes

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INTRODUCTION: Minimally invasive techniques (MIS) for total knee arthroplasty (TKA) have often been accompanied by substantial changes in peri-operative pain management, rapid rehabilitation protocols, and patient education initiatives that made it difficult to determine if these new surgical techniques truly add benefit. This randomized clinical trial used objective comprehensive gait analysis and strength testing data to determine if MIS-TKA improved functional outcome compared to a standard medial approach in a contemporary surgical practice with advanced pain management, rehabilitation and patient education protocols. METHODS: Forty patients were randomized to the mini-subvastus or standard approach using a computerized process administered by our Biostatistics group. One experienced surgeon with an interest in MIS TKA did all procedures. Patient and evaluator were blinded and the groups were dynamically balanced based on age, sex, and BMI. Peak isometric knee flexion and extension strength was measured and comprehensive gait analysis was done during walking and stair climbing preoperatively and the postop at two months and at two years. RESULTS: No difference in the Knee Society Score, quadriceps strength or gait parameters was observed between the mini-subvastus approach and the standard medial parapatellar approach, except a higher speed during stair ascent two months after surgery in the MIS group (p=0.018). As expected after TKA, in both groups improvements in Knee Society Score were dramatic (p<0.0001 for each subscale) as were improvements in gait parameters, particularly in knee kinematic and kinetics, during level walking and stairs (p<0.0001 to 0.045). Quadriceps strength increased two months after surgery in the MIS and MPP groups (p=0.038 and 0.022, respectively) although remaining lower when compared to the sound limb (p=0.007 and 0.002, respectively). DISCUSSION AND CONCLUSION: In our high-volume practice with advanced pain management, rapid rehabilitation, and patient education protocols in place we could find no substantial additive benefit of a minimally invasive TKA over a standard TKA.

POSTER NO. P178

Outcome of Patellofemoral Arthroplasty - Results from a UK Regional Arthroplasty Register

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INTRODUCTION: A patellofemoral unicompartmental knee arthroplasty may offer superior knee function, where a patient has isolated patellofemoral osteoarthritis, in comparison with a total knee arthroplasty. We aim to assess the outcome in these patients. METHODS: The Trent Arthroplasty was established in 1990 to collect prospective data on knee arthroplasty surgery in this region of the U.K. (population 4.7 million). A total of 55,000 primary knee arthroplasties have been registered to date from 37 hospitals. Data is entered by surgeons at the time of surgery, with consent of the patient. Patellofemoral replacements constitute less than 1% of the arthroplasties performed in this region of the U.K. Patients are sent self-administered outcome forms one year post arthroplasty and re-operation and revision procedures are reported. A total of 334 patellofemoral replacements have been registered from 17 hospitals. 79% in female patients. 43% of the patients aged 55 years or less, suggesting dysplasia as the cause of their osteoarthritis. Age range 28-94 yrs (SD 11.8yrs). RESULTS: Some 18% of patients stated that they were dissatisfied with their patellofemoral replacement one year post surgery (7.9% for TKA). A total of 70% were satisfied and 12% unsure of their satisfaction. Two-thirds of the dissatisfied patients stated that severe pain was the cause of their dissatisfaction. Thirty-two percent of the patients considered that they had experienced a complication following their surgery. Fifty-eight of the 334 implants have been revised, 45 to a total knee arthroplasty. The patellar button was revised in 70% of cases. Two were revised within a year of the primary, 30 in less than five years and 49 in less than 10 years. The reason for revision was progressive OA in other compartments in 29, continuing patellofemoral pain in nine, and aseptic loosening of the patella in seven. DISCUSSION AND CONCLUSION: The results of patellofemoral arthroplasty appear to be disappointing. This may be due to patient selection for this surgery or the surgery being technically demanding. Given that this surgery is performed infrequently and the outcomes surgeons should be cautious when considering isolated patellofemoral replacement and should inform the patient.
of patient reported outcomes. It may be that other non-arthroplasty surgery should be considered, or a total knee arthroplasty in these patients.

POSTER NO. P179

Unicompartmental Revision to Total Knee Replacement is Better if a Stemmed Baseplate is Used

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INTRODUCTION: Registries have previously reported that the best outcome following revision of a unicompartmental knee replacement (UKR) is achieved if the UKR is revised to a total knee replacement (TKR). This study was undertaken to determine if there was a difference in a UKR revision to TKR if a stemmed rather than a non stemmed tibial base-plate was used.

METHODS: Analysis of the outcome of 2,300 UKRs revised to TKR recorded in a national database was undertaken. Of these, 559 were revised using stemmed tibial base-plates and 1,741 using non-stemmed tibial base-plates. The principal outcome measure was the time to re-revision using Kaplan-Meier estimates of survivorship.

RESULTS: There is a significantly increased rate of re-revision when non-stemmed tibial base-plates are used. At five years the CPR for non-stemmed is 14.4%(12.5, 16.7) and for stemmed tibial base-plates 9.9%(7.1, 13.7); HR=1.57(1.10, 2.24), p=0.012. The difference is due to a higher rate of loosening in the non-stemmed group.

DISCUSSION AND CONCLUSION: The outcome of a UKR revised to a TKR is significantly better if a stemmed tibial base-plate is used.

POSTER NO. P180

Mobile Bearing Medial Unicompartmental Knee Arthroplasty: A Survivorship Analysis of 1,000 Consecutive Cases

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INTRODUCTION: Unicompartmental knee arthroplasty (UKA), is a conservative treatment for medial gonarthrosis. Registry data have a higher revision rate than total knee. Advantages of UKA are faster recovery, better range of motion, higher activity level and fewer complications. The purpose of this study is to report the survivorship of 1,000 consecutive medial mobile bearing UKA.

METHODS: A retrospective analysis of our electronic database revealed 1,000 consecutive medial UKA in 808 patients between 2004 and 2008. There were 353 male (43.7%) and 520 right UKA (52.0%). Average age was 71.3 (range 29-91 years). Average height, weight and BMI were 66.6 inches (SD 4.1), 204 pounds (SD 44.3), and 32.3 (SD 6.5). Pre-operative range of motion averaged 116 degrees (SD 7.9). Isolated medial pain was present in 68%. Pre-operative Knee Society pain, total and functional scores averaged 10 (SD 7.4), 41 (SD 14), and 56 (SD 15.8).

RESULTS: At an average 43 months follow up, there were 36 revisions for a survivorship of 96.4%. Revisions occurred at an average of 22.5 months. Indications for revision were dislocation (two), loosening (four), femoral loosening (one), tibial loosening (12), persistent pain (10), tibial component collapse (six), and infection (one). Pain, total, and functional scores, and range of motion were 44 (SD 12), 90 (SD 14), 80 (SD 21), and 118 (SD 9).

DISCUSSION AND CONCLUSION: At an average of 43 months follow up, survivorship of medial mobile bearing UKA is 96.4%. Revisions occur early and are mostly related to tibial-sided failure. Improved tibial fixation, better alignment of expectations, and addressing etiologies for pain may improve survivorship.

POSTER NO. P181

Single-Injection versus Continuous Femoral Nerve Catheter Block for Postoperative Pain Control

Following TKA

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INTRODUCTION: Continuous femoral nerve catheter blocks (cFNC) and single-injection femoral nerve blocks (FNB) are often utilized to provide extended pain relief and improved functional outcomes in the initial hospitalization period following total knee arthroplasty. The purpose of this study was to determine if immediate post-surgical outcomes are affected by the type of nerve block utilized.

METHODS: A retrospective comparison study of 154 primary unilateral total knee replacement procedures was performed to evaluate postoperative outcomes of patients who received a cFNC versus a FNB. The cFNC were removed the evening of postoperative day 1 (POD1). Data comparison included information from POD1 and postoperative day 3 (POD3): Narcotic usage (morphine equivalents), Visual Analog Scale (VAS) pain scores upon ambulation, surgical knee extension and flexion, longest distance walked and hospital length of stay (LOS). Data analysis was performed through ANCOVA, checking for distributional assumptions and the existence of outliers.

RESULTS: Ninety-three (93) patients, 36 male, 57 female, with an average age of 71.3, received a cFNC. Sixty-one (61) patients, 20 male, 41 female, with an average age of 70.4, received a FNB. ANCOVA model fitted to the data shows POD1 and POD3 narcotic usage to be significantly lower in the FNB group at p-value = 0.02. After controlling for medication use, with logistic regression, VAS scores in the FNB group were significantly improved from POD1 to POD3 (p< 0.03). Therefore there is statistically significant evidence that pain improvement for FNB is greater than FNC after controlling for narcotic use. No significant difference was noted in comparison of extension, flexion, longest distance walked on POD1 or POD3, and LOS. There is statistically significant evidence that pain improvement for single-injection FNB is greater than continuous FNC after controlling for narcotic use. Single-injection femoral nerve blocks are as, or more, effective than continuous femoral nerve catheter blocks in controlling postoperative pain following unilateral total knee replacement.
INTRODUCTION: There is still a lack of consensus regarding use of minimal invasive (MIS) total knee arthroplasty (TKA). Successful TKA surgery depends on proper patient selection, correct surgical technique and implant alignment and effective postoperative care. In general implant alignment errors of >3° are associated with more rapid failure and less satisfactory functional results. The accuracy and alignment of implantation is therefore an accepted prognostic factor for the long-term survival of TKA implants. The presented study intended to compare computer-navigated TKA using either MIS or conventional surgical technique, using a fixed bearing knee, navigation system and dedicated MIS instrumentation. It was hypothesized that patients benefit from the MIS technique by shorter recovery periods following surgery, less blood loss, faster wound healing and better mobility in early postop rehabilitation.

METHODS: Randomized controlled trial; 69 patients in three centers (Adelaide, Maastricht, Zwickau). Matched for age, gender, BMI (MIS n=36, CONV n=33). Assessments at pre-op, one week, three and six months post-op. Outcome measurements:
1. Surgical: surgery time, bloodloss intra-op & first 24h postop;
2. X-rays (implant position, implant alignment, radiolucency);
3. Range of Motion (ROM); 4. Knee Society Score (KSS) and WOMAC; 5. Chair rise test (anterior knee pain when arising).

RESULTS: 1. Surgical: There is only a statistical significant difference regarding surgery time and loss of blood at 24h postop p<0.05. (Table 1); 2. X-rays: X-rays showed stable implants with no progressive radiolucent lines in all patients; 3. Range of motion: At six months mean flexion values for MIS (106,7°±12.91) and CONV 105,92 ±11.58). No significant differences were found in flexion ROM between both groups at any time point; 4. KSS and WOMAC: KSS scores showed a significant improvement (p<0.01) over time in both groups but no statistical significance between groups (Figure 1). WOMAC score also improved significantly (p<0.01) over time in both groups without reaching statistical significance; 5. Chair rise and anterior knee pain: A significant decrease of pain score was observed over time. No significant differences were seen between both groups.

DISCUSSION AND CONCLUSION: The hypothesis that patients benefit from the MIS technique by shorter recovery periods following surgery, less blood loss, faster wound healing and better mobility in early post-op rehabilitation was not confirmed by the results of this study. In fact, the MIS surgery technique resulted in more blood loss intra-op and in the first 24 hours post op as well as an elongated surgery time. The MIS surgery technique also failed to generate clear advantages in terms of function, pain, ROM, KSS, WOMAC and radiological evaluation clinical or functional outcome that persisted over time.

CONCLUSION: The hypothesis that patients benefit from the MIS technique by shorter recovery periods following surgery, less blood loss, faster wound healing and better mobility in early postop rehabilitation was not confirmed by the results of this study. In fact, the MIS surgery technique resulted in more blood loss intra-op and in the first 24 hours post op as well as an elongated surgery time. The MIS surgery technique also failed to generate clear advantages in terms of function, pain, ROM, KSS, WOMAC and radiological evaluation clinical or functional outcome that persisted over time.
expectations remain unfulfilled. Patient counselling is essential to avoid expectation/outcome mismatch and maximize patient satisfaction, especially in TKA.

POSTER NO. P184

Relation Between Sagittal Alignment of Spine and Flexion Contracture around TKA

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INTRODUCTION: The purpose of this study was to find the effect of sagittal alignment of the spine on the knee posture in standing and redevelopment of flexion contracture (FC) of the knee after correction through total knee arthroplasty (TKA).

METHODS: Sixty-seven patients (mean age 67.7 years; 17 males and 50 females) underwent TKA for severe osteoarthritis. At each follow-up, the sagittal alignment using standing whole spine and lower extremity lateral radiographs, range of motion, the Knee Society score, Tegner score and the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) score were evaluated. For the sagittal alignment of spine, we evaluated thoracic kyphosis (TK), lumbar lordosis (LL), sagittal vertical axis offset (SVA), T1 and T9 spinopelvic inclination (T1- and T9-SPI), pelvic tilt (PT), sacral slope (SS), pelvic incidence (PI) and knee flexion angle at standing. We performed correlation analysis between variables of the spine and the knee. RESULTS: Forty-five patients (67%) had more than 5° of flexion contracture in supine position preoperatively, five patients (7%) at two weeks, seven patients (10%) at six weeks and 10 patients (15%) at six months follow-up. The knee flexion angle at standing was 15.3°, 15.6°, 12.9° and 9.8° at preoperative evaluation and postoperative two weeks, six weeks and six months follow-up, respectively. Clinical score improved gradually during the short-term follow up. The values of sagittal alignment of spine changed variously. Correlation analysis showed preoperative and postoperative knee flexion angle at standing were significantly related to SVA, T1 SPI, T9 SPI, PT and PI and Knee Society knee score, Tegner score and WOMAC score. Postoperative redevelopment of flexion contracture also was related to T1 SPI, T9 SPI, Knee Society Knee and Function score. DISCUSSION AND CONCLUSION: There was a gap between passive flexion contracture and knee flexion angle at standing about 8 to 15 degrees. Knee posture on standing correlated to flexion contracture of the knee, the sagittal alignment of the spine and pelvis and health-related quality of life measures. Sagittal alignment of the spine can affect the knee posture in standing and redevelopment of the flexion contracture of the knee after correction through TKA. For the accurate measurement and improvement of clinical outcome after TKA, sagittal alignment of the spine and pelvis should be considered and managed.

POSTER NO. P185

U.K. Experience of Autologous Chondrocyte Implantation: Medium to Long-Term Follow Up (up to 12 years)

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INTRODUCTION: Chondral injuries of the knee are extremely common and present a unique therapeutic challenge due to the poor intrinsic healing of articular cartilage. There are several treatment modalities for articular osteochondral defects, one of which is autologous chondrocyte implantation.

METHODS: Our study evaluates the mid to long term functional outcomes in the largest cohort of 828 patients who have undergone an autologous chondrocyte implantation procedure (either ACI or MACI), identifying retrospectively factors that may influence their outcome. The influence of factors including age, sex, presence of osteoarthritis and size and site of lesion have been assessed individually and with multivariate analysis. All patients were assessed using the Bentley Functional Score, Visual Analogue Score and the Cincinnati Functional Score. Assessment were performed pre-operatively and of their status in 2010.

RESULTS: The longest follow up was 12 years (range 24 to 153 months) with a mean age of 34 years at time of procedure. The mean defect size was 409 mm² (range 64 to 2075 mm²). The distribution of lesions was 51% medial femoral condyle, 12.5% lateral femoral condyle, 18% patella (single facet), 5% patella (multifacet) and 6% trochlea. Four percent had cartilage transplant to multiple sites. High failure rates were noted in those with previous cartilage regenerative procedures or evidence of early osteoarthritis.

DISCUSSION AND CONCLUSION: Autologous chondrocyte implantation is an effective method of decreasing pain and increasing function, with a survivorship of 80% in the ideal candidate beyond 10 years. However, it is clear patient selection plays a significant role in the success of the procedure.
RESULTS: The most common organisms identified were Staphylococcus aureus (THA 31%, TKA 26% of all infections) and Coagulase negative staphylococcus (THA 20% and TKA 49% of all infections). There was no significant difference between the number of Staph aureus PJI between THA and TKA (p=0.057). However the number of Coagulase negative Staphylococcus PJI was significantly different in TKA compared to THA (p< 0.01). There was no trend or significant difference found between the isolated organism and the timing of infection.

DISCUSSION AND CONCLUSION: This study establishes the emerging importance of Coagulase negative staphylococcus in causing deep PJI in TKA and highlights its potential consequences on the future of antibiotic prophylaxis in arthroplasty surgery.

POSTER NO. P187
Culture Negative Periprosthetic Joint Infection: How Do These Cases Do?
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INTRODUCTION: Periprosthetic joint infection (PJI) is a devastating complication following total joint arthroplasty (TJA). An organism cannot be isolated using conventional culture in up to 9.5% of PJI. Lack of confirmation of an infecting organism poses a challenge with regard to the selection of appropriate anti-infective agent and surgical treatment. The purpose of this study was to identify the treatment outcomes of a recent cohort of culture negative PJI at our institution.

METHODS: A total of 651 cases of PJI were treated at our institution between 1999 and 2007. Fifty-five cases were culture negative. Seven cases were excluded due to follow up of less than one year. Surgical intervention for the remaining 48 cases included: I&D (12), one stage revision (three), and planned two-stage revision (33). Average age was 63.9 years (range: 39.6-85.2 years). Median follow-up duration was 47 months (range: 12-119 months). Results were compared to culture positive cases from the same time period.

RESULTS: Of 48 cases of culture negative PJI, 33 joints underwent planned two stage exchange, of which six were not reimplanted. Twenty-seven joints completed both stages (70.4% success). Twelve joints underwent I&D (50% success), and three culture negative hips underwent one stage exchange (100% success). In our comparison group of culture positive PJI, 228 joints underwent planned two stage exchange, of which 68 were not reimplanted. A total of 160 joints completed both stages (80.6% success). Some 103 joints underwent I&D (45.6% success).

DISCUSSION AND CONCLUSION: Outcomes of treatment for culture negative PJI in our cohort are suboptimal. It is plausible that some of the infections in culture negative cases were caused by fungi or atypical pathogens which could not be isolated using conventional culture methods. This study highlights the importance of investing extra efforts, such as the use of molecular techniques or reinforced medium and/or prolonged culture, to isolate the responsible pathogen in these patients.
Mobile-bearing Prosthesis or Proper Gap Balancing were Not Predictors for Better Knee Flexion
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INTRODUCTION: Range of motion is a crucial measure of the outcome of total knee arthroplasty (TKA). Gap balancing technique and mobile bearing prosthesis can improve postoperative range of motion. The purpose of this study was to determine which factors are predictive of the postoperative range of motion. METHODS: A total of 90 knees with varus osteoarthritis were prospectively randomized to receive either a posterior stabilized fixed-bearing (FB) or mobile-bearing (MB) design. All pre- and postoperative protocols and operative technique were the same between groups. Extension and flex gap was measured using tensor device during the operation. The dependent variable was flexion angle of the knee 12 months after the operation. The independent variables were type of prosthesis (FB or MB), the difference between flexion gap and extension gap (mm), gender, body mass index (BMI), preoperative flexion angle, intraoperative x-ray flexion angle, change of posterior condylar offset (PCO), and posterior tilt of tibial tray (delta angle). Multiple regression analysis was conducted to determine the best predictors of the dependent variable. RESULTS: The average of intraoperative joint gap was 22.1 mm in extension and 22.9 mm in flexion. The average of flexion angle was 119 degrees preoperatively, 142 degrees intraoperatively, and 127 degrees at 12 months postoperatively. Predictors were identified in the three categories: 1) preoperative flexion angle, 2) Intraoperative x-ray flexion angle and 3) BMI (R²= 0.603; p< 0.0001). DISCUSSION AND CONCLUSION: The current study showed MB prosthesis or proper gap balancing did not result in better postoperative flexion angle. Better pre- and intra-operative flexion angles and lower BMI were the significant predictors for better postoperative flexion angle.

Aquamantys Bipolar Sealer in Primary Total Knee Arthroplasty: Experience with 3,172 Consecutive Knee Replacements
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INTRODUCTION: Maximizing hemostasis in total knee arthroplasty (TKA) remains a challenge in current practice. The use of tourniquet, hemostatic agents, medications, and coagulation devices remain under investigation. Aquamantys bipolar device achieve tissue sealing and coagulation with radio-frequency energy and saline. The purpose of this study is to evaluate the safety and effectiveness of this device in primary knee replacement. METHODS: The Aquamantys was used in 3,172 consecutive primary total knees performed in 2,402 patients from 2004-2009 and compared to 686 primary knees from 1998-2004 without use of the device. The surgical approach underwent modifications within the study period. The device was used prior to component implantation with the knee in flexion and tourniquet inflated. All knees had reinfusion drains placed and output monitored. Daily hematocrits and rate of transfusion were also recorded. RESULTS: Tourniquet time averaged 54 minutes. Knee drainage output was less with use of the device, 807ml versus 1290ml (p<0.0001). Hematocrit was similar between groups preoperatively and immediately postoperatively. However, the Aquamantys group had a higher hematocrit at discharge, 31.5 versus 30.2 (p<0.001). The Aquamantys group required fewer transfusions, 79/2402 (3.2%) versus 56/686 (8.4%). Unexplained paresthesias postoperatively occurred in 1/686 (0.15%) without versus 10/3172 (0.31%) knees with the use of Aquamantys (p=0.7).

Correlation of Intraoperative Navigation Data and Postoperative Outcome Measures in Total Knee Arthroplasty
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INTRODUCTION: Computer assisted surgical navigation has played an increasingly central role in total knee arthroplasty (TKA). Given the recognized importance of subtle component position changes in knee function, navigation has emerged as a promising tool for reducing the occurrence of significant malalignment. The ability of this technology to reliably measure multiple parameters intraoperatively may aid in predicting functional outcomes of patients undergoing elective total knee arthroplasty. METHODS: Intraoperative navigation data was collected for 121 patients undergoing cemented, posterior stabilized TKA. Three forward stepwise regression analyses were performed to associate intraoperative range of motion, coronal alignment, coronal alignment correction, tibiofemoral external rotation, alignment under varus and valgus stress, age and BMI with one year outcomes, including range of motion, SF-36, and Oxford scores. RESULTS: A proportion of maximum flexion at one year (R² =12%) was predicted by intraoperative range of motion (p=0.03) and coronal alignment correction (p=0.01). The physical component of the SF-36 outcome score was negatively associated (R² =35%) with change in flexion contracture (p=0.03), correction of valgus deformity (p=0.1), age (p=0.01) and BMI (p<0.01). The Oxford score was negatively correlated (R² =18%) with age (p<0.01) and BMI (p=0.07) only.

DISCUSSION AND CONCLUSION: Despite the potential of navigation data to predict functional outcome at one year, this study failed to detect any relationships that were independent of age and BMI. Additionally, the models predicted a small proportion (<35%) of the variance in the patient scores, leaving a considerable amount of the variance unexplained. Correct interpretation of navigation data may allow surgeons to make subtle changes in real time to produce superior short-term outcomes for patients, but we have not been able to elucidate them in this analysis. Patient factors continue to play a dominant role in predicting outcome after TKA.
INTRODUCTION: Malrotation of the tibial and/or femoral components is a common error in total knee replacement (TKR), frequently cited as a cause of pain, soft-tissue tightness, effusions and symptomatic failure of these procedures. In the case of the tibia, one possible strategy to improve rotational alignment is the use of an anatomically controlled tibial tray to better match the shape of the resected tibial surface. However, the normal 3-5mm increments between sizes and the inherent variability of tibial anatomy may result in minimal benefit with increased cost and size of inventory. To resolve this question this study was performed to assess the differences between bony coverage, axial rotation, and cortical overhang of matched symmetric and asymmetric tibial components implanted by experienced joint surgeons.

METHODS: Two tibial tray profiles, one symmetric and the other asymmetric, were developed from a morphometric analysis of CT reconstructions of the human tibia. Both designs were proportionally scaled to generate a set of seven different sizes. Eight tibias were selected from a large collection of CT reconstructions and virtually resected perpendicular to the canal axis at a depth of 5mm (medial), and a posterior slope of 5 degrees. Fourteen surgeons with significant experience in total knee surgery directed computer implantation of both the symmetric and asymmetric trays on each of the eight tibias. The software employed in this project allowed any size of tray to be selected and adjustment of tray position in the AP and ML directions and in internal/external rotation. Each implanted position was examined to calculate its rotational alignment with respect to the principal anatomic axes of the tibia. Additional analysis was performed to measure the degree of coverage of the exposed resection surface, and the magnitude of any overhang of either tray beyond the cortical boundary.

RESULTS: Significantly more of the exposed surface of the tibial resection was covered by the asymmetric tray vs. the symmetric design (87.6±3.8% vs. 78.2±9.0%; p<0.0001). In 16% of symmetric trays, coverage of the tibial resection was less than 75%, whereas the worst coverage obtained with the asymmetric design was 79.5%. Cortical overhang (>1mm) averaging was present 38% of symmetric implantations, as opposed to 22% for the asymmetric group (p=0.0135). Maximum cortical overhang averaged 0.90±0.78mm in the postero-lateral corner of symmetric cases vs. 0.62±0.77mm with asymmetric trays (p=0.0057). On average, the asymmetric tray was placed in 0.28±3.32° of internal rotation vs. 1.05±4.33° for the symmetric tray (p=0.1246). One fifth (19.6%) of symmetric trays were placed in severe internal rotation (> 5°), compared to only 5.3% of the asymmetric design (p=0.0024).

DISCUSSION AND CONCLUSION: The asymmetric tray provided better alignment with the tibio-femoral motion axis, allowed more coverage of the tibial resected surface, and minimized overhang compared to its symmetric counterpart. Malrotation was also less common with the asymmetric design. On the basis of these results, clinical usage of an asymmetric tray is advocated to reduce complications in TKR.
Patient Expectations of Unicompartmental vs. Total Knee Arthroplasty: A Matched Pair Study
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INTRODUCTION: Uni-compartmental knee arthroplasty (UKA) is purported to be a less invasive and more natural-feeling knee procedure than conventional total knee arthroplasty (TKA). However, little is known regarding the expectations of patients undergoing UKA, and how they compare to those of patients undergoing TKA. The purpose of this study was to determine if patients have different expectations for outcomes of UKAs compared to conventional TKAs. We hypothesized that patients undergoing UKA would expect a more active lifestyle including level of activity, exercise and sports following surgery compared to patients awaiting TKA.

METHODS: Using the knee arthroplasty registry at our institution, 144 patients scheduled for UKA were selected and matched for age, sex, and activity level to 144 patients scheduled for TKA. A validated 18-item Knee Surgery Expectations Survey was completed by each patient pre-operatively. Expectations were compared using the overall expectations score, an item specific analysis of individual expectation questions, and exploratory factor analysis to further examine the patient’s responses.

RESULTS: No difference was found in the overall mean expectations scores between patients scheduled for UKA (81.2 ± 19.8) and TKA (77.1 ± 17.6) (p=0.14). However, significant differences were found in the item specific analysis of individual expectation scores. These included the expectation to relieve pain (U:77.21, T:52.94, p=0.0001), improvement in the ability to go up stairs (U:76.09, T:59.78, p=0.0137), down stairs (U:73.12, T:59.14, p=0.0326), kneel (U:58.59, T:41.41, p=0.0052), ability to squat (U:59.20, T:38.40, p=0.0014), ability to drive (U:88.06, T:73.13, p=0.0253), interact with others (U:75.21, T:61.16, p=0.0219), perform activities of daily living (U:67.48, T:45.53, p=0.0012) and finally, expectation to exercise or participate in sports was also significantly elevated (U:73.58, T:57.55, p=0.0152).

DISCUSSION AND CONCLUSION: Patient’s expectations of post-operative functioning was high in both groups. However, patients in the UKA group had consistently higher expectations in regards to functional activity, mobility, and sports. This discrepancy cannot be explained by differences in age, gender or pre-operative activity level. With the knowledge of the different expectations of these two groups of patients, surgeons can more effectively advise patients seeking knee arthroplasty about their options.
therapy. Current measures of coagulation are incapable of measuring hypercoagulability. Instead, hypercoagulability is measured through surrogate markers, such as the development of a deep vein thrombosis (DVT). DVT and other related adverse clinical events are not desirable surrogate markers for hypercoagulability because they represent end-stage events that orthopaedic surgeons aim to prevent. Consequently, patients are treated with a "standard" dose of anticoagulant as recommended by either the ACCP or the AAOS. What is needed is an accurate test of coagulation that allows for measurement of postoperative hypercoagulability to provide guided therapeutic interventions for the adjustment of procoagulant or anticoagulant activity to achieve a desired, safe critical balance of a patient’s coagulation system. We hypothesized the thrombin generation assays can provide rapid and accurate measures of hypercoagulability, and the efficacy of anticoagulants to treat this hypercoagulability, following total joint arthroplasty. METHODS: TGA was performed on patients who underwent total joint arthroplasty. Plasma was evaluated for “procoagulant capacity” using standard TGA and measured by total thrombin generated. By incorporating a protein C activator into the assay, an “anticoagulant capacity” was determined, thus allowing the measurement of the balance between procoagulants and anticoagulants. RESULTS: We were able to measure hypercoagulability represented by higher levels of thrombin generation in patients undergoing total joint arthroplasty on post-operative days 2 and 3. In patients with total knee arthroplasty (TKA), the TGA indicated that prophylactic aspirin regimens (AAOS guidelines) resulted in significantly higher thrombin levels than warfarin and heparin therapy (ACCP guidelines) (Figure 1). We were also able to detect hypercoagulability in patients who had thromboembolic events postoperatively despite anticoagulation with current ACCP guidelines and hypocoagulable lab values by standard coagulation tests (Figure 2). DISCUSSION AND CONCLUSION: The thrombin generation assay characterized in this study provides a real-time tool for permitting individualization of prophylactic and therapeutic anticoagulant therapy that assures a safe balance of this pro-versus anticoagulant capacity of a patient’s plasma following orthopaedic surgery. Figure 1: Difference in coagulation profiles of patients undergoing TKA according to ACCP guidelines and AAOS. A) control plasma. B-C) Patients on post-operative days 2 and 3. Figure 2: Thrombin generation of a patient who suffered a pulmonary embolus (PE) postoperative day 2 from a total hip arthroplasty. A) TGA before PE B) TGA anticoagulation therapy with LMWH.
Increased Revision Rates Following Total Knee Arthroplasty in Patients Who Smoke

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INTRODUCTION: Because of the vasoconstrictive effect that tobacco use has on the vasculature, patients may have decreased healing potential. Historically, smoking has been associated with delayed time to fracture callus formation, increased non-union and mal-union in orthopaedic cases, as well as increased incidences of soft-tissue complications and skin necrosis after any surgical procedure. All patients are encouraged to stop or decrease their tobacco use during the peri-operative period; however, patients are rarely compliant with this request. The purpose of this study was to compare the clinical outcomes of total knee arthroplasty (TKA) in patients who were, or were smokers, to outcomes in the patients operated on during the same time period who were not smokers.

METHODS: A review of all total knee arthroplasties performed at two high-volume centers in patients who had indicated tobacco use on their intake history and physical at the time of surgery. Between 2005 and 2009, there were 127 TKAs performed in patients who were smokers, and 471 knees in patients who did not smoke. There were 54 men and 61 women who were smokers; they had a mean age of 55 years (range, 35 to 84 years), a mean body mass index of 33 kg/m^2 (range, 18 to 53 kg/m^2), and a mean follow up of 46 months (range, 24 to 72 months). All patients who were smokers were encouraged to participate in some form of smoking cessation program during the peri-operative period. Patients were stratified according to their total tobacco history, and their current status of use. Cigarettes were assumed to contain 1 gram of tobacco, and cigars 6 grams. Pack-year history was calculated by multiplying the daily total mass of tobacco by the length of time the patient reported smoking, and dividing by 20 (the number of cigarettes per pack). Patients were stratified into less than 20 pack-year history, 21 to 40 pack years, and greater than a 40 pack-year history of tobacco use. Additionally, their current smoking status was divided between “smoker” and “former smoker.” Clinical outcomes as measured using the Knee Society pain and function scores, as well as range of motion, were compared between the two groups.

RESULTS: At a mean most recent follow up the patients who were smokers had an overall survivorship of 91% (12 revisions), compared to 17 aseptic failures in the non-smokers (96%; p=0.01) in the non-smokers (p=0.01). The Knee Society objective and function scores in the patients who smoked were a mean 91 points (range, 56 to 100 points) and 89 points (range, 45 to 100 points), respectively. Of the 12 revisions, there were nine aseptic revisions (one for periprosthetic fracture, two for instability, six for pain and component loosening) and three infections (one treated with irrigation and debridement, and two treated with staged revision arthroplasty). All patients except one were doing well at most recent follow up (Knee Society scores > 80 points); the remaining patient required re-revision. Additionally, in the smoking cohort there was one peroneal nerve palsy, and one compartment syndrome (both did well after surgical releases). DISCUSSION AND CONCLUSION: Tobacco and nicotine use is known to be vasoconstrictive, and as such can lead to increased healing times. This has the potential to lead to worse results for patients who are undergoing total knee arthroplasty. Despite encouraging smoking cessation, most patients who are smokers were non-compliant with this request. The results of our study indicate that patients who smoke had a higher overall revision rate and a higher incidence of other complications. Given these results, it is the opinion of the senior authors that all efforts be taken to get patients to stop or minimize any nicotine use prior to total knee arthroplasty.

Open Wedge High Tibial Osteotomy: Comparison Between Manual and Computer Assisted Techniques

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INTRODUCTION: Open wedge high tibial osteotomy is an established technique to treat symptomatic varus malaligned knees. The purpose of our study is to compare clinical and radiological results of two groups of patients treated with either conventional or computer assisted open wedge high tibial osteotomy (OWHTO). We have established the goals of correction in obtaining a postoperative mechanical axis as between 2 - 6 degrees of valgus and an increase or decrease of posterior tibial slope between -2 and +2 degrees.

METHODS: We prospectively followed up 24 patients (27 knees) affected by varus knee deformity and operated with OWHTO. They were randomly divided in two groups, A (11 patients - 13 knees) and B (13 patients - 14 knees). All patients were evaluated radiologically both preoperatively and postoperatively with a comparative lower limb weight-bearing radiograph and anterior-posterior and lateral-lateral Rosenberg view of the knee were used to assess the following parameters: (1) alignment of the lower limb; (2) the posterior tibial slope; (3) The Insall-Salvati index; (4) inferior limb length.

RESULTS: Radiological results showed a 24% (three patients) reproducibility in achieving a mechanical axis of 182-186° in group A compared to a 86% (12 patients) reproducibility in achieving a mechanical axis of 182°-186° in group B (p=0.0392); furthermore, we obtained an increase or a decrease of posterior tibial slope between -2 and +2 degrees in only 24% of patients in group A, while the same goal was achieved in all patients (100%) of group B (p<0.0003).

DISCUSSION AND CONCLUSION: The use of navigation system for the tibial osteotomy has been recently introduced and studies present in literature are still discordant concerning its utility. Many studies concerning patients treated with OWHTO, agree in describing a good long-term clinical results, but there is considerable controversy regarding the ideal valgus correction angle. Conventional OWHTO has been associated with increased posterior tibial slope. When the wedge is placed too anteriorly, the posterior tibial slope increases, and vice versa. A navigation system allows continuous visualization not only of the coronal but also of the sagittal and transverse axes and detects undesired changes of the tibial slope during the correction which influences knee kinematics and stability. High tibial osteotomy with navigator is more accurate and reproducible in the correction of the deformity in both coronal and sagittal plane compared with standard technique.
INTRODUCTION: Patient perceived outcomes are now widely accepted by surgeons to measure results after total knee arthroplasty (TKA). Physical performance tests are objective measurements of function on patients. Our objective was to examine the correlation between patient oriented outcome measures and performance-related testing in patients undergoing TKA.

METHODS: Thirty-four patients undergoing primary TKA secondary to osteoarthritis, with no other joint involvement were studied. Physical performance measures [Timed Up and Go (TUG) and an inter-limb weight-bearing asymmetry index (AI) during 30°, 60° and 90° squats] and patient perceived outcomes [Knee Society Knee Score (KSKS), Knee Society Function Score (KSF), the Hospital for Special Surgery Knee Score (HSSKS), WOMAC, QWB and SF-36] were collected two weeks preoperatively. Pearson-Product Moment correlations were used to assess the relationship between patient oriented measures and physical performance measures.

RESULTS: The mean TUG time was 17.04s. There was a fair to moderate correlation between the TUG and KSKS (r=−0.332; p<0.01), KSF (r=−0.636; p<0.01), HSSKS (r=−0.462; p<0.01), WOMAC function (r=−0.386; p<0.01), WOMAC pain (r=0.320; p<0.01) and QWB (r=−0.485; p<0.01). Regarding the AI, there was a low correlation between the AI at 30° and the SF-36 physical component (r=0.264; p<0.05). Women had significantly lower scores for the QWB (0.529 vs. 0.528; p<0.0001) and SF-36 physical function (5.83 vs 19; p=0.002) greater TUG (19.1 vs 12.5; p=0.005), and less strength in the involved limb (20.5 vs 27.8; p=0.015).

DISCUSSION AND CONCLUSION: Although patient perceived outcomes have a moderate correlation with physical performance tests, our data clearly demonstrates that although both are measures of function the correlation between them is at best moderate. Perception and performance appear to be different in TKR patients.
High Variability in Knee Society Score Between Studies: How Reliable is the Knee Society Score?

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INTRODUCTION: The Knee Society Score (KSS) is widely accepted as clinical outcome in total knee arthroplasty (TKA), even in absence of validity and reliability studies. Only two studies challenged validity by reporting low responsiveness, modest construct validity and negligible to low correlations with alternative scores. This study tests the reliability of the KSS by comparing KSS scores reported in literature for comparable patient groups and follow-up (FU) times assuming them to score similarly.

METHODS: A systematic search in PubMed was done identifying publications on patients with primary TKA since 2000. Inclusion criteria were a) presence of ‘KSS’ in the abstract, b) reporting pre and post-op KSS knee (K) and/or function (F) scores, c) primary TKA, d) osteoarthritis as indication, e) no other complaints (e.g. reuma). This resulted in 37 papers, describing 71 study groups with a total of 4,170 patients (avg. age range 60-74yrs). It was assumed that comparable groups would score similar KSS points at identical FU times. To test this assumption group disparity was described by a) range (max-min mean KSS of all groups) and b) standard deviation (SD) of all group means for each FU time and for both KSS-K (physician administered, e.g. range of motion) and KSS-F (patient information about e.g. walking distance).

Data was put into context of a common KSS classification system (≥90: excellent, 80-89: good, 70-79: fair, < 69: poor). RESULTS: Preoperatively, group means (KSS-K) ranged from 23 to 65 (KSS-F: 28-73) producing a range of 42 points (KSS-F: 44) with a SD of ±9 (KSS-F: ±8). The average KSS-K and KSS-F increased during FU due showing improvements of resp. 33-47 and 14-39 points (Table 1). Disparity at pre-op was almost half (>40%) of the total scale (100 points) and comparable to average improvements reported. In two studies the pre-op KSS-F value would even be classified as a fair outcome (Fig 1). Post-op disparity range was similar or smaller than pre-op (except KSS-F at 1yr, Table 1). However the range still covered three or four of the four outcome classification classes (Fig 1). The lowest disparity range was found at the longest FU. At every FU time, the disparity range of KSS-F was bigger than of KSS-K. Also SD reMed high (e.g. at 3months, KSS-F: ±15), nearly covering the width of one classification class.

DISCUSSION AND CONCLUSION: Huge variability of KSS was found in literature on 71 comparable patient groups. Differences at each time point were large, exceeding what could be assumed as caused by patient, indication or treatment differences in these groups. This shows poor inter-rater reliability for the KSS and indicates that KSS values cannot be compared between studies. The higher disparity in KSS-F may be associated with patients’ subjectivity and pain dominance. The high disparity in KSS-K indicates that this scoring varies considerably between hospitals, countries or cultures and even between individual doctors as the KSS-K score is clinician administered. The low reliability challenges the KSS concurrent validity and explains why many studies fail to distinguish treatment alternatives. Newer questionnaires (e.g. New-KSS) increasingly rely on patient information and more demanding tasks to remove the ceiling effect. However, it remains to be seen if reliability is improved to make study results comparable. The addition of objective functional tests as clinical outcome seems increasingly necessary.

TKA Patients Have Specific Change Patterns of Height, Weight, and BMI During 5 Years After Surgery

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INTRODUCTION: Information on the postoperative changes in body height, weight and body mass index (BMI) is valuable for preoperative education and postoperative rehabilitation in TKA. Many patients undergoing total knee arthroplasty (TKA) present with severe deformity, and deformity correction by TKA increases limb length and it may be correlated with the change of height. It has been our anecdotal observation that patients expect the reduction of weight after TKA because of pain relief and more active involvement of physical activities. There have been many reports of the effect of increased weight and BMI on the outcome of TKA. However, detailed change patterns of limb length, height, weight, and BMI over time after TKA have not been reported. The objectives of this study were to examine whether the patients with TKA demonstrate specific change of limb length, height, weight, and BMI one year after surgery and whether there are related factors. In addition, we attempted to determine whether there are specific temporal change patterns of height, weight and BMI during five-year period.

METHODS: A retrospective review of prospectively collected data of 474 patients was performed to evaluate changes of height, weight, and BMI one year after TKA and to identify related factors. Limb lengths were measured on full-length standing anteroposterior radiographs and compared between preoperative and one year after surgery. To determine the temporal change
patterns of height, weight, BMI during five-year period, data of 291 patients with a follow up more than five years were analyzed. RESULTS: Average lengthening of the operative limb is 8.6 mm (SD, 12.0 mm; range, -95 to 49 mm) and, 630 (81.2%) of the 776 operated limbs in the 474 patients demonstrated a limb lengthening after TKA. The mean height was increased by 9.4 mm (SD, 9.3 mm; range, -30 to 40 mm) and the mean weight of TKA patients was increased by 0.96 kg (SD, 3.3 kg; range, -10 to 13 kg) from preoperative to one year after TKA (p<0.001). The mean BMI was increased by 0.07 kg/m² from preoperative to one year after TKA, however there was no statistical significance (p=0.229). The preoperative limb length, preoperative mechanical tibiofemoral angle were associated with the amount of operative limb lengthening (p<0.05). Having a bilateral TKA, preoperative height were associated with the amount of the change of height (p<0.05). The only factor that was associated with the change of the weight was preoperative weight (p<0.001). The mean height was continuously decreased at every follow up after one year after TKA and, finally, there is no significant difference of the height between preoperative and five year after surgery (p=0.951). Increased weight was maintained until five-year follow up. The BMI was continuously increased from one to five years, even though there was no statistical significance (p>0.05).

DISCUSSION AND CONCLUSION: Limb lengthening occurred frequently after TKA. The TKA have temporal increasing effect on height. The weight of TKA patients was increased one year after surgery. The knee scores, except for WOMAC-stiffness, were not associated with the amount of change of weight. The height was gradually decreased between two to five years. However, the increased weight was maintained until five-year follow up.

POSTER NO. P204

Fasciotomy Following Total Knee Arthroplasty: Beware of Terrible Outcome

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INTRODUCTION: Acute compartment syndrome is a devastating complication of total knee arthroplasty (TKA). In the trauma patient it has been well documented that emergent surgical decompression of acute compartment syndrome is the accepted treatment. Interestingly, it is not known if the same compartment pressure thresholds in trauma patients can be applied to TKA patients. Further, the adverse consequences of compartment decompression in patients with a TKA is quite different and includes infection. The purpose of this study is to identify the postoperative course in a series of patients who were diagnosed or suspected of having compartment syndrome after TKA. METHODS: We identified six patients who underwent fasciotomy for proven or suspected compartment syndrome following primary TKA between 2000 and 2010. A detailed chart review was conducted to study the course of events following fasciotomy. RESULTS: The etiology of compartment syndrome was indirect (three cases) or direct (three cases) vascular injury during TKA. Fasciotomy was performed at a mean of 29 hours (range, 17 to 70 hours) following index arthroplasty. Complications after fasciotomy were numerous and included foot drop (two), periprosthetic joint infection (two), and cellulitis (two). One patient who developed a periprosthetic infection required an above the knee amputation for infection control. DISCUSSION AND CONCLUSION: In the context of acute compartment syndrome in the trauma patient, fasciotomy can be a limb-sparing procedure. What is not known is if these same principles apply for both diagnosis and treatment of compartment syndrome after TKA. In our series, fasciotomy carries disastrous complications following TKA. We conclude that surgeons need to maintain a relatively higher threshold for performing a fasciotomy following TKA.

POSTER NO. P205

Failure of Total Knee Arthroplasty Periprosthetic Femur Fracture Fixation Using Plating Techniques

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INTRODUCTION: Periprosthetic fracture after total knee arthroplasty (TKA) is a devastating complication. Methods of operative fixation include open reduction and internal fixation (ORIF) using plating techniques, revision TKA, or distal femoral replacement (DFR). The goals of this study were to investigate patients who failed plating techniques and were subsequently treated with DFRs, and to compare these patients to periprosthetic fracture patients treated primarily with DFRs. METHODS: A retrospective study was conducted on 48 patients (49 joints) who sustained periprosthetic TKA fractures from 2002-2010. Thirty-five patients (36 joints) underwent a primary DFR for treatment, while 13 patients (13 joints) failed ORIF and were secondarily treated with a DFR. Patient demographic and clinical data were obtained. The average time until follow up was 15.0 months (0.2-76.5 months). Continuous variables were analyzed using Student’s t-test and categorical variables were analyzed using chi-squared tests. Statistical significance was defined as p<0.05. RESULTS: Patients initially treated with ORIF for periprosthetic fractures failed due to nonunion (7, 53.8%), infection (4, 30.8%), loosening (1, 7.7%), and refracture (1,7.7%). There was a trend towards greater postoperative complications for patients who failed ORIF and were subsequently treated with DFRs (p=0.09). Patients who were treated secondarily with DFRs experienced postoperative complications including infection (3, 23.1%), dislocation (1, 7.7%), and recurrent effusions (1,7.7%). Complications for patients who underwent primary repair of periprosthetic fractures with DFRs included infection (2, 5.6%), dislocation (1, 2.8%), and extensor mechanism disruption (3, 8.3%). There were no significant differences between the failed ORIF and primary DFR populations with regards to gender, age, comorbidities, and death. There were four males (30.8%) and nine females (69.2%) who underwent failed ORIFs, and eight males (22.8%) and 27 females (77.2%) who underwent primary DFRs (p=0.54). The average age for secondary DFRs was 74.5 years ± 10.7, and the average age for primary DFRs was 77.3 years ± 9.8 (p=0.43). There were similar numbers of left and right procedures completed for both groups (secondary - 6Rand 7L, primary - 19R and 17L, p=0.68). The average comorbidity index for failed ORIFs was 1.4 ± 1.7 and for primary DFRs was 1.8 ± 1.6 (p=0.54). The death rate was similar between groups (secondary 38.5%, primary 34.3%, p=0.74) (see Table). DISCUSSION AND CONCLUSION: Periprosthetic femur fractures after TKA treated by plating techniques fail most frequently due to nonunion, followed by infection, implant loosening and refracture. Distal femoral replacements are an alternative treatment for periprosthetic fractures that trend towards a lower complication.

AR KNEE

PAPERS, POSTERS & SCIENTIFIC EXHIBITS
Introduction: The combinations of flexion contracture of the knee and internal-external rotation of the leg that result in a clinically relevant error of 1° or more in the measurements of coronal alignment (i.e. limb, knee, tibial joint line, and femoral joint line alignment) are unknown (Study 1). Radiographers can rotationally align the leg by pointing the patella forward, the tibial tubercle forward, and the foot forward; however the method that least affects the measurements of coronal alignment is unknown (Study 2). The effects of mechanical (Study 3) and gap-balancing (Study 4) alignment techniques for total knee arthroplasty (TKA) on the symmetry of the flexion and extension gap are controversial and includes alteration of femoral and tibial bone cuts to accommodate the existing soft tissues, full or partial release of soft tissue elements to facilitate production of a neutral mechanical axis, or a combination thereof. For over seven years we have prospectively recorded the soft-tissue releases performed in primary TKA to intra-operatively produce balanced flexion and extension spaces. The required releases and the clinical and radiographic results of TKA during this time period are presented. Methods: A consecutive series of 1223 primary TKAs from 2004 to 2009 were reviewed at minimum 2 year follow-up (average 42 months). 769 knees (63%) had preoperative varus and 270 valgus (22%) deformity of the knee. Selective soft-tissue releases were made intra-operatively to achieve soft tissue balance with the goal of femoral component coronal alignment of 4-6 degrees valgus and tibial component alignment of 90 degrees to long axis of the tibia. There were 780 female (64%) and 443 male (36%) knees. Average age was 62.7 years (range 26-87), and BMI was 31.8 (range 17.7-87.9). Clinical outcome was measured with Knee Society knee scores, report of failure, reoperation and complications. Intra-operative selective releases were recorded prospectively in a surgical database. Radiographs were measured for component alignment and evidence of loosening. Results: A radiograph of the leg without internal-external rotation is the most important step in limiting the error in the measurements of coronal alignment, especially when the knee has a flexion contracture. The patella forward method is preferred over the tibial tubercle and foot forward methods because the measurements of coronal alignment have the lowest error and least variability. Mechanical and gap-balancing alignment caused an asymmetric flexion and extension gap in a majority of the knees and produced a widely varying change from normal in the distal and posterior femoral joint lines and the proximal tibial joint line. Discussion and Conclusion: A radiograph with internal-external rotation of the leg can result in a clinically important error in both planning of osteotomies and TKAs and assessing alignment postoperatively, especially when there is a flexion contracture at the knee. Radiographers should use the patella forward method and not the tibial tubercle and foot forward methods to minimize these errors. The use of mechanical and gap-balancing alignment techniques in TKA causes an asymmetric flexion and extension gap in the majority of knees and changes the joint line from normal, which might result in instability, stiffness, and unexplained pain. An alignment technique that maintains symmetric flexion and extension gaps and does not alter the joint line might avoid the instability and stiffness inherent in the mechanical and gap-balancing alignment techniques.

<table>
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<tr>
<th>Complications</th>
<th>n (patients)</th>
<th>ORIF to DFR</th>
<th>DFR</th>
<th>p-value</th>
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<td>8 (61.5%)</td>
<td>30 (83.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>3 (23.1%)</td>
<td>2 (6.5%)</td>
<td></td>
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</tr>
<tr>
<td>Dislocation</td>
<td>1 (7.7%)</td>
<td>1 (2.8%)</td>
<td></td>
<td></td>
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<tr>
<td>Recurrent effusions</td>
<td>1 (7.7%)</td>
<td>0 (0.0%)</td>
<td></td>
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<tr>
<td>Extensor mechanism disruption</td>
<td>0 (0.0%)</td>
<td>3 (8.3%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Radiographic analysis showed no significant difference in postoperative alignment (average 3.76 degrees anatomic valgus for all TKAs versus 3.64 for varus knees and 4.1 degrees for valgus knees) and no difference in radiographic loosening. Average tourniquet time was 59.8 for all TKAs and no different for varus or valgus knees (p>0.05). The rate of posteromedial MCL release in varus knees was 47%, anterior MCL 8%, partial or complete PCL release 31%, popliteus 10%. A cruciate retaining bearing was used in 62% of the varus knees, and a posterior cruciate substituting bearing was used in 38%. The rate of releases in valgus knees was 59% illiotibial band, 56% popliteus tendon, 26% PCL, 2% lateral collateral ligament (LCL). A cruciate retaining bearing was used in 45% of the valgus knees, and posterior cruciate substituting bearing was used in 55%.

**Discussion:** Selective soft-tissue release for gap balancing in primary TKA is an effective technique producing excellent clinical and radiographic results. Consistent anatomic coronal plane alignment and soft-tissue balance can be achieved without bone cut modification. The technique is applicable to varus and valgus knees and accommodates PCL retention or substitution. PCL retention is more feasible in varus knees than valgus knees and valgus knees are more likely to require multiple releases to achieve a balanced TKA.

**SCIENTIFIC EXHIBIT NO. SE22**

**The Painful Postoperative Knee: A New Concept Using Spect/CT Combining Biological, Mechanical and Structural Data**

*Michael T. Hirschmann, MD, Bruderholz, Switzerland*

*Johann Henckel, BM, London, United Kingdom*

*Christopher Robert Wagner, Ware, United Kingdom*

*Helmut Rasch, MD*

*Niklaus F. Friederich, MD, Bruderholz, Switzerland*

*Scott F. Dye, MD, San Francisco, CA*

**Introduction:** The painful knee after arthroplasty or osteotomies is an unsolved diagnostic and therapeutic problem. Despite a detailed history and thorough clinical examination, in many patients it is difficult to precisely locate the origin of the pain, analyse the pathomorphology and subsequently establish the correct diagnosis or treatment. Radiological imaging such as radiographs, CT and MRI are readily available investigations. The major disadvantage of these is the poor correlation between structural radiographic abnormalities and pain. In addition metal artifact splatter may reduce their clinical utility. In the last two years combined single photon emission computerized tomography (an osseous metabolic imaging study) and conventional computerized tomography (SPECT/CT) has been increasingly recognized as a promising new diagnostic imaging modality. It combines high resolution anatomical 3D-CT SPECT, which provides 3D information about biological processes, into a single hybrid imaging. The pattern of tracer uptake is known to correlate with pain. Over planar scintigraphy or SPECT/CT has been shown to be more specific and to a lesser extent more sensitive in detecting and interpreting bone and joint pathologies. With its’ accurate anatomical localization orthopaedic surgeons can gain valuable information in patients having pain post knee surgery HTO, UKR or TKR. Although clear diagnostic guidelines and indications for the use of SPECT/CT are lacking, it offers a great potential to improve and change current diagnostic algorithms.

**Methods:** We have developeled and evaluated a variety of classification and grading systems in terms of inter- and intra-observer reliability (ICCs) and these will be demonstrated. Optimal clinical use of SPECT/CT requires an understanding of its fundamental principles. Hence, we will describe these principles, our low dose diagnostic protocol, biomechanical measurements and the used tracer classification and localization schemes in detail.

**Results:** This exhibit demonstrates how to evaluate and analyze SPECT/CT data using our standardized protocol, which is defined by a 3D volumetric quantitative approach of tracer localization and activity as well as mechanical measurements such as component orientation, mechanical and anatomical axes. Our method is based on 3D localisation using clinically relevant anatomical landmarks and frames of reference, along with intensity value normalisation using reference regions. We demonstrate how the normalised, 3D-rendered data can provide a richer source of clinical information and allow quantitative comparison of SPECT/CT measurements across patients. A variety of different case scenarios (e.g. patients after TKR fig. 1, UKR fig. 2) will highlight the clinical value of the combination of mechanical, biological and structural information. Discussion and Conclusion: This scientific exhibit critically reviews the current evidence of SPECT/CT in patients with pain after knee surgery.

**SCIENTIFIC EXHIBIT NO. SE23**

**Knee Society - Total Knee Arthroplasty in the Young, Active, Osteoarthritic Patient: Is This a Realistic Option?**

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*Giles Scuderi, MD, New York, NY*

*Olga Foley, Rosemont, IL*

**Purpose:** During the past decade, there has been a trend to perform total knee arthroplasties replacements (TKAs) in young, active patients with 20-30 years life expectancy. The purpose of this study is to review the available literature on the outcomes of total knee arthroplasties in young, active patients with a diagnosis of osteoarthritis; to outline contemporary initiatives to increase the survivorship of TKAs in young patients; to determine if contemporary outcome tools are...
well suited to assessing TKA outcomes in the young patient and to encourage post-market surveillance of these patients. **Methods:** Meta-analyses in the peer-reviewed literature were analyzed on the topic of total knee arthroplasty outcomes in the young, active, osteoarthritic patient population with >20 years life expectancy was performed. To be included, peer-reviewed studies had to provide the outcomes of consecutive cohorts of patients <60 years of age with a diagnosis of osteoarthritis and a minimum of ten years (preferably >20 years) follow-up. In addition, data reported in national joint replacement registries on TKA outcomes in younger patients was assessed. **Results:** 1) Trends In TKAs National joint replacement registry data have demonstrated that since 1996 more TKAs have been performed than THAs and that since that time, the rate of growth of TKAs has outpaced that of THAs. The age distribution of TKAs followed a bell-curve distribution with the largest cohort of patients being in the 65-74 year age groups for both males and females. Over the past decade, the age groups with the largest percent increases in TKA rates have been 45-54 years (337% increase for females and 271% increase for males) and 55-64 (260% increase for females and 213% increase for males). In fact, 25% of TKAs are now performed in patients <65 years of age, often with life expectancies of >20-30 years. 2) Historical TKA Outcomes For OA Patients <60 Years Of Age Keeney et al performed a systematic review of the literature (1950 to 2009) to assess how TKAs perform in patients <55 years of age, to determine if TKA was a durable procedure for younger patients and to seek guidance on techniques for younger patients. To be included, a study had to have at least two years follow-up. Two hundred and forty one articles were identified, but only thirteen studies met these criteria (908 TKAs in 671 patients). Mean Knee Society clinical and functional scores increased 47 and 37 points, respectively. Implant survivorship was reported to be between 90.6% to 99% for the for the first decade and between 85% and 96.5% during the second decade of follow-up. The authors noted that most of the outcome data reported was surgeon-derived and encouraged the use of patient-derived data in the future. To be included, a study had to have at least two years follow-up. Two hundred and forty one articles were identified, but only thirteen studies met these criteria (908 TKAs in 671 patients). Mean Knee Society clinical and functional scores increased 47 and 37 points, respectively. Implant survivorship was reported to be between 90.6% to 99% for the for the first decade and between 85% and 96.5% during the second decade of follow-up. The authors noted that most of the outcome data reported was surgeon-derived and encouraged the use of patient-derived data in the future. The authors also commented that most of the young TKA patients studied would outlive their TKAs and that there were virtually no twenty to thirty year follow-up studies. The authors recommended multicenter collaboration and improving the data collected in national registries to provide ongoing reliable information on the outcome of TKAs performed in young, active patients. 3) Level Of Evidence For Contemporary Initiatives To Increase Survivorship In TKAs Performed In Patients >20 Years Of Life Expectancy A) Mobile Versus Fixed Bearing TKAs No long term, randomized studies are available comparing the survivorships of mobile versus fixed bearing TKAs. There are a few cohort studies of single TKA implant designs which suggest comparable long term outcomes. B) Crosslinked Polyethylenes Several “in vivo” studies have demonstrated superior long term wear performance with the use of crosslinked polyethylenes. Other studies have urged caution in adopting crosslinked polyethylenes in TKAs due to inferior mechanical properties and increased notch sensitivity. No clinical studies with >10 years follow-up are available on TKAs which used crosslinked polyethylenes. C) Ceramicized Metal Counterface On Crosslinked Polyethylene Recently, the FDA approved a ‘30 year wear claim’ for a TKA with a ceramicized metal femoral counterface which articulated with a crosslinked polyethylene. The approval was based on ‘in vivo’, aggressive, wear machine data of more than 60 million cycles. Clinical collaboration of this data will not be available for many years. **Discussion:** Total knee arthroplasty is being performed with greater frequency in young, active, osteoarthritic patients with twenty or more years life expectancy. The available scientific literature suggests that with historic implants, TKAs survivorship falls off in the second decade of use and that few studies have >20 years follow-up. A number of promising contemporary initiatives are underway to improve TKA survivorship in the younger, active patient, but as of today, only short term clinical results are available or the results are based only on laboratory tests. Post-market surveillance by national joint replacement registries is crucial to determine whether the current trend to perform TKAs in young, active patients is justified. **SCIENTIFIC EXHIBIT NO. SE24** **Things You Should Know About Asian Knee Before Doing Total Knee Replacement** **Samih Tarabichi, MD, Dubai, United Arab Emirates** **Muaz M. Adi, MBBS, Abu Dhabi, United Arab Emirates** **Mohamed M. Elfekky, SR, MSc, FRCS, MD, Dubai, United Arab Emirates** **Ibrahim M. Gado, SR, Dubai, United Arab Emirates** **Marwan Hawari, MD** **Introduction:** Medical literatures has documented some unique features of the Asian knee. These features need to be addressed when performing TKA on Asians. The senior writer of this paper has performed over 3,000 TKA on Americans and over 4000 TKA on Asians. This enabled us to document specific anatomical, systemic and functional features. The objective of this exhibit is to introduce surgeons to these features and recommend specific modifications for each feature to improve clinical outcome. **Material and Methods:** We performed over 4000TKA on Asians. We collected all relevant clinical data and the data were processed by a US implant manufacturer. We used 3 different knee systems, which were produced in the US. We encountered specific difficulties during surgery especially with small sizes such as ; posterior referencing instrument proved to be misleading in defining trans epicondylar axis. It is almost impossible to use CKK implant in primary knee in some small knees. Also, we encountered more implants over hang using standard implant ,and we had difficulties in matching flexion and extension gaps with 4 mm increment between sizes. **Results:** Knee score was similar to most clinical series in the West. However, maximum flexion was better than that reported over there. Implant survival was the same. We encountered more supracondylar fractures than in the west. **Discussion:** We believe that there are systemic, anatomical, and functional features that are unique in Asian patients. Systemic feature such as osteopenia can lead to increase risk of supracondylar fractures and surgeon should be able to stem the femur in some primary selected cases. Anatomical feature dictate the need for narrow femur implants (Ching et al.) to better fit the femur. An average of 6 degrees of external rotation is more appropriate for Asians as compared to the 3 degree used normally on Americans (Zahng et al). Other important anatomical unique features will be addressed. Activities of daily living in Asians require high flexion and surgeons should always strive to obtain better flexion and use implants which is friendlier to flexion. Most patients submit to surgery at advanced stage which make surgery more challenging, requiring less bone resection and more soft tissue release. We measured the thickness resected bones and found the average thickness of resected bones is less than what the idustry recommend. **Conclusion:** Surgeons who intend to perform surgeries on Asians should make some changes in their surgical technique and select proper implants which suit better Asians. We call on the industry to make specific changes in their instruments and implant to serve this growing market.
The Step-by-Step Pictorial Guide to Total Knee Arthroplasty: A New Technique in Orthopaedic Training

Nathan W. Skelley, MD, Saint Louis, MO
Carl A. Johnson, MD, Kingville, MD

Introduction: Recent research has shown that ACGME work hour restrictions may have decreased resident case logs by as much as 20%. This is extremely concerning considering new enhanced work-hour restriction rules take effect in 2011. Numerous studies have shown that operative confidence is closely correlated with operative experience. For these reasons, we set out to design an educational guide that quickly, efficiently, and comprehensively demonstrates the main steps involved in performing a common orthopaedic procedure. Our first guide focused on total knee arthroplasty. We hope to create, and inspire others to create, a database of similar step-by-step pictorial guides for other procedures that can facilitate the learning curve and enhance the operative experience for trainees.

Methods: A review of medical literature demonstrated that there were no similar projects in print or in production. We met throughout a one-year period to design the project, photograph the technique, and create this guide book. We based the guide book design on related literature for high-yield learning of complex multi-step procedures used in other areas of industry. This design uses at least one image per page with a 1-3 sentence amount of specific text describing that stage of the procedure. One author served as photographer and editor while the other author performed the TKA procedure in his usual manner. Over 3,500 images were taken of the surgeon’s TKA technique over 2 cases. After excluding repeat or poor quality images, approximately 900 images were edited to create a 321 page guide in Microsoft PowerPoint. The guide was then made freely available in spiral bound, Acrobat PDF, and online PowerPoint formats.

Results: Residents surveyed at our programs reported that this was the most efficient and comprehensive way to prepare for a TKA case compared to other resources. In this exhibit, we show how this technique facilitates operative learning by allowing a trainee to see every step of an operation before performing the case. Additionally, we demonstrate how similar guides can be created at other institutions for various common procedures; femoral nail, carpal tunnel release, arthroscopic procedures, etc. Furthermore, we compare the limitations of other teaching methods, such as textbooks, technique guides, instructional videos, and one-on-one courses, given the procedural and step-by-step nature of many orthopaedic operations. Finally, for the exhibit, we will provide examples of our step-by-step pictorial guide in print, on a mobile device, and on a repeating PowerPoint presentation.

Discussion: Using our successful design, two people can now create similar guides in a few days and with the same format at little to no expense. The guides allow for efficient studying or quick review “flipping” through the essential steps of these common orthopaedic procedures. When similar guides are produced, it will benefit many groups of people including operating room staff, medical students, residents, fellows, and even practicing surgeons. In the future, these guides could be shared via the AAOS OrthoPortal in a database profiling leaders in the field teaching techniques they have perfected.

Custom Patellofemoral Arthroplasty of the Knee: An Eleven Year Follow-Up

Domenick J. Sisto, MD, Sherman Oaks, CA
Vineet Sarin, Camarillo, CA

Introduction: While interest in patellofemoral arthroplasty (PFA) for isolated, end-stage patellofemoral arthritis has grown substantially in recent years, its published clinical results have shown varying degrees of success due primarily to shortcomings in the design of so-called “off-the-shelf” prostheses. Custom PFA, in which the trochlear prosthesis is custom-made to fit the individual patient’s patellofemoral groove, was developed to address these limitations. Our initial experience with custom PFA was published in 2006 and reported 100% survivorship with excellent or good Knee Society scores in all knees at a mean duration of follow-up of 6 years (range, 2.7 to 9.9 years). The study was a retrospective review of a consecutive series of custom PFAs performed by a single surgeon at a single institution between March 1995 and August 2002. There were 25 PFAs performed in 22 patients (three staged bilaterals), 16 of whom were female. Mean age at the time of index arthroplasty was 45 years (range, 23 to 51 years). The surgical technique and design methodology of the custom trochlear prosthesis have been previously described in detail. The objective of the present study was to evaluate the longer-term success of custom PFA in the original patient cohort.

Methods: The original cohort of patients was selected to undergo PFA with a customized trochlear prosthesis based upon the presence of isolated, end-stage, patellofemoral arthritis in their affected knee. The radiographic evaluation scale described by Ahlback was used to evaluate the severity of the disease in each knee compartment on the basis of sclerosis, joint-space narrowing, subluxation, and the presence of osteophytes. Only patients whose medial and lateral compartments scored less than or equal to 1 point on the Ahlback scale were included for PFA. The patellofemoral compartments for all knees scored at least 4 points. The mean preoperative Knee Society functional score was 49 points, and the mean preoperative Knee Society objective score was 52 points. At a mean duration of follow-up of 6 years, the mean Knee Society functional score was 89 points, and the mean Knee Society objective score was 91 points, and no patient had required additional surgery or had component loosening. For assessment of longer-term follow-up, a validated questionnaire was adapted and administered to each patient via telephone. The questions were designed to assess the status of each patient’s custom PFA(s) as well as their degree of knee function.

Results: The questionnaire was completed for all 25 knees. No knees from the original study were lost to follow-up. At a mean duration of 11.3 years (range, 7.8 to 14.9 years) from the time of index arthroplasty, all 25 PFAs were still in place and all patients reported themselves as being very satisfied with the arthroplasty. There were no reports of weakness, instability, or additional surgery. Two patients reported that their PFA prevented them from participating in sports activities. All knees experienced some pain, but no patients took medication because of their knee pain. All 22 patients reported that they would undergo custom PFA again.

Discussion and Conclusion: This 11 year follow-up study demonstrates that custom patellofemoral arthroplasty is a safe and effective treatment for patients with isolated patellofemoral arthritis of the knee. These results compare favorably with those involving so-called “off-the-shelf” patellofemoral arthroplasties that have been reported on over the past 30 years. We believe the major factors that contribute to the success of custom patellofemoral arthroplasty are as follows: (a) a strict inclusion criteria based on preoperative radiographic evaluation; (b) a meticulous attention to detail.
to soft-tissue balance and patellofemoral tracking at the time of arthroplasty; and (c) a patient-specific design and manufacturing methodology that ensures accurate and precise anatomic fit while simultaneously providing proper patellofemoral alignment and medial-lateral constraint.

SCIENTIFIC EXHIBIT NO. SE27

Dynamic In Vitro Analysis of Post-Cam Mechanism in Posterior Stabilized Total Knee Arthroplasty Designs

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Luc Vanlommel, MD, Pellenberg, Belgium
Jan Vanlommel, MD, Pellenberg, Belgium
Luc Labey, Leuven, Belgium
Bernardo Innocenti, PhD, Leuven, Belgium
Jan M. Victor, MD, Brugge, Belgium
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Introduction: Posterior Stabilized Total Knee Arthroplasty (PS TKA) designs were introduced to compensate for the resected or deficient Posterior Cruciate Ligament (PCL) and to avoid paradoxical roll forward of the femur. Despite excellent clinical and functional results, concern may arise about the stresses acting between the post and the cam. Furthermore, the mechanical function of the post-cam mechanism and its relation to design features has not been investigated in great detail before. In this study, the post-cam contact mechanics, as well as the knee kinematics were measured for several PS designs, during a simulated squat. The goal was to explore the relationship between design features of the post-cam mechanism, its contact mechanics, and the knee kinematics of different PS designs. The results were compared to information about PCL function and roll back in the healthy human knee.

Methods: In the experimental part of the study, 9 implants were attached to custom designed metal fixtures simulating the tibia and femur and mounted in a knee rig. For each design, five loaded squats were performed between 30° and 130° of flexion with a variable load of the quadriceps, constant forces in the medial and lateral hamstrings (50 N, each) and a constant vertical ankle force of 150 N. Contact pressure, area and force were measured using a thin pressure sensitive film taped to the posterior face of the post. Kinematics was recorded with reflective markers and infrared cameras. A simplified sagittal model of the replaced knee kinematics was made to describe the relationship between the position of the cam relative to the centre of the femoral condyles and femoral roll back. The model predicts the roll back distance after post-cam engagement if the angle for this engagement is known. The roll back distance is a function of the initial contact angle, the flexion angle and the relative position of the cam to the condylar center.

Results: A wide variability was shown for the flexion angle at which the post and the cam engage (43° to 102°), the maximal contact force (318 N to 997 N) and the lateral femoral roll back (5.6 mm to 15.4 mm). All designs showed a gradual increase in contact area, pressure and force during flexion and a maximum contact pressure exceeding the yield strength of polyethylene in deep flexion. There is a good correlation for the maximal contact force with the initial post-cam contact angle (R = -0.81, p = 0.009) and with both the lateral femoral roll back and femoral rotation after post-cam engagement (R = 0.77, p = 0.071). A good correlation (R = 0.91) was found between the measured roll back distances and the calculated roll back values from the simplified model. Post-cam mechanisms which engage early, show contact forces and roll back closer to the horizontal component of the PCL force and roll back of the healthy knee.

Discussion and Conclusion: For the first time, the post-cam function and contact mechanics of a large number of widely used PS knee implants have been documented in a standardized setting. Post-cam mechanisms show large variations in terms of initial post-cam contact angle, maximum contact force and femoral roll back. The roll back distance is mostly determined by the initial contact angle and the position of the cam with respect to the femoral condylar center. The maximal contact force tends to be higher for designs with an earlier post-cam engagement and for designs inducing more roll back and/or femoral rotation. More functional post-cam mechanisms (showing earlier post-cam engagement) show femoral roll back and horizontal forces closer to the native human knee. With regard to the design of post-cam mechanisms, a compromise has thus to be made between functional requirements on one hand and risk for failure on the other.

SCIENTIFIC EXHIBIT NO. SE28

A Motion Analysis Framework Allowing Non-invasive Quantitative Assessment of In-vivo Knee Joint Function

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Luc Labey, Leuven, Belgium
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Kaat Desloovere, PhD

Introduction: Research has not yet succeeded in identifying tools to objectively and non-invasively assess clinical and functional performance in patients before and after knee arthroplasty. In patients with neural disorders such as cerebral palsy, three-dimensional marker-based motion analysis has evolved to become a well standardized procedure with a large impact on the clinical decision-making process. On the other hand, in knee arthroplasty research, motion analysis has been little used as a standard tool for objective evaluation of knee joint function. Furthermore, in the available literature, applied methodologies are diverse, resulting in inconsistent findings. Therefore we developed and evaluated a new motion analysis framework to enable standardized quantitative assessment of knee joint function.

Methods: The proposed framework integrates a specifically designed motion analysis protocol with an associated reference database, together with a standardized post-processing phase including statistical analysis. Kinematics are collected using a marker set defined by merging two existing protocols and adding a knee alignment device. Acquisition of a standing trial, a star-arc hip joint motion and a set of knee joint flexion/extension cycles allows functional-based subject-specific calibration of the underlying kinematic model. Marker trajectories are then acquired for three trials of a set of twelve motor tasks: walking, walking with crossover turn, walking with sidestep turn, stair ascent, stair descent, stair descent with crossover turn, stair ascent with sidestep turn, trunk rotations, chair rise, mild squat, deep squat and lunge. This specific set of motor tasks was selected to cover as much as possible common daily life activities. Furthermore, some of these induce larger motion at the knee joint, thus improving the measurement-to-error ratio. Kinetics are acquired by integrating two forceplates in the walkway. Bilateral muscle activity of 8 major muscles is monitored with a 16 channel wireless electromyography system. Finally, custom-built software with
an associated graphical user interface was created for automated and flexible analysis of the acquired data, including repeatability analysis, analysis of specific kinematic and kinetic patterns, spatiotemporal parameters as well as statistical comparisons.

Results: Following ethical approval and informed consent, the proposed framework was successfully applied in a control group of 80 normal subjects within a wide age-range (age: 54.5±19.1 years; BMI: 25.5±4.0; 40M/40F; 60 Caucasian, 20 Asian) thus constructing the reference database for control. Moreover, the same framework was applied successfully in a randomly selected group of 10 patients with a bi-compartmental knee replacement (BKR) (age: 67.3±5.3; BMI: 29.7±5.1; time post-op: 1.65Y±0.4; 2M/8F Caucasian). Comparison between these patients and age-matched controls demonstrates that, for a large range of motor tasks, knee joint kinematics after BKR are as much consistent with the healthy controls (coefficient of multiple correlation (CMC) =0.49) as the consistency within a group of controls or BKR-subjects individually (CMC=0.52). Nevertheless, also significant differences (p<0.0167) were identified which are indicative for retention of preoperative motion patterns and/or remaining compensations.

Discussion and Conclusion: The proposed framework allows in-vivo evaluation of knee joint performance in a standardized, objective and non-invasive way. It is applicable in both healthy subjects and knee replacement patients and is shown to be sufficiently sensitive to detect even relatively small differences between the two populations.
situation as would occur with peel off intraoperatively. A modified reconstruction technique is described with biomechanical evaluation and clinical experience in 4 patients is outlined. **Methods:** Seven fresh frozen cadaveric knees were dissected to expose the extensor mechanism. Three independent observers determined the patellar tendon insertional dimensions and bony insertional area using digital images and characterized the histological features of insertion into bone. Specimens were loaded to failure (MTS Sintech 1/G) at a displacement rate of 20mm/min at 25 degrees of flexion and using the contralateral normal knee as control. A modified reconstruction technique using free semitendinosus graft through transverse tunnels in the tubial tubercle and inferior third of patella was then used to substitute for the transected tendon. **Results:** 1. The tibial insertion demonstrated an uneven polygon shape with a medially orientated proximal apex. There was a strong correlation between patella width (42 +/- 4.2mm) and insertional width ($R^2 = 0.804, p < 0.001$). Histology showed a clear transitional fibrocartilaginous zone and extensive distal insertion of fibers as well by polarized light. 2. A recession of the medial third was performed to simulate intraoperative release and load to failures were reduced to mean 84 % ± 16% of the contralateral normal side. 3. A full thickness disruption of the tendon was reconstructed by a semitendinosus graft through the patella and tubial tubercle and was as strong as the contralateral normal, providing a brace free, full weight bearing post operative course. This is demonstrated on video and with 4 clinical case examples. **Conclusion:** This study defines the anatomy and load to failure characteristics of the distal insertion of the patellar tendon. A “safe” amount of recession of nearly 30 % width can optimize surgical exposure without significantly compromising biomechanical load to failure. Direct avulsions can be readily treated with free autogenous semi tendinosus graft through transverse drill holes in the patella and tibia.

**Total Knee Arthroplasty Fingerprints: A Tool to Characterize Surgical Variability of Several Designs**

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Scott A. Banks, PhD, Gainesville, FL

**Introduction:** Although total knee arthroplasty (TKA) is a highly successful procedure, surgical variability of component positioning and soft tissue corrections can lead to poor clinical performance caused by overloading of joint surfaces and soft tissues. Preoperatively identifying sensitive directions, that would cause these undesirable effects, may decrease poor outcomes. We introduce the concept of TKA fingerprinting as a tool to characterize and graphically convey the sensitivity of a TKA design to surgical variability in implant component position. To provide several examples of TKA fingerprinting, the contact forces in four different TKA types for several configurations were estimated and compared, simulating surgical variability and patient-related anatomical factors during a loaded deep squat. The purpose of this study was not to analyze the behavior of those specific TKA designs but rather to illustrate a tool that could be used to show, in general, how surgical errors or anatomical factors can alter patello-femoral (PF) and tibio-femoral (TF) contact forces, for each type, compared to its own reference configuration. **Methods:** Computed tomography images of one full cadaveric leg were used to generate a three-dimensional physiological knee model. Four TKA types were considered in this study: a fixed bearing posterior stabilized (PS) knee, a high flexion fixed bearing PS knee, a mobile bearing knee and a hinged knee. All prostheses were the same size and replaced both cruciate ligaments and all resurfaced the patella. Following the proper surgical procedure, each TKA was virtually implanted, thus defining the reference replaced knee model. Each derivative replaced knee model was then obtained by changing the values of one parameter, or a combination of two, in a range based on literature and surgical experience (Table 1). A validated musculoskeletal model was used to simulate a 10 s loaded squat to 120° with a constant vertical hip load of 200 N for each configuration. For each model maximum PF and TF contact forces were evaluated and represented in the fingerprinting graphs to show the sensitivity with respect to reference configuration **Results:** An example of a fingerprint graphs is shown, presenting the main results for one knee design (Figure 1). **Discussion and Conclusion:** In general a TKA should be implanted in the correct position to obtain the biomechanical behavior for which a TKA was designed because placement variations can alter the functionality of a TKA. A fingerprinting tool for TKAs was developed and used to show the sensitivity of PF and TF contact forces in surgical variability. The graphs show that PF contact forces were altered mostly by errors in positioning of patellar and tibial components, while TF contact forces were mostly affected by ligament release. Additionally, for the definition of a TKA numerical model much attention should be given to the selection of the boundary conditions, because even a small change can influence the resulting contact forces significantly. **Table 1:** Sample of the different configurations for the sensitivity analysis (SFP: Sintech 1/G).

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<td>-</td>
</tr>
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<td>TKA/Patient</td>
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**References:**

- The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e. the drug or medical device is being discussed for an off label use).
- For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
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Introduction: The 30° varus inclination of the tibia plateau and approximately the same degree valgus orientation of the distal femoral condyles are the norm for most surgical instrumentation systems for total knee arthroplasty (TKA). However, several studies reported that these anatomical features vary substantially with ethnicities and countries. Furthermore, a few studies of Asians found that femoral lateral bowing and varus inclinations of the tibia plateau greater than 30° are more frequent. It has been our frequent observations in practice for Koreans that the femur has lateral bowing in the shaft and varus orientation at the condyles and the tibia has much larger varus inclination at the plateaus. These anatomical features different from the well-known standard anatomy required us to apply different surgical techniques such as external rotation of the femur greater than 3 and more extensive medial release. This study was conducted to document the radiographic features of the femur and tibia in the coronal plane in Korean patients undergoing TKA, to determine whether the presence of lateral bowing, varus condylar orientation of the femur as well as tibial varus inclination of the proximal tibia, are associated with residual varus positioning of TKA components, and to determine whether the use of computer assisted navigation contributes to a more neutral postoperative component position. In addition, we attempted to determine whether coronal alignments of the overall limb and individual components are associated with functional outcomes evaluated at 1 year after surgery.

Methods: In 327 knees with TKA (TKA group) and 74 gender-age-matched normal knees (control group), the patterns and degrees of femoral bowing and condylar orientation and tibia plateau inclination were measured on preoperative full-limb radiographs. Postoperatively, coronal alignment of the limb, and femoral and tibial components was measured in terms of mechanical tibiofemoral angle, with the reference of the mechanical axis of the femur, and with the reference of the mechanical axis of the tibia, respectively. To document radiographic features, data were summarized as means, standard deviations, and ranges. In addition, the severity of femoral bowing, femur condylar orientation, and tibia plateau inclination was assessed by grading relevant values into different grades such as mild, moderate, severe with relevant cut-off values. To determine whether these anatomical features influence the coronal alignment of femoral and tibial components, correlation analyses and subgroup comparisons according to the grades of the anatomical variations were performed. Furthermore, regression analyses and subgroup comparisons were carried out to determine whether the use of navigation reduce the effects of the anatomical variations on the coronal alignment. Finally, correlation analyses and subgroup comparisons between the aligned knees and outliers defined as alignment beyond ±3° were carried out for functional outcomes evaluated at 1 year after surgery.

Results: The prevalence of lateral femoral bowing in Koreans was high (TKA: 89.3%; Control: 66.2%). Mean femoral bowing angle was 5.5° lateral in the TKA group compared to 2.3° lateral for the control group. Varus condylar orientation of the femur was common (81.1%) in the TKA group whereas the majority (79.7%) in the control group had a valgus condylar orientation. The mean varus angle of the condyles was varus 2.6° in the TKA group and valgus 1.3° in the control group. Mean tibial plateau inclination was varus 8.2° in the TKA group and varus 5.1° in the control group, moreover, 78.1% of subjects in the TKA group and almost half (45.4%) of the control group presented with very severe varus tibial inclination (>5°). Correlation analyses revealed a significant association between the preoperative femoral bowing angle (correlation coefficient=0.24, p<0.001) and femoral condylar orientation (CC=0.35, p<0.001) to residual varus positioning of the femoral component. Preoperative tibial varus inclination had few effects on postoperative tibial component positioning. Although weak correlations were found for preoperative tibial varus inclinations to postoperative tibial component position (CC=0.113, p=0.05). Linear regression discovered that femoral component position was less sensitive to varus condylar orientation and lateral bowing in the navigation subgroup than the standard subgroup. In the subgroup analyses, navigated TKAs showed closer coronal femoral component alignment to the neutral position (varus 0.30 vs. varus 1.00, p<0.001), and the outlier defined as beyond ±3° to the mechanical axis was lower in the navigated group (100% vs. 95.8%, p=0.007). For the tibial component alignment, reduced outliers were observed with a narrower cut-off (<2°±TCP±2°) in the use of navigation. There were no meaningful correlations between coronal alignment of the limb and individual prostheses. Comparisons between the aligned and the outliers found no meaningful differences for ROM, AKS knee and function scores, Patellofemoral scores, WOMAC scores, and SF-36 scores.

Conclusion: This study documents that the lateral bowing and varus condylar orientation of the femur and the varus inclination of the tibial plateau are highly prevalent in Koreans undergoing TKA for advanced OA. These anatomical features should be considered in designing surgical instruments and executing surgical procedures for TKA.
Contemporary Knee Design Motion: All Things For All People?
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Introduction: Although Total Knee Arthroplasty (TKA) surgery enjoys 90% of outcomes with good to excellent results, some patients have difficulty adjusting their gait to accommodate the new articulations inherent in contemporary implant designs. Paradoxical motions inclusive of anterior sliding and lateral pivot are examples of aberrant TKA kinematics. This study compares the motion of six contemporary TKA designs within recent in vivo kinematic data of the healthy un-operated knee through deep flexion by employing a computational kinematic simulator, which accounts for the presence of the soft tissue envelope.

Methods: Three-dimensional solid models of the femoral, patellar and tibial insert components were created for each total knee design using laser profilometry to measure the articular surfaces of implantable quality parts. The modeled components were “implanted” in the virtual knee joint space per the manufacturer’s surgical procedure. A deep flexion activity was conducted to the maximum flexion angle achievable prior to bony impingement for each design.

Results: Synchronized animations of component motions and quantitative data plots were generated to characterize each design and compared to that of the normal knee. Paradoxical motion was displayed in varying degrees with maximum flexion angles varying between 104 degrees (Figure 1) and 144 degrees (Figure 2). Each still image captures the moment when maximum flexion occurred for each design. The top images depict component orientation appreciated from a superior view. The bottom plots illustrate anterior/posterior translation of the femoral component as the knee flexes. The blue and red spheres are reference points that contribute to understanding the relative motion of the femoral component to the tibial component.

Discussion and Conclusion: The computational kinematic simulator employed was robust enough to model a variety of TKA designs. In general, the knee implants investigated did not replicate the kinematics of the healthy un-operated knee. The post and cam designs drove tibio-femoral contact toward the posterior edge of the insert, allowing higher flexion prior to impingement than the non-post designs. This study illustrates the importance of surgical technique inclusive of bone preparation and soft tissue releases that are necessary to enable total knee designs to more closely approximate normal knee kinematics.

Surface Cementing Technique of the Tibial Tray in Rotating Platform Total Knee Arthroplasty: It Is Not a Bad Idea!
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Introduction: The optimal method of prosthetic fixation in total knee arthroplasty (TKA) remains controversial. Proponents of full cementation of the tibial component (cementation of both undersurface and stem) state that this technique provides better short- and long-term fixation. On the other hand, advocates of surface or hybrid cementation (cementation of the undersurface only) and press-fitting of the tibial stem state that a sufficient implant stability is achieved, with decreased metaphyseal bone loss in case of revision and without the potential stress shielding effect. The surface cementation technique demonstrated excellent mid-term results, when using fixed-bearing devices, and biomechanical properties comparable to full cementation technique, most of all when the undersurface cement mantle is around 3 mm. Mobile-bearing tibial components were designed to reduce polyethylene wear and stress across fixation interfaces. Nevertheless, very little is known about the use of combined surface cementation and rotating-platform devices. This Scientific Exhibit will review the surgical techniques and outcomes of most commonly used cementing techniques in TKA. The literature will be compared with a consecutive series of patients treated at authors’ institution with unidirectional rotating platform (URP), posterior stabilized (PS), TKA, using surface cementation.

Methods: 109 consecutive primary implants with URP, PS TKAs (NexGen Complete Knee Solution Legacy, Posterior Stabilized Mobile-Bearing Knee, Zimmer, Inc, Warsaw, IN; PFC SIGMA™ Knee System With Rotating Platform) were performed in 94 patients (64 women, 30 men). The average patient’s age at surgery was 70.6 (SD ±9.76). The mean follow-up was 49 months (SD 18.66). Coronal deformity was varus in 82 (75%) knees, valgus in 15 (14%), while 12 (11%) knees presented preoperative neutral alignment. For radiographic evaluation, the tibial plateau was divided into four zones in anteroposterior view and into two zones in lateral view, and the cement penetration was evaluated in each zone. Multivariate analysis was performed to identify any

For full information refer to page 14. An alphabetical faculty financial disclosure list can be found starting on page 19.
correlations between early loosening or radiolucency lines and clinically relevant covariates: age, sex, follow-up time, cement penetration, tibial slope, femoral flexion, frontal alignment, preoperative and post-operative Knee Scores.

**Results:** The preoperative average clinical and functional Knee Society ratings were 46.6 (C.I.:43.1-50) and 43 points (C.I.:39.13-47.06), respectively, and at the final follow-up evaluation 86.5 (C.I.:84.5-88.5) and 81.4 points (C.I.:77.2-85.2), respectively. The mean radiographic cement penetration in anteroposterior view was 2.2 mm (C.I.:2.1-2.3) in zone 1, 2.9 mm (C.I.:2.8-3) in zone 2, 2.8 mm (C.I.:2.7-3) in zone 3 and 2.5 mm (C.I.:2.4-2.7) in zone 4. The mean radiographic cement penetration in lateral view was 2.5 mm (C.I.:2.3-2.6) in zone 1 and 3 mm (C.I.:2.8-3.2) in zone 2. No early loosening was detected, but in 12 asymptomatic patients (11%) radiolucency was noted around the tibial stem. The presence of radiolucent lines was not correlated with any of the covariates.

**Discussion and Conclusion:** In light of these considerations, the authors can conclude that full cementation technique still remains the gold standard, according to the longer follow-up outcomes reported in the literature. Nevertheless, at short-medium term follow-up, the rate of early loosening and radiolucency lines with mobile tibial tray and surface cementation is comparable to other studies using different cementation techniques or surface cementation combined with fixed platform total knee arthroplasties.

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**How to Minimize Infection Risk and Maximize Patient Outcomes in Total Joint Replacement**

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**Introduction:** Infection after total joint arthroplasty (TJA) is a devastating problem that expends patient, surgeon, and hospital resources. Although the incidence is on a downward trend, the overall burden of infected TJA will continue to rise due to the increase in utilization of TJA. This exhibit provides relevant information on the preoperative, intraoperative, and postoperative factors that impact infection after TJA, as well as the methods and measures to minimize the risks.

**Methods:** A comprehensive search of the literature was performed, using Medline, to find peer-reviewed articles on infection risk after TJA. Articles, expert opinions, and clinical guidelines were reviewed to synthesize information related to factors impacting infection risk after total hip and knee replacement. Moreover, various preoperative, intra-operative and post-operative methods to minimize the risk of infection were reviewed.

**Discussion and Conclusion:** This scientific exhibit presents current knowledge on methods to identify and correct preoperative factors such as nutritional, immunological, and colonization status associated with infection after TJA. Also, intraoperative measures to reduce airborne and deposited bacterial load are highlighted. Finally, advances in antibiotic delivery, use of antibiotic-loaded cement, and metallurgy in resisting biofilm development and colonization are presented. The exhibit will provide a comprehensive overview of measures that can be taken at each phase of TJA, with the aim of reducing the risk of infection. This will serve to increase surgeon and health care providers’ awareness of infection after TJA and measures to minimize such risk.