AAOS
American Academy of Orthopaedic Surgeons

Management of Ankle Osteoarthritis

Evidence-Based Clinical Practice Guideline

Adopted by:
The American Academy of Orthopaedic Surgeons Board of Directors
(insert approval date here)

Endorsed by:

Disclaimer

This clinical practice guideline (CPG) was developed by a physician volunteer clinical practice guideline development group based on a formal systematic review of the available scientific and clinical information and accepted approaches to treatment and/or diagnosis. This clinical practice guideline is not intended to be a fixed

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protocol, as some patients may require more or less treatment or different means of diagnosis. Clinical patients may not necessarily be the same as those found in a clinical trial. Patient care and treatment should always be based on a clinician's independent medical judgment, given the individual patient's specific clinical circumstances.

Disclosure Requirement

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

Funding Source

This clinical practice guideline was funded exclusively by the American Academy of Orthopaedic Surgeons who received no funding from outside commercial sources to support the development of this document.

FDA Clearance

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

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SUMMARY OF RECOMMENDATIONS

Recommendations are formed when there is sufficient evidence by which to create a directional statement. This is defined as evidence from two or more high quality studies (i.e., a strong recommendation), two or more moderate quality studies (i.e., a moderate recommendation), or statements resulting in a strong or moderate strength following Evidence to Decision Framework upgrading and/or downgrading.

Intra-Articular Hyaluronic Acid

Intra-articular hyaluronic acid alone is not recommended for the treatment of symptomatic ankle osteoarthritis, however, there may be a benefit for short term improvement in pain and function when combined with corticosteroid.

Quality of Evidence: High

Strength of Recommendation: Strong  (against)

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD Framework.

Intra-articular Platelet-Rich Plasma (PRP)

Intra-articular platelet-rich plasma is not routinely suggested for the treatment of symptomatic ankle osteoarthritis.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate  (against)

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD Framework.

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SUMMARY OF OPTIONS

Options are formed when there is little or no evidence on a topic. This is defined as low quality evidence or a single moderate quality study (i.e., a limited strength option), no evidence or only conflicting evidence (i.e., a consensus option), or statements resulting in a limited or consensus strength following Evidence to Decision Framework upgrading and/or downgrading.

Intra-Articular Corticosteroid (Monotherapy)

In the absence of sufficient evidence, it is the opinion of the workgroup that intra-articular corticosteroid injections are an option for short-term symptomatic relief in patients with symptomatic ankle osteoarthritis.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Intra-Articular Stem Cell Therapy

In the absence of sufficient evidence, it is the opinion of the workgroup that there is no reliable evidence regarding intra-articular stem cell therapy for symptomatic ankle osteoarthritis.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Skilled Physical Therapy

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with mild to moderate symptomatic ankle osteoarthritis who wish to avoid surgical intervention, the use of skilled physical therapy may improve patient-reported outcomes and potentially affect disease progression.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Home Exercise Programs

In patients with mild to moderate symptomatic ankle osteoarthritis who wish to avoid surgical intervention, group education and exercise including a home exercise program, may improve satisfaction, pain, and global rating of change.

Quality of Evidence: Low
Strength of Option: Limited ★★☆☆
Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for or against the intervention. Also, higher strength evidence can be downgraded to limited due to major concerns addressed in the EtD Framework.

Opioids

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle osteoarthritis, prescription opioids should not be used in the management of OA.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

NSAIDs/Acetaminophen

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle osteoarthritis the use of NSAIDs and/or acetaminophen may be used for initial symptomatic relief, when no other medical contraindications exist.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

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Durable Medical Equipment

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle OA, durable medical equipment may improve patient reported outcomes, and affect progression of OA symptoms, or need for invasive intervention.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Weight Reduction

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle osteoarthritis, weight reduction may improve patient reported outcomes and affect progression of OA symptoms.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Surgical Treatment for OA (Arthroscopic Debridement, Periarticular Osteotomy, Arthroplasty)

In the absence of sufficient evidence, it is the opinion of the workgroup that, in patients with symptomatic ankle osteoarthritis who have failed non-operative care and desire joint preservation, arthroscopic debridement, or periarticular realignment osteotomy, are options that may improve patient-reported outcomes and/or delay progression to joint-sacrificing procedures.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Surgical Treatment for End Stage Ankle OA

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with end-stage ankle OA, who have failed non-operative

treatment, either Ankle Arthrodesis (Fusion) or Total Ankle Arthroplasty (Replacement) can be utilized to improve patient reported outcomes.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Postoperative Physical Therapy

In the absence of sufficient evidence, it is the opinion of the workgroup that postoperative physical therapy may improve patient reported outcomes, range of motion, return to work/activity, strength, and gait restoration.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

Tranexamic Acid

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients undergoing total ankle arthroplasty or ankle arthrodesis for end-stage ankle OA, perioperative TXA may reduce complications, improve patient outcomes, and decrease perioperative blood-loss.

Quality of Evidence: Very Low
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a recommendation based on their clinical opinion.

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DEVELOPMENT GROUP ROSTER

VOTING MEMBERS

Christopher Gross, MD, FAAOS
Co-Chair, American Academy of Orthopaedic Surgeons

Jeannie Huh, MD, FAAOS
Co-Chair, American Orthopaedic Foot & Ankle Society

Marshall Boose, DO
American Academy of Orthopaedic Surgeons

Mallory Gagliano-Barnhart PT, DPT
American Physical Therapy Association

Kelly Hynes, MD, MS, FAAOS, FRCSC
American Academy of Orthopaedic Surgeons

John Louis-Ugbo, MD, FAAOS
American Orthopaedic Foot & Ankle Society

Kristin Mende, PT, DPT, OCS
American Physical Therapy Association

David Neuman, MD, FAAOS
American Academy of Orthopaedic Surgeons

Garett Pangrazzi, MD, FAAOS
American Academy of Orthopaedic Surgeons

Daniel Scott, MD, MBA
American Academy of Orthopaedic Surgeons

NON-VOTING MEMBERS

CONTRIBUTORS

Kathryn O'Connor, MD, FAAOS
American Academy of Orthopaedic Surgeons

Kodali Siva Prasad, MD
American Orthopaedic Foot & Ankle Society

OVERSIGHT CHAIR

Charles P. Hannon, MD, MBA, FAAOS
Committee on Evidence-Based Quality and Value, American Academy of Orthopaedic Surgeons

AAOS STAFF

Jayson Murray, MA, EMBA
Director, Clinical Quality and Value

Kaitlyn Sevarino, MBA, CAE
Director, Clinical Quality and Value

Danielle M. Schulte, MS, EMBA
Clinical Quality & Value Development Manager, Clinical Quality and Value

Kevin Jebamony, MPH
Clinical Quality & Value Development Manager, Clinical Quality and Value

Kristine Sizemore, MPH
Research Analyst, Clinical Quality and Value

Michael Herrera, MPH
Research Analyst, Clinical Quality and Value

Lauren Isenman, MPH
Research Analyst, Clinical Quality and Value

Tyler Verity, MSLIS
Medical Research Librarian, Clinical Quality and Value

Barbara Krause
Quality Improvement Specialist, Clinical Quality and Value

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INTRODUCTION

OVERVIEW

This clinical practice guideline (CPG) is based on a systematic review of the published scientific literature regarding the management of ankle osteoarthritis (OA) in adults. In addition to providing evidence-based recommendations for non-operative and operative treatment, this guideline highlights limitations in the current literature and identifies areas where further research is needed.

Ankle OA presents unique challenges compared with OA of other major joints, given its distinct etiology, patient demographics, biomechanical demands, and evolving surgical treatment options.[1]

This guideline is intended for use by qualified and appropriately trained physicians and surgeons involved in the management of patients with ankle OA. It may also serve as an informational resource for healthcare systems, payers, and policymakers engaged in musculoskeletal care delivery and guideline development.

GOALS AND RATIONALE

The purpose of this CPG is to improve the care of patients with ankle OA by promoting treatment decisions informed by the best available evidence. Evidence-based medicine (EBM) standards require physicians to integrate high-quality scientific evidence with clinical expertise and patient preferences in their clinical decision-making. This CPG was developed by the physician work group through a rigorous, standardized AAOS methodology, including systematic literature review performed between January 2024 and July 2025, critical appraisal of evidence, and structured consensus processes.[2] Where high-quality evidence exists, recommendations are provided. Where evidence is limited or absent, consensus-based statements reflect the collective clinical judgment of the workgroup.

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

Unlike hip and knee OA, ankle OA most commonly arises from prior trauma and often affects younger, working-age individuals.[1] The disease course is frequently complicated by deformity, instability, prior surgery, and compromised bone or soft-tissue envelopes. At the same time, treatment options for ankle OA, including joint-preserving procedures, ankle arthrodesis, and total ankle arthroplasty, have expanded substantially over the past two decades. These factors underscore the need for an ankle-specific, evidence-based guideline.

INTENDED USERS

This guideline is intended for use by orthopaedic surgeons, particularly those treating foot and ankle conditions, as well as other physicians involved in the care of patients with ankle OA. Additional users may include primary care physicians, physical medicine and rehabilitation specialists, physical therapists, podiatrists, nurse practitioners, physician assistants, and other healthcare professionals who participate in the diagnosis, nonoperative management, or postoperative care of patients with ankle OA.

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Health system administrators, insurance payers, and health policy decision-makers may also find this guideline useful as a contemporary synthesis of evidence on ankle OA management.

Ankle OA management assumes that decisions are made through mutual communication between the patient and the physician, with discussion of available treatments and procedures applicable to the individual patient. Once the patient has been informed of available therapies and has discussed these options with their physician, an informed decision can be made. Clinician input based on experience with conservative management and the clinician's surgical expertise and skills increases the probability of identifying patients who will benefit from specific treatment options.

This guideline is not intended for use as a benefits determination document. It does not cover allocation of resources, business and ethical considerations, and other factors needed to determine the material value of orthopaedic care.

PATIENT POPULATION

This guideline applies to adult patients with symptomatic ankle OA, regardless of etiology or disease severity. It addresses patients across the full continuum of care, including those undergoing nonoperative treatment, joint-preserving surgical interventions, and joint-sacrificing procedures such as ankle arthrodesis or total ankle arthroplasty.

This guideline does not address acute ankle fractures, isolated osteochondral lesions without established OA, or pediatric populations.

BURDEN OF DISEASE

Ankle OA is a debilitating condition that significantly impairs mobility, gait mechanics, and quality of life.[3] Given the ankle's critical role in gait efficiency and balance, even a modest loss of ankle motion or alignment can result in substantial functional impairment.

Although ankle OA is less prevalent than hip or knee OA, it disproportionately affects younger, working-age individuals, mainly due to its post-traumatic etiology.[4] As a result, the economic burden of ankle OA extends beyond direct medical costs related to diagnostic workup, conservative treatment, and surgery. Also, it includes substantial indirect costs related to lost productivity, work absenteeism, reduced functional independence, and long-term disability.[5] Given the younger age at onset for many patients, the cumulative lifetime burden may be substantial.

ETIOLOGY

Unlike hip and knee OA, which are predominantly idiopathic or age-related, up to 70–80% of ankle OA cases are post-traumatic, most commonly following ankle fractures, ligamentous injuries, or chronic instability.[1,4] Malalignment, residual deformity, cartilage injury, and altered joint mechanics contribute to progressive degeneration of the tibiotalar joint. Less commonly, ankle OA may result from inflammatory disease, infection, avascular necrosis, or idiopathic degeneration.[6]

The post-traumatic nature of ankle OA frequently results in asymmetric cartilage loss, coronal or sagittal plane deformity, and compromised bone stock, all of which influence treatment selection and outcomes.

INCIDENCE AND PREVALENCE

Ankle OA is substantially less prevalent than OA of the hip or knee, accounting for approximately 1–4% of all cases of lower extremity OA;[7] however, it represents a distinct clinical entity, frequently developing one to two decades earlier than OA in other major joints, thus disproportionately affecting younger and more active patients during their working years.[3]

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The prevalence and clinical impact of ankle OA are expected to increase over time due to several factors, including improved survival after ankle fractures, increased participation in high-impact activities, rising obesity rates, and greater patient expectations for mobility and function. Additionally, advances in surgical reconstruction, particularly total ankle arthroplasty, have increased recognition and referral of patients with end-stage ankle OA, further highlighting the clinical relevance of this condition.

RISK FACTORS

Multiple patient- and disease-related factors influence the development of ankle OA and outcomes following treatment. These include, but are not limited to, age, body mass index, diabetes mellitus, peripheral neuropathy, tobacco use, vascular disease, coronal plane deformity, bone loss, and bone quality.

To support shared decision-making and patient counseling, this guideline is accompanied by Prognostic Summaries of Evidence (PSEs) that synthesize the current literature related to selected prognostic factors. These summaries do not provide treatment recommendations but offer context regarding factors that may affect outcomes after ankle arthrodesis or total ankle arthroplasty.

POTENTIAL BENEFITS, HARM, AND CONTRAINDICATIONS

Treatments for ankle OA span a wide range of non-operative and operative interventions, each associated with potential benefits and risks. Nonoperative treatments may provide symptom relief and functional improvement with relatively low risk. At the same time, surgical interventions may offer more substantial pain relief or functional gains but carry risks such as infection, nonunion, implant failure, wound complications, and medical morbidity.

FUTURE RESEARCH

Despite advances in ankle OA management, significant gaps remain in the evidence base. Consideration for future research is provided for each recommendation within this document. Priorities for future research include high-quality comparative studies of joint-preserving procedures, optimizing multimodal pain control, ankle arthrodesis, and total ankle arthroplasty; long-term survivorship and patient-reported outcomes with contemporary implants and techniques; standardized outcome measures; cost-effectiveness analyses; and strategies for risk modification and optimization of high-risk patients. Continued research in these areas is critical to improving outcomes and refining evidence-based care for patients with ankle OA.

METHODS

The methods used to perform this systematic review were employed to minimize bias and enhance transparency in the selection, appraisal, and analysis of the available evidence. These processes are vital to the development of reliable, transparent, and accurate clinical recommendations. To view the full AAOS clinical practice guideline methodology please visit https://www.aaos.org/quality/research-resources/methodology/ .

This clinical practice guideline evaluates patient outcomes in the management of osteoarthritis of the ankle. The AAOS approach incorporates practicing physicians (clinical experts) and methodologists who are free of potential conflicts of interest relevant to the topic under study, as recommended by clinical practice guideline development experts.[1]

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This clinical practice guideline was prepared by the AAOS Osteoarthritis of the Ankle physician development group (clinical experts) with the assistance of the AAOS Clinical Quality and Value (CQV) Department (methodologists). To develop this clinical practice guideline, the clinical practice guideline development group held an introductory meeting on January 14, 2024, to establish the scope of the clinical practice guideline. As the physician experts, the clinical practice guideline development group defined the scope of the clinical practice guideline by creating PICO Questions (i.e. population, intervention, comparison, and outcome) that directed the literature search. The AAOS Medical Librarian created and executed the search (see eAppendix 1 for search strategy).

LITERATURE SEARCHES

The systematic review begins with a comprehensive search of the literature. Articles considered were published prior to the start date of the search in a minimum of three electronic databases: PubMed, EMBASE, and the Cochrane Central Register of Controlled Trials. The medical librarian conducts the search using key terms determined from the guideline development group's PICO questions.

A CQV methodologist will review/include only primary literature but will supplement the electronic search with a manual search of the bibliographies of secondary literature sources, such as systematic reviews, as available. The methodologist will then evaluate all recalled articles for possible inclusion based on the study selection criteria and will summarize the evidence for the guideline work group who assist with reconciling possible errors and omissions.

A study attrition diagram is provided that details the numbers of identified abstracts, recalled and selected studies, and excluded studies that were evaluated in the CPG. The search strategy used to identify the abstracts is also included in eAppendix 1 of the CPG documents.

DEFINING THE QUALITY OF EVIDENCE

The quality of evidence for a recommendation is determined by the quality and quantity of included literature for the statement. Statements with evidence from two or more "High" quality studies are considered to have "High Quality Evidence". Statements with evidence from two or more "Moderate" quality studies, or evidence from a single "High" quality study are considered to have "Moderate Quality Evidence". Statements with evidence from two or more "Low" quality studies or evidence from a single "Moderate" quality study are considered to have "Low Quality Evidence". Statements with evidence from one "Low" quality study or no supporting evidence are considered to have "Very Low Quality Evidence" or "Consensus" respectively.

DEFINING THE STRENGTH OF RECOMMENDATION

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

Strength of recommendation expresses the degree of confidence one can have in a recommendation. As such, the strength expresses how possible it is that a recommendation will be overturned by future evidence. It is very difficult for future evidence to overturn a recommendation that is based on many high quality randomized controlled trials that show a large effect. It is much more likely that future evidence will overturn recommendations derived from a

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few small retrospective comparative studies. Consequently, recommendations based on the former kind of evidence are given a "strong" strength of recommendation and statements based on the latter kind of evidence are presented as "Options" to the practicing clinician, rather than a directional recommendation, with either a "limited" strength or, in the event of no supporting or only conflicting evidence, a "consensus" strength. For any "consensus" strength option, the decision to include a statement in the CPG is at the discretion of the guideline development group.

VOTING ON THE RECOMMENDATIONS

The recommendations and their strength were voted on by the guideline development group members during the final meeting. If disagreement between the guideline development group occurred, there was further discussion to see whether the disagreement(s) could be resolved. Recommendations were approved and adopted in instances where a simple majority (60%) of the guideline development group voted to approve; however, the guideline development group had consensus (100% approval) when voting on every recommendation for this guideline. Any recommendation strength upgrade or downgrade based on the Evidence-to-Decision Framework requires a super majority (75%) approval of the work group.

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UNDERSTANDING THE QUALITY OF EVIDENCE AND STRENGTH OF STATEMENT

Table I. Strength and Quality Descriptions

Statement Strength	Evidence Quality	Statement Description	Strength Visual
Strong	High*	Evidence from two or more "High" quality studies with consistent findings recommending for or against the intervention. Or Rec is upgraded using the EtD Framework.	
Moderate	Moderate*	Evidence from two or more "Moderate" quality studies with consistent findings or evidence from a single "High" quality study recommending for or against the intervention. Or Rec is upgraded or downgraded using the EtD Framework.	
Limited	Low*	Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for or against the intervention. Or Rec is downgraded using the EtD Framework.	
Consensus	Very Low, or Consensus*	Evidence from one "Low" quality study, no supporting evidence, or Rec is downgraded using the EtD Framework. In the absence of sufficient evidence, the guideline work group is making a statement based on their clinical opinion.	

*Unless statement was upgraded or downgraded in strength, using the EtD Framework.

Table II. Interpreting the Strength of a Recommendation or Option

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

REVIEW PERIOD

Following the final meeting, the CPG draft undergoes a 3-week review period for additional input from external content experts. Written comments are provided on the structured review form. All reviewers are required to disclose their conflicts of interest.

Specialty societies relevant to the topic are solicited for nominations of individual reviewers approximately six weeks before the final meeting. The review period is announced as it approaches, and others interested are able to volunteer to review the draft. The chairs of the guideline work group review the draft of the guideline prior to dissemination.

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

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

The CPG is also provided to members of the AAOS Board of Directors (BOD), members of the Research and Quality Council (RQC), members of the Board of Councilors (BOC), and members of the Board of Specialty Societies (BOS) and members of the Committee on Evidence-Based Quality and Value (EBQV) for review and comment. The CPG is automatically forwarded to the AAOS BOD, RQC, and EBQV so that they may review it and provide comment prior to being asked to approve the document. Based on these bodies, over 200 commentators have the opportunity to provide input into each CPG.

The chairs of the guideline work group, the manager of the AAOS CQV unit, and the Director of AAOS CQV draft the initial responses to comments that address methodology. These responses are then reviewed by the chair and co-chair, who respond to questions concerning clinical practice and techniques. All comments received and the initial drafts of the responses are also reviewed by all members of the guideline development group. All proposed changes to recommendation language as a result of the review period are based on the evidence. Final revisions are summarized in a report that is provided alongside the guideline document throughout the remainder of the approval processes and final publication.

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

THE AAOS CPG APPROVAL PROCESS

This final clinical practice guideline draft must be approved by the AAOS Committee on Evidence Based Quality and Value, and subsequently the AAOS Research and Quality Council, and the AAOS Board of Directors. These decision-making bodies are described in the Ankle OA CPG eAppendix 1. Their charge is to approve or reject its publication by majority vote.

REVISION PLANS

This clinical practice guideline represents a cross-sectional view of current treatment and may become outdated as new evidence becomes available. This clinical practice guideline will be revised in accordance with new evidence,

changing practice, rapidly emerging treatment options, and new technology. This clinical practice guideline will be updated or withdrawn in five years.

CPG DISSEMINATION PLANS

The primary purpose of the present document is to provide interested readers with full documentation of the best available evidence for various procedures associated with the topic of this review. Publication of most clinical practice guidelines is announced by an Academy press release, articles authored by the clinical practice guideline development group and published in the Journal of the American Academy of Orthopaedic Surgeons, and articles published in AAOS *Now*. Most clinical practice guidelines are also distributed at the AAOS Annual Meeting in the Resource Center. The final guideline recommendations and their supporting rationales will be hosted on www.OrthoGuidelines.org.

Selected clinical practice guidelines are disseminated by webinar, the AAOS Learning Management System (LMS), Media Briefings, and by distributing them at relevant Continuing Medical Education (CME) courses and at the AAOS Resource Center.

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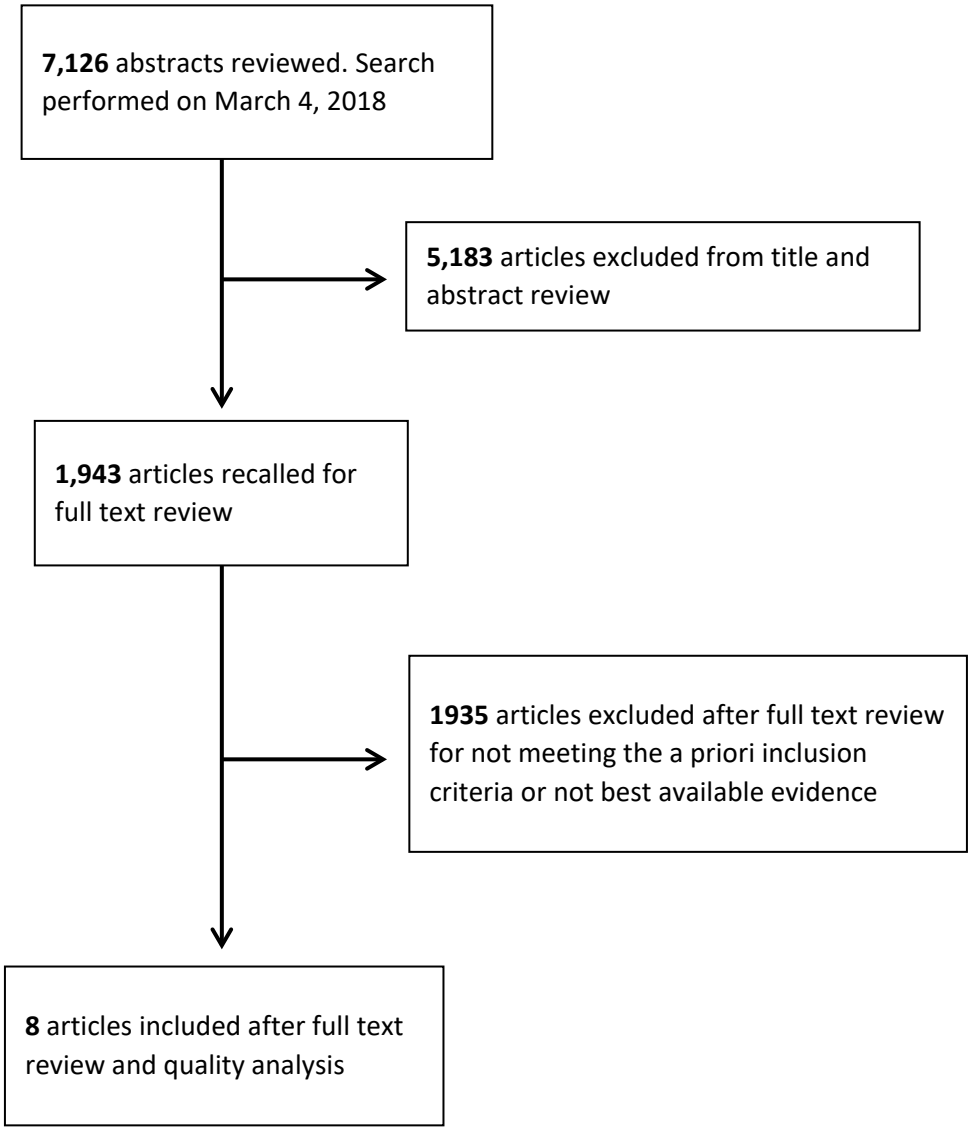
STUDY ATTRITION FLOWCHART



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RECOMMENDATIONS

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Hyaluronic Acid

Intra-articular hyaluronic acid alone is not recommended for the treatment of symptomatic ankle osteoarthritis, however, there may be a benefit for short term improvement in pain and function when combined with corticosteroid.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★ (against)

Description: Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD Framework.

Rationale

Three high-quality RCTs evaluated intraarticular (IA) hyaluronic acid (HA) versus saline control with 1.5-6 month follow-up.[8–10] Cohen 2008 found saline superior to HA across multiple outcomes at 1.5, 3, and 6 months (AOS Total, WOMAC Total, Pain scores).[8] DeGroot 2012 found no differences between HA and saline.[9] Kubo 2022 showed diclofenac etalhyaluronate (DF-HA) reduced adverse events but no improvement in patient-reported outcomes.[10] Meta-analysis confirmed no benefit of HA over saline.

Two high-quality RCTs compared combination IA therapy (HA + corticosteroid) to corticosteroid monotherapy.[11,12] Gomes 2023 found combination superior for VAS Pain at 1 month and for both AOFAS Total and VAS Pain at 3 months, with trends persisting at 6 months.[11] Woo 2025 found combination superior for AOS Total at 1.5 and 3 months.[12] Both studies consistently demonstrated combination therapy provides superior improvement in disease-specific ankle outcomes and pain scores versus corticosteroid alone at 1.5-3 months. However, neither study compared combination therapy to placebo, so absolute efficacy cannot be determined.

Benefits/Harms:
Hyaluronic Acid Alone: No demonstrated benefit over saline placebo. Generally well-tolerated but multiple injections required (3-5 weekly), with potential for post-injection pain/effusion and false patient expectations.

Hyaluronic Acid combined with Corticosteroid: Improved pain and ankle-specific function at 1.5-3 months versus corticosteroid alone. Combination of adverse events from both agents. Multiple

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injections required (3 weekly), increased cost versus corticosteroid alone, and no long-term (>6 months) safety data.

Cost Effectiveness/Resource Utilization:
Hyaluronic Acid Alone: HA costs $500-2000+ per injection series. Given lack of efficacy versus placebo, routine use represents poor resource utilization.

Hyaluronic Acid combined with Corticosteroid: Significantly more expensive than corticosteroid alone (additional $500-2000+). Incremental benefit must be weighed against cost and lack of placebo comparison. Requires multiple clinic visits versus single corticosteroid injection.

Acceptability:
Hyaluronic Acid Alone: Despite use in knee OA, ankle-specific evidence demonstrates lack of efficacy. Patients should be counseled that high-quality evidence does not support benefit over placebo. Stakeholder resistance expected given widespread HA marketing.

Hyaluronic Acid combined with Corticosteroid: May be acceptable to patients willing to undergo multiple injections for added benefit. Higher cost may limit accessibility, insurance coverage may be limited, and some hesitancy given HA alone showed no benefit versus placebo. Shared decision-making should emphasize incremental (not absolute) benefit, cost, and treatment burden.

Feasibility:
Hyaluronic Acid Alone: Widely available and technically feasible, but feasibility does not override lack of efficacy.

Hyaluronic Acid combined with Corticosteroid: Feasible in most practices performing IA injections. Requires availability of both agents and ability to schedule multiple visits. Less feasible in rural settings or for patients with transportation/scheduling limitations.

Future Research:
Hyaluronic Acid Alone: Investigation of patient subgroups, different HA formulations, comparison to non-surgical interventions, longer-term outcomes, and mechanistic studies to understand ineffectiveness in ankle OA.

Hyaluronic Acid combined with Corticosteroid: Critical need for comparison to placebo/control, comparative effectiveness versus other non-surgical interventions, optimal injection protocols, patient characteristics predicting response, long-term outcomes and safety, cost-effectiveness analyses, and stratification by OA severity.

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Intra-articular platelet-rich plasma (PRP)

Intra-articular platelet-rich plasma is not routinely suggested for the treatment of symptomatic ankle osteoarthritis.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆ (against)

Description: Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD Framework.

Rationale

One high-quality RCT (Paget 2023) compared two platelet-rich plasma (PRP) injections to saline with 12-month follow-up.[13] Saline was superior to PRP at 1.5 months (AOFAS, VAS Pain), 3 and 6.5 months (EQ-5D QOL), and 12 months (patient satisfaction). No significant differences between PRP and saline for AOS Total, SF-36, FAOS subscales, or AAS Total at any time point. No sustained benefit of PRP through 12 months.

Benefits/Harms: No demonstrated benefit over saline. PRP requires blood draw and centrifugation (additional time/discomfort). Generally well-tolerated with no serious adverse events but creates false expectations given lack of efficacy.

Cost Effectiveness/Resource Utilization: PRP costs a patient an out-of-pocket expense of $500-1500+ per injection plus blood draw and preparation costs. Complete lack of efficacy versus placebo represents very poor resource utilization.

Acceptability: Despite popularity of "regenerative" treatments, ankle-specific evidence does not support use. High out-of-pocket cost limits accessibility. Patients should be counseled that high-quality evidence demonstrates no benefit over placebo.

Feasibility: Requires specialized equipment and technical expertise, increasingly available but feasibility does not override lack of efficacy.

Future Research: Investigation of specific PRP formulations (leukocyte-rich vs. poor, concentration levels), patient subgroups, different injection protocols, mechanistic studies, economic analyses, comparison to other treatments, and longer-term outcomes.

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OPTIONS

Low quality evidence, no evidence, or conflicting supporting evidence have resulted in the following statements for patient interventions to be listed as options for the specified condition. Future research may eventually cause these statements to be upgraded to strong or moderate recommendations for treatment.

Intra-Articular Corticosteroid (Monotherapy)

In the absence of sufficient evidence, it is the opinion of the workgroup that intra-articular corticosteroid injections are an option for short-term symptomatic relief in patients with symptomatic ankle osteoarthritis.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

No studies meeting inclusion criteria directly compared intraarticular (IA) corticosteroid to control. Two high-quality studies (Gomes 2023, Woo 2025) compared corticosteroid only to combination therapy, not control. The workgroup recognizes corticosteroid injections are commonly used based on anti-inflammatory mechanisms, clinical experience suggesting short-term benefit, and generally favorable safety profile. These injections can be used as short-term symptom relief to facilitate physical therapy, a diagnostic/prognostic tool or a bridge to surgical decision-making. These injections provide short-term pain relief (weeks to months), and while not disease-modifying, may still be clinically meaningful for selected patients when framed within shared decision-making.

Benefits/Harms: Clinical experience suggests potential short-term pain relief, though magnitude and duration in ankle osteoarthritis (OA) is not evidence-based. Well-documented adverse effects include steroid flare, theoretical cartilage damage with repeated injections, rare systemic effects, infection risk, and potential to mask progressive joint damage.

Cost Effectiveness/Resource Utilization: Relatively inexpensive compared to other IA injections. Cost-effectiveness cannot be determined without efficacy data versus placebo.

Acceptability: Widely accepted by surgeons and patients. Concerns about repeated injections and cartilage damage may limit acceptability for some.

Feasibility: Highly feasible - readily available, inexpensive, performed in office setting.

Future Research: High-priority RCTs comparing IA corticosteroid to placebo, dose-response studies, comparative effectiveness versus other treatments, long-term safety studies, patient characteristics predicting response, and optimal timing/frequency of injections.

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View data summaries via the CPG eAppendix 2

Intra-Articular Stem Cell Therapy

In the absence of sufficient evidence, it is the opinion of the workgroup that there is no reliable evidence regarding intra-articular stem cell therapy for symptomatic ankle osteoarthritis.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

No studies meeting inclusion criteria evaluated intraarticular (IA) stem cell therapies for ankle osteoarthritis (OA). Efficacy, safety, optimal protocols, and appropriate patient selection cannot be determined. Patients should be counseled about investigational nature and lack of evidence.

Benefits/Harms:
Cannot be assessed. Stem cell therapies are marketed despite lack of rigorous evidence with significant heterogeneity in products, preparation methods, and protocols. Patients should be fully informed about investigational nature.

Cost Effectiveness/Resource Utilization:
IA stem cell therapy can typically range from approximately, $3,000-$10,000+, and is usually not covered by insurance. High cost and lack of evidence raise significant value concerns.

Acceptability:
Marketing drives demand despite lack of evidence. Ethical concerns exist regarding offering expensive therapies without established efficacy.

Feasibility:
Limited availability - requires specialized facilities, expertise, and regulatory compliance with significant variation in products and protocols.

Future Research:
High-priority, IRB-approved investigational therapies within clinical trials examining the standardization of cell preparation and protocols, dose-finding studies, identification of appropriate patient populations, long-term safety and efficacy data, mechanistic studies, cost-effectiveness analyses, and comparative effectiveness studies should be conducted.

Skilled Physical Therapy

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with mild to moderate symptomatic ankle osteoarthritis who wish to avoid surgical intervention, the use of skilled physical therapy may improve patient-reported outcomes and potentially affect disease progression.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

No studies meeting inclusion criteria were identified evaluating skilled physical therapy (in-clinic or virtual, with or without manual therapy) in patients with symptomatic ankle osteoarthritis (OA).

Clinical Takeaway

In the absence of direct evidence, expert consensus supports the use of skilled physical therapy to improve patient-reported outcomes and potentially affect disease progression or the need for invasive interventions in patients with symptomatic ankle osteoarthritis.

Clinical Implications

Based on expert consensus:

- Skilled physical therapy can be administered to improve patient-reported outcomes, including pain, function, and quality of life, in patients with symptomatic ankle OA.
- It may also affect progression of OA symptoms and the need for invasive interventions, although the magnitude of these effects is unknown.
- Physical therapy may include patient education and self-management strategies, progressive therapeutic exercise (strength, power, endurance, and task-specific functional training), neuromuscular and motor control interventions (balance, proprioception, and movement coordination training), manual therapy (joint mobilization, manipulation, and soft tissue techniques), gait retraining, and development and progression of a home exercise program. Individualized treatment should consider patient history, presence of instability, OA etiology, and functional status.
- Physical therapy should be integrated into a multimodal management plan, which may include activity modification, bracing, and pharmacologic interventions.

Limitations

- No primary studies were available; recommendations rely solely on expert consensus.

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- Effects on long-term outcomes, disease progression, or timing of invasive interventions are unknown.
- Variation in physical therapy modalities and delivery methods has not been formally studied in ankle OA.

Future Research

- Conduct randomized controlled trials and high-quality observational studies assessing skilled physical therapy in ankle OA.
- Evaluate specific therapy modalities, delivery methods (in-clinic vs. virtual), and long-term outcomes.
- Assess cost-effectiveness and integration with multimodal management strategies.

Benefits and Harms:

- **Potential benefits:** Symptom relief, improved function, and potential delay of invasive interventions.
- **Potential harms:** Minimal; mostly fatigue, soreness, or injury from inappropriate exercises. Serious adverse events appear uncommon, although harms are not consistently reported.

Cost-Effectiveness and Resource Utilization:

- Physical therapy is generally accessible but requires provider time and patient commitment.
- Virtual therapy may reduce barriers to access and cost but requires further study.

Future Research:

- Prospective trials to define effectiveness, optimal modalities, long-term outcomes, and cost implications are needed.

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Home Exercise Programs

In patients with mild to moderate symptomatic ankle osteoarthritis who wish to avoid surgical intervention, group education and exercise including a home exercise program, may improve satisfaction, pain, and global rating of change.

Quality of Evidence: Low

Strength of Option: Limited 

Description: Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for or against the intervention. Also, higher strength evidence can be downgraded to limited due to major concerns addressed in the EtD Framework.

Rationale

A single moderate quality article suggests that exercise combined with education is superior to general advice alone to improve the average pain levels, stiffness at its worst, and the global rating of change scores in individuals with ankle osteoarthritis.[14] The exercise plus education group participated in group physiotherapy for 6 weeks, then transitioned to a home exercise program for the remainder of the study duration. Outcome differences between groups peaked at the 8-week time frame and were less pronounced at the 12-week follow-up.

Limitations:

- Recommendation is based upon a single, moderate quality study
- The study is a feasibility study with small sample size
- The participants in the study who were provided with a home exercise program had first received 6 weeks of supervised group physiotherapy, which may have impacted the results as it pertains to the effectiveness of the home program.

Benefits & Harms:

- Possible benefits include relief of pain and stiffness with improved global rating of change for individuals who perform a prescribed home exercise program following supervised physical therapy.
- Potential harm is largely minimal and primarily associated with the effects of exercise, such as fatigue and muscle soreness.

Outcome Importance:

- Individuals with ankle osteoarthritis may benefit from group education and exercise, including a home exercise program. Inclusion of a home exercise program following discharge from a supervised group exercise program may assist in maintaining or further improving the benefits.

Cost Effectiveness/Resource Utilization:

- Use of a home exercise program could potentially mitigate costs associated with more invasive interventions.

- Performance of a home-based exercise program is a cost-effective intervention as minimal equipment is needed.
- Use of a home exercise program may reduce the number of physical therapy visits needed, thus minimizing costs.

Feasibility:

- Use of a home exercise program is very feasible for individuals with ankle osteoarthritis to perform. Little if any equipment is necessary for completion of the program and the time commitment is minimal.

Future Research:

- Conduct randomized controlled trials examining the effectiveness of home exercise programs for symptom relief and quality of life improvement for individuals with ankle osteoarthritis.
- Assess optimal dosing of home exercise programs for individuals with ankle osteoarthritis.
- Evaluate effectiveness of specific exercises to be included within a home exercise program for individuals with ankle osteoarthritis.

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Opioids

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle osteoarthritis, prescription opioids should not be used in the management of OA.

Quality of Evidence: Consensus
Strength of Option: Consensus 

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

The 2022 CDC Clinical Practice Guideline for Prescribing Opioids for Pain recommends against opioids for chronic pain management, emphasizing non-pharmacologic and non-opioid pharmacologic therapies. When opioids are used, the CDC recommends the lowest effective dosage for the shortest duration necessary.

Benefits:
Opioids are associated with no demonstrated benefit in ankle OA specifically. Theoretical short-term pain relief is possible, though the magnitude of benefit versus non-opioid analgesics is unclear and likely minimal based on general OA literature.

Harms:
Extensive and well-documented harms include addiction/dependence risk, overdose mortality risk, tolerance and dose escalation, opioid-induced hyperalgesia, constipation, nausea/vomiting, sedation and cognitive impairment, increased fall and fracture risk, respiratory depression, immunosuppression, and potential for diversion/misuse. Chronic opioid use is associated with worse functional outcomes in musculoskeletal conditions.

Outcome Importance:
Pain relief and functional improvement are critical for ankle osteoarthritis (OA) patients. However, opioids provide only symptomatic masking without addressing underlying pathology. The risk-benefit ratio is unfavorable given well-documented harms, lack of disease-modifying effects, and availability of alternative treatments.

Cost Effectiveness/Resource Utilization:
Opioids are relatively inexpensive medications ($10-100/month depending on formulation). However, true costs include monitoring requirements (prescription drug monitoring program checks, urine drug screens, frequent follow-up visits), management of side effects and complications, treatment of opioid use disorder when it develops, overdose events and emergency department visits, and societal costs of the opioid epidemic.

Acceptability:
Patient perspectives vary. Some patients request opioids for pain relief, influenced by prior prescribing practices and direct-to-consumer pharmaceutical marketing. However, increasing public awareness of opioid risks and the epidemic has shifted attitudes. From provider perspective, growing recognition of opioid harms, regulatory scrutiny, liability concerns, and professional guidelines have reduced willingness to prescribe opioids for chronic non-cancer pain.

Feasibility:
The recommendation against opioids is highly feasible given availability of multiple alternative treatments. Barriers to alternatives should be addressed rather than defaulting to opioids.

Future Research:
While the workgroup recommends against opioids based on known harms and lack of evidence, potential research questions include:

1. **Epidemiologic studies:** What is the current prevalence of opioid prescribing for ankle OA? Has prescribing changed over time in response to guidelines and the epidemic?
2. **Comparative effectiveness:** For patients with ankle OA already on opioids, what are outcomes of opioid tapering/discontinuation versus continuation? Does tapering improve or worsen function?
3. **Alternative analgesics:** What is the comparative effectiveness of non-opioid analgesics (NSAIDs, acetaminophen, topical agents, gabapentinoids) versus placebo specifically for ankle OA?
4. **Multimodal pain management:** What multimodal approaches (physical therapy + NSAIDs + injections + psychological support) provide optimal pain control without opioids?

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NSAIDs/Acetaminophen

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle osteoarthritis the use of NSAIDs and/or acetaminophen may be used for initial symptomatic relief, when no other medical contraindications exist.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

In the absence of direct evidence, expert consensus supports the use of nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen for symptomatic relief in ankle osteoarthritis (OA) as part of a multimodal management plan, with consideration of patient-specific safety risks.

Clinical Implications

Based on expert consensus:

- NSAIDs or acetaminophen **can be administered** to patients with symptomatic ankle OA to improve patient-reported outcomes.
- Their effect on OA progression or need for invasive intervention is **unknown**.
- Choice of therapy should consider **patient comorbidities, contraindications, and potential adverse effects** (e.g., gastrointestinal, renal, cardiovascular for NSAIDs; hepatotoxicity for acetaminophen).
- Topical NSAIDs may be preferred in patients at higher risk of systemic adverse events.
- These medications should be integrated into a **multimodal management plan**, including activity modification, bracing, and physical therapy.

Limitations

- No primary studies specifically evaluated NSAIDs or acetaminophen in ankle OA.
- Recommendations rely solely on expert consensus and extrapolation from other joints (e.g., knee or hip OA).
- Long-term effectiveness, impact on structural disease progression, and ability to delay invasive intervention remain unknown.

Future Research

- Conduct randomized controlled trials or high-quality observational studies evaluating NSAIDs and acetaminophen in ankle OA.
- Assess short- and long-term effects on patient-reported outcomes, OA progression, and need for surgical intervention.
- Compare oral versus topical formulations regarding efficacy, safety, and tolerability.
- Evaluate integration with multimodal management strategies and cost-effectiveness.

Benefits and Harms:

- **Potential benefits:** Symptom relief, improved function, and quality of life.
- **Potential harms:** NSAIDs carry gastrointestinal, renal, and cardiovascular risks; acetaminophen carries hepatotoxicity risk, particularly at high doses or with chronic use.

Cost-Effectiveness and Resource Utilization:

- NSAIDs and acetaminophen are inexpensive and widely available.
- Long-term cost-effectiveness and impact on delaying invasive interventions remain unknown.

Future Research:

- Prospective trials and health economic analyses evaluating effectiveness, safety, and cost implications are needed.
- Studies should examine integration of pharmacologic treatment within multimodal management strategies.

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Durable Medical Equipment

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle OA, durable medical equipment may improve patient reported outcomes, and affect progression of OA symptoms, or need for invasive intervention.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

In the absence of conclusive evidence, durable medical equipment (DME), including ankle-foot orthoses (AFOs), bracing, canes and walkers, and shoe modifications, should be considered as part of a comprehensive, individualized management plan for patients with symptomatic ankle osteoarthritis (OA). These devices may provide symptom relief, improve stability, and support functional mobility, particularly for patients with pain, instability, or gait deviations. Clinicians should recognize the current evidence is insufficient to determine effects on structural disease progression or future need for invasive interventions, and decisions should be guided by patient-specific factors, clinical judgment, and patient preferences.

Benefits & Harms:
Benefits

- Symptom relief/reduced pain
- Improved gait mechanics
- Reduced falls risk
- Improved stability and ability to perform ADLs

Harms

- Skin breakdown
- Device discomfort
- Patient adherence and use
- Out of pocket costs

Outcome Importance:
Pain reduction, physical function (walking, transfers), balance and fall prevention, patient-reported quality of life, ability to participate in daily activities, and adverse events (skin issues, falls) are outcomes that may be favorably affected through the use of appropriate DME.

Cost Effectiveness/Resource Utilization:

- Custom vs off the shelf items
- Low cost compared to surgical interventions
- Should consider payer coverage, patient ability to pay, and potential future savings from reduced falls or delayed surgical interventions

Acceptability:
Generally acceptable to patients and clinicians when devices are used as part of a tailored plan and fit/comfort is optimized.

Feasibility:

- Widely used and available in most clinical settings
- Custom orthoses and specialist fitting require access to orthotists and may be limited by geographic location, insurance, or cost
- Requires clinician assessment, prescription, fitting, and follow-up for adjustments and support to improve adherence

Future Research:

- RTC's comparing specific DME types
- Studies of adherence, patient preferences, and strategies to improve comfort
- Longitudinal studies to determine device on progression and need for invasive interventions

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Weight Reduction

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with symptomatic ankle osteoarthritis, weight reduction may improve patient reported outcomes and affect progression of OA symptoms.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

No studies meeting inclusion criteria were identified when evaluating the influence of weight reduction on patient reported outcomes and the progression of symptoms in patients with symptomatic ankle osteoarthritis (OA).

Clinical Implications:

Based on expert consensus:

- Weight reduction **is an option** to improve patient-reported outcomes, including pain, function, and quality of life, in patients with symptomatic ankle OA.
- The effect of weight reduction on the progression of symptomatic ankle osteoarthritis is unknown.
- In the absence of evidence against the use of weight reduction to prevent the progression of ankle OA in patients with symptomatic ankle OA, a discussion between the surgeon and the patient is required to determine if the patient is a suitable candidate for an initial trial period of this modality prior to other invasive interventions.
- Weight reduction should be integrated into a multimodal nonoperative management plan for patients with symptomatic ankle OA prior to surgical intervention.

Limitations:

- No primary studies specifically evaluated weight reduction and progression of symptomatic ankle OA.
- Despite established evidence on the effect of weight gain and weight loss on the progression of OA in other joints, like the knee, the long-term outcomes and disease progression after weight loss, or timing of invasive interventions are unknown.

Benefits and Harm:

- **Potential benefits:** Potential benefits of weight loss include symptom relief, improved function, improved overall quality of life, reduction in cardiovascular risks or thromboembolic events in the event of a surgical intervention, and potential delay of invasive interventions.
- **Potential harms:** Potential harm is minimal, including possible progression of symptoms, persistent pain and discomfort, and a possible delay in appropriate surgical intervention.

Cost-Effectiveness and Resource Utilization:

- Weight loss programs are universally available today and affordable.
- Modalities may include both non-pharmacologic and pharmacologic interventions.
- The only cost may involve patient commitment.

Future Research:

- Conduct randomized controlled trials examining the effect of weight loss on the progression of symptomatic ankle OA.
- Further research is needed to determine those patients with symptomatic ankle OA who are the best candidates for weight loss programs.
- Conduct long term observational and case controlled prospective studies on patient reported outcomes after a structured weight loss program in patients with symptomatic ankle OA.
- Assess cost-effectiveness of integration of a standard weight loss program in patients who present with symptomatic ankle OA.
- Long term prospective trials are also needed to define the effectiveness of weight loss programs based on patient reported outcomes and to define the stage at which a patient is no longer benefiting from this modality.
- Long term prospective trials are needed to examine the effects of GLP-1s on patient reported outcomes and adverse events.

Additional Citations Not Meeting Inclusion Criteria

i. Solanki P et al. Association between weight gain and knee osteoarthritis: a systematic review. Osteoarthritis Cartilage. 2023 Mar;31(3):300-316. doi: 10.1016/j.joca.2022.10.023. Epub 2022 Nov 26. PMID: 36511280.

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Surgical Treatment for OA (Arthroscopic Debridement, Periarticular Osteotomy, Arthroplasty)

In the absence of sufficient evidence, it is the opinion of the workgroup that, in patients with symptomatic ankle osteoarthritis who have failed non-operative care and desire joint preservation, arthroscopic debridement, or periarticular realignment osteotomy, are options that may improve patient-reported outcomes and/or delay progression to joint-sacrificing procedures.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

No eligible comparative studies evaluating arthroscopic debridement, periarticular osteotomy, or distraction arthroplasty vs appropriate controls in patients with ankle osteoarthritis (OA). Most available studies were case series, technique reports, or retrospective cohort studies with no relevant comparator, small sample size, or outcomes below inclusion thresholds. Therefore, this recommendation is based on expert consensus.

Benefits and Harms

Potential benefits:

- Pain relief and improved functional scores
- Delay or avoidance of joint-sacrificing procedures
- Preservation of motion and potential restoration of alignment or joint mechanics

Potential harms:

- Procedure-specific complications (infection, neurovascular injury, hardware problems, nonunion/malunion for osteotomy, pin-site infection for distraction)
- Longer rehabilitation time and higher resource utilization (distraction)
- Possible progression to end-stage arthritis despite intervention

Outcome Importance

For younger or more active patients, delaying arthrodesis or arthroplasty while maintaining ankle motion aligns with patient preferences, emphasizing activity, motion, and avoidance of fusion or implant surgery. Preservation of joint motion and pain relief are important considerations in patients with ankle arthritis, especially those who want to lead an active lifestyle.

Cost Effectiveness/Resource Utilization
Surgery is generally costly, however, distraction is more costly than supramalleolar osteotomy (SMO), which is more costly than arthroscopy. Arthroscopy, being minimally invasive and commonly available, represents the least resource-intensive option but may yield more limited benefit in advanced OA.

Distraction and osteotomy require specialized equipment, prolonged rehabilitation, and extended follow-up, which increase cost compared to arthroscopy.

Acceptability
This will depend on both surgeon and patient factors. The joint-preserving options discussed in the recommendation are widely accepted among surgeons experienced in reconstructive foot and ankle surgery. However, acceptability varies by institutional expertise, access to postoperative resources, and patients' willingness to commit to a prolonged recovery (distraction). Additionally, older and lower demand patients may opt for total ankle (TAR) or ankle arthrodesis (AA).

Feasibility
Arthroscopy is feasible in most centers with arthroscopic capabilities. Osteotomy and distraction require more advanced surgical expertise, preoperative planning, and infrastructure support (distraction).

Future Research
- Identify clear indications/contraindications for each joint-preserving technique
- Evaluate comparative outcomes (ie. pain, function, time to conversion to fusion/TAA, impact on subsequent outcomes after fusion/TAA)
- Standardize PROMs and long-term follow-up
- Investigate cost-effectiveness and value-based frameworks for joint-preserving surgery in ankle OA

Summary
No eligible comparative evidence currently supports or refutes the use of arthroscopic debridement, periarticular osteotomy, or distraction arthroplasty for the treatment of ankle OA.

However, based on clinical experience and non-comparative literature, these procedures may offer meaningful symptomatic relief and delay more definitive joint-sacrificing options for appropriately selected patients seeking motion preservation.

Additional Citations Not Meeting Inclusion Criteria

<u>Arthroscopy</u>
- **Hassouna et al., 2007** — 5yr survival analysis. Reports durable symptom improvement and survivorship without immediate conversion to arthrodesis/TAA in select cases (when impingement/focal pathology coexists with early OA).[i]
- **Herrera-Pérez et al., 2019; 2020** — Post-debridement motion-facilitation associated with improved symptoms and function in degenerative ankles.[ii, iii]

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- Short- to mid-term pain and functional improvement in carefully selected patients with early/moderate ankle OA w/impingement or focal lesions

Osteotomy

- **Ahn et al., 2015** — Distal tibial osteotomy (without fibular osteotomy) for medial ankle arthritis with mortise widening. Demonstrated improved alignment and associated with pain relief and functional improvement in varus OA with preserved joint space.[iv]
- **Krähenbühl et al., 2017; 2019** — SMO techniques/outcomes in ankle OA. Repeatedly showed pain/functional improvement and joint-space realignment in asymmetric OA. Realignment improved load distribution and PROMs; many patients delayed conversion to arthrodesis/TAA.[v, vi]
- **Lai et al., 2022** — Reported clinically meaningful gains (pain/function) in intermediate-stage OA after SMO.[vii]

- Can offload diseased compartments, improve patient-reported outcomes, and delay conversion to fusion/TAA in appropriately selected asymmetric varus/valgus OA with residual cartilage.

Distraction

- **Nguyen & Saltzman, 2016** — PROM improvement with delay of joint-sacrificing surgery, especially in younger/active patients.[viii]
- **Greenfield et al., 2019** — Pain/function gains and extended time-to-conversion to fusion/TAA in selected near-end-stage OA.[ix]
- **Barg et al., 2013** — Summarized multi-center experiences: symptom relief with motion preservation, highlighting patient-selection principles.[x]

- Symptom relief and postponement of joint-sacrificing surgery, particularly in younger, motivated patients seeking motion preservation. However, without comparative data, the magnitude and durability of benefit relative to continued non-operative care or joint-sacrificing procedures remain unclear.

Reference Citations

i. Hassouna H, Kumar S, Bendall S. Arthroscopic ankle debridement: 5-year survival analysis. *Acta Orthop Belg*. 2007;73(6):737-740.

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Surgical Treatment for End Stage Ankle OA

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients with end-stage ankle OA, who have failed non-operative treatment, either Ankle Arthrodesis (Fusion) or Total Ankle Arthroplasty (Replacement) can be utilized to improve patient reported outcomes.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

End-stage ankle osteoarthritis (OA) causes substantial pain and loss of function, and when non-operative measures fail, surgery is primarily aimed at improving patient-reported outcomes (PROs). Both total ankle arthroplasty (TAA) and ankle arthrodesis (AA) produce meaningful improvements in symptoms and function, with uncertainty around the magnitude of between-group differences, supporting the view that either procedure can be used to improve outcomes in appropriately selected patients. While no primary literature evaluating ankle arthrodesis or total ankle arthroplasty meeting inclusion criteria was found in our CPG, systematic reviews/meta-analyses of modern implants and techniques report improved functional outcomes after both procedures, while highlighting different complication and reoperation profiles rather than a universal for one strategy. Therefore, in the absence of sufficient evidence to mandate one approach, the workgroup opinion that either AA or TAA can be utilized to treat patients with end-stage ankle arthritis is consistent with the current body of knowledge with the acknowledgement that each intervention comes with its own set of considerations and nuances that need to be weighed when treating individual patients.

Limitations

The evidence base is constrained by (1) heterogeneity in patient selection (age, deformity, bone quality, inflammatory arthritis, post-traumatic OA), (2) variability in implant generation and surgeon experience for TAA, (3) differing definitions of complications/reoperations, and (4) limited high-quality long-term comparative data (particularly >10 years) using outcomes measures. Longer-term comparative durability and downstream effects (adjacent joint degeneration, late revisions) remain areas where confidence is lower than desired for definitive superiority claims.

Benefits and harms

Benefits (shared): Both AA and TAA can reduce pain and improve function/quality of life in end-stage ankle OA as measured by validated outcomes.
Distinct harms/tradeoffs: Meta-analyses commonly show higher reoperation/revision burden after TAA (implant-related failure, loosening, wear, infection, conversion procedures) but higher overall complication rates after AA, reflecting different risk profiles rather than a single "safer" option.

Outcome importance

The outcomes that matter most to patients with end-stage ankle OA are pain relief, walking tolerance, return to desired activities, and durability (avoidance of major reoperation). Systematic reviews confirm that symptom improvement is achievable with both procedures, making shared decision-making—anchored on patient priorities - essential.

Cost effectiveness / resource utilization

Economic studies suggest TAA can be cost-effective over a lifetime horizon in selected cohorts, despite higher upfront implant and follow-up costs. This stated cost-effectiveness is sensitive to implant survivorship and revision risk.

Feasibility

Both AA and TAA are widely performed and feasible in modern orthopaedic practice, but feasibility is context dependent. AA is technically reproducible and less dependent on implant systems, while TAA feasibility depends more on implant availability, surgeon volume/experience, and infrastructure for long-term follow-up and revision capability. The contemporary literature emphasizes that appropriate indications and patient selection strongly influence outcomes for both strategies.

Future research

Key gaps include: (1) longer-term (>10 year) head-to-head comparative studies using consistent PRO measures, (2) stratified analyses to define which subgroups benefit most from TAA versus AA (age, deformity, post-traumatic patterns, obesity, neuropathy, inflammatory disease), (3) standardized reporting of complications and reoperations (including “minor” vs “major” procedures), and (4) robust real-world cost-effectiveness studies incorporating revision pathways and adjacent joint outcomes. As applicable, future iterations of this CPG should also focus on expanding this PICO to include broader questions pertaining to the unique considerations of each intervention.

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Postoperative Physical Therapy

In the absence of sufficient evidence, it is the opinion of the workgroup that postoperative physical therapy may improve patient reported outcomes, range of motion, return to work/activity, strength, and gait restoration.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

Physical therapy may include patient education and self-management strategies, progressive therapeutic exercise (strength, power, endurance, and task-specific functional training), neuromuscular and motor control interventions (balance, proprioception, and movement coordination training), manual therapy (joint mobilization, manipulation, and soft tissue techniques); gait retraining, and development and progression of a home exercise program. While no evidence met our full inclusion criteria for this question, Uselli et.al. provided relevant information on fast-track protocols, which may be of use to clinicians. Enhanced recovery after TAR surgery programs, also called fast-track protocols, in patients with ankle osteoarthritis, is also a viable option. There is no convincing evidence to suggest that immediate postoperative weight bearing without a cast is not a viable option in well selected patients.

Usuelli et al developed a selection score for proper patient selection with a low risk for perioperative complications who were appropriate for a fast-track protocol which included cast removal on post op day 1 and immediate protected weightbearing (Fast-Track Protocol) compared to the standard post op protocol of non-weight bearing and application of cast for a period of three weeks prior to weight bearing activity.[i] Stratification was based on the presence or absence of eight validated predictive variables (including body mass index >30, the state of anxiety or depression, functional preoperative status, fixed ankle equinus, the coronal malalignment, operative time, the surgical accessory procedures, and the bone quality) that may affect the outcome of TAR. Using this selection criteria, no significant differences were found in both clinical and radiologic date between the "standard protocol" versus the "Fast-track protocol" patients at different time points after surgery.

Benefits & Harms:

Potential benefits

- Earlier mobilization and weightbearing may accelerate functional recovery and reduce deconditioning.
- Early removal of the cast could allow for advanced cryotherapy (Game Ready) and low-intensity electromagnetic field (Limfa) therapy with a potential benefit on postoperative edema and inflammation.[ii]

- Potential for improved patient satisfaction and faster return to activities for appropriately selected patients.

Potential harm / risks

- If misapplied to patients who do not meet the strict selection criteria (poor bone quality, high BMI, significant deformity, psychiatric comorbidity, prolonged surgery or multiple accessory procedures), there may be increased risk of wound problems, implant early loosening, or other complications (not proven in the paper but a plausible risk). Usuelli's study avoided such high-risk patients by selection.
- The results of the case-controlled study by Usuelli et al are not generalizable. Application of this fast-track protocol to most patients who present for TAR for OA will lead to significant complications because a lot of these patients have associated severe comorbidities which will preclude them based on the strict criteria presented by Usuelli et al.
- Evidence base is limited (nonrandomized; smaller fast-track group) so rare adverse outcomes or late implant survivorship differences may not yet be apparent.

Outcome Importance:

TAR for OA is steadily gaining popularity with significant advancement in implant technology and improved perioperative care of these patient populations. Usuelli et al. reported comparable short-term clinical and radiographic outcomes and no increase in complications using their Fast-Track protocol, but long-term implant survivorship differences remain unknown. Demonstrating enhanced recovery protocols for rehabilitation for TAR which have been used effectively in the hip and knee patients will greatly enhance the delivery of care to this fast-evolving patient population. With future randomized controlled studies, this protocol can be extended to many high-volume practices and demanding patients without the fear of increased complications.

Cost Effectiveness/Resource Utilization:

Direct evidence in TAR fast-track is not provided in the Usuelli paper. However, ERAS / fast-track programs in hip and knee arthroplasty have consistently shown reduced length of stay and lower early resource utilization and sometimes reduced complications — suggesting likely cost savings if similar reductions occur for TAR.

Acceptability:

Likely acceptable to many patients (quicker mobilization) and to multidisciplinary teams familiar with ERAS for large-joint arthroplasty, but acceptability depends on clear patient selection, preop counseling, and local practice cultures. Some surgeons may be cautious until further TAR-specific evidence accumulates.

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Feasibility:
Feasible in centers that have:

- Multidisciplinary ERAS infrastructure (anesthesia protocols for multimodal analgesia / nerve blocks, perioperative nursing, physiotherapy for immediate mobilization).
- Surgeon experience with TAR and ability to limit operative time and accessory procedures in selected patients.
- Pathways for early follow-up, wound checks, and clear patient education materials.
  In less-resourced settings or with less TAR experience, implementation should be cautious and limited to well-selected patients.

Future Research:

- **Randomized controlled trials** comparing fast-track vs standard protocols in TAR with stratification by the selection score used by Usuelli et al. (or validation of that score).
- **Multicenter prospective cohorts** to increase sample size, test generalizability across different implants/approaches and surgical volumes.
- **Long-term follow-up** (≥5–10 years) on implant survival and late complications to ensure early mobilization does not adversely affect longevity.
- **Cost-effectiveness analyses** specifically in TAR (hospital costs, readmissions, rehabilitation costs).
- **Patient-reported outcome studies** (PROMs, return to activity, satisfaction) and qualitative work on acceptability.
- **Validation and refinement** of the 8-variable selection scoring system in independent datasets.

Additional Citations Not Meeting Inclusion Criteria

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Tranexamic Acid

In the absence of sufficient evidence, it is the opinion of the workgroup that in patients undergoing total ankle arthroplasty or ankle arthrodesis for end-stage ankle OA, perioperative TXA may reduce complications, improve patient outcomes, and decrease perioperative blood-loss.

Quality of Evidence: Very Low
Strength of Option: Consensus ★☆☆☆

Description: Evidence from a single "Low" quality study or no supporting evidence. Higher strength evidence can also be downgraded due to major concerns addressed in the EtD Framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.

Rationale

There is one low quality article that does not support the use of tranexamic acid (TXA) and multiple very low-quality articles that do support its use in reducing blood loos and/or wound complications.[15]

Benefits & Harms:
The risks are very low, TXA is generally considered very safe and is widely used. A benefit in wound complications, probably more so than blood loss would be very helpful in patients undergoing TAR or AA.

Outcome Importance:
Wound complications and blood loss in TAR/AA are important issues, especially wound complications.

Cost Effectiveness/Resource Utilization:
TXA is generally very cheap and used widely at most orthopaedic surgery centers and hospitals.

Acceptability:
This intervention is generally very acceptable given its wide usage in total joints, spine, and pediatric orthopaedics

Feasibility:
This intervention is generally very feasible

Future Research:
A multi-center prospective trial would substantially strengthen the literature in this area.

APPENDICES

Appendix I: References

Introduction References

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Included CPG Evidence

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