

# Clinical Faceoff

## Ankle Arthrodesis Versus Ankle Replacement for Ankle Arthritis

Judith F. Baumhauer MD

Ankle arthritis is nine-times less common than hip or knee arthritis [2]. When ankle arthritis does occur, it causes

pain and severe disability. Ankle arthritis is as physically debilitating as end stage renal disease, congestive heart failure, cervical spine arthritis, and radiculopathy [5]. The treatment options for severe ankle arthritis have changed during the past 10 to 15 years. Currently, treatment options include ankle arthrodesis and total ankle replacement. There remains considerable controversy about the benefits of each procedure, and important questions about which patients might benefit from one approach more than the other.

To gain insight on this topic, I invited two experts in the field of foot and ankle surgery to discuss ankle arthrodesis and total ankle replacement. Charles L. Saltzman MD is the lead author on the largest prospective, case-controlled study examining functional outcomes after ankle arthroplasty versus ankle arthrodesis [4]. Bruce J. Sangeorzan MD is a world expert in ankle biomechanics, specifically after ankle fusion and compared to ankle replacement [3].

**Judith Baumhauer MD:** *Let us begin by discussing the traditional treatment for end stage ankle arthritis: ankle arthrodesis. Dr. Sangeorzan, what are the perceived advantages of an ankle arthrodesis?*

**Bruce J. Sangeorzan MD:** Ankle arthrodesis is a surgical procedure that heals reliably, relieves pain, and allows increased activity when performed for proper indications and within technical standards. When there is a normal subtalar joint and talonavicular joint, one can expect a normal gait when in a shoe and on a flat surface. Minimal modifications to shoe wear are needed. Infection is uncommon. Coronal and sagittal malalignment can be treated at the time of arthrodesis and once corrected cannot recur. There are no issues with instability after an ankle fusion. Even when an infection occurs, it can often be treated in a way that does not affect final outcome. Implant costs are low with this procedure. Three to five screws are sufficient a majority of the time, keeping implant costs under USD 100. Finally, many patients with end stage ankle arthritis had prior surgical procedures with scars in the field. Ankle arthrodesis can be done with a number of different approaches and allows the flexibility to accommodate the soft tissue limitations imposed by these prior procedures.

**Dr. Baumhauer:** *Certainly an ankle arthrodesis is a reliable and cost-effective surgical procedure. Dr. Saltzman, do you have any thoughts*

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J. F. Baumhauer MD (✉)  
Department of Orthopaedics, University of Rochester School of Medicine,  
601 Elmwood Ave., P.O. Box 665,  
Rochester, NY 14642, USA  
e-mail: judy\_baumhauer@urmc.rochester.edu

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*about this surgical approach to ankle arthritis?*

**Charles L. Saltzman:** I agree with everything Dr. Sangeorzan stated except the contention that ankle fusions reliably heal. On average, ankle fusion has an approximately 10% nonunion rate. Some patients develop malunion or subtalar arthritis. Some patients eventually require further surgery. I agree that the initial costs of surgery are less with ankle fusion, but the overall cost effectiveness — if the patient lives long enough — may be less for ankle fusion. Using a Markovian model approach, Courville et al. [1], published in this journal an estimate that an ankle replacement performed in a 60-year-old hypothetical cohort gain 1.7 quality-adjusted life years (QALY) with an incremental cost-effectiveness ratio of USD 11,800/QALY. This is a relatively modest cost for the QALY gained. Ankle replacement designs and materials continue to change. The hope is we will get to the point where ankle fusion is not necessary, because replacements work so well and reliably. We are certainly not at that point today, but we expect continued progress towards that goal.

**Dr. Baumhauer:** *Dr. Saltzman makes some good points regarding quality of life improvement with total ankle replacement. Dr. Sangeorzan, are there circumstances which you might*

*favor a total ankle replacement, and if so, tell me about those?*

**Dr. Sangeorzan:** I have a bias toward ankle replacement in patients nearing or older than 60 years of age with moderate subtalar or talonavicular arthritis, or if they have had a preexisting arthrodesis of those joints. Additionally, patients whose lifestyle or employment requires walking down ramps may have an advantage in having an ankle replacement compared with an arthrodesis. While there is, as yet, no advantage shown with either procedure, gait analysis of the procedures supports a theoretical advantage for a procedure that allows continued sagittal plane motion under these circumstances. Finally, I have a bias toward ankle replacement in younger individuals with inflammatory arthritis. This population is likely to have lower demands, but also an enhanced likelihood for involvement of other joints.

**Dr. Baumhauer:** *Dr. Sangeorzan, can you expand on the issue of adjacent joint arthritis? How do the issues of adjacent joint involvement at the time of an ankle fusion or the possibility of adjacent joint degeneration affect your decision to perform an arthrodesis?*

**Dr. Sangeorzan:** Adjacent joint disease plays a large, but not yet clearly defined role in decision making. First, there is little functional information for

patients who undergo tibio calcaneal fusion. Giving up both ankle and subtalar or ankle and midfoot markedly limits foot motion and adaptability. In the absence of good data about functional limits, one could make a strong argument for ankle replacement even for young people. Additionally, one might argue, as some patients have, that young people should have an ankle replacement with minimal bone resection to preserve the other joints through middle age. Since the presumption is that fusion at a young age will inevitably lead to destruction of the subtalar and transverse tarsal joints, having an ankle replacement in one's thirties might allow function without destroying the subtalar joint during the most critical work years. Until we have data comparing these circumstances, this discussion will remain theoretical.

**Dr. Baumhauer:** *This is a great segue into our discussion on total ankle replacements. Dr. Saltzman, what do you perceive as the advantages of total ankle replacements?*

**Dr. Saltzman:** Compared to arthrodesis, the primary advantages of total ankle replacements are maintenance of motion of the ankle and reduced risk of developing adjacent joint arthritis. Maintenance of motion, especially in patients with relatively stiff feet, has many potential advantages over fusion.

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Common complaints of highly satisfied patients after ankle fusion include difficulty walking on uneven ground, difficulty with stair ascent or descent, need to modify the way they pick up objects off the floor, altered use of driving pedals, and difficulty putting boots on.

**Dr. Sangeorzan:** Dr. Saltzman is correct that these are challenges faced by patients even with a successful arthrodesis. Lack of sagittal plane motion limits crouching and managing uneven surfaces. Fortunately, only a small amount of modern life involves uneven surfaces. Weight bearing gait on flat surfaces has been shown to be well-maintained and undetectable to observation. The protection of adjacent joints remains a theoretical advantage of arthroplasty. Data on time to adjacent joint arthritis are contradictory and the prevention of it by an arthroplasty, while reasonable in theory, has no evidence yet to support it.

**Dr. Baumhauer:** *There is little question in my mind that if there were low risks and extended longevity with an ankle arthroplasty, it would have functional advantages over an ankle arthrodesis. However, because of the increased risks and limited survivorship of the current implants, we need to make decisions on which patients benefit the most from each procedure. Dr. Saltzman, are there particular*

*medical or orthopaedic conditions that would make you lean away from total ankle replacement and towards a fusion?*

**Dr. Saltzman:** Like all major joint replacements, ankle replacements involve simple mechanical parts that must align well to wear sustainably for decades. Eventually, all mechanical parts wear out. To maintain the longest function of ankle replacements, the mechanical conditions should allow smooth and continuous interaction between the gliding surfaces. Uncorrectable deformities preclude this from happening and should not be considered for ankle replacement. Similarly, patients with active lifestyle interests that involve rapid acceleration and deceleration forces on the articulating surfaces will likely prematurely wear their ankle replacement. Patients with poor sensation who cannot sense malalignment or pain are not good candidates for replacement. History of previous infection may be a contraindication to ankle replacement, as is soft tissue envelope issues as they may lead to deep infection necessitating ankle removal. Most ankle replacements require bone ingrowth to have successful anchoring of the replacement to the host bed. Talar or distal tibial avascular necrosis will reduce the likelihood of integrations and should be considered a relative contraindication. We do not know if there should be a weight limit for

patients undergoing ankle replacement. Clearly, larger patients will exert more force on their replacement with each step, but many of them take far fewer steps than normal habitus patients.

**Dr. Baumhauer:** *Dr. Sangeorzan, do you have thoughts about patient characteristics that make arthrodesis a more viable option than ankle replacement?*

**Dr. Sangeorzan:** I concur with the issues shared by Dr. Saltzman. Though we have not yet defined what degree of deformity or instability is incompatible with ankle replacement, and it may be implant-dependent, it is likely that there are some deformities that do not have an appropriate soft tissue or bone envelope to carry out a replacement in a way that will last. To make an arthroplasty work, alignment and stability must be attainable. If too much of the bone is removed to get coronal realignment, it may change the center of rotation of the joint and adversely effect soft tissue constraint. Remote infection may or may not be a contraindication to ankle replacement. While it does raise concerns, there are small studies indicating successful implantation without recurrence of infection.

**Dr. Baumhauer:** *This is an excellent list of potential conditions that would lead you away from recommending an ankle replacement. Dr. Saltzman, how*

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does the possibility of having to revise one of your total ankle replacements affect your decision to perform one?

**Dr. Saltzman:** Unlike total hips or knees, there are limited choices for revising ankle replacements currently available. If a lot of bone stock is removed to insert and remove an ankle replacement, the “salvage” can be challenging. Alternative approaches include direct fusion with shortening, arthrodesis with interposition graft (autograft, allograft, or shape porous metals) or revision ankle replacement with a larger replacement. If the reason for revision is mechanical — the source of that mechanical failure must be reversed prior to revising the implant to another implant. If the reason is infection, the infection must be fully eradicated before reimplantation — except in the rare circumstance of early infection with highly sensitive organisms — which may be worth trying to save with poly exchange, mechanical débridement of all related tissues and surfaces, and other standard total joint infection protocols.

**Dr. Baumhauer:** *Dr. Sangeorzan, do you have thoughts about revision surgery for ankle replacements?*

**Dr. Sangeorzan:** I agree that the potential for revision should be part of the preoperative decision and discussion for ankle replacement. The same is true for ankle arthrodesis. Adjacent joint arthritis is a known, though an incompletely quantified, adverse outcome from ankle arthrodesis. Young patients need to factor in failure of an implant, as well as failure of adjacent joints that renders the arthrodesis a failure of sorts. A strategy for getting the patient to his or her eighties should be part of the planning. The surgeon should select an implant that removes minimal bone that could be revised to existing implants or future implants designed for revision even if there is some additional bone loss.

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