We are in the midst of an evolution as well as revolution in the surgical management of end-stage ankle arthritis. Ankle arthrodesis has long been considered the primary surgical intervention for symptomatic ankle arthritis, with good patient satisfaction, pain relief, and clinical outcomes when fusion is achieved. However, the overall efficacy of arthrodesis has come into question over the past decade with long-term clinical studies reporting high rates of ipsilateral hindfoot arthritis, decreased range of motion, and gait abnormalities. Total ankle arthroplasty (TAA) was first introduced to the orthopedic community more than 40 years ago with the first implant systems used in the early 1970s. Progressive development in TAA punctuated by recent major advances in implant design, instrumentation, surgical technique, surgeon training, clinical and functional outcomes, and survivorship has caused a rapid growth in the popularity of TAA worldwide. The number of ankle arthrodesis procedures performed in the United States remained relatively unchanged from 2004 to 2009, while the number of TAAs increased by 57% to 0.99 cases per 10,000 patients. A recent systematic review revealed that mean American Orthopaedic Foot and Ankle Society scores consistently increased from an average of 40 before TAA to 80 afterward at a mean follow-up of 8.2 years. As surgeons continue to explore, expand, and redefine the role of total ankles, the question arises: “Are the scales now tipping toward TAA as the better treatment for end-stage ankle arthritis?”

We believe that TAA will become the standard for end-stage ankle arthritis in the next decade. Proposed advantages of TAA over arthrodesis include better restoration of and improvement in joint range of motion, superior gait kinematics, and decreased incidence of adjacent joint hindfoot arthritis, with equivalent pain relief and patient satisfaction. However, the clinical benefits of these advantages have only recently been borne out in the literature. Early first-generation permutations of TAA were infamous for high early failure rates due to non-anatomic designs, high levels of constraint (or complete lack of restraint), excessive bony resection, and gross component loosening. Current second- and third-generation TAA implants have more anatomic designs, have increased coronal and rotational stability, and require less bony resection. Survival rates for TAA have been reported to be 71% to 77% at 10 years, with a review of 58 modern TAA studies reporting a survivorship of 89% at 10 years with an annual failure rate of 1.2%. In addition, mid- and long-term outcomes comparing TAA with ankle arthrodesis indicate that the risks of early complications and long-term failure are comparable between the 2 procedures in diverse cohorts of patients. There is now reproducible evidence that TAA can positively impact patients’ quality of life with measurable benefits in pain and function.

Total ankle arthroplasty indications are expanding, implant designs are improving, balancing techniques are refining, and postoperative rehabilitation protocols are maturing. We are in an exciting period of unprecedented innovation, achieving outcomes with TAA previously thought unattainable. Moderate to severe coronal ankle malalignment has been considered a con-
traindication for TAA and is currently a heavily debated topic.\textsuperscript{13,14} New investigations are demonstrating better predictability for more significant coronal plane deformities through a structured and thoughtful approach, occasionally requiring staged reconstructions.\textsuperscript{15} Expanded indications to include younger patients with increasing deformity have been recently implemented with success. Many patients with end-stage ankle arthritis who may benefit from TAA have associated deformity from asymmetric joint deterioration, particularly in posttraumatic settings. Improved clinical and functional outcomes with TAA have been reported independent of preoperative tibiotalar deformity, even with articular angulations greater than 20°.\textsuperscript{16} Meticulous surgical planning, soft-tissue handling, gutter debridement, hindfoot deformity correction, and ligament balancing are essential to achieve good outcomes. It is our opinion that deformity no longer precludes the use of a TAA in most circumstances.

With any new surgical technique and advancement there should be an accompanying sense of caution and need to critically evaluate results rather than base decisions on anecdotal evidence. While infection and wound complication rates have dropped with better surgical approaches and improved postoperative protocols, talar component subsidence and avascular changes in the residual talus remain sources of concern.\textsuperscript{17} Limited talar bone mass compromises component revision following this mode of failure.\textsuperscript{18} In addition, osteolysis temporally occurs sooner following TAA than following total hip and knee arthroplasty. Conceptually, product design, joint reaction forces, joint size, polyethylene composition, and joint tracking/congruence most likely contribute to this issue, and we need to better understand how to minimize the impact of these components of total joint destruction.\textsuperscript{19} While we received a setback from the Food and Drug Administration when custom components for revision TAA became restricted, new revision systems on the horizon will hopefully combat the challenges involved in revising a total ankle implant.

Successes and failures must both be scrutinized to determine how and why outcomes differ as each new promising study brings with it an endless series of unsettling questions with unknown answers. We must strive to ask better, harder, more probing questions of what we don’t understand to further improve outcomes. Meaningful debate is essential to improve our nuanced understanding of how procedures affect patient satisfaction and provide context for when different surgeries should be employed. In addition, we must face the reality of medical resource utilization head on and determine the cost-effectiveness of surgical treatment for ankle arthritis. While recent literature surrounding TAA has an overall optimistic tone, survivorship data vary across different studies and implant systems and are greatly influenced by individual surgeon skill, training, and case volume. There is also considerable debate concerning the future implications of prosthesis survival and the need for revision surgery due to lack of long-term studies. An impulsive and dogmatic approach to end-stage ankle arthritis, with individual surgeons treating all patients in their practice with arthrodesis, or all patients with TAA, will inevitably lead to poor clinical outcomes. We must be vigilant and unbiased, critically evaluating the literature and properly educating patients regarding the possible benefits and risks with each procedure.

Total ankle arthroplasty is not intended for every patient and neither is arthrodesis. Each patient is different and uniquely complex in his or her own needs and goals, and each clinical situation warrants careful consideration of what treatment may offer the best possible outcome. Often what matters most to achieving a successful result is aligning patient expectations with the information we have available. Long-term randomized controlled trials between TAA and arthrodesis are critical to understand how each treatment can benefit patients and what the respective aggregate values are to society. We live in a period of intense global innovation with constantly emerging new ideas to redefine the treatment of ankle arthritis. Total knee and hip arthroplasty have fundamentally changed the way we currently treat end-stage arthritis, allowing us to reach high levels of reproducibility and clinical success over the past 50 years through dedication and perseverance in basic science and clinical research. Although the modern era of TAA is still relatively young, it is important that we challenge ourselves with the next question: “Can TAA achieve the same success as total knee and total hip arthroplasty?” We believe that it can and will in the future, but collaborative large-scale prospective clinical trials, national joint registries, and systematic reviews are needed if total ankles are to move forward and reach their full potential.

REFERENCES


