Essential Insights On Treating End-Stage Ankle Arthritis

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Sharing insights from the literature and surgical experience, these authors suggest a re-evaluation and possible elevation of ankle arthroplasty over ankle arthrodesis as a preferred option for appropriate patients with end-stage ankle arthritis.

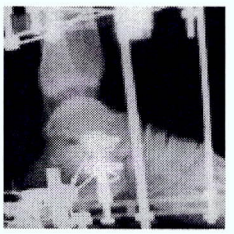
End-stage arthritis is the point where progressive wearing down of the articular cartilage results in bone-on-bone grinding down of the joint surface. The patient with end-stage arthritis has pain combined with a loss of function and mobility, which severely limits normal activity. When a patient reaches this stage and has failed conservative care (NSAID therapy, other oral therapy, corticosteroid injections, bracing) as well as alternative methods of pain control and management, there are three possible methods of surgical treatment: ankle arthrodesis, ankle replacement and distraction arthroplasty.

A lack of good supportive data for distraction arthroplasty has made it a temporary solution at best that surgeons seldom employ. Until more favorable literature suggests this as a corrective method of treating end-stage ankle arthritis, for the purposes of this article, we will focus on the two remaining treatment options.

End-stage arthritic changes secondary to progressive wearing of the articular cartilage cause pain, disability, decreased quality of life, limitation of activity, loss of function and loss of mobility. The prevalence of ankle arthritis is approximately nine times lower than that of the knee and hip.[1] However, despite advancing medical treatment as well as technological advances in internal and external fixation, there are approximately 50,000 new cases of lower extremity arthritis each year.[2]

Primary osteoarthritis is the most common indication for total hip and knee arthroplasty whereas post-traumatic arthritis is the most common diagnosis for ankle replacement or arthrodesis.[3] Secondary causes of degenerative joint disease are inflammatory conditions, infection, dysplasia and vascular or neurological insults.[4] With an increasing aging population, the numbers of patients with severe osteoarthritis who want to remain active longer continues to grow. Conservative options for ankle arthritis traditionally include medications, injections and bracing.

When patients have severe arthritic changes that are unresponsive to non-operative care, one may perform ankle arthrodesis or total ankle replacement.



Various researchers have noted that cemented, first-generation total ankle implants (constrained and unconstrained) "often failed" due to poor implant design, loosening and instability.[5-7] The first-generation Agility implant had several design flaws that caused higher re-operation rates and failure. Gougoulias and colleagues noted that the Agility implant was "designed to absorb rotational forces by allowing a space between the medial and lateral sides of the talar component resting against the bearing."[8] Delays in syndesmotic fusion, frequent malleolar fractures in the perioperative period and subsidence secondary to a nominal talar component plagued the initial generation of total ankle implants. The loosening rates of the initial generation implants were as high as 60 percent and 90 percent after five and 10 years respectively.[8,9]

Although failure rates of total ankle arthroplasty initially led to the favoring of ankle arthrodesis, advancements in total ankle implants have recently improved implant longevity, function and overall outcomes.

The current systems (second-generation implants) are more advanced with extensive modifications. These total ankle implants include semi-constrained, cement-less designs, mobile and fixed-bearing designs.[6,10,11] Studies with the newer generation implants show that survivorship of total ankle arthroplasty implants ranges from 70 percent to 98 percent at three to six years and from 80 percent to 95 percent at eight to 12 years when researchers define survivorship as the retention of metal components.[12] A recent study by Mann and coworkers indicated the survival rate of the STAR implant was 96 percent at five years and 90 percent at 10 years.[13] As more long-term studies are published, improving survivorship is making ankle replacement an increasingly popular option versus the longer established ankle arthrodesis.

Are We Seeing A Shift With Ankle Arthroplasty Being Favored More Than Ankle Arthrodesis?

The improved timing of gait and theorized protection of adjacent joints are also persuasive arguments for replacing rather than fusing the ankle joint.[14] Researchers have shown that total ankle arthroplasty, regardless of the specific implant used, improves functional outcomes.[15] In fact, functional outcomes tend to favor arthroplasty over arthrodesis. Saltzman and colleagues have reported the initial results of a prospective controlled trial comparing total ankle replacement with ankle arthrodesis, demonstrating the superiority of total ankle replacement in postoperative pain relief and functional outcome.[16] Several studies have shown statistically equivalent changes in pain scores between arthroplasty and arthrodesis.

Specifically, a systematic review of the literature by Haddad and coworkers showed comparable AOFAS scores of 78.2 and 75.6 for arthroplasty and arthrodesis respectively.[5] However, arthroplasty is technically difficult and more experienced surgeons generally perform it.

One important factor in the outcome is the position of the talar component. A study by Barg and coworkers indicated that an anterior-posterior offset ratio of 0 on a lateral ankle radiograph not only corresponded to reduced pain but also improved functional outcome as measured by the AOFAS score in a two- to eight-year follow up.[17] Brodsky and colleagues showed that patients exhibited improved walking velocity, cadence and stride length after undergoing a total ankle arthroplasty.[18] These patients had improved ankle power, increased ankle range of motion and improved hip and knee range of motion, leading to overall improvement in ankle function and gait.

In comparing the gait of healthy patients, those who had prior total ankle arthroplasty and those with prior ankle arthrodesis, Piriou and coworkers found that while neither the arthroplasty nor the arthrodesis patients returned to "normal" gait, the arthroplasty group showed a greater reduction in limp, greater movement at the ankle, a symmetrical timing of gait and a restored ground reaction force pattern.[14]

Revision rates are also comparable. The total ankle arthroplasty revision rate is around 7 percent with the primary reason for revision being loosening or subsidence. The revision rate following ankle arthrodesis is about 9 percent with non-union being the major factor. Of note, 1 percent of patients who previously underwent ankle arthroplasty required a below-the-knee amputation in comparison to 5 percent who had undergone arthrodesis.[7]

The failure rate of ankle implants may be related to the intrinsic design as well as surgeons' incomplete restoration of the critical stabilizing role of the ligaments, triplanar motion and the lack of involvement of the underlying subtalar joint in the coupled motion of the joint complex.[8,19-21] While SooHoo and colleagues found that total ankle arthroplasty had a greater risk than ankle arthrodesis for implant-related infections requiring revisional surgery, there was a decreased risk of the patient requiring a subsequent subtalar joint fusion.[22] This suggests that ankle fusion increases the risk of adaptive arthritis on adjacent joints. An isolated ankle fusion, especially in a younger patient, could therefore eventually progress into a pantalar fusion, further increasing limitations instead of preserving the patient's existing movement and function.[18]

In an intermediate and long-term meta-analysis, Haddad and coworkers concluded that the data suggests a minimum equivalence between an ankle arthrodesis and ankle replacement once the poor connotations associated with first-generation ankle implants are negated.[5]

According to Easley and colleagues, "Comparative studies with a fair to good quality level of evidence suggest that total ankle arthroplasty provides equal pain relief and possibly improved function compared with ankle arthrodesis."[12] They also found that the literature supports a return to an active lifestyle of recreational sporting activities and low-impact exercise after patients have had a total ankle implant procedure.[12]

Anecdotally, the lead author has had patients who ran marathons and participated in team sports after a successful ankle implant (of course, this was totally against advice). There is no universal list of indications for this procedure as the increasing familiarity and experience of surgeons have expanded the application. Surgeons had considered deformity and angulation as contraindications but more surgeons have performed total ankle implants while concurrently or previously addressing some of these deformities. As ankle implants increase in popularity with the development of this new generation of implants, this procedure is an excellent option for an experienced surgeon to help patients maintain function and mobility in the setting of advanced end stage arthritis.

Three Factors To Keep In Mind When Comparing Reported Outcomes Of Ankle Arthroplasty And Ankle Arthrodesis

The literature is relatively sparse when it comes to a true comparison of the results of ankle replacements as opposed to arthrodesis results for three reasons.

1. Scoring systems that try to judge function, such as the AOFAS score, are partially based on range of motion, making them skewed as far as the evaluation of these two techniques goes (favoring replacement).

2. In most cases of reporting data on ankle replacement, the authors have reported relatively short-term data (five years or less) on their first 100 cases of ankle replacement whereas ankle arthrodesis data might offer more long-term results and be based on better technical skills of the surgeon. Typically, we then have a problem with the evaluation of cases when the surgeon who is excellent at ankle arthrodesis and has been doing the procedure for years suddenly begins to do ankle arthroplasties and reports the data before gaining

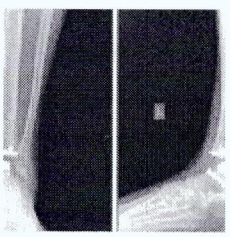
comparative experience. These naturally have a large learning curve associated with them and it is in the period of this learning curve (the first 100 procedures) when cases are being reported. We would be better served if a highly skilled and experienced surgeon who is excellent at ankle arthroplasty was reporting on these procedures.

3. We are also changing the technology associated with ankle arthroplasty but not reporting on this as quickly in our literature. In other words, studies that take place over the course of years are actually studying older technology. Current technology is available but it has not been studied long enough to give it validity. Accordingly, our data is even less significant.

Given these reasons, the lead author thinks we have stifled what should have been a more aggressive switch to ankle arthroplasty when comparing it to ankle arthrodesis.

A Retrospective Review Of 100 Procedures With The Agility LP Total Ankle System

In his own study, the lead author first began doing FDA-approved ankle arthroplasty with the Agility LP Total Ankle System (DePuy). This system had complications that are not as common in more recently developed ankle replacement systems. For example, failure of a syndesmotic fusion was a common complication with the Agility system whereas more recently developed ankle replacement systems do not have the requirement for a tibial/tibular syndesmotic fusion concurrent with their implantation.



Other complications with the Agility system include both medial and lateral malleolar fractures as one would have to perform an ostectomy to incorporate an Agility ankle replacement device. This led to stress risers that would often cause fractures. Additionally, other system failures included subsidence, which was caused by a number of flaws in this initial system such as a smaller talar component that would have extra pressure exerted on it due to surgeons having to implant the device with a distraction technique. Additionally, complications occurred because of maneuvering with the distraction technique, which could lead to everything from wound healing problems to release.

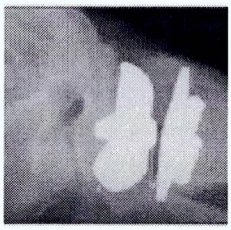
Given these issues, the lead author suggests taking a harder look at the data as well as the results of ankle replacement surgery, and consider that more recently developed models have far lower complication rates and far greater success rates than previous models.

In addition, we must continue to keep in mind that surgeons who are excellent at ankle arthrodesis and are currently evaluating arthroplasty in comparison to arthrodesis may not be excellent ankle joint replacement surgeons. In addition, we can't emphasize enough the learning curve that exists with ankle replacement. Those who are good at hip and knee replacement may not necessarily excel at ankle arthroplasty and a surgeon who is good at ankle arthrodesis may not necessarily be good at ankle arthroplasty.

In the lead author's own retrospective review of results in the first 100 Agility total ankle replacements that occurred between 1998 and 2005, the patient's age ranged from 29 to 76. The average patient age was 54 years. The average follow-up time was 73.5 months. The minimum follow-up time was five years. There were 83 cases of post-traumatic osteoarthritis, 11 cases of rheumatoid arthritis and six cases involving other types of arthritis. Failed conservative care therapy included ankle bracing, cortical steroid injections, ankle-foot orthoses, physical therapy modalities and ankle arthroscopy.

The average pre-op pain was 8.4/10. The average pre-op range of motion with dorsiflexion was -1.3 degrees and plantarflexion was 5.67 degrees. The average post-op pain was 1.4/10 or an 85 percent reduction. The average post-op range of motion with dorsiflexion was 9.29 degrees and plantarflexion was 24.28 degrees. The total range of motion was 33.57 degrees or a 400 percent increase.

Complications included malleolar fractures (10), talar component rotation (2), tibiofibular diastasis (4), bone growth around implant (4), wound dehiscence (2), lateral malleolar fracture (6), lack of dorsiflexion (2), DVT (1), arterial thrombus (1), varus deformity (3) and infection (3). In most of these cases, we were able to address these complications (such as a fractured malleolar) either intra-operatively or postoperatively (such as fractured malleoli that were repaired postoperatively or immobilized until they healed). In addition, some of these cases involved more than one complication in a single patient.



Despite these complications, 92 out of the first 100 patients reported good or excellent results, and would have chosen to have the procedure again. We removed the implant in four patients who went on to ankle arthrodesis. One patient lost her leg. Out of the first seven implants, there was a 71 percent complication rate with 7.43 degrees of dorsiflexion. The subsequent 93 implants had a 16 percent complication rate with 13.14 degrees of dorsiflexion. This demonstrates the learning curve.

In addition, the earlier implants used an older model Agility design and the later implants were with more recent models. The next 100 implants had a 6 percent complication rate, further demonstrating the learning curve. Indeed, the learning curve is even more reason to view with skepticism the results of people publishing their first 100 cases after a short period of time.

Comparing One Surgeon's Ankle Arthroplasty Results With Ankle Arthrodesis Outcomes

In the same period of time of his first 100 ankle implants, the lead author assessed his ankle arthrodesis rate and complications, looking at 26 patients from 1998 to 2002 with a follow-up of two years. For these patients, etiologies included post-traumatic osteoarthritis (22), rheumatoid arthritis (3) and psoriatic arthritis (1). The average pre-op range of motion was 12.5 degrees of plantarflexion and -3 degrees of dorsiflexion. The average post-op range of motion was 3 degrees of plantarflexion and 1.3 degrees of dorsiflexion. The average pre-op pain was 8.2/10 and the average post-op pain was 2.1/10 or a 74 percent reduction in pain.

There was an 8 percent complication rate. The complications were a non-union that the lead author was able to successfully revise and a dehiscence, which closed with conservative care in two months. Despite the apparent success, 7 out of 26 patients (27 percent) considered the results less than good and would not have chosen this procedure again. Four out of six satisfied patients had a subsequent knee replacement and one hip replacement.

This suggests that the arthrodesis of the ankle puts more pressure on the hip and knee although these are people with arthritis in general so one cannot interpret too much from that result.

Final Notes

We should not compare data from a surgeon with good ankle arthrodesis experience to data from a surgeon who is inexperienced with ankle arthroplasty. Rather, we should compare the data of a surgeon who has decent experience with ankle arthrodesis to the data of a surgeon who has decent experience with ankle arthroplasty. In addition, techniques have changed so much that early studies on ankle replacement are not as relevant as more recent studies.

We believe more patients would prefer ankle replacement over arthrodesis, particularly in most young patients, even though several reports have suggested that the survivorship of implants and outcomes is less favorable in younger patients.[23,24] It is the lead author's experience, however, that younger patients actually

do better and are even more satisfied with the results over the course of time even though there is the risk of early wearing out or implant failure. Obviously, there are circumstances (such as severe deformity or neuropathy) in which ankle arthrodesis would be favorable to ankle arthroplasty.

In conclusion, the question no longer is, "Which is the better procedure: ankle arthrodesis or ankle joint replacement?" Rather, the question is, "Who is the ideal candidate for ankle replacement and who has to settle for arthrodesis as a solution to end-stage ankle arthritis?"

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For further reading, see "Emerging Insights With The Ankle Implant Arthroplasty" in the October 2011 issue of Podiatry Today.

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