

Total Ankle Arthroplasty

OVERVIEW

Total ankle arthroplasty (TAA) is an evolving option for treating painful arthritis of the ankle. Early techniques and materials led to high failure rates due to osteolysis, impingement, infection, and soft tissue complications. Newer materials and improved surgical technique have increased longevity and improved outcomes, renewing interest in TAA as an alternative to arthrodesis. Ankle arthrodesis has long been considered the standard treatment for severe ankle arthritis however, recent analysis revealed that TAA provides improved walking velocity compared to arthrodesis. Continuing research in materials and clinical outcomes will improve TAA reliability as a treatment for severe tibiotalar arthritis.

ANATOMY

The talus, distal tibia, and distal fibula articulate to create a mortise joint which is further stabilized by a joint capsule and ligamentous complexes. Medially, the deltoid ligament complex stabilizes the joint against eversion. The deltoid ligament is a triangular complex consisting of superficial and deep components as well as up to eight bands. Laterally, the ligament complex is made up of the anterior talofibular ligament, the calcaneofibular ligament, and the posterior talofibular ligament. These ligaments restrain inversion in various degrees of ankle plantarflexion. The syndesmotic ligament complex, consisting of the anterior inferior tibiofibular ligament, the posterior tibiofibular ligament, and the interosseous tibiofibular ligament, prevents excessive separation of the tibia and fibula under physiologic loading. The stability provided by joint congruency varies according to ankle position. The superior articular surface of the talus is trapezoidal with a larger width anteriorly. As the ankle is dorsiflexed the wider portion of the talus engages the ankle mortise and spreads the syndesmosis, creating a tighter fit and allowing less translation and rotation of the talus in the mortise. The opposite occurs during plantarflexion; the talus is narrower and thus is allowed more translation and rotation.

The articular cartilage of the ankle joint is much thinner than other weight bearing joints, ranging from 1mm to 3mm thick. Additionally, the contact area of the ankle is only 25-30% of that of the knee and hip. Accordingly, the forces across the ankle joint are thought to be much higher.

PATHOGENESIS

In the majority of cases, arthritis of the ankle is secondary to trauma. Rotational ankle fractures and chronic ankle instability rank as the most common injuries. It is thought that these injuries result in damage to the articular surface whether acutely or through chronic instability. Additional causes include rheumatoid arthritis, osteonecrosis, hemophilia, septic arthritis, gout, and primary osteoarthritis. Primary osteoarthritis is commonly associated with hindfoot deformity or malalignment which can alter the contact area of the joint, leading to joint surface breakdown.

CLINICAL PRESENTATION

As ankle arthritis worsens, it can cause a dramatic decrease in quality of life to a similar degree as severe hip arthritis. Early in the disease process symptoms may be limited to periodic pain and swelling with activities. As progression occurs, the pain can become severe and a deformity may develop. Range of motion typically becomes severely limited and painful.

Examination may reveal a visible deformity, an antalgic gait, and a painful and limited range of motion. Weight-bearing x-rays should be reviewed. Joint space narrowing, osteophyte formation, subchondral sclerosis, and cyst formation are common findings in severe arthritis and have been used by Kellgren et al to classify ankle arthritis.

TREATMENT

Non-operative treatments for ankle arthritis remain largely unrepresented in the literature. Common treatments are aimed at reducing force across the arthritic joint. Rocker bottom

shoes, weight-loss, use of a cane, and analgesic or anti-inflammatory medication use are commonly advocated as initial treatments.

Debridement of the arthritic joint and removal of impinging osteophytes has been shown to improve pain in early arthritis. Performing this procedure arthroscopically allows for a faster recovery.

In the setting of a deformity causing malalignment of the ankle, a supramalleolar osteotomy can be used to change the orientation of the joint to allow for improved contact characteristics. This procedure provides more improvement, functionally and radiographically, in lower grade osteoarthritis.

Distraction arthroplasty is performed by distracting the arthritic joint with external fixation for an extended period of time. The reported results have been promising, however, this procedure is typically performed in combination with other procedures such as ankle debridement and Achilles tendon lengthening, thus, it is difficult to attribute clinical improvement to distraction arthroplasty alone.

Ankle arthrodesis remains the gold standard treatment for symptomatic arthritis of the ankle. Tibiotalar fusion provides a reduction in pain and return to function. However, long term studies have shown a high rate of arthritis in adjacent joints. This can lead to decreased function and increased pain over time. In an effort to maintain ankle range of motion, total ankle arthroplasty was developed.

The first generation of TAA components was plagued by a high subsidence rate. Highly constrained components offered great stability but the technique required significant tibial bone resection. This placed the tibial component in the poorer metaphyseal bone and led to failure. The second generation of component systems improved on this by including semi-constrained design and porous coating to improve fixation with less bone resection. The third generation of TAA components has been designed with focus on minimizing bone resection, maximizing osteointegration, improving contact area characteristics, and utilizing soft tissue balancing to allow more natural mechanics and, theoretically, improved longevity.

Long term studies reporting the outcomes of TAA are increasing, but remain limited. A recent study showed great improvement in pain and function as well as greater than 90% implant survival at least 10 years follow. However, the authors also report a high incidence of additional surgical procedures

CONCLUSION

Total ankle arthroplasty is a powerful tool for treating end-stage arthritis of the ankle. However, the procedure carries the risk of complications and additional procedures. TAA techniques and technology continue to improve and evolve. Continuing basic science research and clinical outcome studies will help elucidate how TAA systems succeed or fail as well as help to create newer techniques and materials to improve the outcomes for patients suffering from osteoarthritis of the ankle.

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