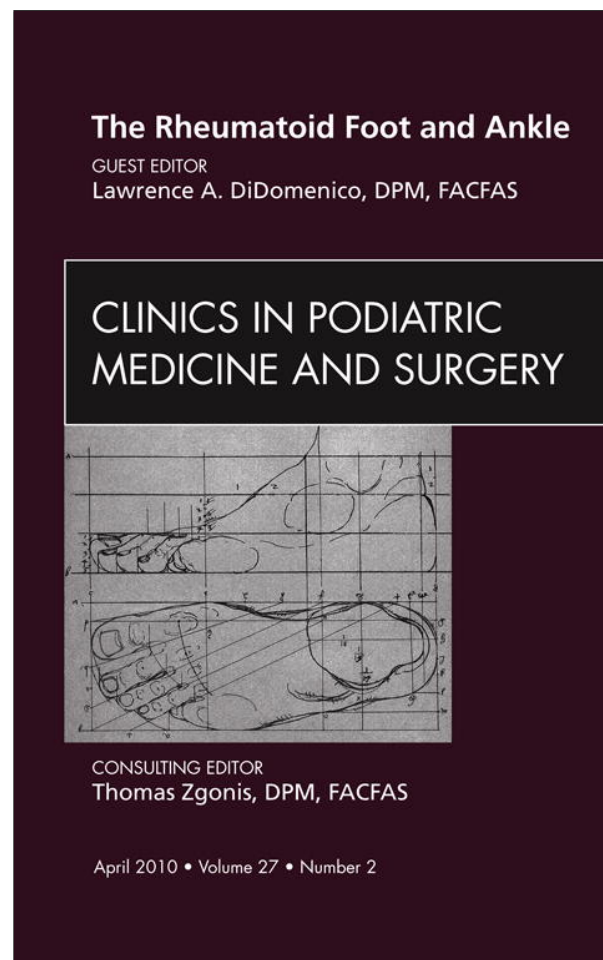


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Total Ankle Arthroplasty in the Rheumatoid Patient

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KEYWORDS

- Rheumatoid arthritis • Total ankle arthroplasty
- Total ankle replacement • Rheumatoid disease
- Ankle arthrodesis

Rheumatoid arthritis is a systemic disease that commonly affects the foot and ankle joints. It is an autoimmune connective tissue disorder that specifically targets synovial membranes, thus causing inflammatory arthritis.¹ As the disease progresses, adjacent cartilage and bone erode, leading to joint destruction. There is a connection. Evidence has shown a clear pattern of hindfoot involvement following rheumatoid arthritis diagnosis.² The most common finding is ankle valgus (varus deformities are rare), which is reported as high as 29% among those who had rheumatoid arthritis disease for more than 5 years. Reports also indicate that the tibiotalar joint is affected in up to 50% of rheumatic patients.³ Furthermore, in correlation to clinical findings, one study has demonstrated that nearly half of patients who have had the disease for more than 13 years report hindfoot symptoms worse than forefoot symptoms.⁴

A myriad of surgical procedures are available for treatment of the rheumatoid forefoot. These include arthrodesis, total joint implants, hemi-joint implants, joint resection, and joint-sparing techniques.⁵ In sharp contrast, however, procedures for the hindfoot are limited to total ankle replacement and arthrodesis. Joint fusion has long endured as the gold standard for treatment. Unfortunately fusion imparts stress on adjacent joints, leading to further joint destruction and subsequent intervention. Ankle arthroplasty provides a feasible option.

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BACKGROUND

Total ankle arthroplasty (TAA) allows motion and reduces stresses on proximal and distal joints as compared with ankle arthrodesis.⁶ A proper review of the literature about TAA in patients with rheumatoid arthritis requires a basic appreciation of the progression of implant design as well as an understanding of the advances in rheumatoid arthritis therapy. TAA developed in the 1970s with at least 10 designs reported in the literature in that decade.⁷ Implant designs included constrained, semiconstrained, and unconstrained designs. Unconstrained designs, relying on ligamentous support, allowed for the greatest freedom of ankle movement, often leading to instability.⁸ Early constrained designs imparted forces to the cement-bone interface, resulting in loosening because movement was allowed in only one plane. Current systems permit motion in multiple planes while providing stability.^{9,10}

PATIENT SELECTION

No one has yet been able to define precisely the best criteria for determining which patients are best suited for total ankle replacement. Certainly nonoperative care should be tried before any patient becomes a candidate. If the patient does not respond to bracing, physical therapy, or other nonoperative treatment, the patient and surgeon should carefully consider TAA when the ankle joints limits his or her function and causes pain. The ideal patient should be older and have low physical demands, normal body weight, good vascular status, good bone stock, ligamentous integrity, and limited to no hindfoot malalignment.¹¹ The theory that an older patient is a better candidate than a younger patient is controversial and based on the patient's likely physical demands. The theory assumes that the older patient, who is, let's say, retired and less active than a younger patient, will generate less wear and tear on the device. However, because design options, device materials, and patient activity vary, no one has precisely clarified how to determine the minimum candidate age. Similarly, no one has determined how best to limit candidates by weight. Aside from significant comorbid medical conditions, other problems that typically preclude intervention with TAA include peripheral vascular disease, neuropathy, absent malleoli, severe bone loss, severe deformity, and active infection. Additional absolute contraindications have been significant osteonecrosis of the talus, poor tissue/healing quality, profound malalignment, lower extremity motor dysfunction (eg, Charcot-Marie-Tooth disease, paralysis), and high-demand patients (**Fig. 1**).¹²

Rheumatoid disease is not a contraindication to total ankle replacement. In fact, one study illustrated no statistical difference in implant survival or clinical outcome between rheumatoid and osteoarthritic patients.¹³ There is, however, associated perioperative complications, such as wound infections, prosthetic subsidence perhaps due to associated poor bone quality, and aseptic loosening owing to subtalar joint subluxation.¹⁴ An additional concern is the valgus positioning of the ankle, which typically results from rheumatic disease. Deltoid incompetence must be addressed prior to or after ankle replacement to avoid subsequent failure.¹⁵ If the rheumatic disease is longstanding, bony erosions are often identified, furthering valgus, causing deltoid insufficiency, and producing poor bone stock for tibial prosthesis placement.

One should also consider the presence of significant vasculitis and long-term immunosuppressive agents, both of which are linked to wound infection and failure to close.¹⁶ The inflammation associated with rheumatoid arthritis is typically controlled today with corticosteroids and methotrexate. Therefore, perioperative management to avoid adrenal suppression is necessary.¹⁷ Other drugs, such as etanercept, adalimumab, and infliximab, are "newer" drugs classified as anti-tumor necrosis factor



Fig. 1. A preoperative lateral radiograph of a patient with a rheumatoid arthritic ankle.

(TNF). While debate about perioperative management of these drugs goes on, a recent report indicated that continued use of these drugs did not increase the incidence of infection or impaired wound healing.¹⁸

Other absolute contraindications and relative contraindications depend on the surgeon's experience. Controversy persists about what degree of coronal plane deformity is sufficient as the cutoff for consideration of TAA. Doetz and colleagues¹⁹ found that, during use of mobile-bearing design implants, instability and subluxation of the bearing increases when frontal plane deformity is greater than 10°, leading to failure.¹⁹ They recommended 10° or greater varus or valgus of the ankle or hindfoot as a contraindication to TAA. Hobson and colleagues²⁰ set 30° of frontal plane deformity to be a contraindication to TAA. Haskell and Mann²¹ felt edge loading was 10 times more likely to occur in patients with preoperative incongruent joints as compared with those with congruent joints. The narrowed ankle from the previous fusion requires a smaller implant, which increases stress at the talar component-bone interface, which can lead to loosening, subsidence, and failure.²² The body mass index relative to the size of the ankle joint is of concern as well. In heavy patients with very small ankle-joint surfaces, increased contact pressures may not be tolerated, leading to poorer outcomes.²³ The use of custom prosthesis components may increase the likelihood of relative contraindications to TAA, such as contraindications involving patients with a high body mass index.²⁴ Any ipsilateral frontal plane knee deformity should be surgically corrected before TAA because such a deformity will affect the alignment of the ankle and its position relative to the weight-bearing surface. Realignment procedures of the foot at the time of TAA have not been shown to increase incidence of complications.²⁵

Patients with rheumatoid arthritis are not immune from complications common to TAA procedures in the general population. Osseous impingement, extra-articular procedures for malalignment, and component replacement occur in the rheumatoid population.²⁶ Intraoperative and postoperative malleolar fractures, syndesmosis nonunion complications, and wound-healing complications are to be expected, especially early in the learning curve.^{27,28} Prosthetic joint infection, when it does occur, is best resolved with a two-stage exchange.²⁹ Finally, the progressive nature of rheumatoid arthritis and the associated decreased bone mineral density increase the likelihood of periprosthetic osteolysis and implant loosening.

Particle and particulate-induced periprosthetic osteolysis is a major cause of implant loosening and failure.³⁰ Polyethylene particles in synovial fluid occur in

mobile- and fixed-bearing implants in patients undergoing TAA.³¹ Wear debris is continually created at the bearing surfaces during motion.³² Particle concentration and size in TAA are similar to those in total knee arthroplasty as determined by electron microscopy. Particle material, size, shape, and number are factors in tissue reaction to polyethylene and osteolysis. Wear particulates, including polyethylene and metal, induce a chronic inflammatory response at the bone-implant interface. Osteoclastogenic cytokines RANKL (receptor activator nuclear factor- κ B ligand), TNF, interleukin (IL) 1 (IL-1), IL-6, IL-8, macrophage colony-stimulating factor (M-SCF), and prostaglandin E2 are mediators of particle osteolysis.³⁰ These cytokines also interfere with osteogenesis. At the bone-implant interface of a failed total joint arthroplasty, a pseudomembrane forms. This pseudomembrane is composed of fibroblasts, foreign body giant cells, and macrophages. These cells produce IL-6, which induces bone resorption, as well as TNF α and IL-1 β . Osteoblasts phagocytose polyethylene and particulate, which significantly increases the secretion of TNF α , IL-6, and RANKL.³³ Fibroblast expression from failed implant biofilm has shown a similar response as synovium from patients without TAA. Angiogenesis is an essential event in the formation and progression of the pseudomembrane.³⁴ Metal particle exposure to macrophages results in increased vascular endothelial growth factor, which mediates angiogenesis and osteolysis.³⁵ This pathologic process is enhanced in the rheumatoid arthritis population, increasing the risk of implant loosening. Radiographic assessment of the talar component can frequently be obscured, making it difficult to assess for periprosthetic lucency. Helical computed tomography with metal-artifact minimization has shown to be more accurate than plain radiographs for early detection and quantification of periprosthetic lucency.³⁶

The effectiveness of TAA has been reviewed in various studies. Wood and colleagues³⁷ reviewed 200 TAAs implanted between 2000 and 2003 in a prospective randomized controlled trial of two mobile-bearing implants. The 6-year survival rate was 95 % for the STAR (Scandinavian Total Replacement System) implants (Small Bone Innovations, Inc, Morrisville, PA, USA) and 79% for the Buechel-Pappas implants (Endotec, Inc, South Orange, NJ, USA). Sixty-two of the 200 patients had rheumatoid arthritis. A patient who had a preoperative varus or valgus greater than 15° before surgery was found to have a 6.52 times greater likelihood of developing edge loading. Fourteen (8%) of the 200 TAAs failed and underwent fusion. In two additional studies, Wood and Deakin^{38,39} followed the same 200 patients who underwent TAA between 1993 and 2000. One hundred and nineteen patients had inflammatory joint disease, of which 112 were seropositive rheumatoid arthritis. Their 5- and 10-year survival rates were 93.3% and 80.3% respectively. Twenty-four ankles (12%) had been revised, 20 by fusion and 4 by further replacement since the 2000 publication. The investigators did not show TAA to prevent progression of subtalar arthritis. Most patients had preoperative arthritic changes. In their 2000 study, Wood and Deakin commented that it was unlikely that ankle replacement would replace arthrodesis as has occurred in the knee and that arthrodesis is preferred in patients where heavy and prolonged activity is expected. In their 2008 study, Wood and Deakin anticipated that TAA would become as reliable as knee replacement, making it a standard option for the arthritic ankle in the absence of severe frontal plane deformity.

Fevang and colleagues⁴⁰ reported on 129 patients with rheumatoid arthritis among 257 patients who underwent TAA.⁴⁰ The 5- and 10-year survival rates were 89% and 76% respectively. Two hundred sixteen of the implants were the cementless STAR with three other implants accounting for the remainder of ankles. Twenty-one revisions in the STAR group occurred with 27 (11%) revisions overall. San Giovanni and colleagues⁴¹ reviewed 31 Buechel-Pappas TAAs implanted between 1990 and 1997

in a select low-demand (average age 61 years) patient population with rheumatoid arthritis. The average follow-up was 8.3 years (range 5–12.2 years) with a 93% survival rate and a patient complete satisfaction rate of 83%.^{42,43} Two failures resulted in arthrodesis. A prospective study by Doetz and colleagues¹⁹ assessed two cementless mobile-bearing designs in 93 ankles with inflammatory joint disease, mainly rheumatoid arthritis, implanted between 1988 and 1992 (19 ankles) and 1993 to 1999 (74 ankles). The survival rate was 84% at 8 years. Fifteen ankles failed, 13 requiring fusion and 2 resulting in implant exchanges. Seventeen ankles had a preoperative frontal plane deformity of greater than 10°. The 8-year survival rate for this group was 48%. Ankles with less than 10° frontal plane deformity had a survival rate of 90%.

Stengel and colleagues⁴⁴ performed a meta-analysis of three-component meniscal-bearing devices that included 1107 TAAs including 415 ankles with rheumatoid arthritis. All but one study used cementless fixation. End-stage rheumatoid arthritis was the leading cause for TAA (37.5%). Superficial infections were 14.5% and 2.5% for retrospective and prospective studies respectively. Deep infections were 3.3% and 0.6% for retrospective and prospective studies respectively. The 5-year survival rate was 90.6%. Revision surgery averaged 12.5% and patients with rheumatoid arthritis had higher incidence of implant loosening and dislocation of components as compared with osteoarthritis and posttraumatic arthritis ankles. The overall range-of-motion improvement was 6.3° (95% CI 2.2–10.5). Su and colleagues⁴⁵ reviewed 27 TAAs in patients with rheumatoid arthritis using two different cementless implants (one meniscal-bearing and one two-piece component) between 1988 and 2000. Results were similar between the two systems and, at 6.3 years, 88.5% of the implants were well fixed in stable positions. The postoperative range of motion was greater than 15° arc in all 27 ankles with 17 having greater than 30° of motion. Anderson and colleagues⁴⁶ reviewed 51 uncemented STAR TAAs, 28 in patients with rheumatoid arthritis with an average age of 60.5 years. The 5-year survival rate was 70%. Twelve ankles were revised.

Earlier studies are available specific to patients with rheumatoid arthritis. However, they include cemented implants.^{3,47} The later generation cemented designs showed a 14-year survival rate of 75.5% in patients with rheumatoid arthritis.¹⁵ Studies

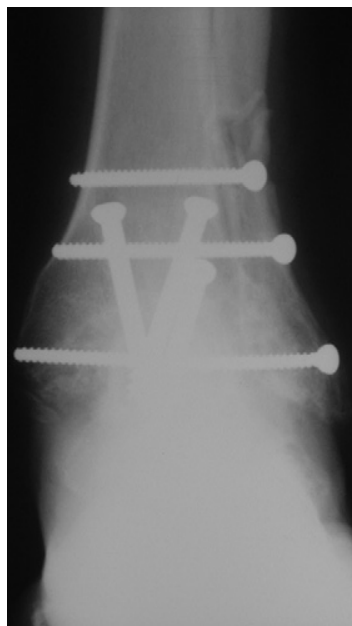


Fig. 2. A rheumatoid patient with an arthritic ankle who underwent a successful ankle arthrodesis.



Fig. 3. Intraoperative fluoroscopy is useful to ensure proper alignment of the cutting block.

show a trend of a decreasing survival rates over time for TAAs in the rheumatoid arthritis population. TAA allows for improved walking kinematics as compared with ankle arthrodesis and does not significantly alter mechanical loading of the ankle after ankle replacement.⁴⁸ The proprioceptive abilities after TAA do not change when compared with the individual's contralateral side.⁴⁹ Studies have not addressed the efficacy of TAA in rheumatoid arthritis patients with severe bone mineral density deficiency.

TOTAL ANKLE ARTHROPLASTY VERSUS ANKLE ARTHRODESIS

Comparison studies provide a unique assessment of TAA and ankle arthrodesis outcomes from within the same surgical groups or centers. Four such studies,

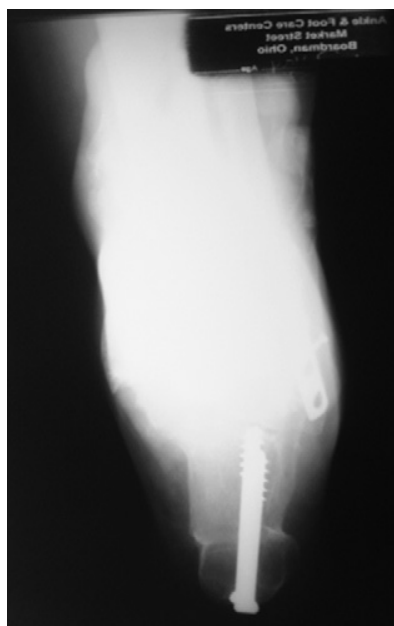


Fig. 4. A postoperative calcaneal axial view demonstrating a lateral calcaneal slide needed for balancing a foot with a calcaneal varus deformity.



Fig. 5. A lateral preoperative radiograph of a young rheumatoid arthritic patient VO.

including one meta-analysis, are provided. McGuire and colleagues⁵⁰ reviewed outcomes comparing the TAA to ankle arthrodesis.⁵⁰ TAA was performed in 25 ankles with 10 rheumatoid arthritis ankles in the group. Eighteen patients underwent ankle arthrodesis. Follow-up averaged 3.8 years with an average age of 49.5 years. The arthrodesis group was fused by Charley compression clamp^{6,51,52} with interposed iliac bone graft.⁷ There was no mention of rheumatoid arthritis patients in this group. Post-traumatic arthrosis,^{53–56} failed ankle arthroplasty,³ and postinfectious arthritis¹ were the indications for ankle arthrodesis. The average age was 41.3 years with an average follow-up of 3.3 years. The arthrodesis group^{57,58} had 14 (77%) excellent, 3 (16%) good, 0 fair, 0 poor, and 1 (6%) failed results. The arthroplasty group¹³ had 9 (36%) excellent, 9 (36%) good, 0 fair, 2 poor, and 5 (20%) failed results. Koefoed and Stürup⁵⁹ performed a prospective study comparing 14 ankle arthrodeses to 14 TAAs.⁵⁹ The average age was 54 years (range 27–71 years) and 39 years (range 21–68 years) for the TAA and ankle arthrodesis groups respectively. The average age for the arthritis subset groups was 48 years (range 45–50 years) and 24 years (range 21–31 years) for the TAA and ankle arthrodesis groups respectively. Four ankles in each group had rheumatoid arthritis. All surgeries were performed between 1981 and 1985. Median follow-up was 84 months. Arthrodeses were performed with



Fig. 6. An intraoperative anterior-posterior view of a medial column stabilization before implantation of a prosthesis (a staged surgery) in patient VO.

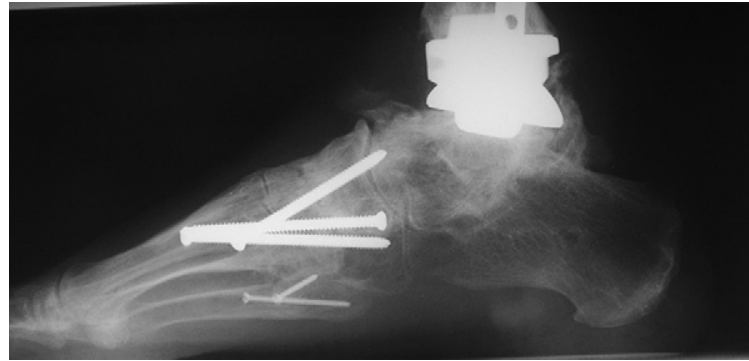


Fig. 7. A 7-year postoperative lateral radiograph of patient VO post-medial column stabilization (a staged surgery) followed by insertion of an Agility ankle prostheses (DePuy Orthopaedics, Inc, Warsaw, IN, USA).

a Charnley frame and arthroplasty was performed with a two-piece cemented implant. The ankle arthrodesis group had four deep infections, three nonunions, and five cases where subtalar arthrosis developed. The TAA group had no deep infections, three cases of skin necrosis, one revisional arthrodesis, and no development of subtalar arthrosis. Investigators found that those in the arthroplasty group experienced better pain relief, higher levels of function, and lower infection rates without the development of subtalar arthritis (**Fig. 2**).

SooHoo and colleagues⁶⁰ compared reoperation rates between 4705 ankle arthrodeses and 480 ankle replacements during a 10-year study period from 1995 to 2004. Six percent of the ankle fusion patients and 10 percent of the TAA patients had rheumatoid arthritis. Rates of revision surgery were 9% at 1 year and 23% at 5 years in the TAA group. Corresponding rates of revision in the arthrodesis group were 5% and 11%. Patients who had an ankle arthrodesis had a 2.8% occurrence of subtalar fusion at 5 years as compared with a TAA rate of 0.7%. Regression analysis confirmed a significant increase in the risk of major revision surgery in the TAA group.

Saltzman and colleagues⁶¹ performed a nonrandomized study with concurrent controls as part of a Food and Drug Administration (FDA) study to evaluate the safety and efficacy of the STAR implant to treat arthritis. The pivotal STAR group included

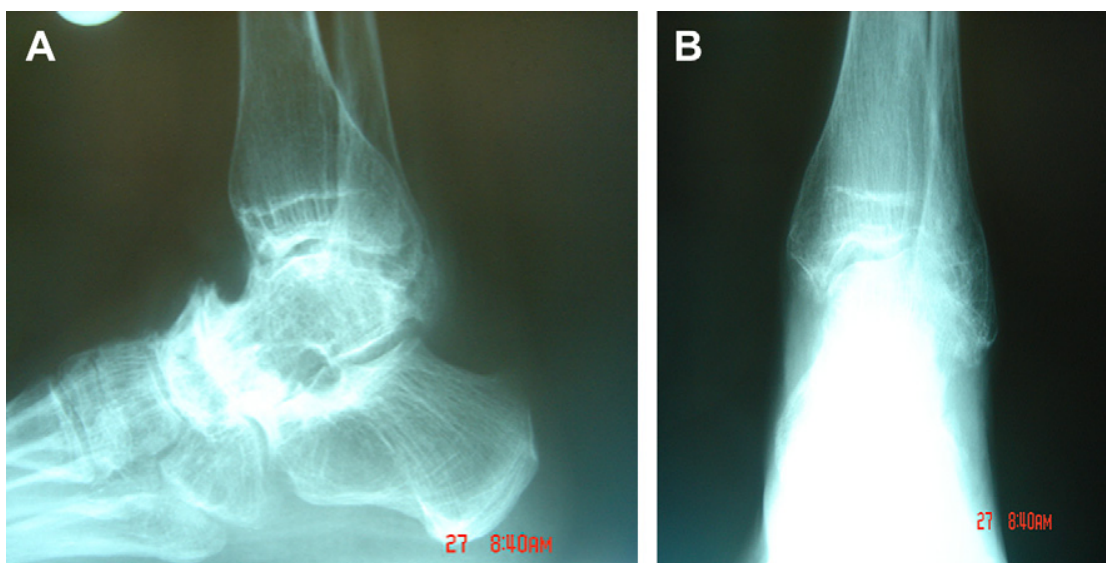


Fig. 8. Anterior-posterior (A) and lateral (B) radiographs of a rheumatoid arthritic ankle and talar-navicular joint of patient TZ.



Fig. 9. A lateral radiograph of patient TZ postoperative talar-navicular arthrodesis (staged surgery) before implantation of prosthesis.

158 ankles and the pivotal fusion group included 66 ankles. A continued access STAR group (N = 435) was evaluated also. Patients with rheumatoid arthritis accounted for 12.7% of the STAR group and 6.5 % of the fusion group. The pivotal groups were similar in gender, race, height, and weight. With the exception of pain and an expected loss of motion in the fusion group, operative site adverse events were higher in the STAR pivotal group. These events included nerve injury, bone fracture, edema, wound problems, and bony changes. Major complications, with the exception of infection, were also higher in the STAR group. The STAR group performed better in most functional scoring subscales except for pain relief, walking, and the presence of a limp.

Haddad and colleagues,^{62,63} in a systematic review of the literature, compared 852 TAAs to 1262 ankle arthrodeses. Fifty-six percent of the arthrodesis studies were published between 1990 and 1997 and all of the TAA studies were published between 1998 and 2005. Follow-up was 2 to 9 years for the TAA group and 2 to 23 years in the arthrodesis group. Results in the TAA group were 38% excellent, 30.5% good, 5.5% fair, and 24% poor with a 7% revision rate. Five- and 10-year survival rates were 78% and 77% respectively. The corresponding results in the arthrodesis group

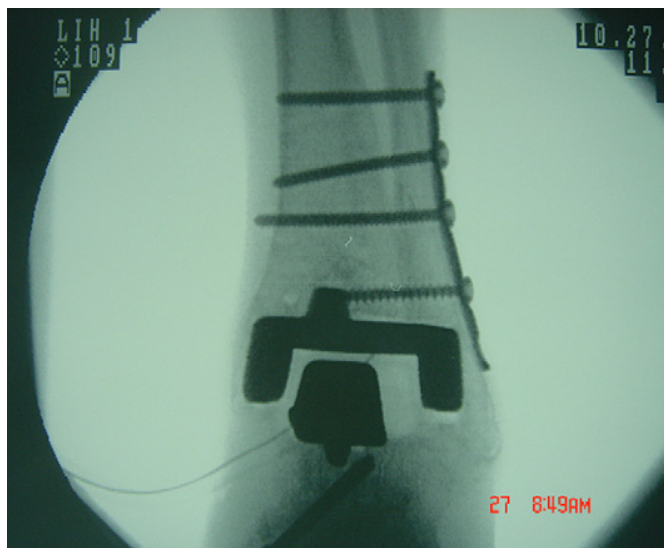


Fig. 10. Intraoperative anterior-posterior view of patient TZ following implantation of an Agility prostheses.

were 31%, 37%, 13%, and 13% with a 9% revision rate. The main reason for revision was nonunion (65%).

SURGICAL TECHNIQUE

There is a steep learning curve with TAA as it is probably one of the most technically demanding procedures performed in the foot and ankle.²⁵ Most of the current FDA-approved prostheses use an anterior approach. This approach requires an extensive incision and it must be handled with great respect. The incision is made between the tibialis anterior and the extensor hallucis longus tendons. The anterior neurovascular structures should be recognized and retracted laterally. The incision is carried down to the bony structures and full-thickness flaps must be fashioned to avoid undermining. The incision needs to be sufficiently long to prevent needless tension while retracting.

Balancing of the foot and ankle should be performed with ligament tension or loosening (if not already addressed with a prior surgery) through a variety of techniques. To address ankle instability, this balancing may include a lateral ankle stabilization procedure, which may require, for example, a midfoot arthodesis in the case of a collapsed midfoot. Failure to address ankle instability will likely lead to a failed TAA. Subsequent



Fig. 11. Clinical postoperative view of extension (A1 and A2) and flexion (B1 and B2) of a rheumatoid patient who has undergone a TAA. Although range of motion postoperatively is limited, the range of motion is greater than what it was preoperatively and the motion is pain-free.



Fig. 12. A clinical and radiographic view of a prospective TAA patient. Consideration is needed for balancing the foot and ankle before implantation. Lengthening on the fibula and a supramalleolar osteotomy would be indicated before implantation.

to balancing of the foot and ankle, the ankle is prepared for bone cuts. All of the current FDA prostheses use an alignment guide and cutting block. It is essential to use intra-operative fluoroscopy to line up the cutting jig for suitable placement of the prostheses. It is crucial for the surgeon to be conscious of the posterior medial tendons and neurovascular structures of the posterior medial ankle as these structures are easily visible once the tibial bone cut is resected. Once the bone cuts are complete, a trial prosthesis is inserted and viewed both clinically and radiographically. The proper size is determined and inserted. Frequently following a TAA, a gastrocnemius recession or an Achilles tendon lengthening may be needed for a tight posterior



Fig. 13. An intraoperative anterior-posterior view of a Salto Talaris ankle prosthesis (Tornier, Minneapolis, MN, USA). Note the long expansile full-thickness incision to decrease tension on the soft tissue envelope.

muscle group. Careful soft tissue closure is performed to avoid unnecessary tension. A closed suction drain is typically used and it is imperative that the soft tissues are handled delicately to avoid postoperative soft tissue complications (**Figs. 3–13**).

POSTOPERATIVE COURSE

Typically a drain is used and removed approximately 3 days postoperatively. Sutures can be removed at 2 to 3 weeks. Following the below-the-knee casting, the patient is placed in a walking boot and prescribed physical therapy for 1 to 2 months. The protocol of the authors is 6 weeks of strict non-weight bearing in a below-the-knee cast for all implants except the STAR. The STAR implant patients are non-weight bearing for 2 weeks in a below-the-knee cast. The prosthesis relies on bony in-growth at the prosthesis-bone interface.

The authors recommend serial ankle radiographs every 2 to 3 weeks until good bonding is noted at the bone-implant interface. Clinical examinations can be deceiving and may not correlate with radiographic changes. Weight-bearing and non-weight-bearing views should be routinely taken.⁶⁴ The latter should be taken while maximally dorsiflexing and plantarflexing for evaluation of range of motion. Any angular change greater than 5° in either component suggests subsidence or implant migration.⁹ Loosening of the talar component should be considered if comparative lateral views illustrate more than 5-mm subsidence.⁴⁶ Radiolucency around an implant can be also a sign of loosening and 2 mm is considered significant.⁶⁵ Correlate these findings to operative and postoperative views to ensure radiolucency is not a result of surgical technique. In cases of concern, computerized tomography has been shown to be superior to radiographs for periprosthetic radiolucencies.³⁶

COMPLICATIONS

Wound healing with ankle replacement procedures are well documented in the literature. The surrounding tissues can be frail and closer to bone, making resistance to edema and tissue strain difficult, especially in rheumatoid patients. Complications related to wound healing have been reported in up to 40% of cases.⁶⁶ Wound dehiscence can be counteracted by minimizing edema, through leg elevation and the use of firm compression bandages, and by offsetting hematoma formation, through the use of drains (**Figs. 14 and 15**).⁶⁷

Thromboembolism is a highly debated topic amongst foot and ankle surgeons. The authors have found no literature that suggests rheumatoid disease increases risk of deep vein thrombosis. However, surgeries over 30 minutes, hypertension, history of deep vein thrombosis, smoking, prolonged postoperative immobilization, stroke, oral contraceptives, obesity, age older than 40 years, diabetes, and other factors have been linked to increased risk of thromboembolism.⁶⁸ The medical literature does not support mandatory routine prophylaxis in patients undergoing foot and ankle surgery.⁶⁹ However, mechanical methods, such as sequential compression device or compression stockings, are recommended.⁶⁹

Malleolar fractures are the most frequent complication during surgery, the most at risk being the medial malleolus.¹⁹ To reduce the risk for this complication, some suggest that the medial malleolus be pinned before any osteotomy is made. This should prevent excursion of the saw blade and overzealous cuts.¹⁷

Malalignment can of course occur in not just one plane, but in multiple planes. Placement of the jig, design of the device, varus/valgus positioning, lateral/medial/anterior/posterior positioning, and improper sizing of the implant have all been implicated in malalignment.²⁸ Distraction can be a potential danger. Too little distraction

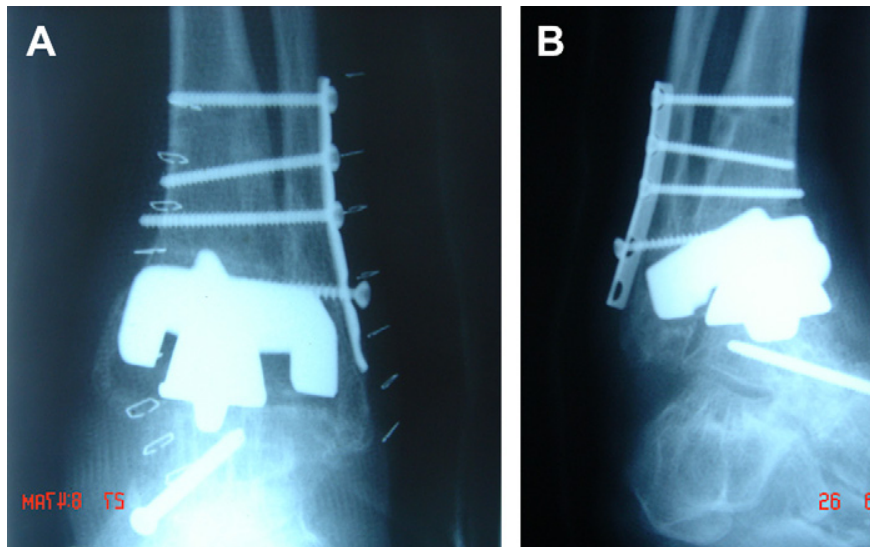


Fig. 14. A complication involving a medial malleolus fracture and tibial component subsidence.

can result in “stuffing” the joint with the prosthesis, leading to pain and limited range of motion.

Infection, particularly in patients who have rheumatoid arthritis with immunosuppression, is a major concern. These infections can be classified into two types: superficial and deep. Early and prompt treatment is necessary to stop the infection before it reaches a stage requiring removal of components. Aseptic loosening and osteolysis are possible in total ankle replacements. It is extremely important for the surgeon to ensure that components have good cortical support. Without good cortical support, soft cancellous bone inevitably subsides. The level of the tibial resection is determined to generate sufficient room for the components and restore length and tension to the ligaments.



Fig. 15. Clinical view of a rheumatoid patient with implant exposure and a large wound dehiscence.

SUMMARY

Total ankle replacement in the rheumatoid patient is feasible and effective treatment for ankle arthritis. The benefits of ankle prosthesis are good pain relief, acceptable function, and patient satisfaction. It is a joint-sparing procedure to restore functionality. All investigators of total ankle replacement feel that, as clinicians gain experience with the procedure and related products, difficulties and risks associated with the procedure will decline. Despite an early history of failure and poor patient satisfaction, more recent results have shown promise.

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