ARTICLE IN PRESS

The Journal of Foot & Ankle Surgery xxx (2017) 1–5

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Original Research

Perioperative Complications and Initial Alignment of Lateral Approach Total Ankle Arthroplasty

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ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
ankle arthritis
ankle replacement
fibula osteotomy
fixed bearing
TAR
trabecular metal
transfibular

ABSTRACT

Total ankle replacement continues to become a more common treatment of end-stage ankle arthritis. A lateral approach total ankle implant system is an innovative approach for this treatment. We performed a retrospective review of 16 patients treated with lateral approach total ankle replacement. The implant was successful and retained in all cases during a follow-up period of 769 ± 221.3 days (25.3 ± 7.3 months). Initial satisfactory alignment was achieved in all cases. For patients in whom a frontal plane incongruent deformity was present preoperatively, a statistically significant correction was obtained ($p = .0122$). Three cases of delayed or nonunion of the fibula (18.8%) occurred, and one case of infection that led to removal of the fibular plate developed, for a total of 4 complications (25.0%) related to the fibular osteotomy. Our findings indicate that lateral approach total ankle replacement is effective with unique advantages and disadvantages for treating end-stage ankle arthritis.

Total ankle replacement (TAR) continues to become more commonplace. Registry data around the world have shown the ever-increasing use of TAR for end-stage ankle arthritis (1). Although some might still consider ankle arthrodesis the reference standard for ankle arthritis, in centers in which ankle replacement is available, it is often the treatment of choice, even in patients with more complicated cases (2,3). However, even with its increased use and our better understanding, complications can and do occur.

Several complications can occur that are common with performance of TAR. Early complications include wound healing issues, deep component infection, injury to sensory nerves, malalignment, malleolar fracture, tendon injury, and complications related to concomitant procedures. Late complications include periprosthetic fracture, subsidence, osteolysis, heterotopic ossification, and polyethylene fracture (4–7). Complications can arise from 3 main categories: (1) inappropriate patient selection, (2) lack of surgeon experience, and (3) surgeon error (8). Appropriate patient selection continues to evolve, and, as our understanding of the implants and techniques increases, previous contraindications such as severe malalignment can be overcome (9). Several published reports of the initial patients using a specific implant have demonstrated that a learning curve exists and that with experience the results improve (6,10,11). More recent published data of the use of modern implants have indicated that surgeon experience can be assisted with the use of third-generation implants (12). In addition, more highly specialized instrumentation has been created in an attempt to minimize surgeon error (13).

In 2012, a lateral approach, semiconstrained, fixed-bearing TAR acquired Food and Drug Administration approval for use under the 510(k) process (Zimmer® Trabecular Metal Total Ankle; Zimmer Inc., Warsaw, IN). This implant was designed to avoid several of the challenges and subsequent complications associated with TAR. The system uses a lateral approach in an attempt to decrease wound healing complications and also to aid surgeon experience because this is a familiar approach used for ankle fractures and fusions. This approach has, however, been shown to place the peroneal perforator artery at risk (14). The system uses an extramedullary, external alignment jig to facilitate accurate and reproducible implantation. Arched resection of the talus and tibia is performed to preserve bone and use the body's natural trabecular pattern. Also, the system uses a simple and consistent application of bone cement (15).

A recent report retrospectively evaluated the results of this TAR, for which the senior author (L.C.S) was a developer and patent holder

Financial Disclosure: None reported.
Conflict of Interest: J.G.D. and B.S. are consultants with Bioventus; T.A.D. is a consultant with Stryker.

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1067-2516/$ - see front matter
http://dx.doi.org/10.1053/j.jfas.2017.04.016

of the implant (16). The purpose of the present report was to evaluate the early results in our initial patient cohort. Our hypothesis was that the outcomes would be similar to those with other TAR systems currently available.

Patients and Methods

The institutional review board approved a retrospective medical record and radiographic review (approval no. 16-60e) of patients who had undergone TAR through a transfibular approach performed by 2 of us (T.A.D., R.L.). The inclusion criteria were all consecutive patients who had undergone a lateral approach TAR from August 2013 to October 2015 and had a minimum of 10 months of clinical follow-up data available. In addition, a longer term, >12-month radiographic follow-up period was attempted by contacting all patients, and these data were collected for all patients with >12-month radiographs available. The exclusion criteria were a lack of adequate follow-up duration, incomplete records, and the use of an alternative implant.

The medical record review was performed by a clinical research coordinator (T.R.) to collect the demographic patient data (age, sex, body mass index [BMI], laterality), medical history, and date of surgery. The postoperative course was determined from the medical record review and included any complications and their treatment. Complications were assessed and recorded by the operating surgeon and entered into the medical records during routine follow-up examinations. The radiographs were also assessed for preoperative and initial postoperative alignment. Plain film radiographs were used. Preoperative weightbearing films were used; the initial postoperative films were non-weightbearing. In addition, patients were interviewed after ≥12 months of follow-up visits for longer term radiographic measurements using weightbearing images. The radiographic review was performed by 2 of us (J.G.D., T.A.D.). The measures recorded were the lateral distal tibial angle (LDTA), anterior distal tibial angle (ADTA) (17), and joint congruity (the angle between the tibial and talar joint surfaces or tibial–talar congruence). The preimplant angles were measured as previously described (Fig. 1). After implantation, the ADTA and LDTA angles were measured using a method similar to that of Tan et al (16). The superior surface of the tibial implant was used to determine the tibial–talar congruence and LDTA. The superior surface of the metallic talar component was also used for the tibial–talar congruence measurement. For the ADTA, a line connecting the most distal points of the metallic tibial component was used (Fig. 2).

Statistical Analysis

The statistical analysis was simple, with continuous variables represented as the average ± standard deviation and range and categorical variables counts and percentages. A comparison of the radiographic measurements was performed using a paired, 1-tailed t test for congruence and paired 2-tailed t test for the ADTA and LDTA. Statistical significance was set at $p < .5$. Statistical analysis was performed using Excel® (Microsoft Corp., Redmond, WA) and was performed by 1 of us (J.G.D.).

Surgical Technique

The patient was positioned supine with an ipsilateral hip bump placed to align the tibial tuberosity in the straight anterior position. A 15-cm linear incision was made just posterior to the axis of the fibula. An oblique fibular osteotomy was performed, ending approximately 1.5 cm above the level of the ankle joint line. The distal fibula segment was freed of soft tissue attachments proximally, and the anterior joint capsule, including the anterior talofibular ligament, was sectioned, allowing the lateral malleolus to be reflected distally and posteriorly. The calcaneofibular ligament and posterior capsule were left intact, and the lateral malleolus was pinned to the calcaneus. The anterior and posterior joint capsules were reflected off the tibia, allowing debridement of osteophytes. In patients in whom medial gutter debridement was deemed necessary, a separate 3-cm incision was made anteriorly over the medial gutter, allowing access for gutter debridement and leaving the deltoid ligament intact. Initial sizing in the medial lateral direction was performed using the depth gauge. The size was verified under direct visualization in patients requiring medial arthrotomy and under fluoroscopic guidance in those without arthrotomy.

The ankle was then placed into the external fixator alignment jig, the leg was internally rotated to the mortis position, and the position was verified using fluoroscopy. After confirmation of the alignment in the coronal and sagittal planes using fluoroscopy, the foot and leg were fixated to the frame with a transfixation pin in the calcaneus and half pins in the talus and tibia. The anterior posterior size was now measured and compared with the medial lateral size obtained earlier. If the sizes were different or between sizes, the smaller of the 2 was selected. The appropriate cut block was then selected, and cut guide alignment was performed. After alignment, the precut block was attached, and each hole was drilled using a peck drilling technique under fluoroscopic guidance to prevent overresection of the medial bone. The cut guide then replaced the precut block, and a high-speed burr was used to resect the remaining joint. After joint resection was complete, the appropriate-size rail hole drill guide was inserted, and fluoroscopy was used to determine the appropriate anterior to posterior rotation of the tibia and talar implants independently. When the desired alignment had been achieved, the rail hole drill guides were pinned into place, and the rail holes were drilled. Trial implants were then inserted to ensure proper alignment and bone resection and determine the polyethylene thickness. The range of motion was assessed, and the need for adjunctive procedures such as gastrocnemius recession was determined. The trial implants were removed and the actual implants inserted. Cement was applied in accordance with the surgical technique at the surgeon's preference. The fibula was reduced, and internal fixation was applied. The anterior talofibular ligament was repaired, and any other ligamentous laxity was addressed. Other adjunctive procedures to correct alignment, adjacent joint arthritis, or other pathologic features were

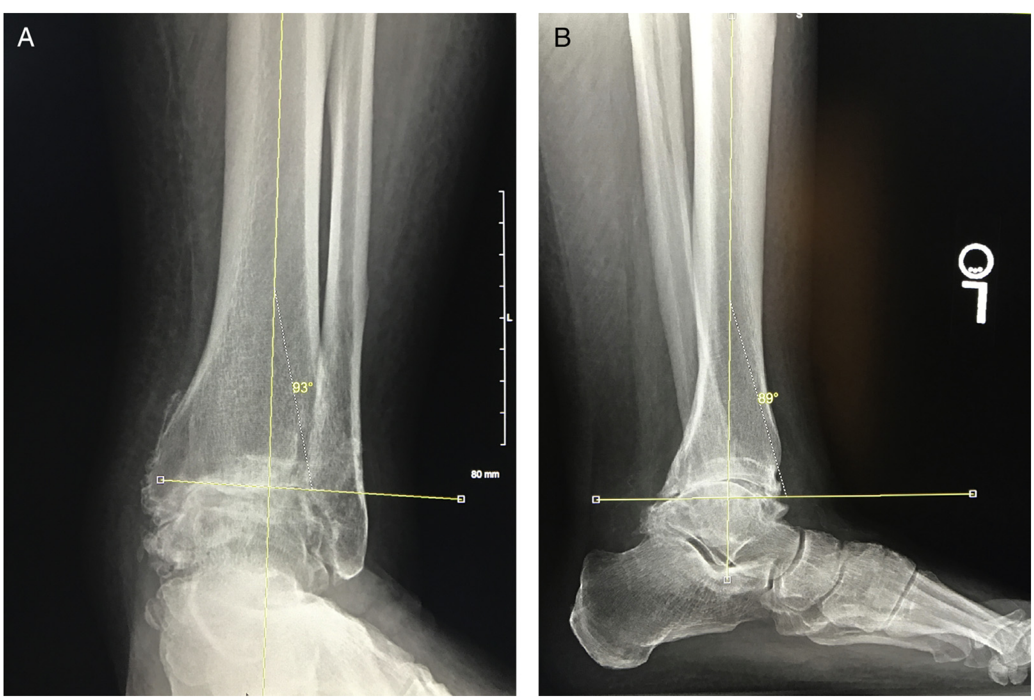

Fig. 1. (*A*) Preoperative anteroposterior weightbearing image used to measure lateral distal tibial angle. This image was also used to record congruence, which, in this case, was parallel. (*B*) Lateral preoperative weightbearing image used to measure the anterior distal tibial angle.