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Ankle Joint Fusion With an Anatomically Preshaped Anterior Locking Plate

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ABSTRACT

We present a novel fixation plate for primary ankle joint fusion. A single anatomically preshaped angular stable plate was used with an anterior approach. An excellent result with good bone consolidation was present at the 1-year follow-up examination.

End-stage osteoarthritis of the ankle joint is commonly found in patients who have sustained previous fractures at the level of the ankle joint (1) or have post-traumatic conditions such as ankle joint instability (2). Although total ankle replacement has been increasing in popularity (3,4), ankle joint arthrodesis remains the most reliable procedure for patients with poor bone stock, severe malalignment, metabolic disease, and/or a high activity level (5). Several fixation techniques for isolated ankle joint arthrodesis have been described in the current published data, including screw fixation (6,7), a T-shaped locking screw plate (8), double plating (9), external fixators (10,11), and others. We present a case in which a novel technique for ankle joint fusion using a single anatomically preshaped anterior locking plate was applied.

Case Report

Preoperative Management

A 47-year-old female patient was seen in our outpatient clinic with the complaint of recurrent weightbearing-dependent pain of her right hindfoot. The patient had undergone previous reconstruction of a large osteochondral lesion of the talus 2 years earlier. The clinical examination showed distinct swelling around the ankle joint and painful tenderness at the anterior joint line. The range of motion of the ankle joint was slightly reduced compared with that of the healthy side, with dorsiflexion and plantar flexion of 10° and 25°, respectively (tested with a hanging leg). The patient was an active smoker. The pain severity, measured using a visual analog scale (with 0 indicating no pain and 10, the maximal pain) during normal walking was a score of 8 (12). The American Orthopaedic Foot and Ankle Society ankle-hindfoot scale (including pain, function, and alignment; with a minimum score of 0 points and maximum score of 100 points) score was poor at 55 points (13). A total score of 0 points represents severe disability and 100 points, normal ankle joint function. Although the American Orthopaedic Foot and Ankle Society scale has only been partially validated, it is commonly used to evaluate the outcome after surgical hindfoot procedures (14). The initial conventional weightbearing radiographs showed a large translucency of the medial talar shoulder (Fig. 1*A*). Single photon emission computed tomography–computed tomography (15) revealed a large osteochondral defect with elevated ^{99m}technetium-dicarboxypropane diphosphonate uptake for almost one half the mediolateral width of the talus (Fig. 1*B*). The operative treatment approach was chosen in agreement with the patient.

Surgical Technique

The patient was positioned supine, and a modified anterior approach to the ankle joint between the tibialis anterior and extensor hallucis longus tendons was performed. A laminar spreader was inserted into the ankle joint, and all cartilage was removed using a

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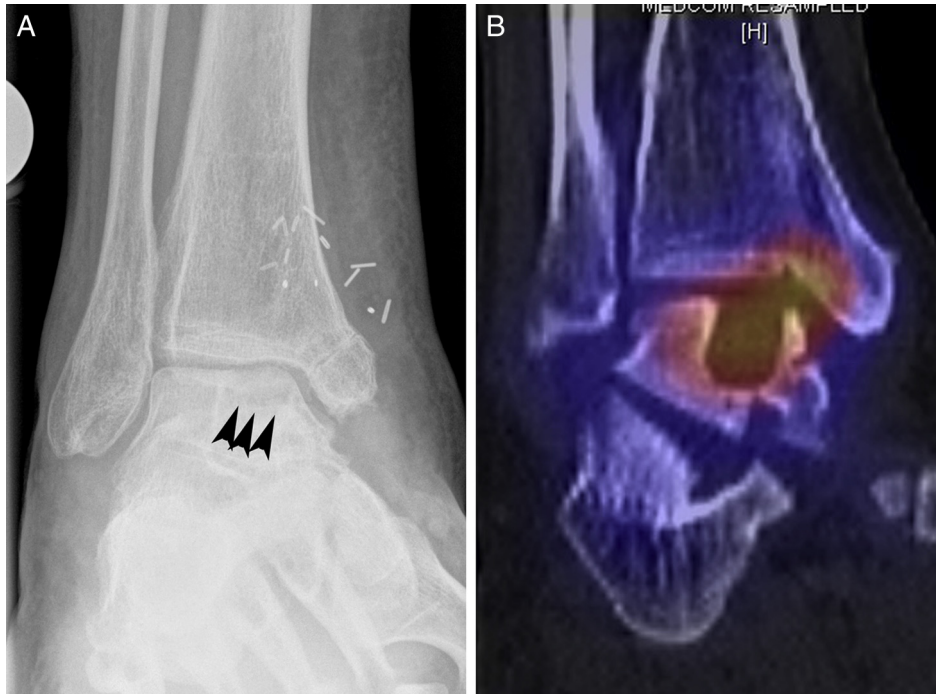

Fig. 1. Preoperative imaging studies. The patient had a recurrent osteochondral lesion of the talus after a failed reconstruction attempt. (*A*) Planar radiograph (anteroposterior view) and (*B*) single photon emission computed tomography–computed tomography scan (coronal view) showing a large bony defect (*arrowheads*) at the medial talar edge.

curved chisel. The necrotic tissue on the talar side was completely debrided. Spongiosa harvested from the ipsilateral iliac crest was packed to fill the osseous defect. All osteophytes were removed. The ankle joint was positioned 90° in the sagittal plane and 5° in the valgus, with 10° of external rotation. An anatomically preshaped locking compression plate (Synthes®, Solothurn, Switzerland) was inserted over the anterior surface of the tibia and talar neck and temporarily fixed using a conventional screw (AO 3.5 mm, Synthes®). The appropriate plate position was checked using fluoroscopy, and the plate was finally fixed with locking screws proximally and distally. Finally, a large, 7.3-mm compression screw (Synthes®) (16) was inserted through the oblique hole of the plate through the tibia into the calcaneus to obtain additional compression over the tibiotalar joint.

Postoperative Care

The initial dressing and splint were removed and changed on the second postoperative day. When the wound conditions were appropriate (dry wound, no secretion), the foot and ankle were immobilized using an ankle walker boot (Aircast XP Walker™, DJO Global, Vista, CA) with partial weightbearing (15 kg) for 6 weeks. A gradual progression to full weightbearing during the next 6 weeks was allowed after the radiographic examination at 6 weeks postoperatively.

Follow-Up Findings

Osseous fusion was achieved at 3 months postoperatively, with trabecular bridging observed at the arthrodesis side on weightbearing radiographs. At 12 months postoperatively, the patient was pain free (visual analog scale score 0) during daily activities. The American Orthopaedic Foot and Ankle Society hindfoot score had increased to 76 points (from 55 preoperatively). Conventional weightbearing radiographs at 12 months postoperatively showed complete fusion of the ankle joint, without implant dislocation or failure (Fig. 2). The position of the arthrodesis remained unchanged during the postoperative course.

Discussion

In the present case report, we have demonstrated successful ankle joint fusion using a single anatomically preshaped locking plate. To our knowledge, this case report is the first description of this novel technique. The rationale behind using anterior plating for ankle joint fusion was that the plate will stabilize the ankle joint anteriorly, and the Achilles tendon will transform its potentially deforming force into a compressive correcting force posteriorly. The implant used for this approach was a preshaped, locking plate that was specifically designed to match the anatomy of the anterior ankle joint. The plate is placed through a single anterior approach at the anterior surface of the distal tibia and the talar neck. Using 2 anterior plates has been associated with complications, including irritation of the extensor tendons, problems with wound healing, and discomfort due to bulky implants requiring hardware removal, as previously reported (9).

Looking at the ankle joint from anteriorly, the talar neck will not be in line with the anterior tibial surface and is directed medially (Fig. 3*A*). The plate used in the present case respected this offset and was shaped asymmetrically at the talar component (Fig. 3*B*). Thus, 2 implants, 1 for the right side and 1 for the left are available.

The reasons an anterior plate should match the bony anatomy in the best possible way are several. An exact fit of the implant will reduce soft tissue complications (wound healing problems, tendon irritation) and increase the primary compression and stability between the talus and tibia. Several investigators have used anterior or lateral ankle joint bridging plates, which can be bent to match the form of the tibia and talus (8,17–19). However, forceful bending of the plate could potentially lead to structural weakness of the material, which could facilitate implant failure (20). Because of the anatomic shape of the plate we used, no prebending was needed and the plate structure was not violated.