

Distal Tibial Osteotomy without Fibular Osteotomy for Medial Ankle Arthritis with Mortise Widening

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Based on an original article: *J Bone Joint Surg Am.* 2015 Mar 4;97(5):381-8.

Introduction

A patient with medial ankle osteoarthritis and a widened ankle mortise can be treated successfully with an oblique distal tibial osteotomy, without fibular osteotomy, to narrow the mortise and shift the weight-bearing axis to a more normal position (Video 1).

The mortise structure of the ankle joint is a primary constraint that provides osseous medial and lateral stability. Loss of osseous stability of the ankle mortise accelerates degenerative changes. In patients with advanced medial ankle osteoarthritis, with obliteration of the medial joint space, the ankle mortise is often widened as a result of medial erosion due to medial translation of the talus. The widened mortise decreases ankle stability. The sole focus of most previously reported joint-sparing osteotomies for medial ankle osteoarthritis has been on shifting the weight-bearing axis laterally. Opening wedge osteotomy of the distal parts of the tibia and fibula for a supramalleolar lesion angulates and translates the ankle joint laterally without changing the width of the ankle mortise¹⁻⁵. While shifting the weight-bearing axis laterally can redistribute the weight, it does not narrow a widened mortise, which is necessary to restore osseous stability (Figs. 1-A and 1-B). An oblique distal tibial osteotomy, without fibular osteotomy, both shifts the weight-bearing axis laterally and narrows the abnormally widened mortise. It is performed with the following steps.

Step 1: Patient Positioning and Preoperative Assessment

With the patient under spinal or general anesthesia, check for mortise widening with a valgus stress test.

- With the patient supine on the operating table and under spinal or general anesthesia, apply abduction and valgus force to the ankle in a neutral position.
- Check the gap between the medial malleolus and the medial wall of the talus on an anteroposterior fluoroscopic image.

- Apply a tourniquet to the ipsilateral thigh, drape the limb below the knee, and inflate the tourniquet to 350 mm Hg after limb exsanguination.

Step 2: Surgical Approach

Expose the ankle joint through an anterior approach.

- Make a longitudinal incision along the anterior midline of the ankle from 10 cm proximal to 5 cm distal to the joint line.
- Identify the extensor hallucis longus and the extensor digitorum longus tendons and dissect between them. Incise the capsule and expose the ankle joint (Fig. 2).
- Apply abduction and valgus force to the ankle in a neutral position and measure the gap between the medial malleolus and the medial wall of the talus using a ruler. If the gap is >3 mm, mortise widening is suspected (Fig. 3).

Step 3: Corrective Osteotomy

Perform an oblique osteotomy of the distal part of the tibia and narrow the widened mortise by shifting the osteotomized fragment.

- Plan the osteotomy line by drawing a line connecting a point at the medial cortex 5 cm proximal to the joint line and a point on the lateral tibial cortex 5 mm proximal to the joint line.
- Insert two or three 1.6-mm Kirschner wires along the planned osteotomy line and confirm the position of the wires under fluoroscopy (Fig. 4).
- Make multiple holes using Kirschner wires along the planned osteotomy line (Fig. 5).
- Perform an oblique osteotomy by connecting the holes; use a thin osteotome to minimize injury to the distal parts of the anterior and posterior tibiofibular ligaments (Fig. 6). Do not break the lateral cortex at the apex of the distal part of the tibia so that it can be used as a hinge.

- After completing the osteotomy, shift the distal osteotomized fragment inferiorly by spreading the medial edge of the osteotomy site. Rotate the fragment around the lateral cortex, which acts as a hinge, until contact is made with the medial wall of the talus in the coronal plane.

Step 4: Fixation and Bone-Grafting

Stabilize the osteotomy site with a locking plate and apply bone graft to the osteotomy site.

- Make an incision parallel to the iliac crest, beginning 3 cm posterior to the anterior superior iliac spine.
- Apply a distal lateral locking plate (Zimmer, Warsaw, Indiana) anteriorly, keeping the osteotomy site from spreading (Fig. 7).
- Fix the plate to the bone with multiple screws.
- Fill the gap with autogenous and/or allogenic bone graft (Fig. 8).
- Confirm the position and stability of the fixation using fluoroscopy.

Step 5: Closure

Close the soft tissue in layers.

- Repair the joint capsule with absorbable sutures.
- Close the extensor retinaculum and subcutaneous tissue with absorbable sutures.
- Close the skin with nonabsorbable sutures.
- Apply a short leg splint with sterile dressings.

Results

Eighteen patients (fifteen female and three male; mean age, fifty-seven years) with symptomatic medial ankle osteoarthritis and mortise widening underwent distal tibial oblique osteotomy without fibular osteotomy between 2008 and 2011⁶. The mean duration of follow-up was thirty-four months. The mortise widening (>3 mm of medial clear space) was confirmed by a preoperative valgus stress radiograph and/or an intraoperative valgus stress test under direct visualization. Preoperatively, the radiographic stages according to the Takakura classification system¹ were II, IIIA, or IIIB. (Stage I indicates no narrowing of the joint space but evidence of early sclerosis and osteophyte formation; stage II, narrowing of the medial joint space; stage IIIA, obliteration limited to the medial malleolus; stage IIIB, obliteration extending to the roof of the talar dome; and stage IV, obliteration of the whole joint space with complete bone contact.)

The mean medial distal tibial angle (MDTA: the angle between the tibial axis and the tibial plafond on an

anteroposterior radiograph) improved significantly from 86.6° preoperatively to 92.9° at the time of follow-up and the mean anterior distal tibial angle (ADTA: the angle between the tibial axis and the tibial plafond on a lateral radiograph) improved from 81.1° to 84.3° ($p < 0.001$) (Figs. 9-A through 9-D). However, the mean talar tilt angle (the angle between the tibial plafond and talar dome) did not improve significantly ($p = 0.916$), as six patients showed an increased talar tilt angle postoperatively. The mean American Orthopaedic Foot & Ankle Society (AOFAS) Ankle-Hindfoot Score improved from 78.4° preoperatively to 89° at the time of follow-up, and the mean visual analog scale (VAS) score improved from 6.7° to 2.7° ($p < 0.001$ for both). Postoperative complications included pain over the implants (nine patients), lateral osseous impingement caused by narrowing of the mortise (six patients), intra-articular fracture (one patient), and collapse of the ankle joint (one patient).

What to Watch For

Indications

- Medial ankle osteoarthritis with mortise widening and preservation of the joint space between the talar dome and the tibial plafond
- Failure of nonoperative treatment
- A talar tilt angle of $<5^\circ$
- Lateral ankle instability with medial ankle osteoarthritis

Contraindications

- End-stage ankle arthritis
- Inflammatory ankle arthritis
- Neuropathic ankle arthritis
- A paralytic limb
- Infectious arthritis
- Congenital deformity
- Traumatic deformity or defect

Pitfalls & Challenges

- Neurovascular injury should be avoided during the anterior approach. Identify the deep peroneal nerve and the anterior tibial artery beneath the extensor hallucis longus under direct vision and expose the ankle joint carefully.
- When performing the osteotomy toward the lateral cortex of the distal part of the tibia, be careful to avoid damaging the anterior and posterior tibiofibular ligaments. If diastasis has resulted from complete sectioning of these ligaments, insert one or two transverse syndesmosis screws from the fibula to the tibia.

- Intra-articular fracture can occur if an incomplete osteotomy to the lateral apex of the distal part of the tibia is followed by shifting of the osteotomized distal fragment.
- Shifting the distal osteotomized fragment may lead to lateral impingement between the fibula and the lateral wall of the talus. To avoid this complication, we recommend intraoperative removal of osteophytes from the fibula and talus.

Clinical Comments

While supramalleolar osteotomy provides the benefits of shifting of the weight-bearing axis while sparing the joint, some patients experience continuing widening of the mortise postoperatively. Consequently, distal tibial osteotomy without fibular osteotomy can be a more appropriate procedure and can provide osseous stability in patients who have medial ankle osteoarthritis with mortise widening.

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Disclosure: None of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of any aspect of this work. None of the authors, or their institution(s), have had any financial relationship, in the thirty-six months prior to submission of this work, with any entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. Also, no author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

References

1. Tanaka Y, Takakura Y, Hayashi K, Taniguchi A, Kumai T, Sugimoto K. Low tibial osteotomy for varus-type osteoarthritis of the ankle. *J Bone Joint Surg Br.* 2006 Jul;88(7):909-13.
2. Lee WC, Moon JS, Lee K, Byun WJ, Lee SH. Indications for supramalleolar osteotomy in patients with ankle osteoarthritis and varus deformity. *J Bone Joint Surg Am.* 2011 Jul 6;93(13):1243-8.
3. Cheng YM, Huang PJ, Hong SH, Lin SY, Liao CC, Chiang HC, Chen LC. Low tibial osteotomy for moderate ankle arthritis. *Arch Orthop Trauma Surg.* 2001 Jun;121(6):355-8.
4. Takakura Y, Tanaka Y, Kumai T, Tamai S. Low tibial osteotomy for osteoarthritis of the ankle. Results of a new operation in 18 patients. *J Bone Joint Surg Br.* 1995 Jan;77(1):50-4.
5. Pagenstert GI, Hintermann B, Barg A, Leumann A, Valderrabano V. Realignment surgery as alternative treatment of varus and valgus ankle osteoarthritis. *Clin Orthop Relat Res.* 2007 Sep;462:156-68.
6. Ahn TK, Yi Y, Cho JH, Lee WC. A cohort study of patients undergoing distal tibial osteotomy without fibular osteotomy for medial ankle arthritis with mortise widening. *J Bone Joint Surg Am.* 2015 Mar 4;97(5):381-8.

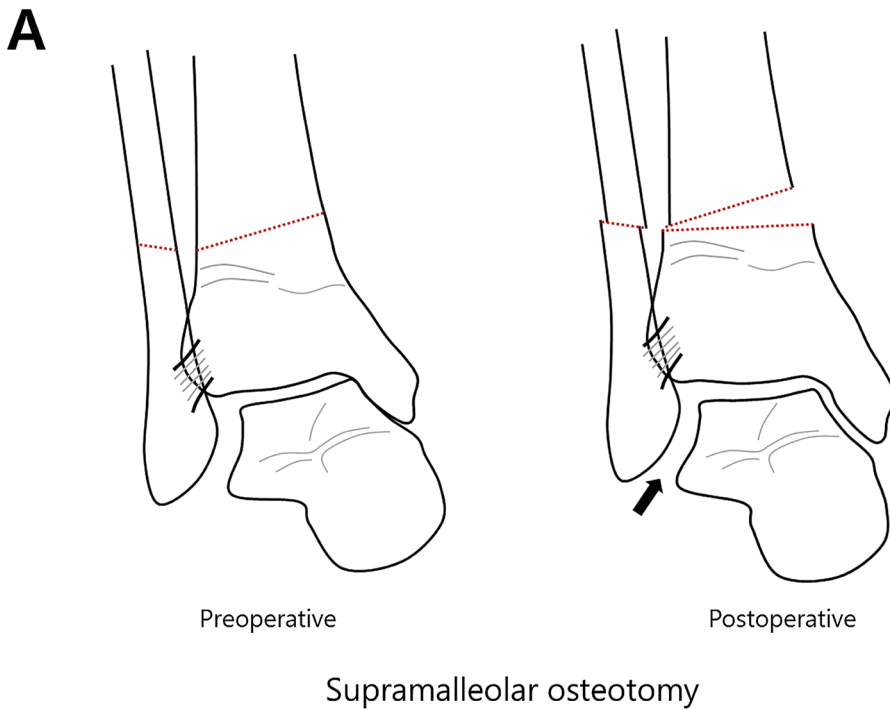


Fig. 1-A

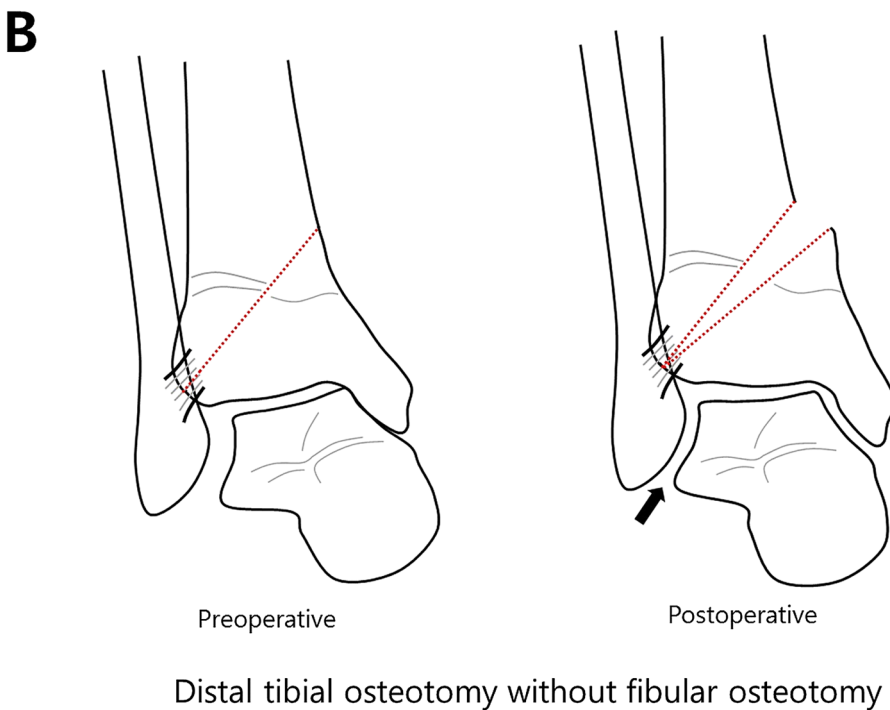


Fig. 1-B

Figs. 1-A and 1-B Both supramalleolar osteotomy (**Fig. 1-A**) and distal tibial osteotomy without fibular osteotomy (**Fig. 1-B**) can shift the weight-bearing axis laterally by angulation of the osteotomized distal part of the tibia. However, only distal tibial osteotomy without fibular osteotomy can narrow the lateral mortise (arrows).

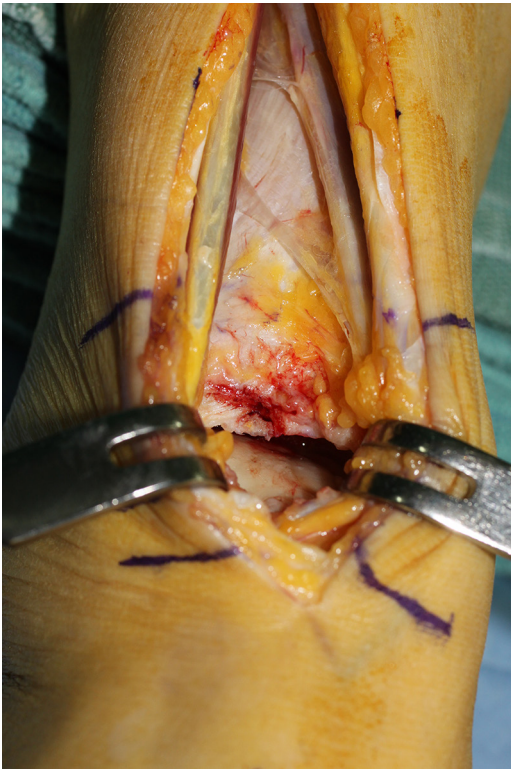


Fig. 2
Exposure of the ankle joint through an anterior midline approach between the extensor hallucis longus and extensor digitorum longus tendons.

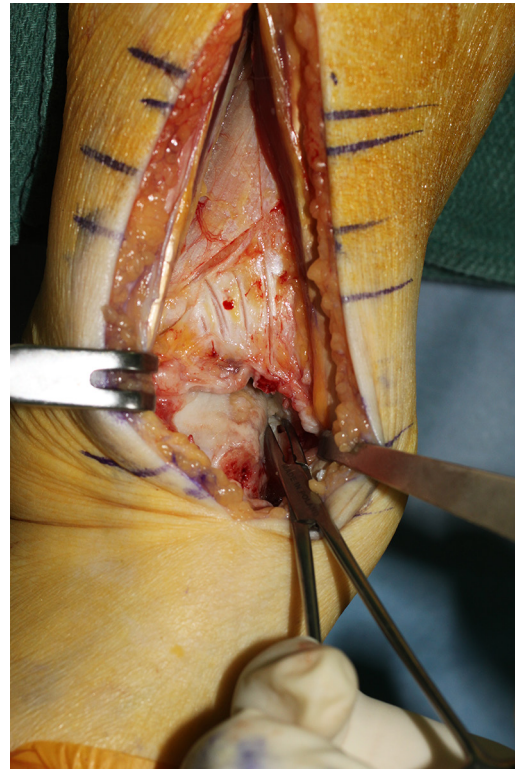


Fig. 3
Mortise widening is checked intraoperatively by applying abduction and valgus force.



Fig. 4
Confirmation of the planned osteotomy line by viewing the positions of three Kirschner wires under fluoroscopy.

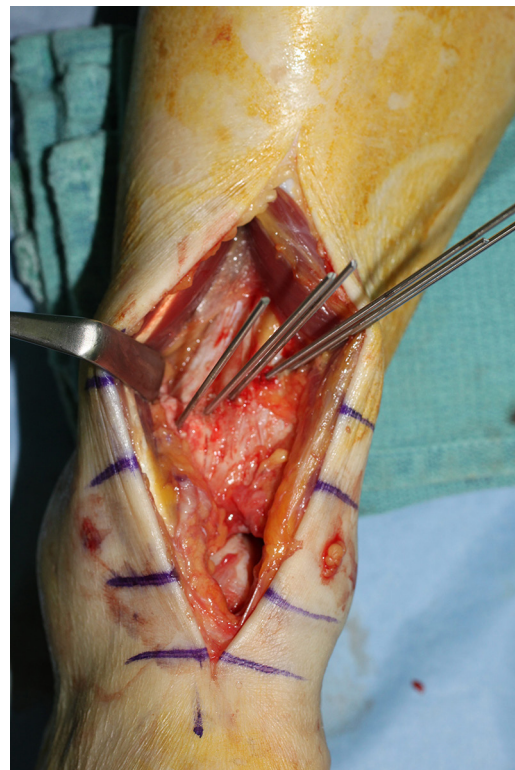


Fig. 5
Making multiple holes with Kirschner wires in the distal part of the tibia.

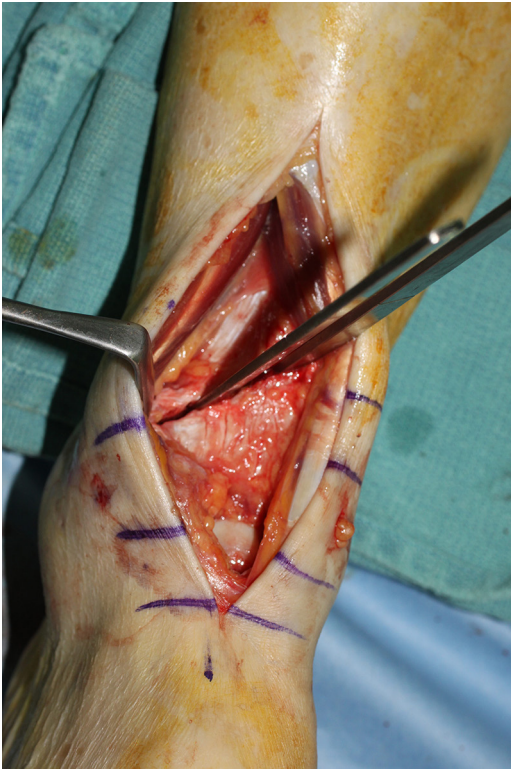


Fig. 6
Performing the osteotomy by connecting the multiple holes with an osteotome.

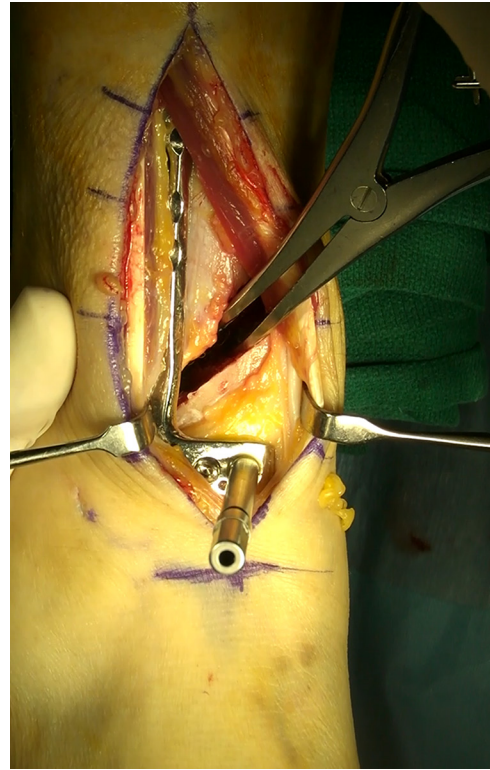


Fig. 7
Anterior fixation of a locking plate while maintaining the new alignment with a lamina spreader.

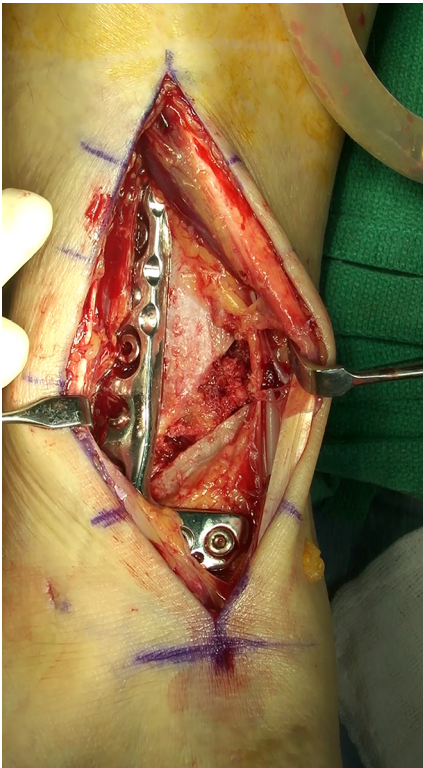


Fig. 8
Photograph after fixation and autogenous iliac bone-grafting.



Fig. 9-A



Fig. 9-B



Fig. 9-C

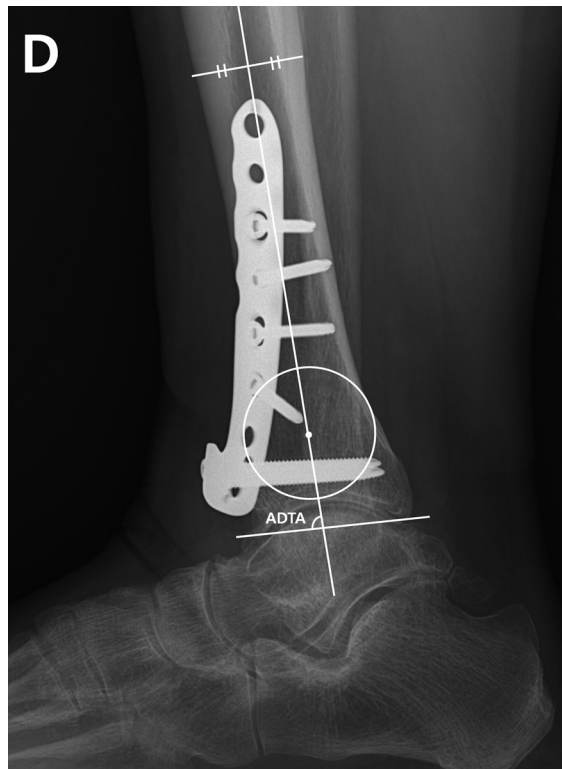


Fig. 9-D

Fig. 9-A Preoperative radiograph of a sixty-one-year-old woman with medial ankle osteoarthritis. The MDTA was 84° . **Fig. 9-B** The MDTA improved to 89° at one year postoperatively. **Fig. 9-C** The preoperative ADTA was 75° . **Fig. 9-D** The ADTA improved to 86° at one year postoperatively.