
Case 53: Supramalleolar Osteotomy with Ankle Distraction

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Contents

1	Brief Clinical History	379
2	Preoperative Clinical Photos and Radiographs	380
3	Preoperative Problem List	380
4	Treatment Strategy	380
5	Basic Principles	380
6	Images During Treatment	382
7	Technical Pearls	382
8	Outcome Clinical Photos and Radiographs	383
9	Avoiding and Managing Problems	383
10	Cross-References	384
	References and Suggested Reading	384

Abstract

Abnormal osseous alignment in weightbearing joints creates asymmetric joint degeneration leading to arthritis, pain, and decreased function. Realigning the mechanical axes and joint can relieve symptoms, prolong function, and improve joint longevity. Furthermore, joint distraction with early motion has been found advantageous in ankle arthritis management. A case is presented with unequal tibia and fibula deformity causing ankle varus and recurvatum with post-traumatic ankle arthritis. This was treated with a supramalleolar osteotomy, gradual deformity correction, and ankle distraction using external ring fixation.

1 Brief Clinical History

A healthy, active 45 year old male presented 3 years following ORIF of a closed tibia pilon fracture sustained in a motocross accident. The chief complaint was anterior ankle pain with recreational and work activity limitations. The patient had 5° ankle dorsiflexion, and there was approximately one-third loss of motion compared to the contralateral ankle. Standing alignment demonstrated a varus ankle without other deformity. Radiographs revealed post-traumatic arthritis with symmetric joint space narrowing and an unequal distal tibia and fibula deformity (Figs. 1, 2, and 3): 9° tibial varus and 20° tibia recurvatum, with fibula deformity of 9° only recurvatum. The CORA was located 16 mm proximal to the ankle joint and there was 4 mm of tibial shortening.

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Fig. 1 Post-traumatic ankle arthritis. LDTA 98°. Talocrural angle 73°. No fibular deformity in the frontal plane. Contralateral ankle: LDTA 89° and talocrural angle 78°



Fig. 2 Distal tibial deformity with ADTA 60° and 17° fibula apex posterior angulation (contralateral side 8° for total of 9° apex posterior deformity)

2 Preoperative Clinical Photos and Radiographs

See Figs. 1, 2, and 3.

3 Preoperative Problem List

1. Distal tibia malunion
2. Partial fibula malunion
3. Post-traumatic ankle arthritis
4. Fixed equinus compensation

4 Treatment Strategy

This patient was relatively young, ankle ROM was preserved, and he maintained high activity level. Therefore, a joint-preserving treatment strategy was employed with deformity correction and ankle distraction arthroplasty. Surgical treatment included an open anterior distal tibial exostectomy and a percutaneous distal tibial osteotomy (Gigli saw technique). Gradual tibial correction was accomplished with a Taylor spatial frame. The foot was incorporated to distract the ankle (performed gradually 1 mm/day for 5 days). Universal Ilizarov hinges were placed on the transmalleolar axis for ankle motion and to address the compensatory equinus deformity (Figs. 4 and 5). A staged fibula osteotomy and frame modification with distal tibia-fibula wire placement were performed once the tibia deformity was equal to fibular deformity (Fig. 6). Continued gradual deformity correction was completed. Throughout deformity correction and osteotomy consolidation, ankle motion and distraction were maintained (Saltzman et al. 2012; Tellisi et al. 2009). Frame removal was performed after bony healing at approximately 14 weeks.

5 Basic Principles

Ideal candidates for ankle joint preservation are healthy young (< 50 years old) motivated individuals without neuropathy who have preserved ankle motion and a relatively non-laborious occupation. Joint preservation typically includes ankle distraction, bony deformity correction, ligament instability repair, and joint debridement. In our experience, symmetric joint wear (especially the absence of anterior asymmetric wear) has shown improved clinical results. Additionally, patients with ankle arthritis and deformity, who undergo deformity correction, have also had satisfactory clinical improvement (Samatis et al. 2003).

A useful method of distal tibia-fibula deformity classification includes equal or unequal deformity of the two bones. This patient had unequal tibia and fibula deformity and underwent correction in a manner to achieve a more equal and anatomic relationship between the distal tibia and fibula at the ankle joint. Slight (2–3°) deformity overcorrection can be considered in cases with asymmetric joint wear. Careful foot alignment consideration is important to avoid creating secondary deformities.

Compensatory foot deformities that require correction may be present with distal tibial deformity. Tibia recurvatum, as with this case, is compensated by ankle plantar flexion. Frontal plane ankle deformity is compensated through the subtalar joint and, in more severe cases, through the forefoot.

Fig. 3 (a, b) Pre-operative deformity diagram. Tibial mechanical axes showing the proximal mechanical axis (blue line) and the distal mechanical axis (red line). Origin (O) is placed at the CORA. Corresponding point (C) is the intersection of “T” perpendicular to PMA

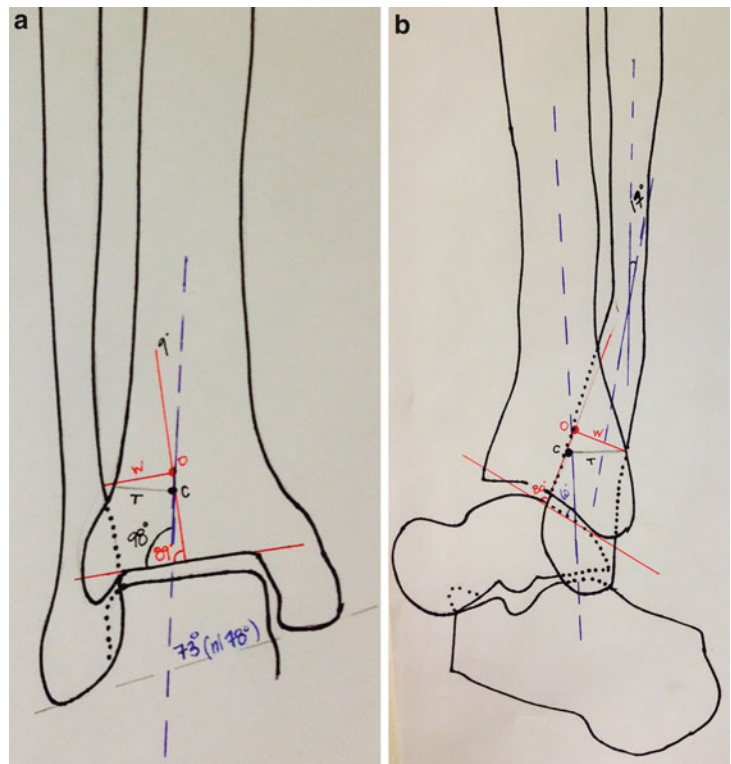


Fig. 4 Intra-operatively, distal reference ring is attached orthogonally. There is no fibula fixation to allow a tibia only deformity correction

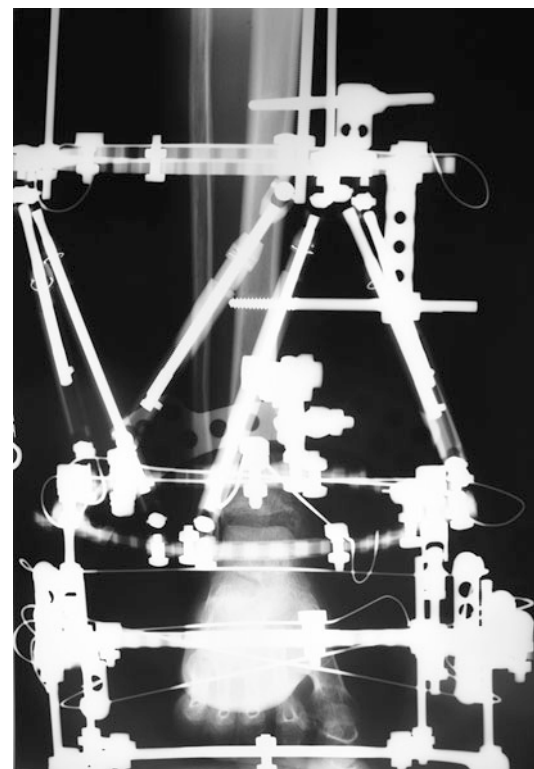


Fig. 5 Tibia deformity is partially corrected and equal to fibular deformity. Ankle joint is distracted (5 mm). Hinges are placed at the transmalleolar axis, allowing ankle ROM

6 Images During Treatment

See Figs. 4, 5, 6, and 7.

7 Technical Pearls

Ankle distraction is typically accomplished gradually over 5–10 days (0.5–1.0 mm/day) to achieve 4–5 mm of distraction compared to pre-operative radiographs. A talar neck wire (not tensioned) is important to prevent excessive subtalar joint distraction. Ankle motion is accomplished through universal Ilizarov hinges placed at the transmalleolar axis (a transmalleolar guide wire is placed temporarily to optimize hinge placement). Motion is initiated at approximately one week post-operatively and can be controlled with a fast-fix TSF strut placed from the proximal tibial ring to the foot ring enclosure. Motion is encouraged and increased gradually during the treatment course, which typically involves a 3-month frame time.

Deformity correction with joint preservation, it is generally corrected acutely with internal fixation. However, if deformity is greater than 10° or in an oblique plane, it is accomplished gradually, as with this case. When there is asymmetric tibia-fibula deformity, the most deformed bone is corrected to the level of the other bone, followed by frame modification to complete deformity correction.

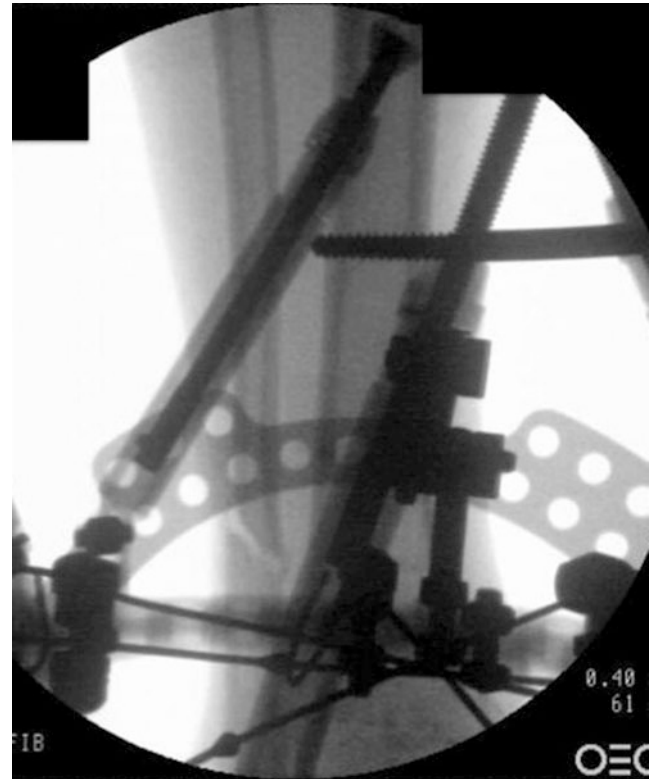
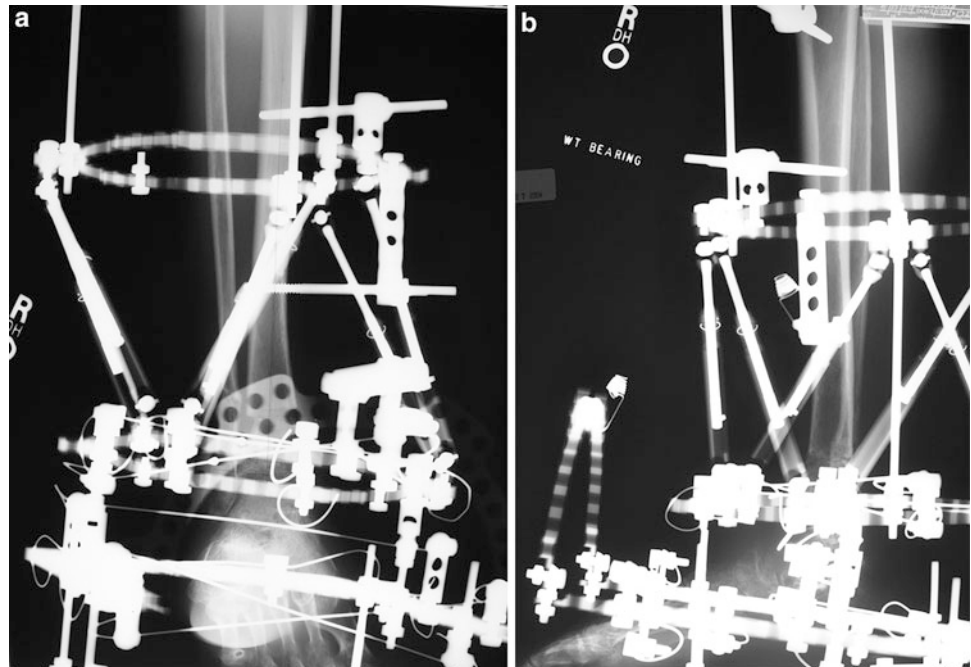


Fig. 6 Distal fibula is osteotomized. Multiple diverging olive wires secure the distal segment and a lateral olive wire stabilizes the fibula

Fig. 7 (a, b) Status-post gradual deformity correction



8 Outcome Clinical Photos and Radiographs

See Figs. 8 and 9.

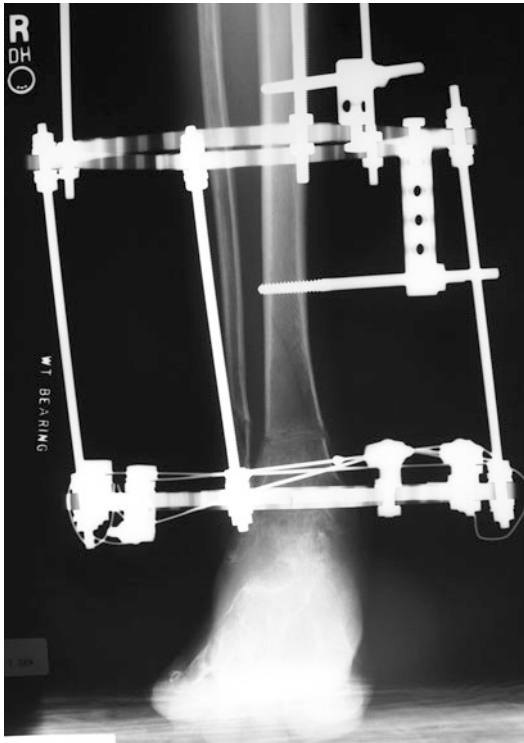


Fig. 8 Foot ring removed at a minimum of 12 weeks status-post ankle distraction. Proximal frame construct remains to allow continued tibial healing

9 Avoiding and Managing Problems

The most common problem with ankle preservation via distraction is persistent ankle pain following treatment. Patient selection and pre-operative counseling are important. In our practice, anterior asymmetric joint wear, significant ankle stiffness (less than 10°), heavy manual labor occupation, and high levels of pre-operative pain requiring narcotic pain medications are specific factors which negatively impact clinical results. Motion, weightbearing, correction of deformities, and obtaining $5\text{--}10^\circ$ dorsiflexion are factors, which may improve results.

During treatment, pin site inflammation and infection can occur around the ankle joint with motion. Prevention measures consist of wrapping periarticular wires with Kerlix Gauze, intermittent motion (rather than continuous), and daily pin care. Treatment consists of oral antibiotics and NSAIDs, cessation of motion and weightbearing, and pin care.

Delayed healing of the gradually corrected distal tibial osteotomy may occur, particularly with ankle distraction and motion. Avoid prolonged healing by achieving appropriate frame stability and placing sufficient distal tibial fixation (four wires or three wires and one half pin). Furthermore, careful attention to the osteotomy technique, preserving periosteum, and avoiding thermal bone necrosis may improve healing. A Gigli saw technique is appropriate if the osteotomy is metaphyseal and without sclerosis; otherwise, a multiple drill hole technique is preferred. Treatment of delayed healing includes bone grafting, osteotomy compression (if possible, this may require repeat fibular osteotomy), and further frame stability optimization.



Fig. 9 (a, b, and c) Final post-operative films with mechanical axes restored (LDTA 89° and ADTA 82°)

10 Cross-References

- ▶ [Case 49: Ankle Distraction](#)
- ▶ [Case 52: Ankle Distraction and Supramalleolar Osteotomy for Arthrosis and Deformity](#)
- ▶ [Case 54: Gradual Correction of Distal Tibia Malunion \(Varus with Shortening\)](#)

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