Case 52: Ankle Distraction and Supramalleolar Osteotomy for Arthrosis and Deformity

Austin T. Fragomen

Contents

Abstract

Ankle distraction arthroplasty and supramalleolar osteotomy have been independently shown to improve pain and function for patients with ankle arthritis. When combined, these techniques may be synergistic, providing further improved results. Ankle distraction is utilized to fill areas of eburnated bone with a layer of cartilage-like matrix and to soften sclerotic subchondral bone. When deformity is present, the high joint contact pressure is concentrated on a small section of the joint surface. There is concern that a successful joint distraction procedure in this environment would quickly wear out, with the new cartilage breaking down and reverting to its pre-procedure status. By combining joint re-alignment with distraction we provide a more even distribution of pressure over a greater area which may help preserve the new cartilage-like matrix and provide long-lasting relief.

1 Brief Clinical History

A 21 year old woman presented with a history of ankle pain and difficulty walking. She had been in an automobile accident 3 years earlier and sustained a bimalleolar ankle fracture with syndesmotic disruption. The fracture and ligaments were repaired, but the tibio-talar joint progressed to arthritis. Ankle arthroscopy and microfracture proved unsuccessful in reducing her pain.

On exam, she had excellent ankle mobility with 5° dorsiflexion and 40° of plantarflexion. Her subtalar motion was preserved, and her rotation was equal bilaterally.

2 Preoperative Clinical Photos and Radiographs

See Figs. 1 and 2.

A.T. Fragomen (✉)
Limb Lengthening and Complex Reconstruction, Hospital for Special Surgery, New York, NY, USA
e-mail: fragomena@hss.edu; afragomen@gmail.com

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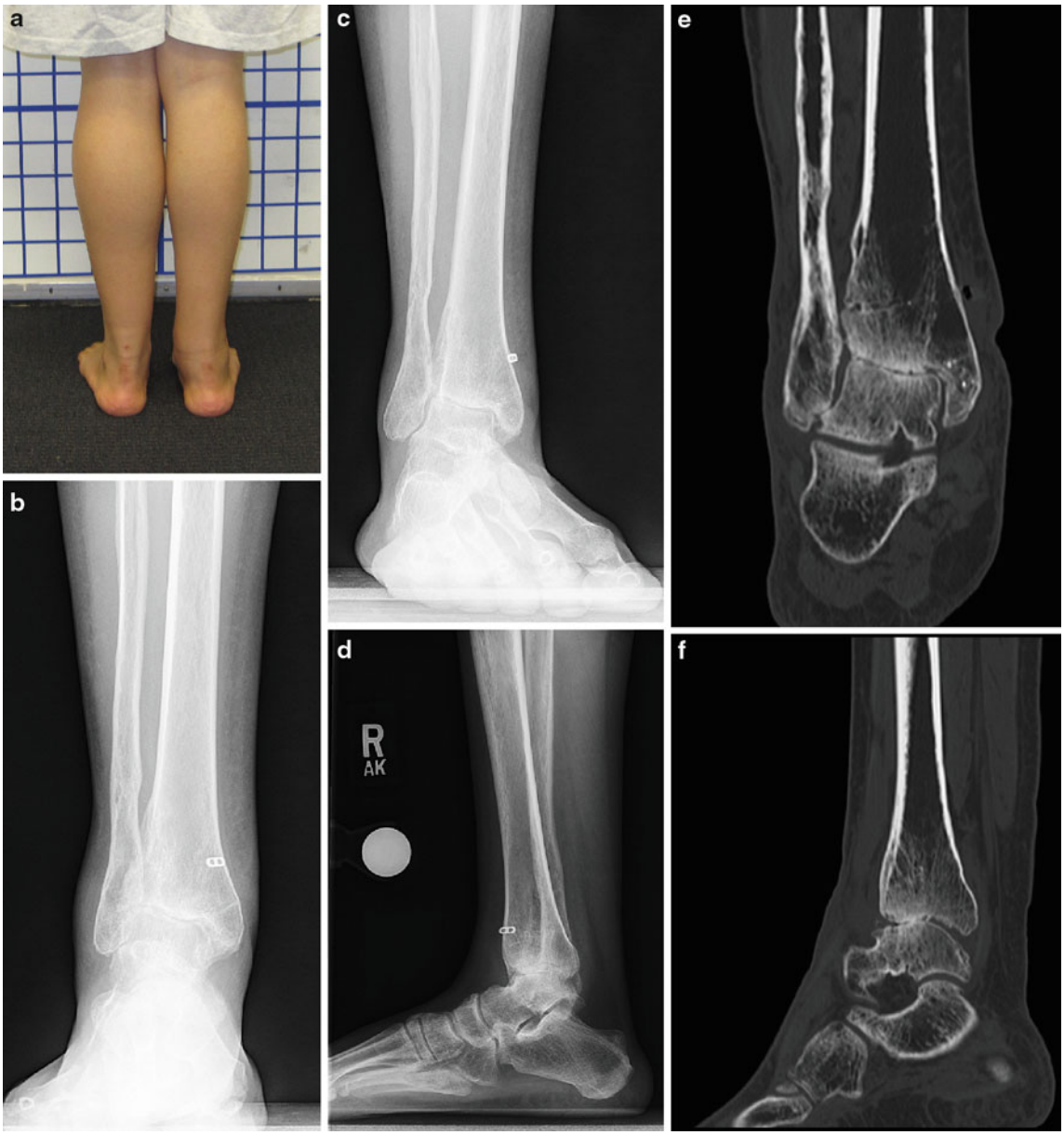

Fig. 1 A clinical photo (**a**) shows increased hindfoot valgus on the right. Weight-bearing radiographs demonstrate advanced post-traumatic osteoarthritis of the tibio-talar joint. AP (**b**), mortise (**c**), lateral (**d**) are seen. CT scan offers higher detail of the loss of articular cartilage, subchondral cyst formation, and subchondral sclerosis. Coronal (**e**) and sagittal CT (**f**) images are seen

3 Preoperative Problem List

1. Post-traumatic tibio-talar osteoarthritis
2. Valgus deformity of the distal tibia
3. Functional range of motion and young age making fusion undesirable

4 Treatment Strategy

Combined ankle distraction arthroplasty and supramalleolar osteotomy were planned. The osteotomy was stabilized with circular external fixation. A Taylor Spatial Frame (Smith & Nephew, Memphis, TN) was selected for its ability to

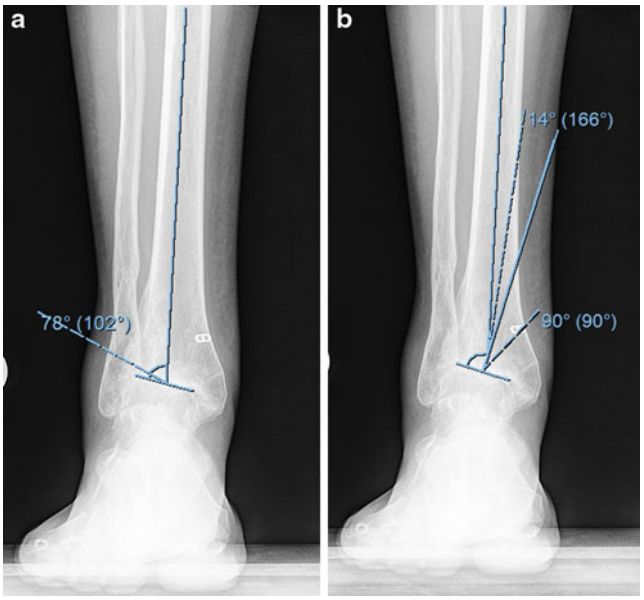

Fig. 2 (**a**) The lateral distal tibial angle measures 78° (normal is 90°). (**b**) Pre-operative planning shows a very distal CORA with a 14° valgus deformity

correct deformity with great accuracy in a gradual fashion. An open arthrotomy and microfracture of the talus was also performed with injection of autologous iliac crest, bone marrow aspirate concentrate. Hinges were used to provide articulated distraction. The joint distraction was applied acutely in the operating room to 5 mm. The osteotomy of the fibula and tibia was gradually angulated to allow for an accurate bony realignment utilizing distraction osteogenesis. The foot ring would be left in place for 3 months and then removed. The tibial rings would be removed at 4 months when the osteotomy was fully healed.

5 Basic Principles

Articulated distraction: A hinge is used to preserve ankle range of motion during the 3-month treatment period.

Distraction osteogenesis: The gradual movement of an osteotomy results in bone formation at the osteotomy site. This principle was used to provide an angular correction. The valgus deformity could have been corrected acutely with a plate but would have required bone grafting or limb shortening. The accuracy of acute correction with internal fixation is less reliable than with adjustable external fixation.

6 Images During Treatment

See Fig. 3.

7 Technical Pearls

The distal tibial ring is applied first with minimal fixation to avoid placing hardware where the hinges will lay. The proximal ring is mounted next and is connected to the distal ring with struts. The Inman axis wire is inserted and hinges are dropped off the distal ring to line up with the ankle axis. Often a plate is needed extending from the ring on the medial side to allow for hinge placement.

8 Outcome Clinical Photos and Radiographs

See Fig. 4.

9 Avoiding and Managing Problems

Crowding of the distal tibial ring: The distal tibial ring requires three to four points of fixation including one half pin and two to three wires. The fixation bolts often occupy the same holes on the ring that the joint distraction hinges need to occupy. This is ring crowding. Plates can be used to build the hinge from adjacent empty holes. It is also recommended to place two points of fixation and then build the hinge. Then place the additional one to two points of fixation after the hinge is secured to the ring. Additionally, the medial hinge is often too close to the distal tibial ring for normal attachment. The hinge can be attached alternatively by building a raised plate off of the ring providing space for hinge attachment. In this scenario, the hinge is not attached to the ring directly but instead to a plate off of the ring.

Tibial nerve injury: Excessive traction could theoretically injury the tibial nerve. Traction on the nerve can come from

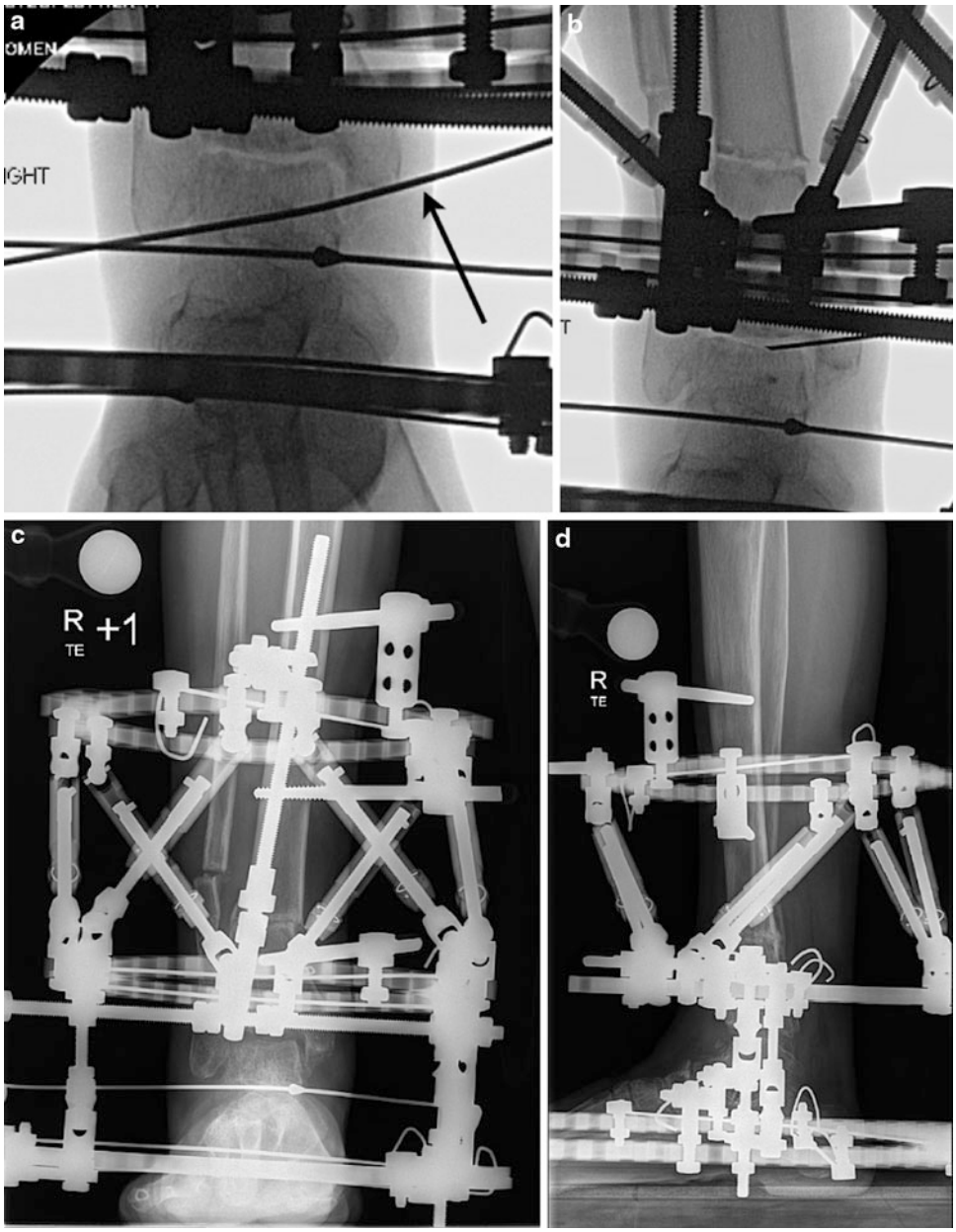

Fig. 3 The axis of ankle motion was established with an intra-articular wire (*arrow*) along the line created by the tips of the malleoli. (**a**) At the termination of the procedure, the ankle was distracted acutely, and BMAC was injected into the joint under fluoroscopy. (**b**) The osteotomy was gradually corrected over a 3–4-week period. Radiographs were obtained to confirm that the desired alignment was obtained. AP (**c**) and lateral (**d**) are seen

Achilles lengthening with acute correction of equinus, joint distraction, and from acute opening wedge osteotomy. If one is planning all of the corrections, different strategies should be considered: (1) perform some of the corrections gradually, (2) add a tarsal tunnel release. The value of external fixation is the ability to gradually correct the deformity. Therefore, one should use this unique opportunity. I recommend acute ankle distraction of 5 mm and gradual correction of the deformity through the osteotomy.

Fig. 4 These radiographs and MRI were obtained 1 year after the external fixator was removed. The SMO has fully healed with maintenance of alignment as seen on AP (**a**) and mortise (**b**). The lateral (**c**) joint space is patent, and the joint line is much wider on these weight-bearing X-rays. The MRI coronal (**d**) and sagittal (**e** and **f**) demonstrates great improvement in the tibio-talar joint space. There is minimal subchondral cyst formation compared with pre-operative CT scan

10 Cross-References

- ▶ Case 51: Fourteen Years of Beneficial Effects Following a Three Months 5 mm Distraction of an Osteoarthritic Ankle Joint Due to Trauma in a 45 Year Old Man
- ▶ Case 54: Gradual Correction of Distal Tibia Malunion (Varus with Shortening)

References and Suggested Reading

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