CHAPTER **25**

PERCUTANEOUS EXTERNAL FIXATION TREATMENT FOR CALCANEAL FRACTURES

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INTRODUCTION

Each year podiatric surgeons are called upon for the treatment of fractures of the foot and ankle. As the profession progresses, trauma treatment is becoming a regular part of many practices. Most of the past literature for trauma has come from orthopedics; this began to change and include podiatry in the mid 1990s. During this period of time, incision placement and hardware advancements improved the treatment of fractures. External fixation was introduced to the podiatric profession and has become commonplace in podiatric practice. It is from the introduction of external fixation and the assimilation into the surgical world of trauma that the idea for percutaneous external fixation for calcaneal fractures was born.

CALCANEAL FRACTURES

The first step in the process of identifying the feasibility of percutaneous reduction begins with examination of the fracture pattern. Calcaneal fractures occur in various patterns both extra-articular and intra-articular in nature. In the case of extra-articular patterns, if the fracture fragments are large enough to support wires, they are probably amenable to an external fixator. More often this is true for the intra-articular pattens (Figure 1). However, the fractures that have caused a joint depression type pattern with excessive comminution of the posterior facet can be difficult due to the lack of bone to support the posterior facet in its original position. It may be necessary to lift the posterior facet and pack a bone graft under the facet through a small incision. In each calcaneal fracture, the goal of the surgical correction should be to get the most normal looking articular facets with the least amount of dissection and internal hardware.

SURGICAL TECHNIQUE

The surgical technique begins with a choice between a standard Ilizarov circular assembly (Figure 2) and a butt frame configuration (Figure 3). The surgeon must decide in which planes the fractures must be distracted and which fixator will allow the proper distraction leading to the reduction and fixation of the fracture fragments. It is often helpful to obtain a computed tomography image or a magnetic resonance image preoperatively to better understand the fragments and their positions with respect to each other. The fixator is first attached to the tibia via half pins or transosseous wires (Figure 4). Once the fixator has been mounted to the tibia, wires are driven through the calcaneus and the fragments are distracted and then pulled back into their original position. This process often takes some time and utilizes the ligamentotaxis principles where the fracture fragments are still attached to soft tissue and are therefore used through distraction to reduce deformity.

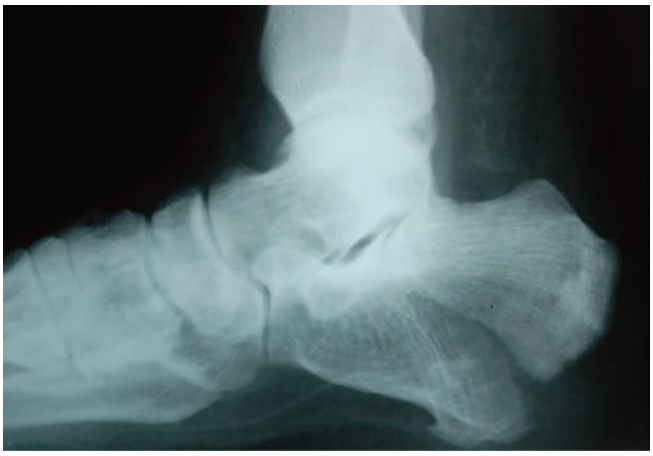


Figure 1. Intra-articular calcaneal fracture.

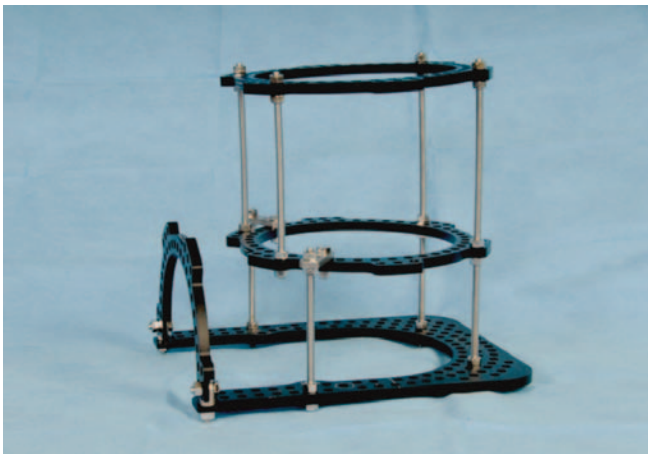
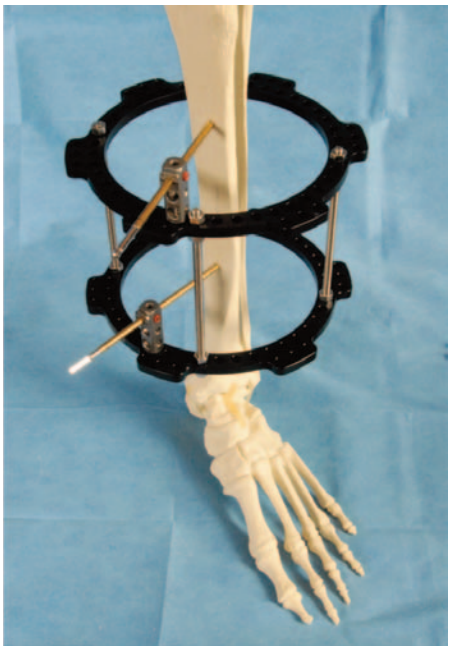


Figure 2. Standard Ilizarov fixators.

Figure 3. Butt frame configuration.



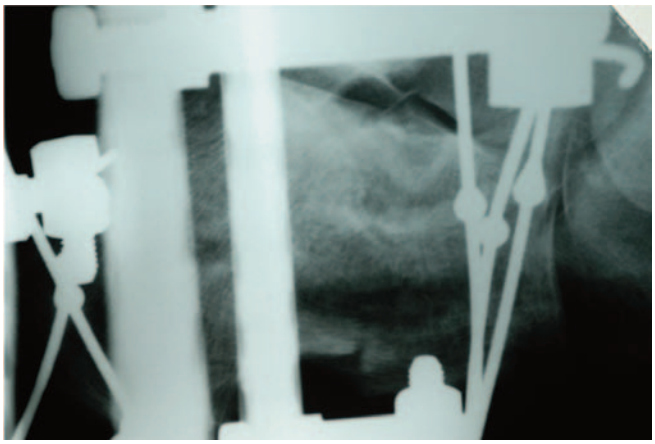


Figure 5. Multiple wires with olives on both sides allowing medial to lateral distraction and then compression.

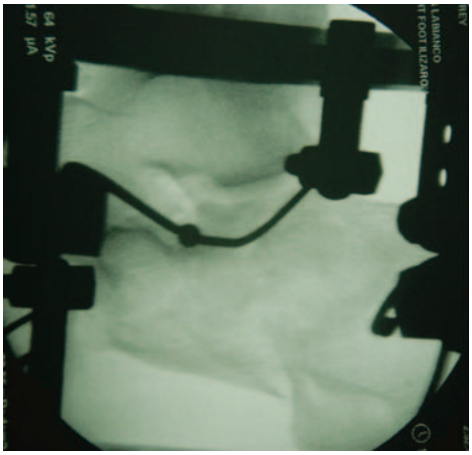


Figure 6. Distraction of the posterior facet up to the talus.

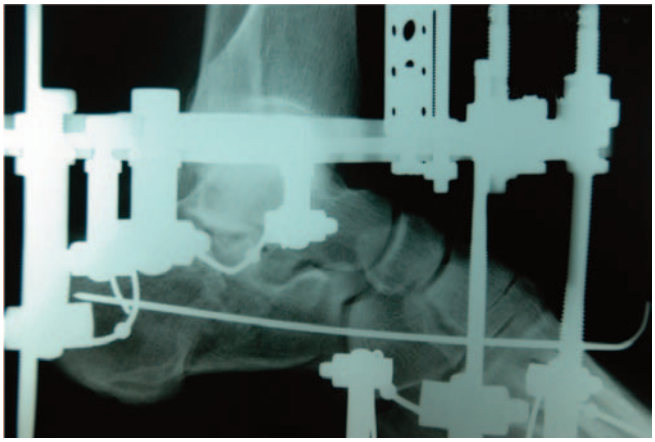


Figure 7. Distraction of the posterior body to realign the calcaneal body following posterior facet alignment.

Multiple wires may be used for distraction purposes and then replaced with final position wires when the reduction has been completed. The fixator in either configuration will allow distraction in multiple directions medial to lateral and dorsal to plantar at the same time (Figures 5-7). If it is determined during the distraction procedure that a bone graft is necessary, a small lateral incision with exposure to the calcaneus can be made. If given the correct fracture pattern, it is possible to reduce the articular facets and get the calcaneus placed in an anatomical position (Figures 8, 9).

Figure 8. Preoperative calcaneal fracture.

Figure 9. Postoperative calcaneal fracture.

POSTOPERATIVE CARE

Following surgery, pin care is performed on a daily basis as is done with all fixators. Radiographs are obtained as necessary to judge progress in healing. Butt frames are never a weight-bearing fixator configuration. Standard Ilizarov type circular fixators will permit weight bearing but only if the bone is strong enough to allow it. Most patients will need to begin the healing period in a nonweight-bearing gait pattern. The fixator is removed when the patient shows adequate bone formation, which usually occurs between 8 and 12 weeks.

DISCUSSION

Historically, calcaneal fractures have been opened from the lateral side with a linear incision and sectioning or retraction of the peroneal tendons. The sectioning or z-plasty of the tendons created good exposure but a large amount of scaring. Early fixation techniques were a combination of wires and single screws. This led to the use of the Zwipp incision and the use of plates and later the use of calcaneus specific plates and locking screw technology. In each case a large amount of dissection is created in an attempt to reduce the calcaneus to the best possible position. There have been many discussions in the literature and the physicians lounge about the lack of range of motion following these techniques. If the calcaneal fracture is amenable to external fixation the soft tissue damage becomes minimal and therefore the range of motion tends to be bigger and better at an accelerated rate during physical therapy. When the surgeon considers the amount of scar that is in place and holding the range of motion to a minimum while converting the old calcaneal fracture to a subtalar or triple arthrodesis, the external fixation option becomes very attractive.

Unfortunately, calcaneal fractures will continue to be life changing injuries. However, with a less is more theory, the probable need for a fusion in the future may turn into a minimal or moderate need for fusion. Certainly, the scaring will be greatly decreased and the tissues easier to heal and handle if revisional surgery becomes necessary.