

Evans Calcaneal Osteotomy A New Surgical Approach

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In 1975, Evans first described the use of the lengthening calcaneal osteotomy for treatment of recalcitrant pes valgus deformities¹. It has since been modified and developed within the podiatric profession, and is considered a cornerstone in the surgical management of this deformity.

Evans initially described a transverse osteotomy in the distal third of the calcaneus with insertion of an allogenic bone graft. By inserting the graft, the lateral aspect of the foot is lengthened, and the foot is adducted. The beneficial effects come from the resulting realignment of the mid-tarsal joint. Frontal plane heel valgus is also reduced as a result of the retrograde effect that the mid-tarsal joint has on the subtalar joint. Apart from these structural effects, several advantageous biomechanical changes will be afforded by this procedure. The dynamic effect of the peroneus longus tendon will be enhanced by lengthening of the lateral column. Also, the increased plantarflexory force along the medial column aids in reducing the forefoot varus or supinatus deformity which is commonly present.

Although autogenous tibial graft was initially used by Evans, an allogenic iliac crest or calcaneal graft is currently being used. The most recent modification is the allogenic calcaneal graft developed by Caldarella² and first described in the literature by Zirm in 1992³. Although these grafting techniques have afforded good results, there are some inherent limitations and complications of the traditional Evans osteotomy, including: overcorrection or under-correction, wound dehiscence, infection, delayed union and non-union, and acquired disease.

When performing the traditional Evans osteotomy, the surgeon may experience difficulty with the grafting material itself, in that the degree of correction is frequently limited by the physical confines of the osteotomy. Therefore, the goal of the procedure will frequently fall short of the desired correction due to an inability to use a larger size graft. The surgeon must also take into

consideration the possibility of disease transmission (primarily AIDS and Hepatitis) through the use of an allograft. Although the actual possibility of transmission is extremely rare, the general public is still very apprehensive about the possibility of disease transmission. Because no guarantees can be made, many patients will refuse the procedure.

The following modified technique, based on the principles of callus distraction, was originally designed to address some of these complications inherent to the traditional Evans procedure. Since Ilizarov's important contribution in 1972, the technique has been used by the orthopedic and podiatric community to address a variety of congenital and traumatic osseous deformities. The most common indications for callus distraction include: limb length discrepancy, traumatic bone loss, adult congenital foot deformities, fibular hemimelia, lengthening amputation stumps, achondroplasia, brachymetatarsia, and pseudoarthrosis.

TECHNIQUE

A linear incision is made along the lateral calcaneal body and calcaneocuboid joint (Fig. 1). There are several important anatomic structures that need to be identified and avoided. The incision is typically centered between the sural nerve superiorly and the peroneal tendons inferiorly. The subcutaneous layer is dissected in standard anatomic fashion, and accurate hemostasis is achieved. An aggressive reflection of the superficial fascia from the underlying deep fascia will be required to gain access to the lateral calcaneal body. In most instances, the extensor digitorum brevis muscle belly will need to be gently reflected superiorly. Care should be taken to not violate the ligamentous attachments of the calcaneocuboid joint. Once the lateral calcaneal wall is adequately exposed, the wound is prepared for pin insertion.

The distraction process is accomplished using the EBI Mini External Fixation System (Fig. 2). This



Figure 1. The incision is placed along the lateral calcaneal wall. Care is taken to avoid injury to the sural nerve and the peroneal tendons.

system uses a series of four pins, with two placed on each side of the osteotomy. There are two sizes of mini self-drilling screws that can be used with this system (2.5 mm and 3.0 mm). Both sizes are tapered .5 mm from top to bottom along the thread pattern. The larger 3.0 mm pin is used for the cancellous bone in this area of the foot.

Accurate pin insertion is critical to achieve an even plane of distraction in the postoperative period. Therefore, the pins should be inserted prior to cutting the osteotomy, and the guide template included in the set facilitates accurate placement (Fig. 3). The two distal screws are the most critical and should be inserted first. The first screw is placed just distal to the area of the planned osteotomy in the calcaneus, while the second pin is placed in the cuboid. The 1.0 cm gap that exists between the two screws allows ample room to bridge the calcaneocuboid joint (Fig. 4). The last two screws are then easily inserted into the more proximal portion of the calcaneal body. The screws come in three different lengths, 50 mm, 60 mm, and 70 mm. To obtain the maximum amount of purchase, the longest possible screw should be used (typically 70 mm). Once the pins are in their proper position, the osteotomy is made identical to the traditional procedure (Fig. 5). Closure should be performed before applying the external frame to allow for ease of suturing (Fig. 6).

The foot is initially dressed in a below-knee compression cast to accommodate immediate postoperative edema. Due to the rapid healing potential of the cancellous bone of the calcaneus, distraction should be started at approximately the

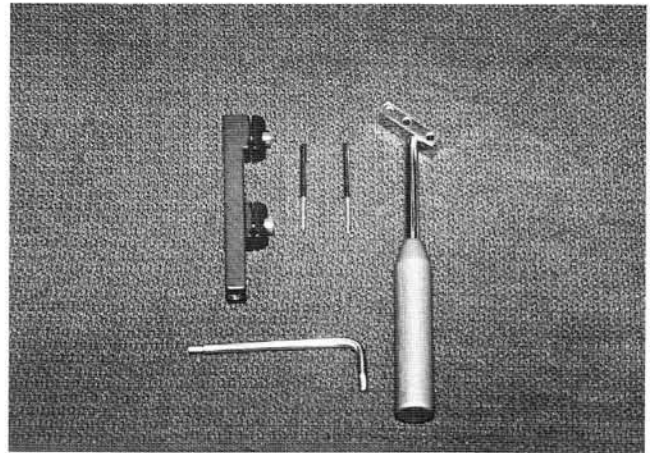


Figure 2. The EBI mini-fixator including the frame, pins, guide (template), and distraction wrench.

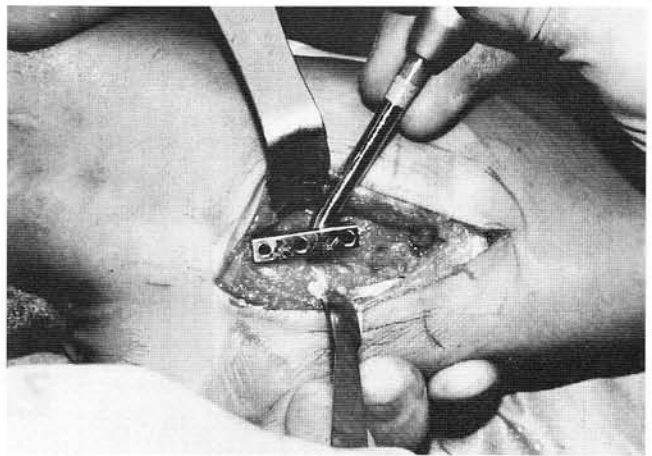


Figure 3. The guide template assures accurate pin placement which is critical to the placement of the frame.

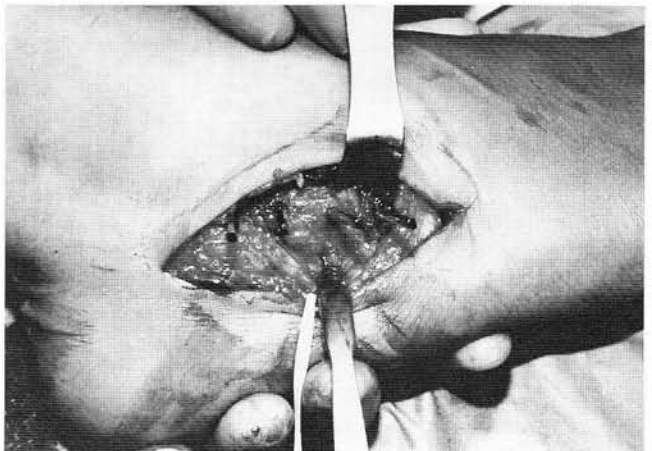


Figure 4. Accurate placement of all four pins. Note the bridging of the calcaneal-cuboid joint with the two distal screws.

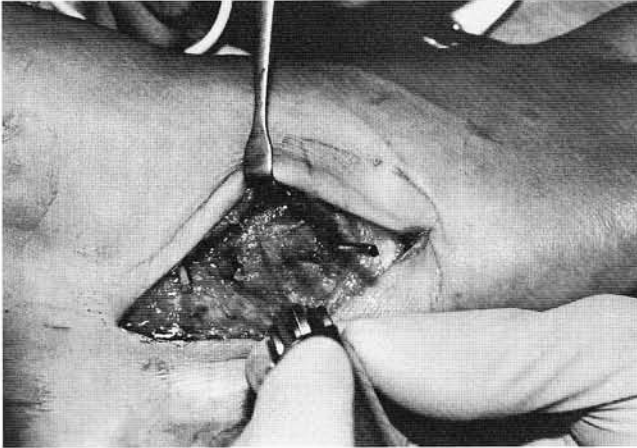


Figure 5. The calcaneal osteotomy executed in similar fashion to the traditional technique.

fifth postoperative day, during which the initial dressing change is performed.

Studies have shown that multiple, gradual, daily distractions result in more normal and predictable bone formation and remodeling. For this reason, a series of five, clockwise 1/4 turns are performed daily until adequate correction has been obtained. This lengthening schedule will result in approximately 1 mm of distraction each day. The right-angle Allen wrench that comes with the kit allows for easy calculation of the required 1/4 turn (Fig. 7A, 7B).

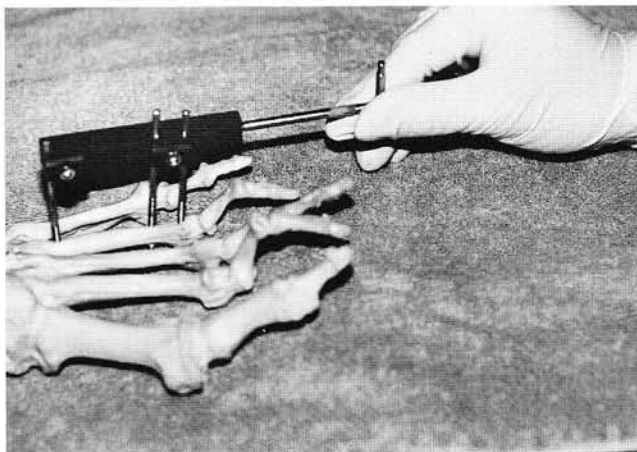


Figure 7A. Placement of the wrench at the starting position.

The lengthening process should rarely extend beyond 14 days. There is a risk of creating a clinically significant forefoot adductus deformity if distraction is continued beyond this point. Once



Figure 6. Wound closure is performed in anatomic layers prior to the placement of the external frame.

the desired correction has been obtained, the external frame is left in place for approximately 2 to 2 1/2 weeks to allow for bone remodeling and strengthening. Following radiographic evidence of adequate bone formation, the frame and pins are removed. Although this may cause a degree of anxiety for the patient, the pins are easily removed in the office without the need for anesthesia (Fig. 8). At this point in the postoperative period (approximately 6 weeks), guarded weight bearing is initiated.

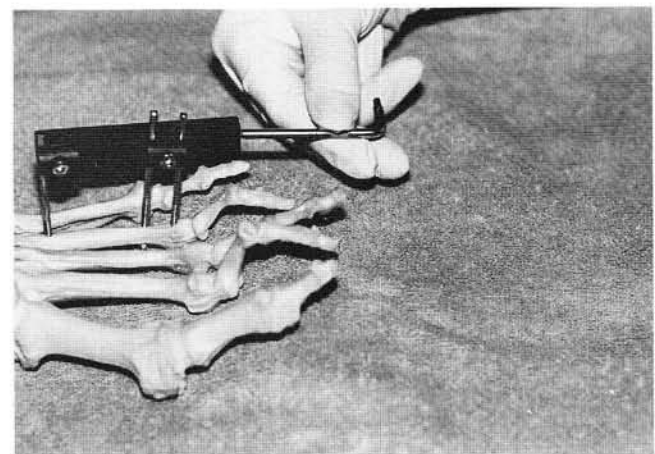


Figure 7B. One-quarter turn results in approximately 0.25 mm of lengthening.

One technical consideration with this procedure is the use of protective casting during the lengthening process. A below the knee cast, applied with an extra amount of soft padding, will

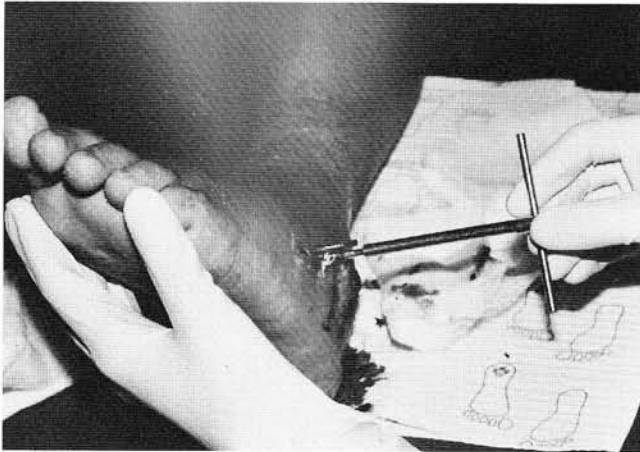


Figure 8. Pin removal is typically performed in the office without the need for anesthesia.

usually allow for adequate distraction without the need for windowing. However if the cast is acting as a structural barrier to lengthening, then the cutting of a window will be necessary.

RESULTS

To date, five patients have undergone this new modification of the Evans calcaneal osteotomy. Clinical results have been exceptional and minimal complications have been encountered. Adequate correction has been achieved with this technique (Figs. 9A - 9E).

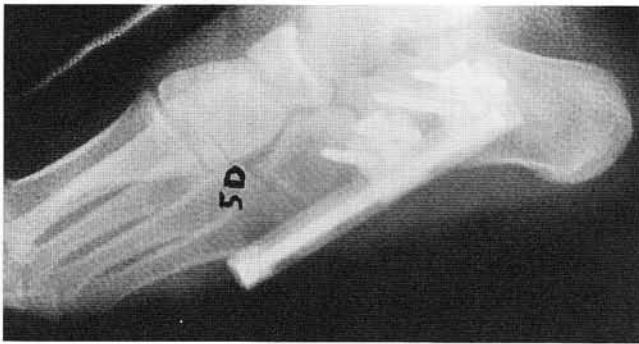


Figure 9B. Lateral view of initial x-ray.



Figure 9A. Initial x-ray, five days prior to the beginning of the distraction process.



Figure 9C. Appearance after two weeks of distraction. Approximately 1.50 cm of length has been obtained.



Figure 9D. Nine weeks postoperative. The area of distraction has remodeled without loss of correction.

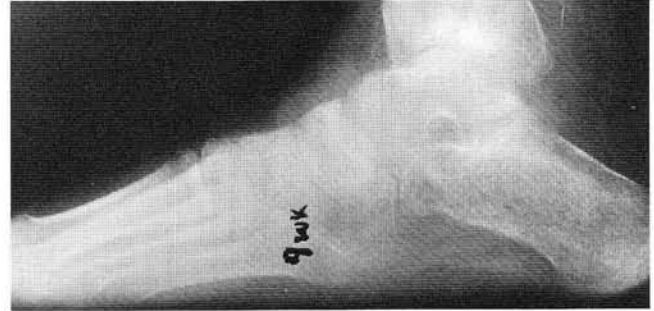


Figure 9E. Lateral view, nine weeks postoperative.

COMPLICATIONS

Although minimal complications have been seen in the early stages of this procedure, there are several potential problems including: delayed union, non-union, vascular or nerve injury, pin track inflammation or infection, pin loosening, premature consolidation, neuropraxia, and lack of patient compliance. Pin track infection and soft tissue irritation are the most obvious pitfalls. This can normally be prevented by careful and attentive postoperative wound care. Premature consolidation of the osteotomy can also be prevented by using the recommended early and frequent distraction sequence.