Technique Guide for the Calcaneal Z-osteotomy for Varus Deformities

Authors: James R. Foster, DPM; Jessica Olson, DPM; Lee M. Hlad, DPM

Introduction:

Cavus foot deformity is a common problem encountered by foot and ankle surgeons and is often a result of multi-level deformity. Prolonged varus can lead to ankle pain or instability, lateral forefoot overload, tendinopathy, and metatarsalgia. Cavovarus deformities can be caused by neurologic etiologies, such as, cerebral palsy, or charcot marie tooth, postratamaic etiologies, or recurrent clubfoot. Workup and treatment of these deformities can include a combination of soft tissue and tendon releases, transfers, and can require bony osteotomies as well (1).

There have been a variety of calcaneal osteotomies described in the literature for treatment of hindfoot varus, many of which were developed for the treatment of deformity resulting from poliomyelitis (2). The Dwyer lateral closing wedge osteotomy corrects for frontal plane rotation. The lateralizing calcaneal osteotomy, is designed to correct in the transverse plane but can also correct some sagittal plane pathology as well. This osteotomy is described as an oblique osteotomy, and the tuberosity is shifted posteriorly and superiorly to improve the moment arm of the Achilles tendon to shift point of contact when walking. The senior author described this a “Z osteotomy,” which theoretically allows for lateral translation and rotation. They also note the anterior cut of the cortex intact if desired or one can penetrate the medial cortex and laterally displace the fragment. This is achieved by removing of the lateral tuberosity. Then a 4 cm incision is created from the superior central tuberosity to the inferior tuberosity and should end just distal to the tubercles of the calcaneus. The skin is incised and then blunt dissection is taken down to the lateral wall of the calcaneus. Care is taken to identify and protect the sural nerve if found within the incision. The senior author then takes two short Steinman pins and places these on the axis of rotation of the Z as pictured (fig 4). These wires are placed perpendicular to each other. The author then creates a Z peristeal incision. Centrally the superior cut is made in line with the long axis of the leg. The inferior portion of the central cut is made in line with the weight bearing surface of the foot. This is very important in ensuring proper frontal plane rotation of the posterior fragment. One can keep the medial cortex intact if desired or one can penetrate the medial cortex and laterally displace the fragment. For fixation the senior author uses either two 5.5mm screws or uses two staples. Certain companies do have offset staples to accommodate shifting of the fragment. It is important when making the plantar arm that one stays in front of the tuberosities but not too distal to disturb the peroneal tubercle.

Technique:

The patient is positioned as necessary for all procedures at hand. The senior author often times will perform the bony osteotomy as one of the first procedures and then perform tendon release or transfer after. For placement of the incision flouroscopy is used and an oblique line is marked just posterior to course of the peroneal tendons within the tarsal tunnel. Then a 4 cm incision is created from the superior central tuberosity to the inferior tuberosity and should end just distal to the tubercles of the calcaneus. The skin is incised and then blunt dissection is taken down to the lateral wall of the calcaneus. Care is taken to identify and protect the sural nerve if found within the incision. The senior author then takes two short Steinman pins and places these on the axis of the Z as pictured (fig 4). These wires are placed perpendicular to each other. The author then creates a Z periosteal incision. Centrally the superior cut is made in line with the long axis of the leg. The inferior portion of the central cut is made in line with the weight bearing surface of the foot. This is very important in ensuring proper frontal plane rotation of the posterior fragment. One can keep the medial cortex intact if desired or one can penetrate the medial cortex and laterally displace the fragment. For fixation the senior author uses either two 5.5mm screws or uses two staples. Certain companies do have offset staples to accommodate shifting of the fragment. It is important when making the plantar arm that one stays in front of the tuberosities but not too distal to disturb the peroneal tubercle.

Figure 1

Sagittal (Figures 1 and 2) and frontal plane (Figure 3) depictions of calcaneal Z osteotomy.

Figure 2

Intraoperative flouroscopy photos depicting Steinmann pin axis guides (Figure 4), temporary fixation (Figure 5), and definitive staple fixation (Figure 6).

Considerations:

It important to take tarsal tunnel syndrome into account when performing a calcaneal osteotomy. A cadaveric study by Bruce et al studied the effect of medial and lateral calcaneal shifting osteotomies on the tarsal tunnel. MRI was used to measure the volume of the tarsal canal before and after each of the osteotomies, they also evaluated the proximity of the osteotomy cut to neurovascular structures. They found a significant decrease in the tarsal canal associated with the lateral shifting of the calcaneal osteotomy. They also noted the anterior cut of the Z-osteotomy put neurovascular structures of the medial ankle more at risk than the posterior cut (12). A different study by Knupp et al demonstrated 4 of 18 patients with positive neurological exam finding following their calcaneal Z-osteotomy (1). The senior author will often times perform a modified tarsal tunnel release with Steindler stripping or plantar fascial release if needed.

Postoperative Course

The patient is kept non-weightbearing in a posterior splint for the first week. This is followed by two consecutive short leg casts for a total of 6 weeks, while the patient remains non-weightbearing. The patient is then weightbearing as tolerated in a CAM walker for 4 weeks with gradual advancement through physical therapy.

Conclusion

In conclusion the purpose of this poster is to illustrate the clinical approach and provide a technical guide to surgical correction of cavovarus foot deformity with a calcaneal Z osteotomy. It’s important to augment this procedure with soft tissue and tendon balancing based on the etiology of the foot type and severity of deformity. The calcaneal Z osteotomy provides triplanar correction, and improves point of contact and tibio-talar contact pressures. The senior author recommends a modified prophylactic tarsal tunnel release in any lateralizing calcaneal osteotomy.

References: