Calcaneal Osteotomy

7:00 – 7:05 am
Standard Slide
Calcaneal Osteotomy in the Treatment of the Flexible Flatfoot Deformity
Steven M. Raikin, MD
Philadelphia, Pennsylvania

Introduction
Tibialis posterior reconstruction surgery for flexible flat foot deformity using tendon transfers in isolation is insufficient to achieve and maintain correction, resulting in failure and poor results. The key step in improving outcomes was the introduction of the calcaneal osteotomy, the first being the medial displacement calcaneal osteotomy. Depending on the degree of deformity, different types of osteotomies have been utilized to correct the alignment and optimize the biomechanics of the associated tendon transfer procedure.

I: Medial Displacement Calcaneal Osteotomy (MCO)

History
Gleich (1893) described a medial closing wedge calcaneal osteotomy to treat Pes planus
Koutsogiannis (1971) introduced the medial displacement calcaneal osteotomy.

Biomechanics
MCO functions in numerous ways to protect the tendon transfer procedure.
- changes the calcaneal axis preventing the heel from going into excessive valgus.
- restores the line of pull of the tendoachilles (TA) from an evertor in the planovalgus foot to an invertor of the heel in the corrected one.
- reduces the contact stresses at the tibiotalar joint potentially protecting the ankle joint from degeneration in the future.
- Medial translation of 10mm substantially decreases the load on the medial column and increases the load on the lateral foot- reversing the change in AAFF

Indications
MCO is used in the surgical treatment of Stage 2a AAFF. A cadaveric study showed that MDCO with FDL transfer was adequate in moderate degrees of deformity, but in cases of severe deformity, additional procedures were required.

Technique
- The osteotomy is made with an oscillating saw blade at a 90° angle to the lateral calcaneal wall and parallel to the posterior facet.
- Displacement of at least 10-12 mm should be achieved.
- fixation with either lag screws, a step plates with locking screws, or bone staples.
- “Crushplasty” of the lateral edge to avoid peroneal tendon and sural nerve irritation

Outcomes
Myerson presented 120 patients treated with tendon transfer and MCO with marked improvement in pain and function in 90% of cases. However, in this and other series, despite good clinical outcomes, radiological arch improvement is not achieved in up to 75% of cases and clinical appearance of the arch is significantly changed in only 4% of patients. Additionally improvement in the radiologic parameters can be lost with time.

Limitations
Medial displacement calcaneal osteotomy does not correct forefoot abduction and uncovering of the talonavicular joint, and medial arch height correction is inconsistent. Wacker showed that despite 75% good early outcomes, there was a 10% recurrence rate at 3-5 years. It is not clear whether this is related to the degree of correction of the foot.
II: Lateral Column Lengthening Osteotomy (LCL)

History
Evans (1961) observing that abduction due to overcorrected clubfoot deformity could be corrected by lengthening the lateral column. This concept was later popularized by Sangeorzan et al. in 1995 for correction of the adult flatfoot

Biomechanics
As the lateral column is lengthened the forefoot moves medially at the transverse tarsal joint. The navicular also moves slightly plantarwards resulting in forefoot adduction and plantarflexion and increased arch height.

Technique
- Evans described the osteotomy parallel to and 1.5cm proximal to the cc joint.
- Raines demonstrated that making the osteotomy 10mm proximal to the cc joint was the safest option to avoid both the anterior and middle facets of the sub-talar joint.
- Lengthening can be performed through the calcaneocuboid joint if arthritic.
- Distraction is undertaken using a laminar spreader until correction of the talonavicular coverage and talus-1st MT axis is re-established.
- An appropriately sized rhomboid shaped interposition graft (autologous ICBG, allograft, synthetic or trabecular metal) is inserted.
- Fixation is undertaken with a screw or plate, unless a stable impacted graft is achieved.

Complications
- Nonunion is seen more frequently with distraction fusion through the calcaneocuboid joint, than with calcaneal neck osteotomy (Evans).
- Lateral foot overload / pain – usually associated with larger grafts >10mm

III: Double Calcaneal Osteotomy (MCO combined with LCL)

Biomechanics
In LCL procedures, the calcaneus does not move into varus relative to the talus or tibia. The significant correction of the mid and forefoot on the hindfoot gives the appearance of a calcaneo-varus. By adding a MCO correction of the hindfoot valgus is additionally achieved further decreasing the load on the dysfunctional posteromedial structures.

Indications and Outcomes
When used in combination with a tendon transfer, there is symptomatic pain relief and the correction obtained has been noted to be lasting at intermediate follow up.

IV: Malerba “Z” Osteotomy

History
Malerba and De Marchi described the Z osteotomy of the retrothalamic portion of the calcaneus. This combines a medial displacement of the calcaneal tuberosity and lateral column lengthening through an extensile approach.

Technique
- 3 cut “z” shaped osteotomy is performed using an oscillating saw.
- Each cut is similar in length and at right angles to each other.
- The central horizontal limb is at least 1.5cms long, parallel to the weight bearing surface and distal to the peroneal tubercle.
- The calcaneal tuberosity is shifted medially and distracted with bone graft or trabecular metal wedges.
- The osteotomy incorporates a large bony surface and is inherently stable. The osteotomy is held with staples or screws.