

Correlation of Radiographic Measurements after Double Calcaneal Osteotomy

Mohammed K. Hassan, DPM (PGY- 2), Jacob Carmichael, DPM (PGY-1), Lawrence A. DiDomenico, FACFAS (Program Director)
East Liverpool City Hospital



Statement of Purpose

The purpose of our study was to explore the difference in pre and postoperative radiographic parameters for the calcaneal inclination and the lateral talocalcaneal angles after double calcaneal osteotomy.

Methodology and Hypothesis

A retrospective chart review was conducted for 10 patients who underwent flatfoot reconstruction surgery. The differences between the radiographic angles (before and after the surgery) were calculated by obtaining weight bearing radiographs. Pearson's chi-square test was performed using SPSS statistics and the statistical significance was defined as $P < 0.05$. We hypothesized that there would be a significant improvement in the calcaneal inclination and talo-calcaneal angles in the post operative films.



Figure 1: A lateral x-ray showing the use of two parallel 6.5 mm cannulated screws.

Procedures

10 surgical patient's charts were reviewed at random. All surgical procedures were performed by the senior attending physician (L.D.). Patients were excluded from the study if they were younger than 18 years old. Two screws were used to fixate the calcaneal fragment (figure 1). An Allograft bone wedge was used in the osteotomy site 1.5 cm proximal to calcaneocuboid joint (figure 2). All patients underwent a gastrocnemius recession of the operated foot to reduce the equinus contracture.

Literature Review

Posterior calcaneal displacement and anterior calcaneal distraction osteotomies have been recommended for management of flexible flatfoot deformity. Both address to correct the lateral column length, rearfoot valgus and forefoot abduction¹. After the successful procedure, the heel to remain vertical in the resting calcaneal stance position, the forefoot to remain parallel to the rearfoot in the frontal plane. These changes lead to the rectus alignment of the forefoot and improvement in pressure under the midfoot area³. Arangio et al. showed a ten-millimeter medial displacement after calcaneal osteotomy in flat foot models decrease the load on medial arch³.



Figure 2: The inferior screw is acting as a dual lag-positional device. It is providing interfragmentary compression, and concomitantly engaging the bone proximal to the Evans osteotomy, the bone graft, and the anterior process of the calcaneus.

Literature Review

There are many different methods available for the fixation of calcaneal osteotomies. The use of a dual lag-positional screw was illustrated in the literature by DiDomenico and colleagues⁴. This device served two functions. It acted as a positional device as well as a tool that provided compression across the osteotomy site, facilitating osseous healing⁴.

	Pre-op Calc Incl angle	Post-op Calc Incl angle	Pre-op talocalc angle	Post-op talocalc angle
Patient 1	11	25	51	40
Patient 2	13	23	60	45
Patient 3	9	23	50	40
Patient 4	10	25	55	43
Patient 5	11	25	56	42
Patient 6	14	24	55	43
Patient 7	15	24	53	44
Patient 8	13	23	54	45
Patient 9	15	20	53	40
Patient 10	10	20	52	40

Table 1: Pre and post-operative measurements of the calcaneal inclination and the lateral talo-calcaneal angles.

Pre-op vs. Post-op	P-Value
Inclination Angle	< .001
Talocalcaneal Angle	< .001

Table 1: A table showing statistically significant difference between the radiographic angles

Results

10 surgical patients reviewed. Mean age of the cohort was 53.6 (range 24-74). Of these patients, 6 (60%) were female and 4(40%) were male. Mean BMI was 27.8. There were two (20%) documented one-pack-a-day smoker in the cohort. Radiographic measurements showed a strong correlation with at final follow-up; There was also strong correlation noted between changes in the calcaneal inclination angle and the lateral talo-first metatarsal angles ($P < .05$ for all). Table 1. The average follow-up was 12 months (range 8-14).

Analysis and Discussion

Adult acquired flatfoot is generally characterized by the loss of the longitudinal arch, hindfoot valgus, and forefoot abduction. The double calcaneal osteotomy using two dual-function screws aimed at flatfoot deformity correction is a powerful procedure. This method may be useful as there is less soft tissue dissection and no need for the use of expensive plate fixation device.⁴.

References

- 1) Myerson, M. S. (2010). Correction of Flatfoot Deformity in the Adult. *Reconstructive Foot and Ankle Surgery*, 205-224. doi:10.1016/b978-1-4377-0923-0.10018-9
 - 2) Greisberg, J., Hansen, S. T., & Sangeorzan, B. (2003). Deformity and Degeneration in the Hindfoot and Midfoot Joints of the Adult Acquired Flatfoot. *Foot & Ankle International*, 24(7), 530-534. doi:10.1177/107110070302400704
 - 3) Medial displacement calcaneal osteotomy reduces the excess forces in the medial longitudinal arch of the flat foot. *Clinical Biomechanics*, 16(6), 535-539. doi:10.1016/s0268-0033(01)00011-0
 - 4) DiDomenico, L. A., Haro, A. A., & Cross, D. J. (2011). Double Calcaneal Osteotomy Using Single, Dual-function Screw Fixation Technique. *The Journal of Foot and Ankle Surgery*, 50(6), 773-775. doi:10.1053/j.jfas.2011.05.011
- Myerson, M. S., Corrigan, J., Thompson, F., & Schon, L. C. (1995).