

RATE OF UNION AFTER SEGMENTAL MIDSHAFT SHORTENING OSTEOTOMY OF THE LESSER METATARSALS

DeSandis, B., Ellis, S., Levitsky, M., Konin, G.,
O'Malley, Q., and O'Malley, M.

Department of Orthopaedic Surgery, Foot and Ankle Service
Hospital for Special Surgery
New York, NY

July 15-18, 2015

NO CONFLICT TO DISCLOSE

RATE OF UNION AFTER SEGMENTAL MIDSHAFT SHORTENING OSTEOTOMY OF THE LESSER METATARSALS

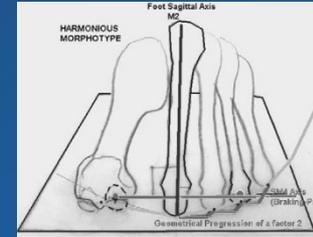
DeSandis, B., Ellis, S., Levitsky, M., Konin, G.,
O'Malley, Q., and O'Malley, M.

Disclosures are in the final AOFAS mobile App
We have no potential conflicts with this presentation

Background

The goal of all osteotomies is shorten or elevate the metatarsals in order to maintain the metatarsal cascade described by Maestro et al. (2003)

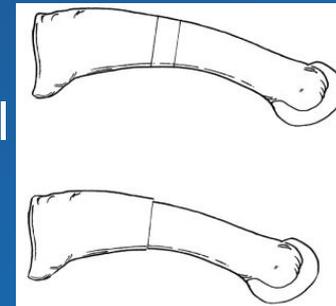
- Many techniques have been developed and literature reports excellent rates of union despite using various shortening techniques (i.e. step-cut, v-shaped, oblique, Weill, chevron, segmental midshaft)



Maestro et al. 2003

Segmental midshaft shortening osteotomy

- Allows for precise shortening and elevation of the metatarsal
- Performed through an area of relatively low blood supply, resulting in the potential to develop delayed unions and nonunions (Petersen et al. 2002)
- The only report which addresses healing of these osteotomies reported a 99.2% union rate (Galluch et al., 2007) without reporting time to healing or providing a definition of union/nonunion



Pearce and Calder 2011

Study Aims

- It has been our experience that segmental midshaft shortening osteotomies of the lesser metatarsals heal slowly and have potential to develop nonunion
- **Purpose:** assess union rates and report the time required for segmental midshaft osteotomies to achieve radiographic union
- **Hypothesis:** due to the location of the osteotomy, the time to healing and rate of nonunion will be higher than other metatarsal osteotomies

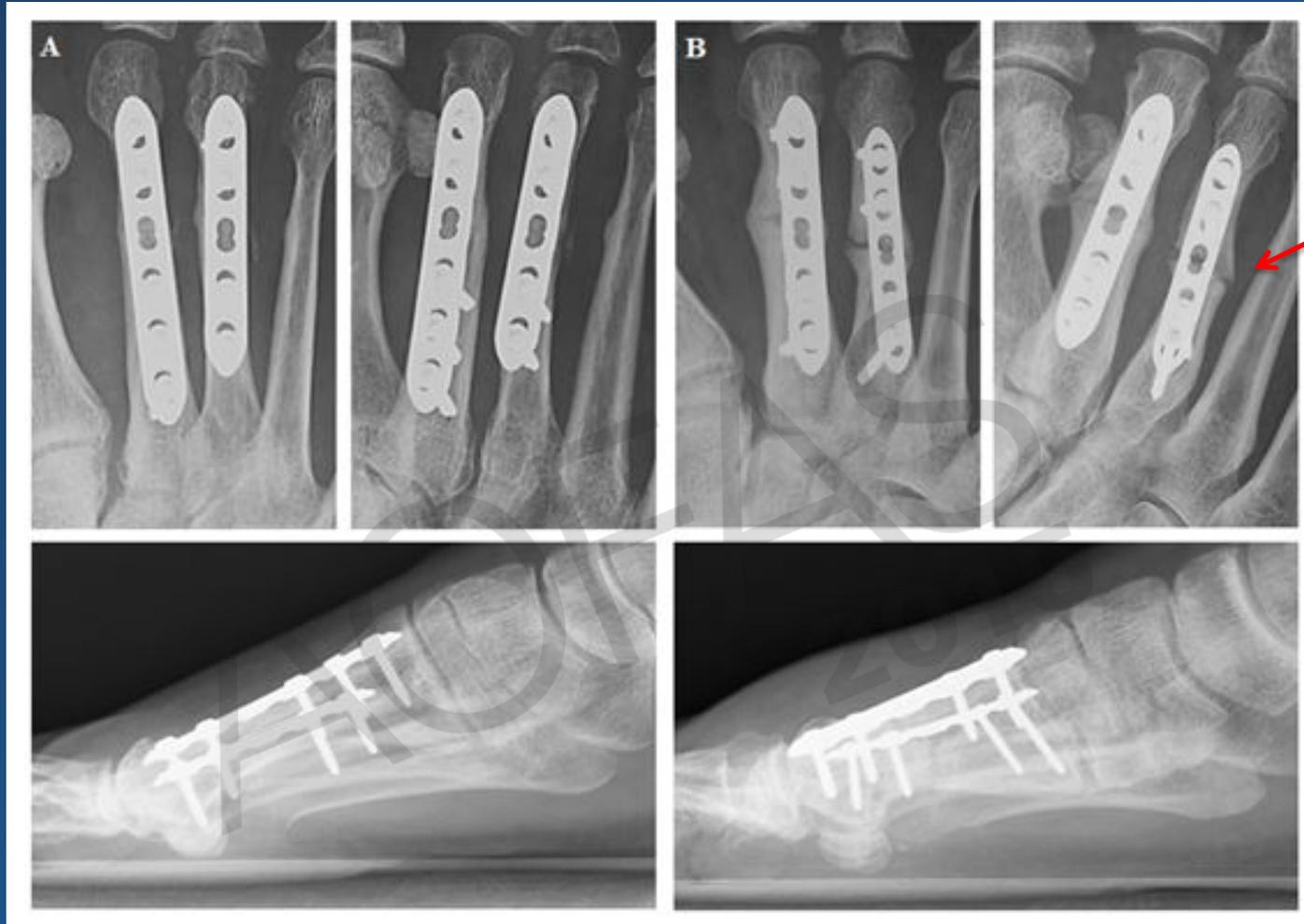
Study Design

- **58 patients representing 91 osteotomies included (average age 58 years):**
 - > 18 years old
 - Underwent midshaft segmental shortening osteotomy with a 2.4 or 2.0 mm plate and four 2.4 mm screws
 - Minimum follow-up of 12 months
 - Routine radiographs taken at 2 weeks, 6 weeks, 10 weeks, 3 months, and 6 months postoperatively (subsequent radiographs taken at additional followup visits if not united at 6 months)

Study Design

- **Retrospective radiographic review**
 - Radiographs reviewed by a blinded radiologist trained in musculoskeletal biology to determine when union was achieved
- **No widely accepted radiographic criteria for metatarsal osteotomy healing**
 - We utilized parameters reported and accepted for tibial shaft fractures which use cortical continuity as the best indicator of union (Bhandari et al. 2002, Panjabi et al. 1985)
- **Our definitions:**
 - **Union** - the bridging of two or more cortices looking at all three weightbearing radiographic views: anteroposterior (AP), lateral, and oblique.
 - **Delayed union** - osteotomies not healed at 3 months postop
 - **Nonunion** - osteotomies not healed at 6 months postop with less than 2 cortices being bridged, broken hardware, and/or angulation or displacement at the osteotomy site

Study Design



cortices not bridged

Not united = less than two cortices being bridged, broken hardware, and/or angulation or displacement at the osteotomy site in all three weightbearing radiographic views: anteroposterior (AP), lateral, and oblique

(A) Osteotomies united at 6 months and considered unions

(B) Osteotomies not united at 6 months and considered nonunions

Results

- 27 of 91 osteotomies healed by 3 months = unions (29.7%)
- 69 of 91 osteotomies not healed by 3 months but healed by 6 months = delayed unions (75.8%)
- 22 osteotomies not healed at 6 months = nonunions (24.2%)
 - 7 of 22 nonunions healed in an additional 2 months (8 months postop) for an overall healing percentage of 83.5% (76/91)
 - By 10 months, 6 more nonunions healed for overall healing percentage of 90.1% (82/91)
 - By 12.9 months, 3 more nonunions healed for a final union rate of 93.4% (85/91)
 - 6 osteotomies were still considered nonunions (6.60%) and were therefore considered nonunions at final followup

Discussion

- **Our nonunion rate (24.2%) is significantly higher than the rate observed by Galluch et al. (0.8%)**
 - However, our use of the definition for tibia and fracture nonunion may not be transferrable to the lesser metatarsal osteotomy
- **Based on our data, delayed union for segmental midshaft metatarsal shortening osteotomies should be defined as failure to heal by 6 months and nonunion by 12 months (instead of 3 months and 6 months, respectively).**
 - If these criteria are used, then our data is more in line with that of Galluch et al.

Conclusions

- Segmental midshaft shortening osteotomies of the lesser metatarsals require a prolonged amount of time to achieve bony healing and have a higher tendency to develop delayed and nonunions than previously reported.
- However, the overwhelming majority of these osteotomies will eventually heal if given enough time without a return trip to the operating room.
- This information can guide the practicing physician in deciding on whether to return the patient to the operating room for a revision procedure.

Acknowledgements

- The authors thank Jayme Burket Koltsov, Ph. D and the Healthcare Research Institute Biostatistics Core at the Hospital for Special Surgery for their statistical assistance.

AOFEAS
2015

References

- Bhandari M, Guyatt G, Swiontkowski M, Tornetta III P, Sprague S, Schemitsch E. A lack of consensus in the assessment of fracture healing among orthopaedic surgeons. *J Orthop Trauma*. 2002;16(8):562-66.
- Giannestras NJ. Shortening of the metatarsal shaft in the treatment of plantar keratosis. *J Bone Joint Surg*. 1958;40-A:61-71.
- Maestro M, Besse JL, Ragusa M, Berthonnaud E. Forefoot morphotype study and planning method for forefoot osteotomy. *Foot Ankle Clin*. 2003;8(4):695-710.
- Panjabi MM, Walter SD, Karuda M, et al. Correlations in radiographic analysis of healing fractures with strength: a statistical analysis of experimental osteotomies. *J orthop Res* 1985;3:212-218.
- Pearce CJ, Calder JD. Metatarsalgia: Proximal Metatarsal Osteotomies. *Foot Ankle Clin N Am*. 2011;16(4):597-608.
- Petersen WJ, Lankes JM, Paulsen F, Hassenpflug J. The arterial supply of the lesser metatarsal heads: a vascular injection study in human cadavers. *Foot Ankle Int*. 2002;23(6):491-95.