

Outcomes of First Metatarsophalangeal Joint Fusion in Patients with Greater than Fifteen Percent Intermetatarsal Angle: Is Lag Screw Essential?

Zachariah Pinter, B.S.², Parke Hudson, B.S.², Ibukunoluwa Araoye, B.S.², Brent Cone, B.S.², Cesar de Cesar Netto, M.D.¹, Bahman Sahranavard, M.D.¹, Ashish Shah, M.D.¹

¹University of Alabama at Birmingham Department of Surgery, Division of Orthopedic Surgery;

²University of Alabama School of Medicine

Financial Disclosures

- No disclosures

AOFEAS
2017

Introduction

- Arthrodesis of the first metatarsophalangeal joint (MTP) joint is a widely established procedure for treatment of hallux valgus (HV)
 - HV is common in patients with degenerative arthritis^{1,2}, inflammatory arthritis³, and other systemic pathologies⁴.
- HV has been associated with higher nonunion rates (14.3%) than other pathologies for which MTP-1 arthrodesis is performed, such as hallux rigidus⁵.
 - For this reason, it has been suggested that HV patients may need a stronger construct when undergoing MTP-1 fusion.

Introduction

- Patients with hallux valgus also suffer from a widened intermetatarsal angle between digits 1 and 2 (IMA 1-2).
- Several studies have shown that MTP-1 fusion alone is adequate to address the metatarsus primus varus deformity ⁶⁻⁹, while other studies have indicated that an additional proximal correction may be required after initial MTP-1 fusion to obtain sufficient IMA 1-2 correction ^{10,11}.
- Such ambiguity in the literature makes it unclear whether MTP-1 fusion alone is enough to correct IMA 1-2 in patients with severe hallux valgus deformity.

Purpose

- The primary aim of the present study was to compare the rate of union in MTP-1 fusion for treatment of severe HV deformity by two different modalities:
 - low profile dorsal plate only
 - low profile dorsal plate with additional compression or “lag” screw fixation, which is considered a stronger construct.
- Secondly, we investigated whether MTP-1 fusion in patients with severe HV is sufficient to correct the widened IMA between metatarsals 1 and 2.
- **Hypothesis:** Union rate in MTP-1 fusion for severe HV will be superior with use of lag screw in addition to dorsal plate. However, IMA 1-2 will not be sufficiently corrected by MTP-1 fusion alone in severe HV patients.

Methods

- Retrospective chart review of 40 feet (36 patients) all with severe hallux valgus deformity was performed.
- All cases were performed using a dorsal plate with or without compression screws across the joint.
- One senior foot and ankle surgeon performed all surgeries.
- Weightbearing anteroposterior and lateral radiographs were obtained.
- The main outcomes assessed were the preoperative and postoperative HVA, postoperative union rate, and the preoperative and postoperative IMA 1-2.

Radiographs



Preoperative:

- HVA: 53°
- IMA: 21°



Postoperative: dorsal plate; no lag screws

- HVA: 8°
- IMA: 15°

Results

- 40 feet (36 patients) identified

Average Age	%Male	Degenerative Arthritis	Rheumatoid Arthritis	No Arthritis	Previous Surgery for HV
61	33.3%	29	2	7	2

- 13 of the feet underwent MTP-1 fusion with a low profile dorsal plate and lag screw fixation.
- 27 feet underwent MTP-1 fusion with only a low profile dorsal plate.
- Mean follow up time was 9 months.

Results

- Of the 13 feet receiving dorsal plating and screw, 84.6% (11/13) achieved union. Of the 27 feet that received only dorsal plating, 81.5% (22/27) achieved union.
 - This difference in union rate did not achieve the level of statistical significance ($p > 0.05$).
- Overall mean preoperative hallux valgus angle (HVA) was 41.4 and postoperative HVA was 18.2 degrees (average correction of 23.2 degrees) representing adequate correction.
- IMA 1-2 improved from a mean of 17.8 degrees preoperatively to 13.1 degrees postoperatively (average correction of 4.7 degrees), representing inadequate correction.

Discussion

- The overall rate of union following MTP-1 fusion found in the present study (82.5%) is comparable to reported values⁵.
- Addition of a lag screw to the low profile dorsal plate produces similar results with regards to radiographic outcomes of time to union and HVA correction. Thus, either modality of osteosynthesis may be effective in MTP-1 arthrodesis for severe hallux valgus.
- The present study shows that MTP-1 arthrodesis alone without further proximal correction will produce acceptable correction of the HVA, but inadequate correction of the IMA 1-2 in patients with severe primus metatarsus varus (IMA > 15). This is a novel finding in the literature.
 - The mean IMA postoperative was still 13.1 degrees, and the mean IMA correction was only 4.7 degrees, both of which are inferior to reported numbers after MTP-1 arthrodesis with additional proximal correction^{11,12}.

Conclusion

- No significant difference was found in union rates when low profile dorsal plate alone was compared to low profile dorsal plate with lag screw.
- Additionally, isolated MTP-1 fusion may be inadequate to correct a severely widened IMA 1-2 in patients with severe hallux valgus deformity.

References

- [1]. Coughlin MJ, Shurnas PS. Hallux rigidus. Grading and long-term results of operative treatment. *J Bone Joint Surg Am.* 2003;85-A(11):2072-2088.
- [2]. Fitzgerald JA. A review of long-term results of arthrodesis of the first metatarso-phalangeal joint. *J Bone Joint Surg Br.* 1969;51(3):488-493.
- [3]. Coughlin MJ. Rheumatoid forefoot reconstruction. A long-term follow-up study. *J Bone Joint Surg Am.* 2000;82(3):322-341.
- [4]. Bishay SNG, El-Sherbini MH, Lotfy AA, Abdel-Rahman HM, Iskandar HN, El-Sayed MM. Great toe metatarsophalangeal arthrodesis for hallux valgus deformity in ambulatory adolescents with spastic cerebral palsy. *J Child Orthop.* 2009;3(1):47-52.
- [5]. Korim MT, Allen PE. Effect of pathology on union of first metatarsophalangeal joint arthrodesis. *Foot ankle Int.* 2015;36(1):51-54.
- [6]. Costa MT, Neto DLL, Kojima FH, Ferreira RC. Evaluation Of The Intermetatarsal Angle After The Arthrodesis Of The First Metatarsophalangeal Joint For Treatment Of The Hallux Valgus. *Rev Bras Ortop.* 2012;47(3):363-367.
- [7]. Coughlin MJ, Grebing BR, Jones CP. Arthrodesis of the first metatarsophalangeal joint for idiopathic hallux valgus: intermediate results. *Foot ankle Int.* 2005;26(10):783-792.
- [8]. Cronin JJ, Limbers JP, Kutty S, Stephens MM. Intermetatarsal angle after first metatarsophalangeal joint arthrodesis for hallux valgus. *Foot ankle Int.* 2006;27(2):104-109.
- [9]. Pydah SK V, Toh EM, Sirikonda SP, Walker CR. Intermetatarsal angular change following fusion of the first metatarsophalangeal joint. *Foot ankle Int.* 2009;30(5):415-418. doi:10.3113/FAI.2009.0415.
- [10]. McKeever DC. Arthrodesis of the first metatarsophalangeal joint for hallux valgus, hallux rigidus, and metatarsus primus varus. *J Bone Joint Surg Am.* 1952;34-A(1):129-134.
- [11]. Rippstein PF, Park Y-U, Naal FD. Combination of first metatarsophalangeal joint arthrodesis and proximal correction for severe hallux valgus deformity. *Foot ankle Int.* 2012;33(5):400-405. doi:10.3113/FAI.2012.0400.
- [12]. Goucher NR, Coughlin MJ. Hallux metatarsophalangeal joint arthrodesis using dome-shaped reamers and dorsal plate fixation: a prospective study. *Foot ankle Int.* 2006;27(11):869-876.