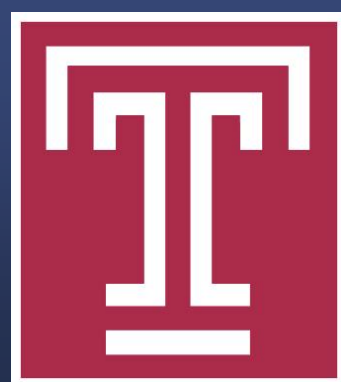


A Systematic Review of First Metatarsal-Phalangeal Joint Arthrodesis Union with Locking and Non-Locking Plate Technology

Spruha Magodia, DPM^a, Matthew J. Dougherty, DPM^a, Laura E. Sansosti, DPM AACFAS^b, and Andrew J. Meyr, DPM FACFAS^c



^aResident, Temple University Hospital Podiatric Surgical Residency Program, Philadelphia, Pennsylvania

^bClinical Assistant Professor, Departments of Surgery and Biomechanics, Temple University School of Podiatric Medicine, Philadelphia, Pennsylvania

^cClinical Professor and Residency Program Director, Department of Podiatric Surgery, Temple University School of Podiatric Medicine and Temple University Hospital, Philadelphia, Pennsylvania (AJMeyr@gmail.com)*

*Please don't hesitate to contact AJM with any questions/concerns. He's happy to provide you with a .pdf of this poster if you email him.



Statement of Purpose and Literature Review

Arthrodesis of the first metatarsal-phalangeal joint is considered a durable treatment option for patients with end-stage hallux rigidus, severe hallux valgus, and other unstable deformities of the medial forefoot. A multiplicity of fixation techniques exist for this procedure including the use of splintage, interosseous compression and dorsal plating. Similarly, a variety of plating options are available when considering locking vs. non-locking technology. However, with respect to Wolff's Law, one might question if locking technology might provide too rigid or stiff of a construct for this functional anatomic location as a primary fixation option [1]. **Therefore the aim of the present study was to investigate radiographic union rates for the first metatarsal-phalangeal joint arthrodesis with the use locking and non-locking plates via a systematic review.**

Methodology

A systematic review of electronic databases (Pubmed and Ovid through Medline®, Embase, and Web of Science) was performed with an additional manual search of the references of any article we identified as meeting selection criteria. This criteria included retrospective case series, retrospective clinical cohort analyses and prospective clinical trials with n ≥ 15 feet, a minimum radiographic follow-up of ≥ 6 months, a clear description of the fixation construct utilizing a dorsal plate, and a reported radiographic incidence rate of non-union.

The search was performed during the Spring of 2019 with no restriction on publication date and with the word query: (("Hallux Rigidus"[Mesh] OR "Hallux Valgus"[Mesh] OR "Hallux"[Mesh] OR hallux[tiab]) AND ("Arthrodesis"[Mesh] OR Arthrodesis[tiab]) AND ("Metatarsophalangeal Joint"[Mesh] OR metatarsal-phalangeal[tiab] OR metatarsophalangeal[tiab]) AND ("Bone Plates"[Mesh] OR plate*[tiab] OR plating*[tiab]) AND (lock*[tiab] OR non-lock*[tiab] OR nonlock*[tiab] OR "Bone Screws"[Mesh]) AND (union*[tiab] OR nonunion*[tiab] OR non-union*[tiab] NOT (lapidus[tiab] OR lesser metatarsophalangeal[tiab] OR tarsometatarsal[tiab])). The abstracts returned from these searches were initially individually reviewed by a single author (LS) for potential relevance. Each potentially relevant report was then reviewed by all study authors for our specific selection criteria and data extraction. Complete agreement was necessary for final inclusion, with the corresponding author (AJM) considered the final arbiter.

Results

Twelve studies met selection criteria and were included in the analysis. This included 980 procedures that utilized a non-locking plate construct with an overall reported radiographic union rate of **94.0%**, and 210 procedures that utilized a locking plate construct with an overall reported radiographic union rate of **87.6%**. This pooled difference was found to be statistically significant with a two-tailed chi-square test (**p=0.0019**).

Considerable heterogeneity of the included studies was observed with a Cochran's Q of **9.612** and an I² of **89.6%**. A table of included studies is presented below.

Study	Number of arthrodesis utilizing a non-locking plate	Number of radiographic unions reported with a non-locking plate	Number of arthrodesis utilizing a locking plate	Number of radiographic unions reported with a locking plate
Bennett and Sabetta 2009	233	230		
Mayer et al 2014	102	94	26	24
Kumar et al 2010	46	45		
Cone et al 2018			99	85
Ellington et al 2010	107	94		
Marudanayagam and Appan 2014	54	53		
Pinter et al 2017	63	53	36	32
Dalat et al 2015	208	202		
Aslam and Ribbans 2005			33	32
Bennett et al 2005	107	94		
Chraim et al 2016	60	56		
Gross et al 2015			16	11
Pooled Data	980	921 (94.0%)	210	184 (87.6%)

Discussion

As with any scientific investigation, critical readers are encouraged to review the study design and specific results and reach their own independent conclusions, while the following represents our conclusions based on the specific results. As scientists, we also never consider data to be definitive, but do think that these results are worthy of some attention and future investigation.

-These results indicate a statistically significant trend toward higher radiographic union rates following first metatarsal-phalangeal joint arthrodesis with the use of non-locking plates in comparison to locking plates when a dorsal plate is utilized as part of the fixation construct.

-With that said however, the authors believe that caution is necessary when interpreting these specific results (or the results of any systematic review for that matter) given the high degree of observed heterogeneity (I² of 89.6%). To be frank, this indicates a relative weakness in our literature reporting the results of a commonly performed procedure. Within the confines of our specific selection criteria (which were relatively broad and conservative), we did not feel comfortable further attempting to extrapolate other potential variables including surgical indication, functional outcomes, rates of symptomatic non-union, complications rates, and/or reoperation rates for examples.

-It is our hope that these results advance the body of knowledge with respect to the first metatarsal-phalangeal arthrodesis procedure, and encourage the critical analysis of systematic reviews within the foot and ankle surgical literature.

References

- [1] Frost HM. From Wolff's law to the Utah paradigm: insights about bone physiology and its clinical applications. *Anat Rec.* 2001; 262(4): 398-419.
 [2] See accompanying table.