

# The Effect of Arthrodesis of the First-Metatarsophalangeal Joint on the Stability of the First-Tarsometatarsal Joint

Ankit Hirpara, BA<sup>1</sup>; M Zhu, DAOM, MPH<sup>1</sup>; D Huo, PhD<sup>1</sup>; M Myerson<sup>1</sup>, MD; Shuyuan Li<sup>1</sup>, MD PhD

1. Department of Orthopedics, University of Colorado Anschutz Medical Campus, Aurora, CO

## BACKGROUND

- The first-metatarsophalangeal (MTP) joint plays a very important role in maintaining mobility of the first ray of the foot.
- Arthrodesis of the first-MTP joint is used to treat arthritis, hallux valgus or varus, and additional conditions of the hallux in which the joint cannot be preserved.
- Intuitively, fusion of a joint may increase its load and potentially cause instability of the adjacent joints.
- However, recent studies have shown that first-MTP joint fusion in patients with hallux valgus can actually improve the stability of the adjacent first-tarsometatarsal (TMT) joint.

## OBJECTIVE

- The goal of this study was to retrospectively investigate the potential impact of first-MTP arthrodesis on the alignment of the first-TMT joint in patients with and without hallux valgus.

## METHODS

- This was an IRB-approved, pilot retrospective study that included one group of patients with hallux valgus (Group 1) (Figure 1) and one group without hallux valgus (Group 2) (Figure 2).
- All patients underwent isolated first-MTP arthrodesis.
- Pre-operative and six-month post-operative weightbearing anteroposterior radiographs were used to evaluate the alignment of the hallux and the first-TMT joint.
- The parameters included the hallux valgus angle (HVA), 1-2 intermetatarsal angle (IMA), and medial cuneiform-first metatarsal angle (MC1A) (Figure 3).
- A paired t-test was used to study the potential impact of first-MTP arthrodesis on HVA, IMA, and MC1A in all patients, and an independent t-test was used to compare the difference of the surgical effect on the three parameters between the two groups.  $P < 0.05$  was considered statistically significant.

Corresponding author:

Ankit Hirpara, BA [ankit.hirpara@cuanschutz.edu](mailto:ankit.hirpara@cuanschutz.edu)

## RESULTS



Figure 1: Anteroposterior weightbearing radiographs of a left foot with failed prior hallux valgus surgery before (left) and after (right) first-MTP joint arthrodesis.



Figure 2: Anteroposterior weightbearing radiographs of a right foot with end-stage arthritis in the first-MTP joint (left) treated with a first-MTP joint arthrodesis (right).

Group	Sample Size	Sex		Age at Operation				BMI			
		Male	Female	Mean	SD	25% Q1	75% Q3	Mean	SD	25% Q1	75% Q3
1	5	4	1	63.11	6.85	59	64.78	24.12	2.61	24.4	25.2
2	18	0	18	62.7	12.24	53.22	70.16	27.7	4.82	23.5	29.2

Table 1: Demographics of Group 1 and Group 2 – including sex, age, and body mass index (BMI)

Group	HVA		IMA		MC1A	
	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
1	9.73*	8.81*	7.00	6.65	22.23*	17.70*
2	29.12	12.28	15.05	12.94	24.86*	20.06*

Table 2: Pre-operative (pre-op) and post-operative (post-op) radiographic measurements, including hallux valgus angle (HVA), 1-2 intermetatarsal angle (IMA), and medial cuneiform-first metatarsal angle (MC1A). \*Statistically significant difference between the pre- and post-operative measurements within the same group.

- There were 5 patients in Group 1 (age 63.11 +/- 6.85 years) and 18 patients in Group 2 (age 62.7 +/- 12.24 years) (Table 1).
- The pre-operative and post-operative HVA, IMA, and MC1A measurements are included in Table 2.
- HVA was significantly reduced by 16.84 +/- 11.80 degrees in Group 2.
- MC1A was significantly reduced by 4.53 +/- 2.03 degrees in Group 1 and 4.80 +/- 5.44 degrees in Group 2.
- Between the two groups, there was significant difference in the surgical impact on HVA but no significant difference in the surgical impact on IMA and MC1A.

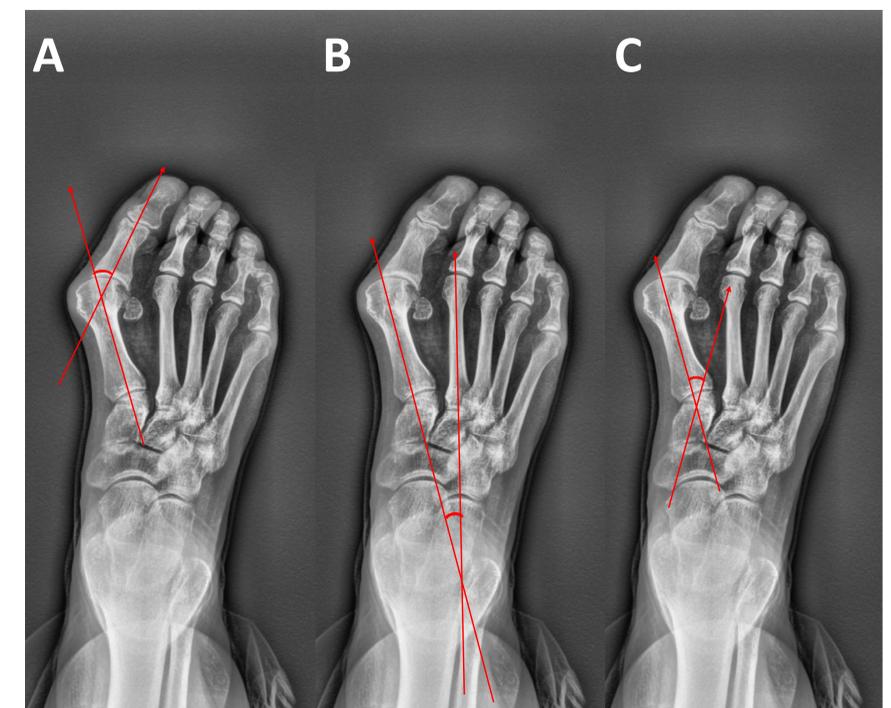


Figure 3: Illustration of the measurements of HVA (hallux valgus angle) (A), IMA (1-2 intermetatarsal angle) (B), MC1A (medial cuneiform – first metatarsal angle) (C).

## CONCLUSIONS

- This pilot study showed that first-MTP arthrodesis may improve the alignment of the first-TMT joint in patients with hallux valgus and in patients without hallux valgus, as indicated by the reduction of MC1A in both groups.
- However, further research with a larger and equalized sample sizes and a longer follow-up time is needed.

## REFERENCES

Traynor C, Jastifer J. First-Tarsometatarsal Joint Alignment After First-Metatarsophalangeal Joint Arthrodesis for Hallux Valgus. *Foot & Ankle Orthopaedics*. 2021;6(2).