A Meta Analysis of the Clinical Outcomes of Different Hallux Valgus Surgical Correction Techniques

Michael Uematsu M2¹, Thomas Cho M2¹, Jiayong Liu, MD¹ ¹University of Toledo College of Medicine, Toledo, OH Michael.Uematsu@rockets.utoledo.edu

INTRODUCTION: There are many hallux valgus surgical correction techniques, the Chevron and Scarf osteotomies being some of the most common. However, in recent years, a new Minimally Invasive (MIS) chevron osteotomy has increased in use. Despite its increase in popularity, evidence as to whether MIS Chevron is comparable to other bunionectomy techniques has not been thoroughly investigated. This meta-analysis aims to see how MIS Chevron compares to two popular correction surgeries, the Scarf and Open Chevron osteotomy.

METHODS: A meta-analysis was performed after a systematic PubMed and Embase literature search. A reviewer extracted surgical outcomes data, which were analyzed with Cochrane's Review Manager. The standardized mean difference (SMD) and a 95% confidence interval (CI) were recorded.

RESULTS: After conducting a systematic review, a total of 11 comparison studies concerning MIS chevron, scarf osteotomy and open chevron were included. For the "Open Chevron vs MIS chevron" there were no significant differences in hallux valgus angle (HVA) and distal metatarsal articular angle (DMAA), P=0.89 and P=0.09 respectively. There was a significant difference in American Orthopedic Foot and Ankle Society (AOFAS) score (P<0.00001) favoring MIS chevron. There was also a significant difference in visual analog score (VAS) favoring MIS chevron as well (P=0.05). It was found that there was a significant difference in intermetatarsal angle (IMA) favoring open chevron (P=0.01). For the "Open chevron vs scarf" group there were no significant differences noted in AOFAS (P=0.53), HVA (P=0.10), IMA (P=0.69), and DMAA (P=0.38). VAS score was not recorded in this group due to lack of data. For the "MIS chevron vs scarf" group there was a significant difference in AOFAS (P<0.00001) and HVA (P<0.00001) both favoring MIS chevron. There was no significant difference in VAS (P=0.42) and IMA (P=0.66) between MIS chevron and scarf. DMAA was not recorded for this group due to lack of data

DISCUSSION: There are many benefits to performing MIS chevron surgery over other well-established bunionectomy techniques that have been described. These benefits include shorter operating times, higher patient satisfaction, faster recovery, and improved cosmetic results. This meta-analysis showed that there are benefits in recovery and radiographic outcomes. Few studies have compared three bunionectomy techniques to other meta-analyses in the field. This meta-analysis used randomized clinical trials and retrospective cohort studies that compared at least 2 of the 3 studied techniques. Findings from this study showed that MIS chevron produced comparable radiographic measurements and statistically significant improvements in clinical outcome scores.

SIGNIFICANCE/CLINICAL RELEVANCE: Hallux valgus is a prevalent deformity across populations that can lead to alterations in lifestyle, pain, and cosmetic dissatisfaction. Examining existing surgical correction techniques along with new ones that show promise in areas of patient satisfaction and recovery time could drastically improve patient outcomes.

	MIS chevron vs Open Chevron	Open Chevron vs Scarf	MIS Chevron vs Scarf
AOFAS	P<0.00001 favoring MIS	P=0.53, no difference	P<0.00001, favoring MIS Chevron
VAS	P=0.05 Favoring MIS	Not recorded	P=0.42, no difference
HVA	P=0.89, no difference	P=0.10, no difference	P<0.00001, favoring MIS
IMA	P=0.01, favoring open chevron	P=0.69, no difference	P=0.66, no difference
DMAA	P=0.09, no difference	P=0.38, no difference	Not recorded

Figure 1. A chart summarizing the findings from the data analysis. Minimally Invasive Chevron Osteotomy Scarf Osteotomy Mean difference s

Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI	ABCDEFG
Lai, et al. 2017	85.6	14.9	29	82.7	14.5	58	5.4%	2.90 [-3.68 , 9.48]		
Lee, et al. 2017	88.7	2.1	25	83	3.5	25	91.9%	5.70 [4.10 , 7.30]		••••
Tay, et al. 2022	79.8	19.9	30	79.3	17.1	30	2.7%	0.50 [-8.89 , 9.89]		
Total (95% CI)			84			113	100.0%	5.41 [3.88 , 6.94]	•	
Heterogeneity: Chi ² = 1.	.74, df = 2 (P = 0.	.42); I ² = 0%								
Test for overall effect: Z	= 6.91 (P < 0.00	001)							-20 -10 0 10 20	
Test for subgroup differe	ences: Not applic	able							Favours [Scarf] Favours [MIS	Chevron]
Risk of bias legend										

Mean difference

Risk of Bias

(A) Random sequence generation (selection bias)

(B) Allocation concealment (selection bias)

(C) Blinding of participants and personnel (performance bias)

(D) Blinding of outcome assessment (detection bias)

(E) Incomplete outcome data (attrition bias)

(F) Selective reporting (reporting bias)

(G) Other bias

Figure 2. A forest plot comparing AOFAS scores of MIS chevron vs Scarf osteotomy.