

Outcomes of Scarf Osteotomy for Hallux Valgus Deformity

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Abstract

Background: Hallux valgus is one of the most common chronic foot conditions in orthopedic practice, affecting 23% of the population. Despite more than 130 different treatment techniques described in the literature for the correction of this deformity, there is no single procedure that has consistently shown superiority in comparison to others. The aim of this study was to prospectively evaluate the functional, clinical and radiological outcomes of Scarf osteotomy for hallux valgus deformity. **Methods:** This study was conducted Benha University Hospitals on 20 patients who were candidate for operative treatment of hallux valgus deformity. **Results:** The mean age of patients was 48.54 years. and 4 patients (20 %) were males and 7 patients (80 %) were female, The mean total AOFAS score was (47.5 ± 16.1) preoperative as pain recorded mean score of 16.2, total function 29.4 and mean Alignment scored 1.9 point. After a proximally 3 months of surgery Dorso-plantar weight bearing radiographs were done again. The mean Intermetatarsal angle (IMA) was 12.2°, Hallux valgus angle (HVA) was 14.9°, Proximal phalangeal articular angle was 8.8° and Distal metatarsal articular angle (DMAA) was 12.1°, The mean total AOFAS score was (88.9 ± 19.3) postoperative as pain recorded mean score of 34.6, total function 40.4 and mean Alignment raised to 13.9 point. **Conclusion:** Scarf osteotomy for moderate to severe degrees of hallux valgus had very good results over 3 months follow-up with a low complication rate.

Keywords: Scarf Osteotomy, Hallux, Valgus, Deformity.

1. Introduction

Hallux Valgus is a complex gradual deformity that affects the forefoot. The main pathological anatomy is the first ray including a varus or media deviation of the first metatarsal and a deformity in pronation on the longitudinal axis. The MTP joint's valgus deformity is classified as congruent or incongruent according to the degree of subluxation of the phalanx off the metatarsal head. The complex deformity may include other conditions, such as second toe overriding, metatarsalgia, hammer and claw lateral toe deformities, and fifth metatarsal bionette deformity. [1]

Hallux valgus is a common condition. Over the past 100 years, surgical correction has remained a challenge with at least 130 procedures described. [2]

Surgical treatment of this deformity involves correction of the alignment of metatarsal osteotomy and the release of soft tissue. Distal metatarsal osteotomies are mainly recommended for mild to moderate hallux valgus malformations. More proximal first metatarsal osteotomies were performed for more severe deformities [3].

Distal osteotomies of the first metatarsal joint like Chevron, Austin, Wilson or Mitchell are used for mild and mild deformities. For more severe deformations, proximal metatarsal osteotomy is recommended because it allows a greater degree of correction. This can be at the cost of stability and osseous cure. Because of its inherent stability, minimal abbreviation and ease of internal fixation, the Scarf osteotomy has gained popularity. [4] [4]

This study aimed at assessing the functional, clinical and radiological results of the Scarf osteotomy for hallux valgus in the future. deformity.

2. Patients and methods

This study was conducted including twenty feet of patients who were candidate for operative treatment of hallux valgus deformity at Benha University and Benha Insurance hospitals.

Inclusion criteria

- Patients with moderate and severe symptomatic hallux valgus deformity.
- Co-operative medically healthy patients.

Exclusion criteria

- Mild or asymptomatic hallux valgus deformity.
- Previous surgical correction of same deformity in the same foot.
- Old or malunited fractures in the 1st metatarsal.
- Patients who are medically un-fit for operations.
- Peripheral vascular disease

Clinical evaluation

Evaluation of symptoms

- presence of difficulty with shoe wear
- pain over prominence at MTP joint
- compression of digital nerve may cause symptoms

Physical exam

- Hallux rests in valgus and pronated due to deforming forces
- Examination of entire first ray for

1. 1st MTP ROM

2. 1st tarsometatarsal mobility

3. callous formation

4. sesamoid pain/arthritis

Evaluate associated deformities:

- pes planus
- lesser toe deformities

Preoperative evaluation

- Radiological evaluation by X ray:
- Dorso-plantar weight bearing radiographs to measure :

The Hallux Valgus Angle (HVA) is measured as the angle between the line from the center of the metatarsal base to the center of the first metatarsal head ⁽⁸⁷⁾ and the line connecting the midpoints of the proximal and distal articular surfaces of the proximal phalanx. The Intermetatarsal angle (IMA) is measured as the angle between the line of first metatarsal and the line bisecting the diaphyseal portions of the second metatarsal. ⁽⁸⁸⁾ Distal metatarsal articular (DMAA) between 1st MT long. axis and line through base of distal articular cap Hallux valgus interphalangeus (HVI) between long. axis of distal phalanx and proximal phalanx.

- Weight bearing lateral and oblique views.

Operative Intervention

- a- Spinal anesthesia.
- b- Supine position, under tourniquet.
- c- Scarf osteotomy

A Median incision has been carried out from a distal centre of the proximal phalanx to the base of the first metatarsal under tourniquet control. During the procedure, the plantar blood supply was taken care of. The capsule and periosteal structures were raised from the head and neck of the metatarsal. Divide the thin septum that connects the abductor muscle to the first metatarsal median border. The first medial metatarsal frontier and its medial plantar surface were thus clearly visible. Keep the dorsal synovial fold closely attached to the first metatarsal articular cartilage. The tissue in the periosteum around the first metatarsal arch is incised according to the proposed osteotomy and raised for a few millimetres plantarily and dorsally. After the osteotomy scarf has been cut, there are two components - a dorsal proximally based fragment and a plantar fragment that includes the plantar surface and the metatarsal head. The longitudinal cut is followed by two cross-sections, which make this a double chevron. Resection of median eminence is done. Proximal cut is 3 mm above the medial rim, 5 mm away from the base of the metatarsal articular surface. The distal end is 3 mm below the dorsal medial edge at the level of the nearest end of the dorsal articular cartilage. The cut is made from near to far. The lateral and plantarward cut is made so it reaches the lateral surface near the plantar border. This lowers the fragment of the plantar head and preserves the lateral surface, which is a strong strut. The osteotomy is performed in a complete manner and is usually between 40 and 50 mm long. Both transverse cuts are chevron, which are directed proximally to longitudinal cuts and 60 degrees. The next cut is done first, from the joint surface about 5 mm and from the plantar

surface 2-3 mm. During the transverse cutting process, the dorsal lateral blood supply is avoided. After cuts are made, the fragments are separated by a spatula. Depending on the correction needed, the fragments can be moved two thirds to three-quarters of the surface. The displacement is done by Barouk's popular "push and pull" technique. This is done by pushing the plantar fragment and the dorsal fragment. The lateral incline of the articular cartilage of the head can thus be corrected by rotating the head and plantar fragment (Distal Metatarsal Articular Angle). The osteotomy is fixed with AO screws - in one case we have used 2 mm screws, and in 2 cases 3.5 mm screws. The distal attachment takes place approximately 1 cm from the distal end of the dorsal fragment. The screw is 45 degrees diagonally, distally and seedlings. Please take care not to penetrate the plantar cortex or articular cartilage with the screw. The screw in the dorsal fragment was counter-sunk. In an oblique direction the proximal screw reaches the plantar cortex in the stronger part of the shaft. After osteotomy displacement, the bone excess is resected on the media distal part of the dorsal fragment and can be used as a bone graft if required.

Post-operative evaluation – Today, post-operative follow-up – Radiological evaluation of results based on standardised measures. The normal HVA value varies between 10° and 15°. Normal IMA is between 7° and 9°. Standard DMAA < 10° and HVI < 10°

- Clinical evaluation of American Orthopedics Foot & Ankle Score (AOFAS) results

- Return to business
- Evaluation of complications

Intraoperative and postoperative complications will be reported during the follow-up period. Including recurrence, infection, nonunion, residual deformity or neurovascular deformity.

Methods of statistics

The collected data will be presented as appropriate tables and as appropriate figures illustrated. Quantitative data will be summarised as +/- SD and as frequency and percentage qualitative data. Data analysis will be performed using the suitable SPSS software package. statistical tests.

3. Results

This study was conducted Benha University Hospitals and benha health insurance on 20 patients who were candidate for operative treatment of hallux valgus deformity, There mean age of patients was 48.54 years . and 4 patients (20 %) were males and 7 patients (80 %) were female Table (1)

Table (1) General characteristic.

Age (years)	Mean	48.54 y
	Range	44-61 y
Gender	Males n (%)	4 (20)
	Females n (%)	16 (80)
Side	Right	11
	left	9
Total		20

In our patient population, the main symptoms was Transfer metatarsalgia in 19 patients (95%), Bunion pain in 11 patients (55%), callous formation in 10 (50%) patients and Cosmesis in 17 patients (85%). One patient presented by lesser toe deformities and another one associated with midfoot and hindfoot conditions. Although mechanism of mechanical transmission through hind to Lisfranc joint seems to be different by the presence or absence of dorsal dislocation of the second MTP joint, Lisfranc looseness also must be considered when assessing hallux valgus including the surgery to avoid the progression or recurrence. Dorsal dislocation of the second metatarsophalangeal joint strongly influences the exacerbation of HV. Thus, it may be important to achieve adequate reduction of the second MTP joint dislocation and make a stable MTP joint to avoid recurrence of HV, table (2).

According to preoperative radiographic data, the mean Intermetatarsal angle (IMA) was 21.3°, Hallux valgus angle (HVA) was 42.1°, Proximal phalangeal articular angle was 15.9° and Distal metatarsal articular angle (DMAA) was 20.9°, table 3

The mean total AOFAS score was (47.5 ± 16.1) preoperative as pain recorded mean score of 16.2, total function 29.4 and mean Alignment scored 1.9 point, table (4).

After a proximally 3 months of surgery Dorso-plantar weight bearing radiographs were done again. The mean Intermetatarsal angle (IMA) was 12.2°, Hallux valgus angle (HVA) was 14.9°, Proximal phalangeal articular angle was 8.8° and Distal metatarsal articular angle (DMAA) was 12.1°, table (5).

Table (2) Symptoms and associated deformities

Symptoms	Transfer metatarsalgia n (%)	19 (95%)
	Bunion pain n (%)	11 (55%)
	callous formation n (%)	10 (50%)
	Cosmesis n (%)	17 (85%)
Associated deformities	lesser toe deformities n (%)	1 (5%)
	midfoot and hindfoot conditions n (%)	1 (5%)

Table (3) Preoperative radiographic data.

Preoperative Radiographic data	Mean
Intermetatarsal angle (IMA)	21.3°
Hallux valgus angle (HVA)	42.1°
Proximal phalangeal articular angle	15.9°
Distal metatarsal articular angle (DMAA)	20.9°

Table (4) Preoperative AOFAS score.

preoperative AOFAS score		Mean ± SD
Pain (40)		16.2 ± 10.7
	Activity (10)	6.7 ± 1.1
	Footwear (10)	5.9 ± 1.5
Function (45)	MTP joint movement (10)	7.4 ± 2.9
	IP joint movement (5)	4.7 ± 0.8
	MTP-IP stability (5)	4.3 ± 1.6
	Callus (5)	0.4 ± 1.1
Alignment (15)		1.9 ± 3.2
total pre operative AOFAS score (100)		47.5 ± 16.1

Table (5) Postoperative (6 m) radiographic data

Postoperative Radiographic data	Mean
Intermetatarsal angle (IMA)	12.2°
Hallux valgus angle (HVA)	14.9°
Proximal phalangeal articular angle	8.8°
Distal metatarsal articular angle (DMAA)	12.1°

The mean total AOFAS score was (88.9 ± 19.3) postoperative as pain recorded mean score of 34.6, total function 40.4 and mean Alignment raised to 13.9 point, table (6).

According to postoperative complications, one patients suffering from infection another one presented with nonunion and 2 patients with Residual deformity while one patient came with Hallux varus deformity and no patient showed Neurovascular insufficiency, table (7)

There was a statically significant difference after 6 months of operation according to Radiographic data (Intermetatarsal angle, Hallux valgus angle, Proximal phalangeal articular angle and Distal metatarsal articular angle), figure 1

There was a statically significant difference after 3 months of operation according to AOFAS score , fig. (3, 4).

Table (6) Postoperative (6 m) AOFAS score.

postoperative AOFAS score		Mean ± SD
Pain (40)		34.6 ±6.9
	Activity (10)	9.2 ±1.8
	Footwear (10)	8 ±1.4
Function (45)		8.4 ±2.1
	MTP joint movement (10)	4.9 ±0.7
	IP joint movement (5)	5 ±0
	MTP-IP stability (5)	4.9 ±0.8
	Callus (5)	13.9 ±2.2
Alignment (15)		88.9 ± 19.3
total Postoperative AOFAS score (100)		

Table (7) Post-operative complications.

	N	%
infection	1	5
Nonunion	1	5
Residual deformity	2	10
Hallux varus deformity	1	5
Neurovascular insufficiency	0	0

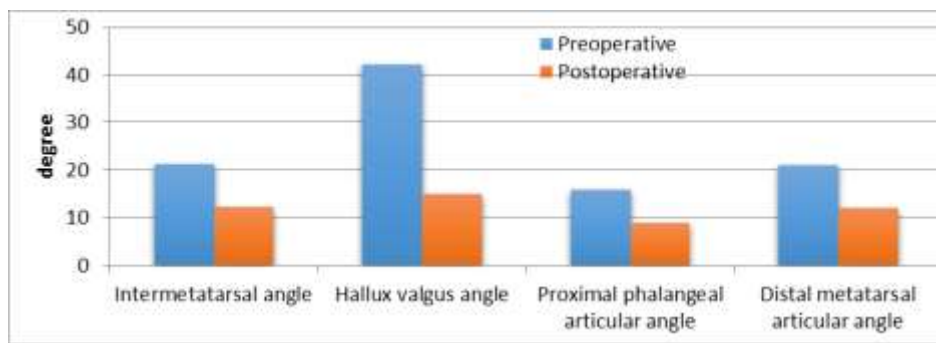


Fig. (1) Comparison between pre and post-operative radiological findings.

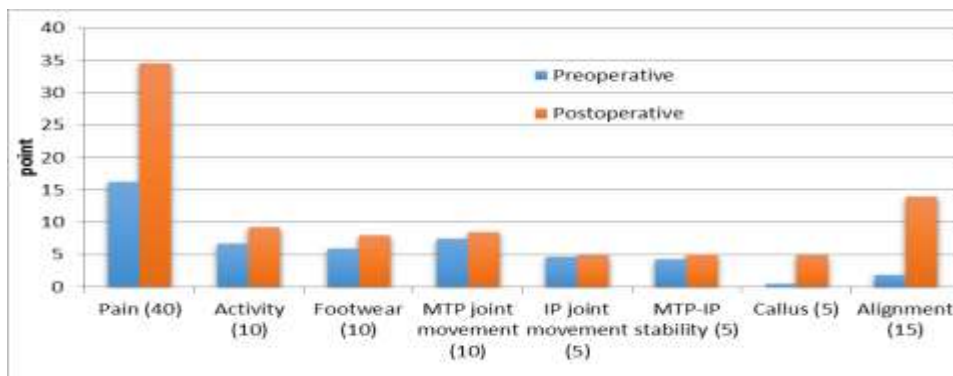


Fig. (2) Comparison between pre and post-operative AOFAS score.

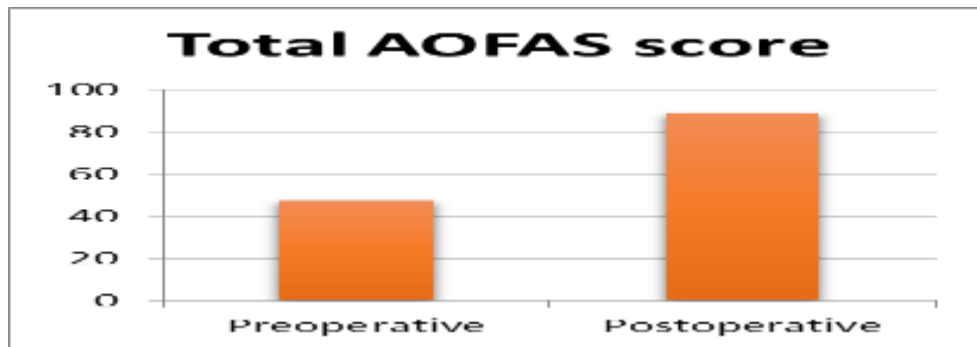


Fig. (3) Comparison between pre and post-operative total AOFAS score.

4. Discussion

This Benha University Hospitals and benha health insurance were conducted in 20 patients who were candidates for hallux valgus deformity surgical treatment. The mean age of our study patients was 48.54 years, with 4 patients (20%) having men and 7 patients (80%) being women.

This matches Law et al.[5] as the mean patients' age at surgery was 50.2 years (age range 19-82 years). Three were male patients and 64 were female patients.

Waly et al. [6] studied an average age of 47.6 years (range of 42-59 years) at the time of intervention. The more affected were the left (n=24 patients, 58.8% of the cases).

In contrast, Wang et al. [7] decided to study in adolescents and their average age was 28,6 years at the time of the operation (range, 20–35).

The principal symptoms for our population of patients were metatarsalgia transfer in 19 patients (95%), bunion pains in 11 patients (55%), callous formation in 10 patients (50%) and cosmesis in 17 patients (85 percent). One has lesser toe deformities and another with midfoot and hindfoot conditions.

In Waly et al.,[6] pain due to bunion and metatarsalgia transfer was the main symptom in 85% of the cases. Most patients with metatarsalgia preoperatively in Fuhrmann et al. (99) (79 feet, 44.4 percent)

The mean intermetatarsal angle (IMA) was 21.3o, Hallux Valgus Angle (HVA) at 42.1o, Proximal phalangeal articular angle was 15.9o and the Distal metatarsal articular angle (DMAA) was 20.9o, according to preoperative radiographic data in this study

In line with our results, Castioni and his colleagues[8] reported that the HVA average was 15.4 IMA, and 14.2 DMAA. The intermetatarsal angle mean was also 20.4° in Waly et al. [6] (range: 18°–24°). The average angle of hallux valgus was 43.5° (range: 39°-46°). The average subluxation of sesamoids was 60% (range: 50–75%). The mean phalangeal joint angle of the proximal articulation was 15.4° (12°–17°). The average articular angle of the distal metatarsal was 21.4° (range 15°–24°). In 80% of cases, the MTP joint was incongruous

In the current study The overall mean score for AOFAS was 47.5 ± 16.1. A median score of 16.2 was

recorded as preoperative pain, total function 29.4 and mean Alignment scored 1.9 points

Many preoperative AOFAS studies have been reported in line with our results[6]. Dorso-plantar weight bearing x-rays were performed again in our study after approximately 3 months of surgery. Mean intermetatarsal angle (IMA) of 12.2o, Hallux valgus angle (HVA) of 14.9o, a proximal joint phalangeal angle of 8.8o and a distal articular metatarsal angle of 12.1o.

In this study, the average overall AOFAS score improved and recorded after surgery (88.9 ± 19.3) as a median pain score of 34.6, total function 40.4 and mean Alignment up to 13.9 point.

After 3 months of operation, there was a statically significant difference after radiographic data (Intermetatarsal angle, Hallux valgus angle, Proximal phalangeal articular angle and Distal metatarsal articular angle). After 3 months of operation, there was a statically significant difference according to AOFAS score.

The results of Ou are in agreement with many previous studies[6] and Adam et al.[9] that found that the preoperative AOFAS score improved by 40 points postoperatively with 85% of patients saying they would do the procedure again and that 94% of patients were satisfied.

One patient suffering from infection another had nonunion and two patients with residual deformation, while one patient had Hallux varus deformity and no patient had a Neurovascular injury, according to postoperative complications.

In six (4%) patients, Murawski et al.[10] reported postoperative metatarsophalangeal stiffness, with an additional manipulation of recurring symptoms after a period of deep tissue massage and class IV laser therapy under post-antesthesia treatments by three. With the exception of 1 patient with hallux varus, who needed major corrective surgery, most patients were relatively satisfied with the results of their operation as most of the revision operations were fairly minor. In law et al.[5], overall complication rates over the course of the 2-year follow up period were 9.6 percent (8/83 feet) including superficial diseases and revision surgeries.

Choi et al [11] reported a 15% complication rate and an 8% symptomatic hardware reoperation rate.

Kristen et al[12] have reported a postoperative 6% hallux valgus repetition and a complication rate of 5.4% including superficial injury infection, distal traumatic dislocation, and hallux imitus.

The scarf osteotomy covers a wide range of hallux valgus and has proven results for short and long-term monitoring. Significant postoperative correction of HVA and IMA was observed across all groups [11].

5. Conclusion

Scarf osteotomy for moderate to severe degrees of hallux valgus had very good results over 3 months follow-up with a low complication rate. The limitation of this study is the short follow-up and limited number of patients with lack of control group.

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