

Treatment of hallux valgus in adults: A comparison study between the closing wedge and scarf technique of the first metatarsal bone osteotomy

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Abstract: Objective: The aim of this study is to evaluate the results of surgical treatments of hallux valgus by a scarf or closing wedge osteotomy of the first metatarsal. In addition to, detection complications resulting from the surgery.

Patients and Methods: Descriptive comparative study was conducted for the period of one year (June2020 – June2021) at Tishreen University Hospital in Lattakia- Syria. The study included two groups of patients that were compared: group1 consisted of 19 patients (57.6%) who underwent closing wedge osteotomy, whereas group 2 consisted of 14 patients (42.4%) who underwent scarf procedure.

Results: The mean hallux valgus angle (HVA) decreased from (31.43 ° ±3.1) preoperatively to (9.15 ° ±0.1) at postoperative in closing wedge group (group. 1), and from (29.45 ° ±2.7) preoperatively to (10.10 ° ±3.7) at postoperative in scarf group (group. 2), p:0.0001. The Foot and Ankle Disability Index (FADI) score increased significantly in the two groups during follow- up periods. Complications developed in the two groups, more frequently in the scarf group which included: wound healing after 8 weeks (35.7% vs 22.2%), operation site infection (21.4) % vs (11.1%), sudeck's disease (14.3% vs 5.6%), impaired wound healing (14.3% vs 5.6%) and recurrence of hallux valgus (7.1% vs 5.6%), without any case of the non-healing wound in the two groups. Satisfaction of the patients was complete in 84.8%, moderate in 9.1%, and 6.1% of the patients were unsatisfied.

Conclusion: The current study demonstrated favorable results in correction deformity with two techniques, with fewer complications in closing wedge compared with the scarf method.

Keywords: Hallux valgus, scarf, closing wedge.

علاج الايهام الأرواح عند البالغين: دراسة مقارنة بين نتائج خزع عظم المشط الأول بطريقة الاسفين المغلق والخزع بطريقة سكارف

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المستخلص: هدفت الدراسة إلى تقييم نتائج العلاج الجراحي للإبهام الأرواح عن طريقة خزع عظم المشط الأول إما بطريقة الاسفين المغلق أو طريقة سكارف. بالإضافة لذلك، تحديد الاختلاطات الناتجة عن الجراحة. طريقة البحث: كانت هذه دراسة مقارنة وصفية أجريت في مشفى تشرين الجامعي في اللاذقية- سوريا خلال الفترة الممتدة ما بين حزيران 2020- حزيران 2021. شملت الدراسة مجموعتين من المرضى تمت مقارنتهما: مجموعة 1 شملت 19 مريض (57.6%) الخاضعين لخزع العظم بطريقة الاسفين المغلق والمجموعة 2 شملت 14 مريض (42.4%) والخاضعين لطريقة سكارف. النتائج: تناقصت زاوية الروح بشكل هام إحصائياً في مجموعة الاسفين المغلق: (3.1±31.43) قبل الجراحة مقابل (0.1±9.15) بعد الجراحة. وفي مجموعة سكارف: (2.7±29.45) قبل الجراحة مقابل (3.7±10.10) بعد الجراحة. p: 0.0001. ازدادت قيم مشعر وظيفة القدم والكاحل (FADI) بشكل هام إحصائياً في كلا المجموعتين خلال فترات المتابعة (p: 0.0001). تطورت بعض الاختلاطات في كلا المجموعتين ولكن بتواتر أعلى في مجموعة سكارف والتي شملت: تأخر الاندمال بعد 8 أسابيع (35.7% مقابل 22.2%)، الانتان حول الجرح (21.4% مقابل 11.1%)، تناذر سوديك (14.3% مقابل 5.6%)، الاندمال المعيب (14.3% مقابل 5.6%)، ونكس الإبهام الأرواح (7.1% مقابل 5.6%). مع عدم حدوث أي حالة عدم اندمال في كلا المجموعتين. (84.8%) من المرضى كانوا راضين تماماً بعد الجراحة. (9.1%) راضين بشكل متوسط و (6.1%) كانوا غير راضين بعد الجراحة. الاستنتاج: أظهرت الدراسة الحالية أن كلا الطريقتين أعطت نتائج ملائمة مرضية ولكن مع نسبة اختلاطات أقل في طريقة الاسفين المغلق مقارنة مع سكارف.

الكلمات المفتاحية: الإبهام الأرواح، سكارف، الاسفين المغلق.

Introduction.

Hallux valgus (HV) deformity is one of the most common, complex, and progressive foot disorders [1]. It is characterized by lateral deviation of the hallux, a medial deviation of first metatarsal and bony enlargement of the first metatarsal head [2].

The prevalence of HV deformity varies; but is more prevalent among adults. It increased proportionately with age, from 3% in persons aged 15- 30 years to 16% in those older than 60 years [3]. The incidence is higher two- to fourfold in females than in males [4]. The precise etiology of HV is unknown, and numerous factors have been implicated in the condition, including genetic predisposition, traumatic, metabolic, and biomechanical factors [5].

HV deformity is strongly associated with impaired health- related quality of life. Patients can present initially in several ways, typically presenting with complaints of aching pain in the metatarsal head. Proper evaluation of the deformity and timely management can improve quality of life [6].

Non operative treatment including physiotherapy in combination with good footwear can help to control symptoms without correcting deformity [7]. Surgical correction of deformity plays a central role in the treatment. There are various operative techniques for HV correction, with increasing concern among orthopedists on which surgical technique is the best. The decision on which technique is used depends on the degree of deformity, the extent of degenerative changes of the first metatarsophalangeal joint, the shape and size of the metatarsal bone, and phalangeal deviation [8]. The scarf osteotomy; has shown to be a versatile and powerful procedure to correct various degrees of HV deformity. Through modifications of bone cut lengths and in combination with a phalangeal osteotomy, most deformities can be corrected [9]. Closing wedge osteotomy is one of the fundamental operations for the correction of severe HV deformity

[10]. The aim of the study: 1- To elucidate differences between the two techniques regarding the results of surgical correction of HV deformity 2- To determine the outcomes of the two methods.

Patients and Methods.

This is a comparative prospective study of a group of patients with hallux valgus attending the department of orthopedic at Tishreen University Hospital in Lattakia- Syria during a one- year period (June 2020- June 2021). The inclusion criteria were: patients older than 20 years with presence of clinical manifestations. The exclusion criteria were: a previous surgical procedure performed on the foot that affect hallux function, marked degenerative changes of the first metatarsophalangeal joint, the presence of ligamentous laxity, and associated congenital or acquired malformation in the foot.

History and physical examination were performed for all patients. Patients assigned to the group (1) who undergone surgical treatment by closing wedge osteotomy (19 patients) and group (2) who underwent surgical treatment by scarf procedure (14 patients).

X- ray images of all patients, feet were taken in weight- bearing anteroposterior and lateral projections both preoperative and postoperative periodically. The following radiographic parameters were measured:

- Hallux valgus angle (HVA): Intersection of the longitudinal axis of the first metatarsal and proximal phalanx, normal value $<15^{\circ}$. Patients were classified into three groups according to the HVA measurement on radiographs: mild (HVA $<20^{\circ}$), moderate (HVA=21- 40 $^{\circ}$), and severe (HVA $>40^{\circ}$).
- Intermetatarsal angle (IMA): Intersection of the first and second metatarsal . Normal value $<9^{\circ}$.
- The Foot and Ankle Disability Index (FADI) were used to assess the function of the foot. The FADI has 26 items, 4 pains related items, and 22 activity- related items. Each item is scored from 0 (unable to do) to 4 (no difficulty at all), and the score has a total point value of 104 points

Ethical consideration:

All patients were provided a complete and clear informed consent after the discussion about the study. This study was performed following the Declaration of Helsinki.

Statistical Analysis

Statistical analysis was performed by using IBM SPSS version20. Basic descriptive statistics included means, standard deviations (SD), median, frequency, and percentages. To examine the relationships and comparisons between the two groups, the chi- square test was used. An independent t student test was used to compare 2 independent groups. The Friedman test is used to detect differences between groups when the dependent variable being measured is ordinal. All the tests were considered significant at a 5% type I error rate ($p<0.05$), β : 20%, and power of the study: 80%.

Results.

Table (1) shows the baseline characteristics of the participants. Ages range from 20 years to 52 years (mean 46.3 ± 4.6 years). Patients were divided into three groups: 25- 35 (36.4%), 35- 45 (54.5%), and ≥ 45 (9.1%). 75% of the patients were female with gender ratio of 3.1:1. The deformity was in the right side in 14 patients (42.4%), left side in 10 patients (30.3%), and bilateral in 9 patients (27.3%).

Regarding the severity of hallux valgus in the patients, 3 patients (9.1%) presented mild deformity, 27 patients (81.8%) presented moderate deformity, and 3 patients (9.1%) presented severe deformity. Six patients (18.2%) had hammer- toes, five patients (15.1%) had pes planus, and familiar history was present in 20 patients (60.6%).

Table (1) Demographic characteristics of the study population by comparison of the two groups

Variables	No. (%)
Number of patients	
Group (1): Closing wedge group	19 (57.6%)
Group (2): Scarf group	14 (42.4%)
Gender	
Male	8 (24.24%)
Female	25 (75.75%)
Age (years)	(SD: 46.3 ± 4.6) (Range: 20- 52)
Age group	
25- 35	12 (36.4%)
35- 45	18 (54.5%)
≥ 45	3 (9.1%)
Affected side	
Right	14 (42.4%)
Left	10 (30.3%)
Bilateral	9 (27.3%)
Severity of deformity	
Mild	3 (9.1%)
Moderate	27 (81.8%)
Severe	3 (9.1%)
Co- morbidities	
Familiar history of HV	20 (60.6%)
Previous trauma	1 (3%)
None	12 (36.4%)
Additional orthopedic deformities	
Hammer toes	6 (18.2%)
Pes planus	5 (15.1%)
None	22 (66.7%)

HVA ranged between 25.7 ° and 35.7 ° preoperative with mean value 30.6 ° ±3.3. IMTA ranged between 12.8 ° and 14.7 ° with mean value 13.7 ° ±0.5. 20 patients (60.6%) were operated on under spinal anesthesia, and 13 patients (39.4%) were operated under general anesthesia.

In the closing wedge group (group1), the operative time ranged between 45 minutes and 60 minutes with mean time 31.5±2.9 minutes, whereas in the scarf group (group 2), the operative time was longer, and ranged between 60 minutes and 90 minutes with mean time 51.9±5.9, p: 0.0001 . In group 1, a statistically significant difference was found between preoperative and postoperative mean values of HVA (31.43 ° ±3.1 vs 9.15 ° ±0.1) and IMA (13.64 ° ±0.4 vs 9.18 ° ±0.5), p: 0.0001. Also in group2, there was a significant difference between preoperative and postoperative mean values of HVA (29.45 ° ±2.7 vs 10.10 ° ±3.7) and IMA (13.81 ° ±0.5 vs 6.62 ° ±0.7), p: 0.0001. Preoperative, the mean FADI scores were 56.33±8.9 and 58.75±8.8 in group1 and group2 respectively. This score increased significantly during the follow-up period to 96.46±6.9 and 93.83±7.6 in group1 and 2 respectively after 12 months of surgery (Table.2).

Table (2) Radiological parameters of the study population by comparison of the two groups

Variable	Closing wedge Group (1)	Scarf Group (2)	P value
Operative time (minute)	31.5±2.9 (45- 60)	51.9±5.9 (60- 90)	0.0001
<u>HVA</u>			
Preoperative	31.43° ±3.1	29.45° ±2.7	0.09
Postoperative	9.15° ±0.1	10.10° ±3.7	
P value	0.0001	0.0001	
<u>IMA</u>			
Preoperative	13.64° ±0.4	13.81° ±0.5	0.09
Postoperative	9.18° ±0.5	6.62° ±0.7	
P value	0.0001	0.0001	
<u>FADI score</u>			
Preoperative	56.33±8.9	58.75±8.8	0.4
<u>Postoperative</u>			
After 3 month	78.33±10.8	75.11±9.7	
After 6 month	82.66±10.33	80.83±10.6	0.4
After 12 month	96.46±6.9	93.83±7.6	0.6
P value	0.0001	0.0001	0.3

Table (3) shows complications occurred more frequently in scarf group compared to closing wedge group, without any case of the non- healing wound in the two groups and healing during 6- 8 weeks was more frequently in closing wedge group (77.8% vs 64.3%).

Table (3) Complications after surgical treatment of the hallux valgus in the two groups

Variable	Wound healing			Operative site infection	Sudeck's disease	Impaired wound healing	Recurrence of HV
	Non-healing wound	During 6-8 weeks	After 8 weeks				
Closing wedge (18 hallux)	0 (0%)	14 (77.8%)	4 (22.2%)	2 (11.1%)	1 (5.6%)	1 (5.6%)	1 (5.6%)
Scarf (14 hallux)	0 (0%)	9 (64.3%)	5 (35.7%)	3 (21.4%)	2 (14.3%)	2 (14.3%)	1 (7.1%)

Patients satisfaction with the operation is reported as follows: complete in 28 patients (84.8%), moderate in 3 patients (9.1%), and unsatisfactory in 2 patients (6.1%).

Difficulty with foot wear was present in 25 patients (75.8%) preoperatively. After surgery, it was continued in 3 patients (9.1%); two of them in the scarf group and one case in the closing wedge group.

Discussion.

This descriptive comparative study of 42 hallux valgus in 33 patients assessed the correction of deformity, as well as complications occurring after surgery by either scarf or closing wedge method.

The present study demonstrated the main findings. First, the majority of the patients were female with the presence of a familiar history of HV in two thirds of the cases. Second, surgical procedure duration was longer in the scarf group compared with closing wedge osteotomy. Third, a significant reduction in HVA, IMA mean values in the two groups postoperative were observed, and a significant improvement in FADI scores during follow-up. In addition to that, complications including operative site infection, Sudeck's disease, impaired wound healing, and recurrence of HV were more frequently in the scarf group, without the presence of any case of the non-healing wound. To date, no satisfactory studies have been performed to compare the various procedures for the management of hallux valgus and their success rates.

These findings are comparable with a study conducted by Paczesny *et al.*, (2009) in 40 feet (32 females) aged 13- 68 years who underwent proximal closing wedge osteotomy and scarf osteotomy for correction of hallux valgus. Radiologic parameters: HVA and IMA improved significantly in the two groups especially in the closing wedge group [11].

Wing *et al.*, (2014) demonstrated a significant improvement in radiological parameters (HVA, IMA) after scarf osteotomy of hallux valgus in 25 patients (31 feet), with complete satisfaction in (77%) [12]. The results of this study agree with Lenz *et al.*, (2021) study, complications occurred in 10.2%; most of them were delay of wound healing with one case of recurrence of hallux valgus [13].

Wagner *et al.*, (2013) found a significant reduction in radiological parameters (HVA, IMA) after closing wedge osteotomy of hallux valgus in a study conducted in 44 patients (187 feet), with complete satisfaction in (87%) [14]. The results of this study agree with Chan *et al.*, (2018) study [15].

In summary, radiological and functional outcomes after scarf and closing wedge osteotomy were similar with low rate of complications after closing wedge method compared with the scarf osteotomy.

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