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ORIGINAL STUDY

The modified scarf osteotomy in the treatment of tailor's bunion : midterm follow-up

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The aim of this study was to present the midterm results of modified scarf osteotomy in the treatment of tailor's bunion.

From 2004 to 2011, 23 modified scarf osteotomies (with the fifth metatarsal shortening) were performed in group of 18 patients for the treatment of tailor's bunion. The mean follow-up period was 58.8 (range : 24-89) months. Patients were evaluated retrospectively – clinically and radiographically, using the American Orthopaedic Foot & Ankle Society scoring system with weight-beared radiographs at the end of 2013.

Five males and thirteen females (mean age : 46.5 years) were included in the study. Two males and three females were operated bilaterally. Average American Orthopaedic Foot & Ankle Society scores were 59.8 preoperatively and 92.3 at the final follow-up. Three patients had complications : delayed union, superficial wound infection and distal screw migration.

The modified scarf osteotomy in the correction of tailor's bunion offers promising results in the midterm.

Keywords : tailor's bunion ; fifth metatarsal bone ; scarf osteotomy.

INTRODUCTION

Tailor's bunion is a painful prominence of the fifth metatarsal head. It was first described by Davies in 1949 (*7*). It is usually caused by a wide 4th/5th intermetatarsal angle (IMA) with associated varus angle of the 5th metatarsophalangeal joint (MPA). Various causes have been implicated in the aetiology of this deformity : structural abnormalities (lateral bowing of the fifth metatarsal, enlarged head, short metatarsals) ; soft tissues conditions (adhesion of the adductor tendon, medial deviation of toe and rotation of the metatarsal, congenital plantar or dorsiflexed fifth-ray deformities) ; extrinsic causes (tailor's sitting posture, wearing of tight narrow shoes, etc) (*2,12,14*). The main indication for surgical correction of tailor's bunion is pain resistant to a conservative treatment. Coughlin divided this deformity into three types : I – enlargement of the head of the fifth metatarsal, II – lateral bowing with a valgus deviation of the fifth metatarsal shaft

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at its middle or distal level, III – increase in the IMA (*5*). Various distal, shaft and basal osteotomies have been described in the literature (*4,6,18*). The scarf osteotomy is a metatarsal osteotomy, which is commonly used in patients with hallux valgus (*3,20*). We recorded good results with its modification (scarf osteotomy of the fifth metatarsal with its shortening) in our previous study (*24*). The aim of this study was to evaluate clinically and radiographically the series of our patients who had undergone a modified scarf osteotomy of the fifth metatarsal for the treatment of tailor's bunion and who were followed for more than two years.

MATERIALS AND METHODS

This is a retrospective cohort study. Patients' records were reviewed retrospectively for demographic data, details of operation and follow-up results.

The study group consisted of 18 patients with painful tailor's bunion deformity who were treated with modified scarf osteotomy (with the fifth metatarsal shortening) between 2004 and 2011. Included in this study were 23 feet of 5 males and 13 females (mean age : 46.5 ; range : 23-65 years), who completed the follow-up of a minimum of 2 years.

The indication for the surgery was unsuccessful non-surgical treatment of painful tailor's bunion for more than 6 months and patient's own decision after the education. Dorsoplantar (Fig. 1) and lateral radiographs were taken with full weight-bearing before the surgery. All patients had a painful Coughlin type II and III fifth-ray deformities (*5,6*). A single surgeon (M.S.) performed all of the procedures. The procedure was performed bilaterally in the same session in one patient (5.6%) and in two sessions in 4 patients (22.2%). The second contralateral surgery was performed 7.8 months in average (range : 2-11). Seven patients had hallux valgus deformity in the same foot which had additional surgical correction performed at a different time.

The patients were evaluated clinically and radiographically using the American Orthopaedic Foot & Ankle Society (AOFAS) scoring system (*25*) with weight-beared radiographs taken preoperatively. Clinical and radiological follow-up was performed in the 2nd and the 6th postoperative weeks and the 3rd, 6th and the 12th postoperative months. Final follow-up was performed using the AOFAS score, dorsoplantar and lateral weight-beared radiographs and the Coughlin Score (which classifies the results in relation to the patient's subjective satisfaction, as excellent, good, fair or poor) during the year 2013 (*5,6*). The clinical and radiological evaluation was performed by the same surgeon (M.H.) who did not perform any of the surgical procedures. We evaluated the range of motion of the fifth toe. On the radiological examination, the intermetatarsal angle between the 4th and 5th metatarsals (IMA), the metatarsophalangeal angle (MPA) between the proximal phalanx and the fifth metatarsal and the fifth metatarsal shortening were measured (Table I) ; IMA > 8°, MPA > 14° were considered as pathological (*9*).

Fig. 1. — Radiograph of a 55 years-old patient (female) before the surgery. Dorsoplantar X-ray (weight-beared) of the right foot with the 4th/5th intermetatarsal angle of 14° and, varus angle of the 5th metatarsophalangeal joint of 24°.

Patients were operated under spinal anesthesia, in a supine position without a tourniquet. We used antibiotics (cefazolin – Biotika, Czech Republic) in single dose preoperatively. The fifth metatarsal was approached through

Table I. — Data of patients; angles, shortening, AOFAS measurement; Follow-ups and complications

Female/ Male	Patient Age (years)	Side	IMA	MPA	Shortening of the fifth metatarsal (mm)	AOFAS	Follow-up until 2013 (months)	Complications
			Preop/Postop (°)	Preop/Postop (°)		Preop/Postop		
F	47	left	14/6	24/4	6	64/90	89	0
F	64	right	14/8	20/6	8	67/91	88	0
	65	left	10/4	20/6	6	66/90	81	0
M	59	right	16/4	22/4	6	58/92	80	0
	60	left	16/8	20/8	8	54/89	71	0
F	23	right	20/6	18/4	6	58/76	70	delayed union
M	38	left	10/4	22/6	4	57/94	70	0
F	57	right	10/4	16/4	6	59/92	68	0
F	47	left	16/6	20/6	8	61/89	66	0
	47	right	16/8	18/6	6	60/94	64	0
F	41	right	10/4	14/4	6	62/96	62	0
F	39	right	20/8	24/6	10	59/94	60	0
F	54	left	14/6	18/6	8	61/95	56	superficial wound infection
M	33	left	18/8	22/8	6	58/97	54	0
F	51	right	10/4	18/6	8	53/98	52	0
F	38	left	14/6	16/4	4	57/98	50	0
M	38	right	16/8	20/8	10	62/96	48	0
	38	left	14/6	18/6	6	59/98	48	0
F	34	left	12/4	20/6	6	62/86	46	distal screw migration
F	54	right	10/4	14/4	4	61/91	44	0
	55	left	12/6	16/6	6	59/89	33	0
F	55	right	14/8	24/4	6	60/92	28	0
M	33	left	10/6	20/6	4	59/96	24	0

IMA - 4th/5th intermetatarsal angle.
MPA - varus angle of the 5th metatarsophalangeal joint.

a longitudinal dorso-lateral incision over the shaft. After removal of the periosteum, the metatarsal shaft was exposed by insertion of two small Hohman retractors. Due to the preoperative reference points (proximal point is approximately 3 cm distaly from the base of the fifth metatarsal, distal point is approximately 2 mm proximaly from the metatarsal head) a longitudinal osteotomy was made along the shaft in the horizontal plane (in distal 2/3 of the fifth metatarsal). The transverse cuts were made at 30° angle to the longitudinal cut. Than we cut and removed small bone block (2-4 mm, which depends on the metatarsal size and peroperative possibility of IMA and MPA reduction) from the distal part of the dorsal (proximal) fragment and from the proximal part of the plantar (distal) fragment to allow the metatarsal to shorten and hence decompress the 5th metatarsophalangeal joint (Fig. 2). The wide of IMA was reduced by medial translation of the plantar fragment, which was achieved by manual pressure. The osteotomy was fixed by two 2 mm miniscrews made of titanium (Beznoska, Czech

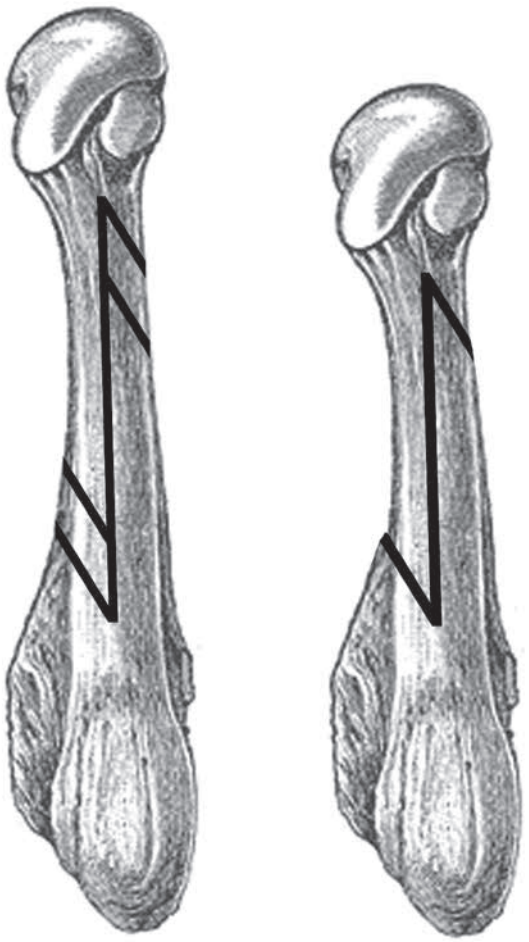

Fig. 2. — The modified scarf osteotomy with the shortening of the fifth metatarsal – lateral view.

Republic). After the fixation, resection of the pseudoexostosis was performed. After the surgery, we used cast fixation of the foot and ankle for 3 weeks.

The deep venous trombosis prophylaxis was achieved with the low molecular weight heparin due to the actual guidelines. Beginning on the day after the operation, the patient is allowed to walk with the crutches and no weight-bearing and started passive exercises. Hospitalization was about 4 days. Sutures were removed after 10-12 days. After the 3 weeks, the cast was removed and postoperative shoe (with a flat rigid sole) was used for next 3 weeks while walking and the patients started with active exercises. With the exception of a patient with delayed union (12 weeks), full weight-bearing without the crutches and postoperative shoe was allowed after clinical and radiological union achieved (6th week).

Student's *t*-test was used for statistical analysis of the pre- and postoperative IMA, MPA and AOFAS score.

RESULTS

All 18 patients were followed and the final evaluation was performed at a mean of 58.8 (range : 24 to 89) months. We did not record any fractures of the metatarsal beam or avascular necrosis of the fifth metatarsal head in our series. From 23 operated feet, we recorded in 3 (13%) postoperative complications. One superficial wound infection was found postoperatively and was treated with oral antibiotics. One delayed union was recorded ; the complete union was achieved in the 12th postoperative week. Migration of the distal fixation screw was recorded in one patient (12th postoperative week, where the osteotomy was healed after 6th week) with the need of the screw removal 6 months after the surgery. Another patient wanted to remove the screws (without any clinical or radiological pathology), which was performed one year after the surgery.

The mean preoperative AOFAS score for the 23 feet of 18 patients was 59.8 (range : 53-67) and was 92.3 (range : 76-98) postoperatively. The lowest postoperative AOFAS was recorded in the patient with delayed union and complex forefoot deformity treated with other procedures after the fifth metatarsal osteotomy. All patients reported disappearance or a reduction of pain in the area of the fifth metatarsal head compared with the level of pain that had been experienced preoperatively.

Subjective satisfaction of the patients according to the Coughlin classification was recorded as excellent (without problems, very satisfied, mild or no pain, walk without difficulty) in 17 feet (74%) ; good (a few problems, satisfied, mild pain, walk without difficulty or with mild difficulty, would still have a surgery) in 5 feet (22%) and fair (moderate pain, limited walking, reservation about success of surgery) in 1 foot (4%). Preoperative mean IMA was 13.7° (range : 10-20°), MPA was 19.3° (range : 14-26°). Postoperative mean IMA was 5.9° (range : 4-8°), MPA was 5.6° (range : 4-8°). The mean fifth metatarsal shortening was 6.4 mm (range : 4-10 mm). Postoperative IMA, MPA averages were significantly lower than the preoperative averages

Fig. 3a. — Dorsoplantar radiograph of the patient in figure 1, at first postoperative day with the cast fixation. Two screws were used for the osteotomy fixation.

Fig. 3b. — Lateral radiograph of the same patient. The osteotomy lines are visible.

($p = 0.001$) ; postoperative AOFAS scores were significantly higher than the preoperative scores ($p = 0.001$). We observed no restriction in the range of motion of the 5th metatarsophalangeal joint in any case.

Typically 72.2% of our patients were females, who used high-heeled shoes with a narrow toe box. In all our cases, bony union was achieved with one delay. We did not find any loss of correction or fracture. We did not find recurrence of deformity as well as a transfer metatarsalgia to the fourth metatarsal. Similar clinical and radiological results were obtained in patients undergoing unilateral or bilateral surgery at the same session (Table I), at the final follow-up there was only one patient with limited daily activities. All patients would undergo the same procedure again if required.

DISCUSSION

Surgical treatment for painful varus deformity of the fifth toe and tailor's bunion is indicated when a conservative treatment is unsuccessful. The aim of any surgery is to narrow the width of the forefoot (*16*). Preoperative clinical and radiological assessment with weight-beared radiographs for the decision of the treatment is essential. Various surgical procedures have been described (*11,17,19,21,22,26*). In bunionectomies, only the excision of the bunion and painful bursa is performed. Kitaoka *et al*

Fig. 4a. — Dorsoplantar radiograph (weight-beared) of the same patient 28 months after the surgery. The screws are *in situ*. The 4th/5th intermetatarsal angle is of 8°, varus angle of the 5th metatarsophalangeal joint is of 4°, shortening of the fifth metatarsal is of 6 mm.

Fig. 4b. — Lateral radiograph of the same patient (weight-beared).

achieved excellent results in 15 patients, good results in 3 patients and poor results in 3 patients (*15*). Metatarsal head resection can be applied as a salvage procedure after failed surgeries or in the presence of joint degeneration (*14*). Osteotomies for tailor's bunion may be proximal, diaphyseal or distal. Proximal osteotomies allow a great degree of correction to be made and are indicated when the deformity involves the entire fifth metatarsal, the absence of arthritis in metatarsophalangeal joint with IMA exceeds 9° (*8*). The disadvantage of these techniques is possible disruption of the blood supply in this area, leading to delayed union or non-union (*18*). Diaphyseal osteotomies allow a greater amount of correction without interruption of the blood supply but may be associated with the delayed union and non-union (*6*). Distal osteotomies have ability to correct the fourth-fifth intermetatarsal angle. They are usually performed in the well-vascularized distal metaphysis, which has good healing potential (*5*). Possible postoperative complications may include decreased mobility related to the surgical exposure of the fifth metatarsophalangeal joint and the surrounding soft tissues, osteonecrosis and transfer metatarsalgia. Akman *et al* achieved in 18 feet very good results, in 4 feet good results and

in 2 feet sufficient results with distal metatarsal osteotomy with K-wire fixation (*2*). They recorded postoperative complications in three patients of 14 in total (avascular necrosis, delayed union and superficial wound infection).

The diaphyseal z-shaped metatarsal osteotomy was first described by Meyer in 1923 (*20*). Scarf osteotomy is one of the widely recognized methods described for correction of hallux valgus. It is commonly utilized for the reduction of an increased intermetatarsal angle between first and second metatarsal (*1,3,10,23*). Statements from the literature concerning fixation of metatarsal osteotomies are controversial. Coughlin mentions the potential risk of secondary displacement, nonunion and transfer lesions in metatarsal shaft osteotomies without internal fixation (*5,6*). Due to the literature and our experience with the scarf osteotomy of the first metatarsal, with the fixation with two 2 mm screws, we used this method in the treatment of tailor's bunion too (*13,23*). The shortening of the fifth metatarsal was described in our previous study (*24*). We define minimal shortening of 4 mm, but it may be more (up to 10 mm). Too much shortening of the fifth metatarsal may lead to transfer metatarsalgia under the fourth and fifth metatarsal head, but we did not record this complication. We performed the osteotomy in the distal 2/3 of the metatarsal with regard to the blood supply (*18*). Guha *et al* described very similar method (with the transverse cuts of 30° angle). They mentioned the shortening of the metatarsal in surgical technique but without any further specification or measurement (*12*).

We recorded the screw loosening only once. Our radiological results demonstrate that these two screws are adequate for internal fixation of the scarf osteotomy of the fifth metatarsal. The diameter of the screws differs in the literature. Guha *et al* used 2.5 mm screws, Seide *et al* used 1.7 mm screws (*12, 22*).

From the another complications in our group of patients, we recorded superficial wound infection in one foot and delayed union in one foot. Avascular necrosis of the metatarsal head has not been observed in our patients. Stiffness at the metatarsophalangeal joint after the fifth metatarsal osteotomy is recognized as a problem and may correlate with the clinical outcome (*14*). The fact that we observed no limitation in the range of motion in any case may be the result of our postoperative rehabilitation. In our series, the mean preoperative IMA was 13.7°, MPA was 19.3°. Postoperative mean IMA was 5.9°, MPA was 5.6°. All postoperative IMA were 8° or bellow, than can be considered as normal (*9*). Guha *et al* reported mean preoperative IMA of 13.1°, MPA of 19.9° ; mean postoperative IMA of 7.27° and MPA of 6.36° in 12 cases (*12*). Seide *et al* reported mean preoperative IMA of 10.3° ; mean postoperative IMA of 6.8° in 10 cases (*22*). The mean preoperative AOFAS score in our study was 59.8 and was 92.3 postoperatively. Comparable results were noted in published literature (Table II) (*2,12,17,19,21,26*). We recorded excellent results in 74%, good in 22% and fair in 4%. Magnan *et al* recorded excellet results in 73%, good in 20% and fair in 7% according to the Coughlin classification (*18*).

Table II. — Outcomes of different surgical techniques in published literature

Study	Surgical technique	AOFAS	
		Preoperative	Postoperative
Radl *et al* (2005)	Modified distal horizontal osteotomy	42/100	87/100
Vienne *et al* (2006)	Modified Coughlin procedure	55/100	95/100
Legenstein *et al* (2007)	Boesch technique	59.1/100	95.2/100
Maher *et al* (2010)	Scarf osteotomy	44.1/100	88.1/100
Akman *et al* (2011)	Distal metatarsal osteotomy with K-wire fixation	64.83/100	91.62/100
Guha *et al* (2012)	"Reverse" scarf osteotomy	54.25/100	89.58/100
Our study	Modified scarf osteotomy	59.8/100	92.3/100

Our study has some strengths, including the length of follow-up (up to 89 months), the fact that no patient was lost to follow-up. However, weaknesses included limited patient numbers due to the rareness of this surgery.

In conclusion, our study has shown that modified scarf osteotomy in the correction of tailor's bunion offers promising results in the midterm. Further long term follow-up would help to establish the benefits of this procedure.

However, as with almost all osteotomies, treatment may need to be adjusted according to the individual needs of each patient. Further research, such as prospective randomized trials in order to compare results other of individual operative techniques, would be required.

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