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Original Article

Radiological Outcome of Patients with Splay Foot Following First and Fifth Metatarsal Osteotomies Performed Simultaneously on the Same Foot
本文研究在外趴扁平足患者的足部同時進行第一及第五蹠骨截骨手術後的放射學之結果

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ABSTRACT

Introduction: There have been many operations documented for the treatment of hallux valgus and fifth metatarsal bunionette deformities in patients with splay foot carried out separately, with variable success rates. Our aim was to assess the radiological outcome following combined chevron osteotomy of the first and reverse chevron osteotomy of the fifth metatarsal in symptomatic patients with splay foot. To our knowledge, this procedure has not been described in the literature.
Methods: Nine symptomatic patients (12 feet) were included in the study. The preoperative and post-operative angles were assessed on weight-bearing radiographs for statistical significance using non-parametric paired *t* tests.
Results: The postoperative hallux valgus angles, intermetatarsal angles, first and fifth metatarsal head widths, and maximum distance between the first and fifth metatarsal heads decreased significantly ($p < 0.05$).
Conclusion: The results suggest a very good radiological outcome in symptomatic patients following simultaneous first and fifth metatarsal osteotomies. All the angles measured postoperatively, except the distal metatarsal articular angle, showed a statistically significant reduction.

中 文 摘 要

介紹：在外趴扁平足的患者，作個別治療拇趾外翻或第五小趾囊腫的眾多手術文獻中，獲得不一致的成功率。我們的目標是以放射學評估患有症狀性的外趴扁平足之病者，同時進行第一蹠骨V形截骨術和第五蹠骨反轉V形截骨術的結果。據我們所知，這種手術還沒有在文獻中被描述。，
材料與方法：9位有症狀的患者（12足）被納入研究。在手術前和手術後進行負重 X -射線的角度評估，應用非參數配對t 檢定統計方法去評定其統計學上的意義。，
結果：拇趾外翻角度，蹠骨縱軸延長線之夾角角度，第一和第五蹠骨頭的寬度，第一和第5蹠骨頭的最大距離，在手術後都明顯減少（$P < 0.05$）。
結論：結果顯示有症狀的患者在同時進行第一和第五蹠骨截骨術後有十分良好的放射學評估效果。在手術後所有的測量角度除DMAA外，在統計學上均顯著減少。

Introduction

The term 'splay foot' connotes an abnormal widening of the forefoot in relation to the heel. Clinically, the splay foot is characterized by valgus of the great toe with bunion formation in association with a relative varus position of the first metatarsal. On the lateral part of the forefoot, there is varus deformity of the fifth toe with a relative valgus position of the fifth metatarsal and resultant bunionette formation. This deformity is often associated with metatarsalgia under the second metatarsal head because of its relative elongation in relation to the first metatarsal bone. Radiologically, splay foot is characterized by an intermetatarsal angle (IMA) between the first and second rays of greater than 12 degrees,

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an IMA between the fourth and fifth of greater than 8 degrees, and a slant of the distal articular surface of the medial cuneiform of more than 105 degrees.[1]

The hallux valgus deformity in splay feet is a complex deformity of the first ray that is frequently accompanied by deformity and symptoms in the lesser toes. The angle between the first and second metatarsals is usually more than 8–9 degrees. In addition, the valgus angle of the first metatarsophalangeal joint is more than 15–20 degrees.

Tailor's bunion or bunionette is a term applied to an enlargement of the lateral aspect of the fifth metatarsal head that produces various degrees of pain, swelling and tenderness. The deformity is located at the dorsolateral or lateral aspect of the fifth metatarsophalangeal joint. Commonly, a splay foot deformity is associated with a tailor's bunion deformity.[2]

In this paper, we present the radiological outcome in nine patients with splay foot (12 feet) who underwent simultaneous first and fifth metatarsal osteotomies, a chevron for the first metatarsal and a reverse chevron for the fifth metatarsal, to correct the combined hallux valgus and tailor bunion deformities, respectively. This combined treatment has not previously been described in the literature.

Patients and methods

This series study included nine symptomatic patients (12 feet) with splay foot deformities. The patient's preoperative and postoperative weight-bearing radiographs (Figure 1) were independently assessed by two senior orthopaedic registrars. The hallux valgus angles (HVAs), first-to-second IMAs, distal metatarsal articular angles (DMAAs), fourth-to-fifth IMAs, maximum widths of the first and fifth metatarsal heads and maximum distance between the centres of the first and fifth metatarsals were measured. The change in the angles and distances postoperatively were then analysed for statistical significance using non-parametric paired *t* tests. The patients were followed up and assessed 6 months and 48 months postoperatively. All operative procedures were carried out by one senior author.

Operative technique

The operation was carried out under general anaesthesia with an ankle tourniquet applied, and first metatarsal osteotomy was performed first using a medial incision through the skin and capsule. Dorsal and plantar capsular stripping was kept to a minimum. A medial exostectomy followed by a standard chevron osteotomy was performed. The head of the metatarsal was displaced between one-third and one-half the width, depending on the extent of the deformity. The osteotomy was held using a 1.25 mm Kirschner wire.

Similarly, a lateral longitudinal incision was made through the skin and capsule over the fifth metatarsal head and neck. Lateral exostectomy followed by chevron osteotomy through the neck of the fifth metatarsal was performed. The head was displaced to the required extent and held with a 1.25 mm Kirschner wire. A standard hallux bandage was then applied.

In the immediate postoperative period, weight-bearing walking on the heel was allowed in a forefoot-protecting surgical shoe. At 4 weeks, the Kirschner wires were removed and full weight-bearing walking was allowed. Weight-bearing radiographs of the foot were taken at 6-month and 48-month follow-ups.

Results

The results of the measurements are summarised in Table 1. HVAs, IMAs, first and fifth metatarsal head widths and maximum distance between the first and fifth metatarsals were significantly decreased postoperatively ($p < 0.05$). Although the DMAAs improved postoperatively, this was not statistically significant. All patients were asymptomatic at their follow-up visits at 6 and at 48 months.

Discussion

When addressing the deformities in splay foot, one must examine each deformity in details. The hallux valgus deformity may result from various aetiological factors. It may be due to a rear foot problem that usually commences when the calcaneus everts beyond the vertical in an excessively pronated foot. The soft tissue musculature around the rear foot and first ray become altered in terms of their biomechanics. The aetiology in hallux valgus deformity has become more refined and could be categorized as follows: hypermobility of the first ray, instability of the midtarsal joint, calcaneal eversion beyond the vertical and instability of the peroneus longus.[3]

The HVA is formed by the intersection of a line drawn through the long axis of the first metatarsal and the long axis of the

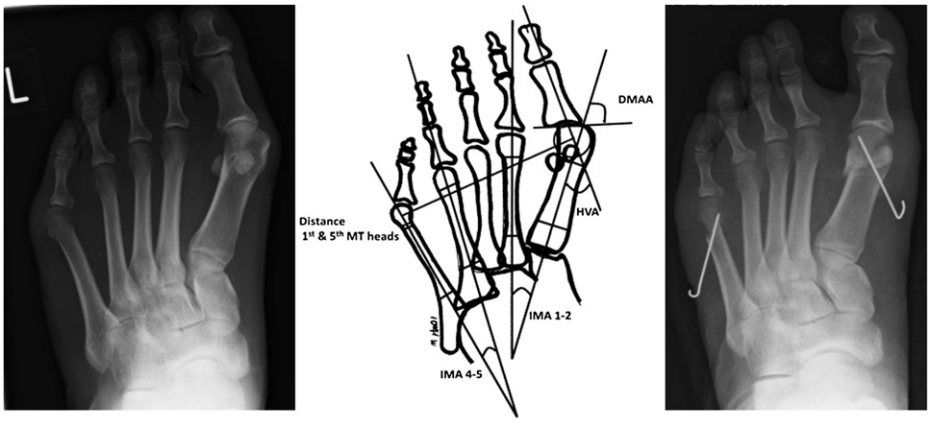

Figure 1. The pre and post-operative radiographs of the foot and the measurements. DMAA = distal metatarsal angle; HVA = hallux valgus angle; IMA = intermetatarsal angle; MT = metatarsal.

Table 1
The pre and post-operative measurements of the patients' feet and the statistics

	Pre-operative	Postoperative	*p*
Hallux valgus angle, mean (range) (degrees)	28.17 (20–40)	16.33 (4–30)	<0.05
Angle between first and second intermetatarsals, mean (range) (degrees)	14 (9–20)	9.29 (4–14)	<0.05
Distal metatarsal angle, mean (range) (degrees)	12.58 (5–21)	9.83 (1–30)	>0.05
Angle between fourth and fifth intermetatarsals, mean (range) (degrees)	11.35 (9–14)	8.17 (4–10.5)	<0.05
Width of first metatarsal head, mean (cm)	2.27	1.87	<0.05
Width of fifth metatarsal head, mean (cm)	1.27	1.09	<0.05
Distance between first and fifth metatarsal heads, mean (range) (cm)	8.05 (7.4–9.1)	7.15 (6.8–7.7)	<0.05

proximal phalanx. A normal HVA is less than 16 degrees, mild deformity being present when this angle is between 17 and 25 degrees. A subluxed joint is usually apparent when the HVA is more than 35 degrees.[4]

Distal metatarsal osteotomies are frequently used to correct hallux valgus deformities in adults.[5] The common procedures to treat hallux valgus deformity (Mitchell, McBride and chevron) are effective in correcting most deformities. The technique and results of chevron osteotomy procedure have been reviewed extensively.[4,6,7] A V-shaped distal metatarsal osteotomy is used for the correction of mild-to-moderate hallux valgus.[8]

Tailor's bunion may present as a hypertrophy of the soft tissue overlying the fifth metatarsal because tailors commonly sit with their legs crossed. This puts pressure on the outer borders of their feet that results a hypertrophic skin callosity over the fifth metatarsal head.[9] Other presentations include a congenitally enlarged or dumbbell-shaped fifth metatarsal head, an abnormal lateral angulation of the fifth metatarsal shaft, or a combination of these conditions.

The most commonly used measurements in the evaluation of tailor's bunions include the fourth-to-fifth IMA and lateral deviation angles. Another measure of deviation is the fifth metatarsophalangeal angle, which indicates the magnitude of medial deviation of the fifth toe in relation to the axis of the fifth metatarsal shaft. The diameter of the fifth metatarsal head is measured to assess the tailor's bunion.

The management of a tailor's bunion involves identifying the cause, thorough clinical and radiographic evaluation of the deformity, and deciding the best surgical procedure to obtain optimal results.[9] No state-of-the-art procedure can as yet be concluded for the correction of this fifth ray deformity.[10] Treatment of a tailor's bunion is usually conservative. Surgery is indicated when non-operative treatment can no longer control the symptoms. The aim of surgery is to decrease the width of the forefoot and the prominence of the lateral eminence.

Numerous osteotomies have been described to treat this condition. Most of the distal osteotomies were originally described for hallux valgus but later incorporated for tailor's bunion. The chevron osteotomy is technically demanding when employed for a tailor's bunion because of the small bony contact area. It is a useful procedure that not only narrows the forefoot slightly to relieve lateral pressure, but also reduces plantar pressures in the presence of a symptomatic plantar callus.[9]

There is very little in the English-language literature about combined first and fifth osteotomies for splay foot deformity and their outcome measures. This study is the first that has looked into the radiological outcome of this procedure, and we have obtained very good and encouraging results. Our postoperative outcomes show a statistically significant improvement in nearly all the radiological parameters measured. None of our patients was symptomatic at the follow-up assessments over 4 years, although no objective scoring was used.

Our study does have its limitations as the number of patients is small and the follow-up may not be long enough. In addition, only the radiological outcome was studied. Objective measures such as patient satisfaction questionnaires and scoring systems could be used in further studies to document the functional outcome. We suggested that the combined first and fifth metatarsal osteotomy procedure is a safe, good, feasible and pertinent operative treatment for splay foot deformity after adequate preoperative evaluation of the abnormal fourth and fifth IMAs and the width of the fifth metatarsal head.

References

1. Bishop J, Kahn A, Turba J. Surgical correction of the splayfoot: the Giannestras procedure. *Clin Orthop Relat Res* 1980;**146**:234–8.
2. Lehtinen JE. Tailor's bunion deformity. In: Hetherington VJ, editor. *Textbook of hallux valgus and forefoot surgery*. Churchill Livingstone; 2002. p. 459–69 [chapter 31].
3. Laporta D, Melillo T, Hetherington V. Preoperative assessment. In: Hetherington VJ, editor. *Textbook of hallux valgus and forefoot surgery*. Churchill Livingstone; 2002. p. 107–23 [chapter 6].
4. Scott G, Wilson DW, Bently G. Roentgenographic assessment in hallux valgus. *Clin Orthop Relat Res* 1991;**267**:143–7.
5. Davies H. Metatarsus quintus valgus. *Br Med J* 1949;**1**:664.
6. Austin DW, Leventen EO. A new osteotomy for hallux valgus: a horizontally directed "v" displacement osteotomy of the metatarsal head for hallux valgus and primus varus. *Clin Orthop* 1981;**157**:25–30.
7. Trnka H-J. The chevron osteotomy for correction of hallux valgus. Comparison of findings after two and five years of follow-up. *J Bone Joint Surg Am* 2000;**82**:1373–8.
8. Marx RC, Mizel MS. What's new in foot and ankle surgery. *J Bone Joint Surg Am* 2009;**91**:1023–31.
9. Ajis A, Koti M, Maffulli N. Tailor's bunion: a review. *J Foot Ankle Surg* 2005;**44**:236–45.
10. Koti M, Maffulli N. Bunionette. *J Bone Joint Surg Am* 2001;**83**:1076–82.