Lengthening of the shortened first metatarsal after Wilson’s osteotomy for hallux valgus

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Metatarsalgia is a recognised complication following iatrogenic shortening of the first metatarsal in the management of hallux valgus. The traditional surgical treatment is by shortening osteotomies of the lesser metatarsals.

We describe the results of lengthening of iatrogenic first brachymetatarsia in 16 females. A Scarf-type osteotomy was used in the first four cases and a step-cut of equal thicknesses along the axis of the first metatarsal was performed in the others.

The mean follow-up was 21 months (19 to 26). Relief of metatarsalgia was obtained in the six patients in whom 10 mm of lengthening had been achieved, compared to only 50% relief in those where less than 8 mm of lengthening had been gained.

One-stage step-cut lengthening osteotomy of the first metatarsal may be preferable to shortening osteotomies of the lesser metatarsals in the treatment of metatarsalgia following surgical shortening of the first metatarsal.

A complication of osteotomy of the first metatarsal for the treatment of hallux valgus is metatarsalgia secondary to shortening, especially in patients who already have a relatively short first metatarsal.1–3 Patients with iatrogenic metatarsalgia have difficulty walking barefoot, are limited in the use of shoes when wearing an insole and some are unable to undertake the same work or enjoy the same lifestyle as before operation. The traditional treatment of this condition is by shortening osteotomies of the lesser metatarsals, but this may produce complications of pain or stiffness in the lesser toes.4–6 The other option of lengthening of the metatarsal has hitherto been used for other conditions, mainly congenital brachymetatarsia,7–11 and only one case of metatarsal lengthening of an iatrogenic short first metatarsal has been reported.12

This study describes our results of step-cut metatarsal lengthening for iatrogenic first brachymetatarsia.

Patients and Methods

A total of 16 females with a mean age of 37 years (14 to 56), underwent a lengthening osteotomy of the first metatarsal. All had previously had a Wilson osteotomy for hallux valgus, bilateral in ten cases. All were complaining of transfer metatarsalgia following this procedure, with callosities under the second metatarsal head. Analysis of the pressure distribution using a standard Harris-Beath mat (Apex Foot Products Corporation, Englewood, New Jersey) showed an increase in pressure beneath the head of the second metatarsal and under-loading under the head of the first (Fig. 1). The patients had first metatarsal...
length ratios of $< 69.5\%$ (66.2\% to 76.1\%) of the length of the second metatarsal\textsuperscript{13} (Fig. 2). The measurements of the maximal length of the long axis of the first and second metatarsals were carried out on weight-bearing radiographs, using a ruler.

A Scarf-type osteotomy was used in the first four cases, but the thin wedges of bone at each end proved to be a disadvantage (Figs 3a to 3c). Another reason for changing the type of osteotomy was because the Scarf osteotomy lengthens the metatarsal in the direction of the plantar weight-bearing surface and does not effectively translate the metatarsal head plantarwards. A simple step-cut of equal thicknesses along the axis of the first metatarsal (Figs 3d to 3f) was performed in the next 12 procedures. We routinely distracted by 1 cm using a laminar spreader and interposed a pre-sized block of allograft or autogenous graft, 1 cm thick, from the lower tibia into the distal cavity. Fixation was with two perpendicular screws (Figs 3e to 3f). Lateral displacement was also undertaken if the correction after the Wilson osteotomy had been inadequate. After elongation of the first metatarsal to the desired length, the passive range of movement of the metatarsophalangeal joint was measured with a goniometer and compared to the other side. If a similar range of movement was not achieved, the extensor hallucis longus tendon was lengthened. If that was insufficient, shortening of the proximal phalanx was carried out. The extensor hallucis longus tendon was lengthened in five patients, and a shortening osteotomy of the proximal phalanx was carried out in two.

The foot was protected in a heel wedge shoe which allowed heel weight-bearing only, and the patient was instructed on movement exercises for the first metatarsophalangeal (MTP) joint after two weeks, when the extensor tendon had not been lengthened and after three weeks if it had been lengthened.

**Results**

The mean post-operative follow-up was for 21 months (19 to 26). The osteotomies united in all patients (Fig. 6), with a mean healing time of eight weeks (6 to 12). Two complications were encountered, namely a superficial
wound infection, and dorsal tilting of the metatarsal head in a patient where a bone graft had not been used.

Of the first four patients who underwent a Scarf osteotomy, two still needed insoles and one later underwent shortening osteotomies of the lesser metatarsals owing to inadequate lengthening (< 8 mm) of the first metatarsal.

In the current technique, three of the first six patients did not achieve adequate lengthening (< 8 mm) of the first metatarsal and still suffered from metatarsalgia. The last six patients, with adequate lengthening and fixation had good relief from their metatarsalgia with four no longer needing an insole and two needing an insole only occasionally. All six returned to their occupations.

Post-operative pressure measurements were not done, mainly because of the relief of symptoms and the disappearance of the callosities under the second metatarsal head.

The post-operative range of movement of each first MTP joint was equal to its pre-operative range.

**Discussion**

Shortening of the first metatarsal after a Wilson osteotomy has been reported to range between 0 mm and 10 mm, 14 2 mm to 15 mm or 1.7% to 11%. This might be more important in patients with a Greek-type foot who already have a relatively short first metatarsal compared to patients with any Egyptian-type foot, in which the metatarsal is long.

Although there are a few reports in the literature which exclude an association between post-operative transfer metatarsalgia and shortening of the first metatarsal, most authors have demonstrated such a relationship. Carr and Boyd proposed 4 mm as an acceptable degree of post-operative shortening, and Schemitsch and Horne concluded that a relative ratio of the length of the first metatarsal compared to the second of < 0.825% is important. This ratio is also in the lower range of normality according to Tanaka et al.

The common methods of lengthening in brachymetatarsia are single stage, with a bone graft, or gradual, by callus distraction. Both achieve more than 50% of lengthening, but have high rates of stiffness of the first MTP joint, depending on the amount of lengthening. A lower complication rate and greater lengthening has been achieved by
gradual distraction, but this depends on patient or family compliance. It is recommended that a single-stage procedure is preferable when < 15 mm is required. In our early cases, < 8 mm of lengthening was performed because of our concern regarding loss of movement at the first MTP joint. However, all these patients regained their pre-operative range of movement by active and passive mobilisation. We initially lengthened the extensor hallucis longus tendon when the joint appeared stiff, but subsequently preferred to decompress the first MPJ by shortening the proximal phalanx, with excision of a cylinder of bone and stabilisation with a compression staple. This shortening reduces the tension in the tendons of extensor hallucis longus.

The narrow, thin bone wedges and diagonal nature of the Scarf osteotomy made it prone to inadequate fixation and when the screws were tightened there was shortening and elevation (Fig. 3c). The straight step-cut osteotomy, with thicker fragments allowed for better fixation owing to the thicker bone. It also allows for the insertion of a bone graft and lengthens along the axis of the metatarsal, whereas the Scarf osteotomy lengthens horizontally (Figs 3b and 3e).

Adequate relief of metatarsalgia was achieved only in patients where > 8 mm of lengthening was obtained. All six patients who achieved 10 mm lengthening had relief of metatarsalgia, whereas the success rate was < 50% when lengthening was < 8 mm.

Although the number of patients is small and longer follow-up is needed, we believe that due to our encouraging results, a one-stage step-cut lengthening osteotomy of the iatrogenic short first metatarsal is a good alternative to shortening osteotomies of the lesser metatarsals.

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References