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The combined reverse scarf and opening wedge osteotomy of the proximal phalanx for the treatment of iatrogenic hallux varus

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ABSTRACT

Background: : Hallux varus is a complication of hallux valgus surgery. Historically the standard treatment has been to arthrodese the first metatarso-phalangeal (MTP) joint. More recently other options have come to light, including reverse osteotomies and tendon-transfer procedures.
Objectives: : This paper presents a small retrospective audit of patients who developed hallux varus following the combined rotation scarf and Akin osteotomy for hallux valgus, and their subsequent treatment with a stepwise approach of soft tissue release and ultimately reverse scarf osteotomy and opening wedge osteotomy of the proximal phalanx.
Method: : Five patients attended for a retrospective audit including reasons for revision surgery, review of intermetatarsal (IM) and first metatarso-phalangeal joint (MTPA) angles, AOFAS scores and patient satisfaction.
Results: : At a mean follow up of 38 months, mean IM angle and MTP joint angle improved from 5 to 9° and −10° to 11° respectively. Mean first MTP joint dorsiflexion and plantarflexion was 26° and 19° respectively. One patient was completely satisfied and four were satisfied with reservations with their surgical outcome and 100% felt they were better off as a result of their surgery.
Conclusion: : The stepwise approach to the reverse scarf and opening wedge osteotomy of the proximal phalanx for iatrogenic hallux varus is an alternative to first MTP joint arthrodesis for those with a viable joint.

1. Introduction

Hallux varus is a rare complication of hallux valgus surgery but is a significant cause of dissatisfaction for patients. A recent nine-year review of the rotation scarf and Akin osteotomies for hallux valgus found a 4% incidence of hallux varus [1]. Other studies have suggested an incidence of between 1% and 5%, although as high as 15% has been cited [2,3]. For the patient the deformity is uncomfortable, cosmetically unsatisfactory and causes footwear irritation [2,4]. Joint stiffness, degenerative arthritis, clawing of the hallux, weakness with push off, compensatory rearfoot supination, medial ingrown toenails and transfer metatarsalgia are all reported symptoms [4,6–9]. Hallux varus may also be congenital or due to hypermobility, increased joint laxity linked to Marfan's syndrome, trauma, poliomyelitis, post burn injury or surgical loss of the fibular sesamoid [4,5,10].

Causes of iatrogenic hallux varus include detachment of the lateral head of *flexor hallucis brevis* (FHB) and in combination with an *adductor hallucis* tendon release may lead to an unbalanced medial pull of the hallux [11]. Leemrijse et al. considered that release of these two tendons combined with a lateral joint capsule release allowed the medial soft tissue attachments, specifically *abductor hallucis* and the medial head of FHB to be unopposed [4]. *Extensor hallucis longus* can then bowstring, drawing the hallux into extension, varus rotation and clawing of the first interphalangeal joint [12]. Excision of the fibular sesamoid leading to overpull of the *abductor hallucis* muscle and medial head of the FHB is associated with a 10% incidence of hallux varus [13]. When the fibular sesamoid is excised, the metatarsal head subsequently slips through the deficit in FHB producing medial drift and hyperextension of the first MTP joint [4]. Overcorrection of the first to second IM angle producing a much reduced or negative IM angle, increases the medial pull of soft tissues and is a possible contributing factor to hallux varus though no statistical data is available to quantify this [4,14–18]. If a first metatarsal osteotomy for the correction of hallux valgus is rotated too far laterally, the tibial sesamoid can be placed medial to the metatarsal head and this creates the potential for hallux varus [19]. Over tightening of the medial capsule or excessive medial capsulorraphy may also contribute to hallux varus formation [13,15,20]. Aggressive resection of the medial eminence of the first metatarsal head, has also been suggested as a cause of instability of the first MTP joint [2,4,14,21,22].

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The literature reports a number of procedures to address hallux varus, many are anecdotal reports, single case studies and case series reports. This is due to the low incidence of the deformity, making larger research studies difficult to complete.

In recent years a stepwise approach to osteotomy or soft tissue repair has been reported with the aim of maintaining a functional first MTP joint [21,23,24]. Soft tissue release of the first MTP joint has been described, though it is believed that this approach will fail to fully correct the pathology and is unlikely to give a lasting result [7,23,25]. McBride reported lengthening the *abductor hallucis* tendon and tightening the lateral structures of the hallux in two of his own patients who developed hallux varus [26]. Repair alone of the *adductor hallucis* tendon and lateral component of the FHB was reported as being ineffective at correcting hallux varus [11]. Instead transfer of *abductor hallucis* to the lateral side of the proximal phalanx with the aim of increasing the dynamic valgus pull on the hallux is proposed [11]. This procedure is technically demanding due to the often insufficient length of the *abductor hallucis* tendon and requires aggressive dissection in the first intermetatarsal space, which can lead to interruption of the neuro-vascular bundle [4]. A passively correctable hallux varus deformity with no joint stiffness could benefit from tendon transfer procedures, however many patients who attend for hallux varus repair are likely to have some level of joint pain, with degenerative joint disease already established. Furthermore degenerative joint disease in one third of cases led Maynou to question the long-term success of soft tissue procedures [27].

Rochwerger et al. proposed the addition of a bone graft to the medial side of the first metatarsal [2]. The graft taken from the iliac crest was added to compensate for extensive resection of bone during a bunionectomy. Combined with a soft tissue release this was thought to physiologically increase the first to second IM angle. Eight patients (10 feet) were reviewed with one patient being dissatisfied, returning with a perceived valgus shape to her foot. Three patients (37%) had degeneration of the first MTP joint along with IM angles of less than 8° which is considered to be the normal angle [28].

Reverse osteotomies in conjunction with a soft tissue step-wise approach have been proposed. The reverse Austin osteotomy was suggested in 1987 to increase the first to second intermetatarsal angle [24]. Jenkin believed that a revisional osteotomy should be made at the level of the original surgery, however if a significant change in IM angle is required, a metatarsal shaft osteotomy that provides a larger alteration in IM angle would be advised [19].

While Miller described the use of the Keller arthroplasty for hallux varus [29], historically the standard treatment for hallux varus has been to arthrodese the first MTP joint and is suggested by many authors [2,22,30–32]. Arthrodesis of the first MTP joint is often used as a salvage operation for failed hallux valgus procedures, particularly when degeneration of the first MTP joint is present [33–35]. Groulier proposed arthrodesis of the first MTP joint for a non-reducible and established varus deformity as it has been shown to reduce pain and maintain a stable medial column [35,36]. Known complications are transfer metatarsalgia, non-union, interphalangeal arthrosis of the hallux and footwear choice limitations. The arthrodesis has been actively avoided in patients whose occupation involves kneeling, or women who prefer high heel shoes [31,35,37]. The fusion of this joint has furthermore been described as being technically demanding [38]. The healing time for a first MTP joint fusion according to Evensen requires 8–12 weeks in a cast [9].

In the following study we propose a new method for correcting iatrogenic hallux varus which aims to preserve the first MTP joint and involves a step-wise approach of reverse scarf osteotomy and opening wedge osteotomy of the hallux proximal phalanx. The causative factors leading to the development of iatrogenic hallux varus, the patients' reasons for revision surgery, and the outcomes following surgical revision of hallux varus are described. The risks and complications associated with the treatment of iatrogenic hallux varus are also described.

2. Patients and methods

The departmental surgical database was searched for patients who were admitted for hallux varus surgery between 1996 and 2009. A total of nine patients were identified. At the time of follow up two patients were non-contactable and two patients were excluded. One patient had undergone surgery for congenital hallux varus rather than iatrogenic deformity and one patient had undergone primary surgery elsewhere. The remaining five patients developed hallux varus following combined rotation scarf and Akin osteotomies for the treatment of hallux valgus. Symptoms included first MTP joint pain and stiffness, an unsatisfactory cosmetic appearance to the foot, footwear discomfort, and transfer metatarsalgia.

All patients were asked to attend an audit appointment. The five participants reviewed were all female. The average age at the time of revision surgery to correct hallux varus was 55 years old (range 46–53; S.D. 6.3). Follow-up was at an average of 38 months following surgery to correct hallux varus (range 3–69). The audit included X-ray measurement of the first to second IM angle and the MTP angle at two points in the patients care; first post hallux valgus surgery and then following revision surgery to correct hallux varus. Weight bearing, dorso-plantar X-rays were assessed. The clinical first MTP joint angle was measured using a digital goniometer. The range of dorsiflexion and plantarflexion of the MTP joint was also measured. Intra-observer repeatability of the goniometer has previously been established by Kilmartin and Bishop [39]. Evaluation of transfer lesions to the lesser MTP joints following hallux varus surgery was observed. This was compared to the patients' original notes and their presenting complaint. Transfer metatarsalgia is such an important factor in forefoot surgery that the incidence of metatarsalgia pre-operatively is routinely documented [40]. A review of the notes was undertaken to assess for post-operative complications. AOFAS scores taken at six months following hallux valgus surgery were compared with the score following surgery to correct hallux varus, recorded at the audit appointment. Patients were asked of the complaints they presented with that drove them to proceed with revision surgery, if they were satisfied with the results of their revision surgery and if they felt they were better off having had their surgery. We recorded the presence of first MTP joint pain, footwear fitting problems, unsatisfactory cosmetic appearance, joint stiffness and pain sub 2nd MTP joint.

3. Surgical technique

Intra-operatively a stepwise approach to correcting the hallux varus was performed. The initial approach was a medial capsulotomy. If correction was inadequate, the sesamoid apparatus was mobilised using a McGlamry elevator. The alignment was then reviewed. If inadequate a reverse scarf osteotomy was performed providing an effective increase in IM angle and placement of the metatarsal head directly over the sesamoid apparatus. If the hallux remained in varus, an opening wedge osteotomy of the hallux proximal phalanx was performed. Deep closure was achieved using 2-0 absorbable sutures which were not overtightened in order to avoid pulling the hallux back into varus. The hallux was then strapped into a valgus position. Strapping was removed at two weeks post-op. The degree of correction was reviewed intra-operatively after each stage, before moving onto the next stage only as required.