Scarf Osteotomy for Correction of Hallux Valgus Deformity

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Abstract

Objective: Presentation of clinical and radiological outcome of a case series of scarf osteotomy.

Patients and Methods: The study involved 20 patients with 24 feet affected with symptomatic moderate to severe hallux valgus. Clinical assessment was done using American Orthopedic Foot and Ankle Society (AOFAS) score. Radiological assessment utilized measurement of hallux valgus angle (HVA), intermetatarsal angle (IMA) and the distal metatarsal articulation angle (DMAA). Akin closing-wedge osteotomy was added for 6 feet (25%).

Results: Mean age of patients was 35.6 ± 3.5 years; with 16 females and 4 males. All the clinical and radiological scores improved significantly after surgery compared to the baseline scores (p < 0.001, for all comparisons). There was no correlation between the clinical score and radiological angles pre- and postoperatively.

Conclusion: Scarf osteotomy of the first metatarsal can be considered to be a safe and reliable solution for the treatment of hallux valgus deformity.

Key Words: Scarf – Osteotomy – Hallux – Valgus.

Introduction

HALLUX valgus deformity has become an increasingly bothersome condition for which more than 130 surgical procedures have been described as treatment. Distal osteotomies of the first metatarsal primarily are advocated for mild to moderate hallux valgus deformities. For more severe deformities, more proximal first metatarsal osteotomies have been performed because they have been proven mathematically to achieve greater correction [1]. The proximal crescentic [2,3] proximal chevron [2,4], Mau [5], Scarf [6,7], Ludloff [8,9] and biplanar closing wedge osteotomies [10,11] are currently the most commonly used proximal metatarsal osteotomies.

The Scarf osteotomy has gained popularity because of its inherent stability, minimal shortening of the first metatarsal and ease of internal fixation [12]. It was first described early in the 20th century as a stable Z step cut osteotomy. With the development of sophisticated instruments, Weil and Borelli [13] in the USA and Barouk [14] in France have made more developments to this procedure. Many retrospective studies reported satisfactory results of the procedure [15-18].

The scarf first metatarsal osteotomy is one of the four steps necessary for correcting hallux valgus deformity: a) metatarsophalangeal joint (MTP) lateral release, b) Scarf osteotomy, c) medial capsulorrhopathy and d) great toe proximal osteotomy.

Looking to the several advantages of the scarf osteotomy, it is considered a reliable surgical procedure. It is extremely versatile, because it allows a wide range of fragment displacement. This is why the scarf is not a single osteotomy but several. This means its indications are broad, from mild to the most advanced deformities, including arthritic, juvenile, iatrogenic and even rheumatoid hallux valgus. The contraindications of scarf osteotomy are a very large hallux valgus deformity with a very thin first metatarsal, extremely deformed MPT joint and hallux valgus combined with a severe pes planus and hypermobility of the first metatarsal [14].

This study presents the clinical and radiological outcome of a case series of Scarf osteotomy.

Patients and Methods

The study involved 20 patients with 24 feet affected with symptomatic hallux valgus, operated upon between January 2006 and February 2008. Inclusion criteria were moderate to severe deformity, a hallux valgus angle of 20-40° and intermetatarsal angle 11-18°. Patients with hallux rigidus, previous fore-foot surgery, peripheral vascular diseases, steroid therapy or diabetes mellitus were excluded from the study.
Assessment:
All patients were assessed clinically and radiologically before and after surgery. The American Orthopedic Foot and Ankle Society (AOFAS) score was used for clinical assessment. It is a scoring system used to evaluate and monitor the progress of patients following foot and ankle surgery. It scores each patient from 100 points divided into 3 categories, 40 points for pain, 45 points for function and 15 points for alignment.

Pre and post operative weight bearing AP and Lateral radiographs were performed for radiological assessment. The hallux valgus angle (HVA), intermetatarsal angle (IMA) and the distal metatarsal articulation angle (DMAA) were measured.

The HVA was measured between the intersection of the bisection of the first metatarsal and proximal phalanx. The normal value is 10° to 15° [19]. The IMA is the angle formed by the intersection of the bisection of the first and second metatarsals. Its normal value ranges from 7° to 9° [20]. The DMAA is formed between the perpendicular to the effective articular cartilage of the first metatarsal head and its intersection with the bisection of the first metatarsal. The normal value is up to 8° [19] (Fig. 1).

Surgical technique:
All operations were done under general or spinal anesthesia. Prophylactic antibiotics were administered with induction of anesthesia. With the patient in the supine position, a mid-thigh or leg pneumatic tourniquet was applied. A medial skin incision was done opposite the first metatarsophalangeal joint extending proximally to the base of the first metatarsal. A Y-shaped capsular incision was performed to allow for V-Y capsulorrhaphy for soft tissue repair at the end of the procedure. Lateral release was done either through a separate incision or by using the same medial incision.

The bony exostosis was then shaved using the micro-oscillating saw. The SCARF osteotomy cuts were done by cutting first the longitudinal cut and then the two transverse cuts with the distal cut on the dorsal aspect and the proximal cut through the plantar aspect to make sure that the head is attached to the distal plantar cut portion of the metatarsal. This helps to preserve the blood supply to the metatarsal head.

The plantar distal fragment was then translated laterally at least one-half the width of the metatarsal shaft and then fixed to the proximal fragment by using two interfragmentary mini-set screws. Excess of the medial bone was then excised and the removed bone was used for local grafting (Fig. 2). At this point, the situation was assessed and if there is any residual deformity, an additional Akin’s closing wedge osteotomy of the proximal phalanx was performed and fixed with either interfragmentary screw or a percutaneous K-wire that was removed later. Medial capsular plication was then performed. Medial capsular repair was then done and skin was sutured.

Post-operative care:
Patients were put in a POP cast with padding between the first and second toes. Plaster was changed after two weeks with removal of skin sutures and then patients were allowed to do heal weight bearing for 4 more weeks after which the plaster was removed.

Results
The patient's age ranged from 18 to 54 years with a mean of 35.6±3.5 years. Female predomin-
nance was evident (16 females constituting 80% of cases). Four bilateral cases were encountered. Akin closing-wedge osteotomy was done for 6 feet (25%). In the unilateral cases the right foot was affected in 7 cases (43.8%) and the left was affected in 9 cases (56.2%).

All the clinical and radiological scores improved significantly after surgery compared to the baseline scores ($p<0.001$, for all comparisons). The HVA returned to normal value (10-15°) in 75% of cases. The IMA returned to normal (7-9°) in 66.7% of cases. The DMAA returned to normal (<10°) in 80.3% of cases (Fig. 3). Only one female patient (with left sided-lesion) was not satisfied after surgery due to persistence of pain mostly over the scar area, while the majority (80%) was very satisfied with the outcome of the procedure. The mean improvement of the three radiological angles was 18.5±4.3 for HVA, 6.7±1.9 for IMA and 1.3±1.5 for DMAA (Fig. 4). There was no correlation between the clinical score and radiological angles pre- and postoperatively as shown in Table (2).

One patient developed a superficial wound infection postoperatively which resolved completely with a course of parenteral antibiotics. Photos and X ray pictures of two cases are presented in Figs. (5,6).

![Fig. (3): The pre- and postoperative American Orthopedic Foot and Ankle Society (AOFAS) score.](image1)

![Fig. (4): Improvement of the hallux valgus angle (HVA), intermetatarsal angle (IMA) and the distal metatarsal articulation angle (DMAA) in radiographs.](image2)

![Fig. (5): A case with left HV, a) Preoperative photo, b) Intraoperative photo showing the osteotomy cut (arrow) and the retracted capsular flap (*), c) Postoperative photo.](image3)
Fig. (6): A case of bilateral HV deformity, a) Preoperative X-ray, b, c) Postoperative x-ray showing correction of the deformity using scarf metatarsal osteotomy with Akin's proximal phalangeal osteotomy, both fixed with interfragmentary screws.

Table (1): Clinical and radiological assessment details of the studied group (n=24).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global AOFAS</td>
<td>39.2±4.5</td>
<td>80.7±3.8</td>
</tr>
<tr>
<td>Pain</td>
<td>16.3±1.3</td>
<td>28.5±3.1</td>
</tr>
<tr>
<td>Function</td>
<td>24.0±1.8</td>
<td>39.2±1.2</td>
</tr>
<tr>
<td>Alignment</td>
<td>1.9±0.7</td>
<td>10.5±1.1</td>
</tr>
</tbody>
</table>

Discussion

Clinically, the AOFAS score improved significantly from 39.2±4.5 to 80.7±3.8, six months after surgery. This compares favorably with studies by O’Kane and Kilmartin [23], which showed an improvement of 46 points, Dereymaeker’s [24] article showing improvements of 58.6 to 86.3, Kristen et al.’s [18] series of 111 procedures producing average improvements of 50.1 to 91 points, Jones et al. [22] showing improvement from 52 points to 89 at follow-up and Lipscombe et al. [25] with significant improvement from 47.94 preoperatively to 96.10 at 1 year.

Radiologically, the procedure resulted in a significant improvement of all the 3 angles evaluated. The mean improvement of HVA was 18.5 ± 4.3°, of IMA was 6.7 ± 1.9° and of DMAA was 1.3 ± 1.5°. This was similar to previous studies [15-18]. HVA and IMA improved at mean 19.1° 6.6°, respectively, in Kristen et al. [18] study. Crevoisier et al. [17] reported significant improvement of all angles. The IMA and HVA improved from mean pre-operative values of 15° and 33° to 9° and 14°, respectively in Jones et al. [22] study. Lipscombe et al. [25] reported significant improvement of the IMA from 13.0±4.2° to 6.1±3.2° and on the HVA from 31.4±8.0° to 11.0±10.8°.
It has been previously reported that radiological criteria like HVA and IMA significantly improve following a scarf osteotomy. However, there is a controversy as regards to the extent of correction of the DMAA. Jones et al. [22], Kristen et al. [18] and Dereymaeker [24] have reported no significant change in DMAA after scarf osteotomy. On the other hand, Crevoisier et al. [17] and our results showed significant change in the DMAA, pointing to the fact that scarf osteotomy causes a rotational correction.

Wagner et al. [15] described improvements of the hallux valgus angle from 43 to 23 degrees and the intermetatarsal angle from 16 to 8 degrees. Patient satisfaction as determined by Shermann score also showed significant improvement. Blair et al. [26] produced improvements of the HVA of 17 degrees and significant improvements in pain scores. Lipscombe et al. [25] reported significant improvement of HVA from 29.7 to 9.9 degrees and IMA from 12.84 to 8.83 degrees.

In this series, Patients were allowed to bear weight on the heel, then to do full weight-bearing when the plaster was removed after six weeks. No significant complications were recorded. The stability of scarf osteotomy was found to be double that of Chevron osteotomy or a proximal crescentic osteotomy as confirmed by cadaver studies [27,28]. Trnka et al. [28] found that Scarf osteotomy, the biplanar closing wedge osteotomy and the Mau osteotomy had even higher mean strength values compared to the proximal crescentic and the proximal chevron osteotomies.

In this study, no correlation was found between the radiological results and the total AOFAS score, which was reported in other studies. reports [17,18]. This suggests that the AOFAS score may not be adequate for assessing outcome and other aspects of skeletal correction not currently included may be required.

In fact, radiographic and clinical improvements were cautioned with concerns about the postoperative mobility of the first ray. Crevoisier et al. [17] recommended the measurement of plantar pressures. Jones et al. [22] used pedobarography and found no significant changes in the measurements of the first and second metatarsals were noted. More recently, this was confirmed by Lipscombe et al. [25].

As a conclusion of this study, the Scarf osteotomy of the first metatarsal can be considered to be a safe and reliable solution for the treatment of hallux valgus deformity.

References