Correction of Hallux Valgus Using Lateral Soft-Tissue Release and Proximal Chevron Osteotomy Through a Medial Incision

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Introduction

As the degree of hallux valgus increases, the lateral capsule of the first metatarsophalangeal joint and the adductor tendon become contracted. In most surgical procedures designed to correct moderate to severe degrees of hallux valgus, the soft-tissue structures on the lateral aspect of the first metatarsophalangeal joint need to be released in order to reduce the subluxated joint. There are two surgical approaches for lateral soft-tissue release for the correction of hallux valgus. One is the dorsal approach between the first and second metatarsals, and the other is the medial approach, which passes under the first metatarsal head. We think that a medial approach is cosmetically as well as functionally better because it does not create a dorsal scar, which can be unsightly (Figs. 1-A and 1-B), and because it is less likely to cause stiffness of the first or second metatarsophalangeal joint. It is, however, difficult to release the lateral soft tissues, including the adductor tendon and the capsule, through a medial incision because, in patients with hallux valgus, the lateral sesamoid is displaced laterally and dorsally. Thus, the dorsal approach between the first and second metatarsals is more widely used among foot surgeons.

Some surgeons prefer to perform a distal osteotomy because of its inherent stability even for correction of a moderate to severe deformity either with or without a lateral soft-tissue release. However, it is very difficult to obtain enough correction with a distal osteotomy in the case of severe deformity, and inadequate correction or recurrence of the deformity is not uncommon. We have devised a method of...

Fig. 1-A
Medial scars (Fig. 1-A), which are barely visible when viewed from above, and dorsal scars (Fig. 1-B) between the first and second metatarsals.

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lateral soft-tissue release under direct vision through a dorsal approach combined with a proximal metatarsal osteotomy, all performed through the same medial incision.

Materials and Methods

The charts and radiographs of thirty-seven consecutive patients (forty-five feet) who had been managed with correction of a hallux valgus deformity by a single surgeon (W.-C.L.) between August 2003 and May 2004 were retrospectively reviewed. Eight patients (ten feet) lacked adequate follow-up and were excluded. The results of our operative procedures for the remaining twenty-nine patients (thirty-five feet) were investigated. The indication for surgery was chronic pain and deformity.

Radiographic criteria included a hallux valgus angle of >30°, a first-second intermetatarsal angle of >12°, and lateral subluxation of the sesamoids. Twenty-eight patients were female, and one was male. The average age at the time of surgery was 51.0 years (range, thirty-three to seventy-one years). The average duration of follow-up was 26.5 months (range, twenty-four to thirty-two months).

An American Orthopaedic Foot and Ankle Society (AOFAS) hallux-interphalangeal score was obtained both preoperatively and at the time of the most recent follow-up visit. The patients were also questioned as to whether they would undergo surgery again and, if so, with or without reservations.

Radiographic Evaluation

All preoperative radiographs included weight-bearing dorsoplantar and lateral views and a sesamoid view. The hallux valgus angle and the first-second intermetatarsal angle and the extent of sesamoid subluxation were assessed on the dorsoplantar radiograph. The talus-first metatarsal angle was measured on the standing lateral radiograph. The hallux valgus angle and the first-second intermetatarsal angle were measured with the method of Hardy and Clapham. Sesamoid position was defined by the position of the medial sesamoid in relation to the axis of the first metatarsal. A normal position was classified as...
grade 0, and the most severe lateral subluxation, in which the medial sesamoid was displaced laterally beyond the midaxis by >75% of its width, was classified as grade 3.

**Surgical Technique**

The procedure is performed with the patient under spinal anesthesia. An approximately 6-cm-long medial incision is made; the incision begins 1 cm distal to the first metatarsophalangeal joint, curves slightly dorsally over the bunion, continues proximally parallel to the plantar surface of the foot (not along the first metatarsal), and ends 1 cm distal to the first metatarsocuneiform joint (Fig. 2). If the incision is made along the shaft of the first metatarsal, the scar ends up on the dorsum of the foot after correction, and it can be seen when the patient stands.

A full-thickness dorsal flap including skin and subcutaneous tissue is then elevated to the first web space (Fig. 3).

The dorsomedial cutaneous nerve over the first metatarsal head is exposed and separated from the flap, and further dissection progresses laterally just superficial to the extensor hallucis longus and brevis tendons (Fig. 4). A vertical medial capsular resection involving the removal of approximately 4 mm of capsule is performed just proximal to the base of the proximal phalanx. A medial axial longitudinal incision is made in the capsule, extending to the neck of the first metatarsal. The medial eminence of the first metatarsal head is resected with use of a micro-oscillating saw after dor-
sal and plantar capsular flaps have been elevated from the medial eminence.

The deep fascia and areolar tissue between the first and second metatarsals are then incised at about 2.5 cm proximal to the first metatarsophalangeal joint, and the incision is extended distally. A lamina spreader is inserted between the first and second metatarsal necks and is opened to widen the first interspace. A curved hemostat is inserted under the deep transverse metatarsal ligament, and the ligament is incised (Fig. 5). Both tendons of the adductor hallucis are released (Fig. 6), and a longitudinal incision in the capsule is made along the dorsal margin of the lateral sesamoid (Fig. 7). The lateral capsule of the first metatarsophalangeal joint, however, is not incised vertically. In our series, we did not transfer the adductor tendon to the neck of the first metatarsal, but we think that this procedure could be performed through this approach.

At this point, the phalanx is abducted to test if the lateral soft-tissue release is adequate. If the phalanx cannot be angulated 20° medially with regard to the long axis of the first metatarsal (Fig. 8), the longitudinal incision along the dorsal margin of the lateral sesamoid is extended further distally, and the capsular attachment laterally at the base of the proximal phalanx is released.

A proximal chevron osteotomy is performed with use of a micro-oscillating saw (Fig. 9). The apex of the chevron is proximal and is located 7 mm distal to the first metatarsal-cuneiform joint. The angle of each arm of the chevron is made at 30° to the metatarsal axis.

After completion of the osteotomy, a small curette is placed on the lateral side of the dorsum of the proximal fragment to lever the proximal fragment medially as much as possible while the distal fragment is displaced and angulated laterally.

Two 0.062-in (0.16-cm) Kirschner wires are inserted from proximal to distal into the metatarsal head (Figs. 10-A...
Fig. 9
Intraoperative photograph showing the proximally apexed proximal chevron osteotomy.

Fig. 10-A
Radiographs showing the preoperative deformity (Fig. 10-A) and the postoperative correction secured with two Kirschner wires (Fig. 10-B).
and 10-B). An additional Kirschner wire is inserted if needed to achieve secure fixation. The degree of correction should be checked with fluoroscopy. If the first and second metatarsals are not parallel, the wires are removed and the osteotomy site is remanipulated. Proximally, the medial protruding bone is removed flush with the distal fragment. This bone and the bone that has been resected from the medial eminence of the metatarsal head is pushed into the osteotomy gap medially and applied to the lateral aspect of the osteotomy site.

A medial capsulorrhaphy is performed with use of interrupted 2-0 nonabsorbable and absorbable sutures. The periosteum is approximated with 2-0 absorbable sutures, and closure is completed with a running 4-0 nonabsorbable suture after about 3 mm of skin is excised from the plantar skin flap (Fig. 11).

**Postoperative Care**
The foot is placed in a splint for about one week postoperatively. Weight-bearing on the heel and the lateral border of the foot is permitted on the day after surgery. The compressive dressings are changed on the third or fourth postoperative day, and the sutures are removed two to three weeks postoperatively. Weight-bearing on the first ray is not allowed until the seventh postoperative week, and the Kirschner wires are removed during the ninth postoperative week.

**Statistical Analysis**
The hallux valgus angle, first-second intermetatarsal angle, sesamoid position, and AOFAS hallux-interphalangeal score at the time of the most recent follow-up visit were compared...

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**Fig. 11**
Intraoperative photograph showing a completed correction.

**Fig. 12**
Graphs illustrating changes in the AOFAS score, the hallux valgus angle (HVA), and the first-second intermetatarsal angle (IMA) from preoperatively to the time of the latest follow-up (at a mean of 26.5 months) for thirty-five feet in twenty-nine patients.
with preoperative values, and paired Student t tests were done. The level of significance was set at p < 0.05.

**Results**

The hallux valgus angle improved by an average of 27.8°, from a preoperative average of 35.8° ± 7.9° (range, 27.3° to 52.7°) to a postoperative average of 8.0° ± 7.6° (range, −10.6° to 22.6°) (p < 0.001) (Fig. 12). The first-second intermetatarsal angle improved from a preoperative average of 16.8° ± 2.8° (range, 12.0° to 21.8°) to a postoperative average of 5.0° ± 3.2° (range, −0.1° to 12.2°) (p < 0.001). The sesamoid position was reduced by an average of 2.5 grades, from a preoperative average of 3.0 to a postoperative average of 0.5 ± 0.6 (range, 0 to 2). The mean lateral talus-first metatarsal angle was 6.5° ± 8.4° (range, −6.3° to 19.4°) preoperatively and 9.1° ± 7.9° (range, −3.7° to 33.7°) postoperatively (p = 0.03). There was one hallux varus deformity of 5°, but the patient had no discomfort.

The average AOFAS hallux-interphalangeal score improved from 54.8 preoperatively to 93.3 postoperatively (p < 0.01). With regard to pain, patients reported that twenty-eight of thirty-five feet were completely pain-free and that seven feet had only occasional or slight discomfort. Postoperative motion (dorsiflexion plus plantar flexion) was regarded as normal or mildly restricted (>75°) in thirty-one feet and moderately restricted (30° to 74°) in four feet.

Twenty-three of the twenty-nine patients stated that they would undergo the same procedure again without reservations. Five patients reported that they would undergo the surgery with minor reservations because of the immediate postoperative pain and the aggravation of Kirschner wire removal. One patient stated that she would not undergo surgery again because she had a dorsiflexion malunion that required revision surgery. There were three cases of marginal wound necrosis, which healed secondarily without the need for any further surgery.

**Discussion**

One concern with this approach is its safety. The main blood supply over the medial surface of the foot originates from the medial plantar artery, and the dorsal area of the medial part of the foot is supplied primarily by the dorsalis pedis artery. Therefore, the dorsal margin of the angiosome of the medial plantar artery is 2 to 3 cm above the medial glabrous junction. Thus, the main concern during exposure is the possibility of necrosis of the dorsal flap. If the main blood supply to some part of the dorsal flap is from the medial plantar artery, there would be a high risk of flap necrosis because the skin incision crosses the borderline between the dorsal and plantar angiosomes. We have used this approach to perform a proximal chevron osteotomy in >200 feet since August 2003. Marginal wound necrosis developed in three patients in that group, and in all three it healed uneventfully without additional surgery. We believe that making the incision plantar to the metatarsal shaft and parallel to the sole of the foot may protect the blood supply to the dorsal flap. We think that this approach, with careful handling of the dorsal flap, can be used safely, with only a slight possibility of marginal wound necrosis.

Another concern with this approach is the possibility of an inadequate lateral soft-tissue release, resulting in a less-than-satisfactory correction of the hallux valgus deformity. The final hallux valgus angle, the first-second intermetatarsal angle, and the sesamoid position were all satisfactory in the present series, so we think that we can achieve a sufficient lateral soft-tissue release through this approach.

In addition to the correction of alignment, we have obtained satisfactory joint motion that is comparable with that described in any other report on hallux valgus correction. We think that this approach creates less scar in the first web space because the skin and subcutaneous tissue are not dissected and the lateral capsule is not disrupted parallel to the joint line.

The apex of the proximal chevron osteotomy can be made distally or proximally. The potential risk associated with making the apex proximally is the creation of a fracture of the proximal fragment, but, to our knowledge, this complication has not been reported. The primary difference between making the apex of the osteotomy proximally or distally is the location of the pivot point for correction of the first metatarsal angulation. If the apex points distally, the pivot point is more distal. Thus, if the apex is proximal, the location of the pivot point is closer to the metatarsocuneiform joint, and we believe that it is geometrically better to correct a deformity as close as possible to the origin of the deformity.

With a proximal chevron osteotomy, the correction occurs through a combination of lateral translation and angulation. Geometrically, more translation is possible if the apex is made distally; however, in our experience, we have been able to achieve a sufficient amount of translation and therefore we prefer the proximal-apex osteotomy.

In conclusion, the present study suggests that we can release the lateral soft tissues sufficiently by approaching the first web space dorsal to the first metatarsal after elevating the skin and subcutaneous tissues. We believe that satisfactory correction of moderate to severe hallux valgus deformities can be obtained by combining this approach with a proximally apexed proximal chevron osteotomy.

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