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Distal Chevron Osteotomy with Lateral Soft Tissue Release for Moderate to Severe Hallux Valgus Decided Using Intraoperative Varus Stress Radiographs

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ABSTRACT

The purpose of the present study was to investigate the outcomes of distal chevron osteotomy with lateral soft tissue release for moderate to severe hallux valgus. The patients were selected using criteria that included the degree of lateral soft tissue contracture and metatarsocuneiform joint flexibility. The contracture and flexibility were determined from intraoperative varus stress radiographs. From April 2007 to May 2009, 56 feet in 51 consecutive patients with moderate to severe hallux valgus had undergone distal chevron osteotomy with lateral soft tissue release. This was done when the lateral soft tissue contracture was not so severe that passive correction of the hallux valgus deformity was not possible and when the metatarsocuneiform joint was flexible enough to permit additional correction of the first intermetatarsal angle after lateral soft tissue release. The mean patient age was 45.2 (range 23 to 54) years, and the duration of follow-up was 27.5 (range 24 to 46) months. The mean hallux abductus angle decreased from 33.5° ± 3.1° to 11.6° ± 3.3°, and the first intermetatarsal angle decreased from 16.4° ± 2.7° to 9.7° ± 2.1°. The mean American Orthopaedic Foot and Ankle Society hallux-interphalangeal scores increased from 66.6° ± 10.7° to 92.6° ± 9.4° points, and 46 of the 51 patients (90%) were either very satisfied or satisfied with the outcome. No recurrence of deformity or osteonecrosis of the metatarsal head occurred. When lateral soft tissue contracture is not severe and when the metatarsocuneiform joint is flexible enough, distal chevron osteotomy with lateral soft tissue release can be a useful and effective choice for moderate to severe hallux valgus deformity.

Numerous operative techniques have been described for the treatment of symptomatic hallux valgus (1–3). Distal chevron osteotomy has gained popularity owing to its several advantages, including the relative ease of the procedure, placement in metaphyseal bone, and a mechanically stable geometry (4–6). Furthermore, compared with proximal osteotomies, distal chevron osteotomy is less extensive and allows for early weightbearing and ambulation (7,8). However, the amount of possible correction is limited to the amount of lateral displacement of the capital, which, it has been recommended, should not exceed 50% of the width of the metatarsal head (4). Therefore, standard distal chevron osteotomy should be limited to mild to moderate hallux valgus with a hallux abductus angle of <30° and an intermetatarsal (IM) angle of <15° (9,10). Nevertheless, several investigators have described its use, with modification, for wider indications (7,8,11,12). Favorable results have been reported using this technique combined with lateral soft tissue release for moderate to severe hallux valgus (11,13,14). However, historically, surgeons have had reservations regarding correction with this type of procedure for more severe deformities because of the possibilities of osteonecrosis, recurrence, and insufficient correction (15–17).

Deenik et al (14) performed a randomized controlled comparative study on distal chevron osteotomy and scarf osteotomy for moderate to severe hallux valgus and reported that chevron osteotomy was at least as effective. However, they also reported that 10% of the cases treated by distal chevron osteotomy recurred. Bai et al (11) performed distal chevron osteotomy with lateral soft tissue release for moderate to severe hallux valgus and reported that a mean hallux abductus angle changed from 36.2° preoperatively to 12.4° at the final follow-up visit. Furthermore, no case of osteonecrosis of the metatarsal head was encountered, although at the final follow-up examination, the hallux abductus angle ranged ≤25°. Although favorable results have been reported for distal chevron osteotomy with lateral soft

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tissue release for moderate to severe hallux valgus, we believe that careful case selection will reduce complications and achieve better results.

The purpose of the present study was to investigate the outcomes of distal chevron osteotomy with lateral soft tissue release for moderate to severe hallux valgus in a cohort carefully selected using criteria that included the degree of lateral soft tissue contracture and metatarsocuneiform (MTC) joint flexibility at surgery.

Patients and Methods

Subjects

Our institutional review board approved the present study. From April 2007 to May 2009, 59 consecutive patients (67 feet), who had undergone distal chevron osteotomy with lateral soft tissue release for moderate to severe hallux valgus, were retrospectively studied. All the patients had undergone surgery by the senior author (Y.W.P). The medical records and radiographs were reviewed, and, at a minimum of 2 years after surgery, the patients were invited for a final follow-up visit for a detailed evaluation. However, 5 patients (8.48%) were unable to be contacted and 3 (5.09%) refused to participate. Accordingly, the study cohort included 51 patients (56 feet; 86.44% of the potentially eligible patients, and 83.58% of the potentially eligible feet). Of the 51 patients, 46 (90.20%) were females, and 5 (9.80%) were males. The mean patient age at surgery was 45.2 (range 23 to 54) years, and the mean duration of follow-up was 27.5 (range 24 to 46) months.

Inclusion and Exclusion Criteria

The inclusion criteria were moderate to severe hallux valgus with a preoperative hallux abductus angle $>30^\circ$ and a preoperative first IM angle of $>14^\circ$. The degree of lateral soft tissue contracture and first MTC joint flexibility were evaluated using intraoperative varus stress radiographs to determined the operative methods. Specifically, lateral soft tissue contracture was evaluated using 2 methods on the operating table before the surgery. First, a fluoroscopic foot anteroposterior (AP) radiograph was taken with the forefoot held in 1 hand and squeezing at the metatarsal heads to reduce the first IM angle, with the other hand pressed to the lateral side of the great toe proximal phalanx to the medial side to apply varus stress (Fig. 1*A*). When the great toe proximal phalanx could be forced back into straight alignment or with a slight overcorrection to the long axis of the first metatarsal (Fig. 1*B*), distal chevron osteotomy with lateral soft tissue release was considered. When this alignment was not observed with stress manipulation (Fig. 1*C*), proximal osteotomy was performed (the results of which were not included in the present study). Second, a similar stress manipulation procedure was used with attention paid to the fluoroscopic tangential sesamoid view to assess the sesamoid reduction. With the ankle at 15° of plantarflexion and the metatarsophalangeal (MTP) joint at 45° of dorsiflexion, the forefoot was held in 1 hand, and the metatarsal heads were squeezed together to reduce the first IM angle. The other hand was used to simultaneously apply varus stress to the great toe proximal phalanx (Fig. 2*A*). The fluoroscopic x-ray beam was directed anteroposteriorly and centered on the sesamoids. A location of the medial sesamoid entirely medial to the central crista on the first metatarsal heads was defined as reduced (Fig. 2*B*), and all other positions were considered unreduced (Fig. 2*C*). When sesamoid reduction was possible, distal chevron osteotomy with lateral release was undertaken. When this position was not achieved, proximal osteotomy with lateral soft tissue release through the dorsal web space incision was performed (the results of which were not included in the present study).

The flexibility of the first MTC joint was evaluated using fluoroscopic radiographs (Figs. 3 and 4). In brief, after lateral soft tissue release, the first metatarsal head was pushed laterally, and the hallux was reduced to a neutral position with temporary medial capsulorrhaphy. This procedure prevented the medializing force of the proximal phalanx against the metatarsal head widening the first IM angle. Fluoroscopic weightbearing foot images were obtained before lateral soft tissue release and after this procedure by pressing the entire foot over the flat fluoroscopic detector to simulate the weightbearing foot in an AP view. The images were converted to a picture archiving communication system (Infinitt Healthcare, Seoul, Korea). The first IM angle was measured using a computerized measurement system (PiviewsSTAR; Infinitt Healthcare). When the first IM angle had decreased to $\leq 14^\circ$ (Fig. 3) on the stress radiograph, we performed distal chevron osteotomy with lateral soft tissue release. However, when the first IM angle measured after this procedure was $> 14^\circ$ (Figs. 4 and 5), we undertook proximal osteotomy (the results of which were not included in the present study.

The exclusion criteria included hallux valgus with a lateral facet at the base of the first metatarsal or with os intermetatarseum, which could prevent the first metatarsal from being adequately approximated to the second metatarsal after lateral soft tissue release (18,19). When a prominence was present on the lateral side of the base of the first metatarsal eroding into the base of the second metatarsal, it was also excluded (Fig. 6). Hallux valgus with osteoarthritis of the first MTP joint or with severe instability

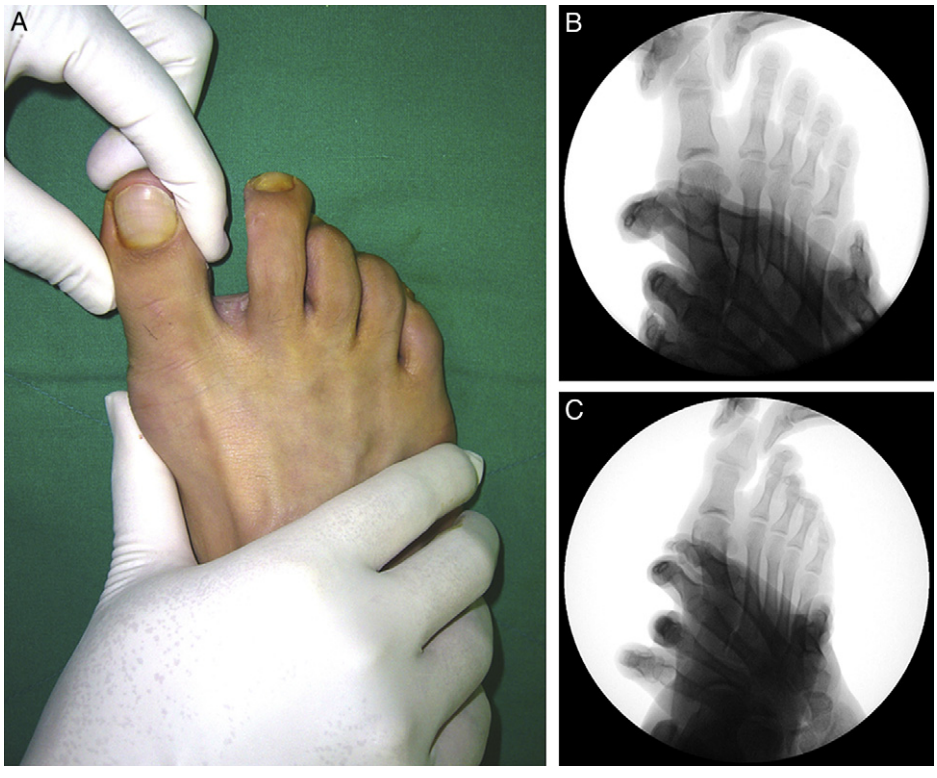

Fig. 1. Lateral soft tissue contracture evaluated on the operating table. (*A*) Fluoroscopic foot anteroposterior radiograph taken with the forefoot held in 1 hand while squeezing at the metatarsal heads to reduce the first intermetatarsal angle, while the other hand pressed the lateral side of the great toe proximal phalanx to the medial side to apply varus stress. (*B*) When the great toe proximal phalanx could be forced back into straight alignment or with slight overcorrection to the long axis of the first metatarsal, distal chevron osteotomy with lateral soft tissue release was performed. (*C*) When it was not possible, proximal osteotomy was considered; these cases were excluded from the study.