Modified Crescentic Proximal Metatarsal Osteotomy and Distal Soft Tissue Procedures in Hallux Valgus

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The results of a modified crescentic proximal metatarsal osteotomy and distal soft tissue procedures for patients with symptomatic, incongruent, metatarsophalangeal joint, hallux valgus deformity were reviewed. Forty-nine feet of 41 patients were evaluated. All of the patients were male military personnel of different ranks, and their mean age was 23 years (range, 20–43 years). The mean follow-up period was 25 months (range, 10–60 months). The patients were evaluated according to the American Orthopedic Foot and Ankle Society forefoot scoring system. The mean preoperative score was 54.4, and the mean postoperative score was 95.4. The mean hallux valgus angle was 39.4° before surgery and 12.8° after surgery (26.6° correction); the mean intermetatarsal angle was 15.9° before surgery and 7.1 after surgery (8.8° correction). A total of 93.8% of the patients were satisfied with the results of the procedure. Complications included delayed union in one case and superficial wound infections in two cases. We also emphasize small modifications performed while shifting the metatarsal shaft laterally and compare the results of our study with those of similar studies.

Introduction

Napoleon said that an army moves on its stomach. However, today we know that it moves on the ends of its legs. If one thinks of the average person walking several miles (~8,000 steps) during the course of the day, it is obvious that foot care becomes very important for military personnel. Proper foot health is essential for all soldiers to maintain their optimal health and physical fitness. Military boots generally are not very comfortable, and even minor foot problems can cause great disability, especially during hard training with these boots.

Hallux valgus (HV) is the most often encountered deformity of the forefoot; it has more than one component and commonly occurs in persons who wear improper shoes. The etiology also includes many factors such as genetic, systemic, and neuromuscular factors. More than 100 surgical procedures have been described to correct HV deformities; for the treatment of moderate/severe cases, in addition to the distal soft tissue procedures, corrective osteotomies performed at the proximal aspect of the first metatarsal are necessary. This combination is especially used for cases with a HV angle of >30° and intermetatarsal (IM) angle of >15°. The foot should be carefully examined for flexible pes planus and hypermobility of the tarsometatarsal joint, for the prevention of recurrences. In addition, deformity should never be despised, indication must be considered, utmost attention should be paid to the surgical technique, postoperative care should not be neglected, coordination with the patient should be taken into consideration, and conditions such as systemic diseases like rheumatoid arthritis, neurological disorders like diabetic neuropathy, and generalized joint laxity should be recognized. Various proximal metatarsal osteotomies were defined to correct metatarsus primus varus, performed at the proximal aspect of the first metatarsal, including crescentic, chevron, open-wedge, closed-wedge, and oblique osteotomies.

The crescentic osteotomy described by Mann et al.[1] is one of the most commonly performed proximal procedures. This procedure is efficient in correcting HV angle, allows triplanar correction of the deformity, and is very practical.

We have managed to overcome the difficulty encountered during lateral shifting of the metatarsal shaft after crescentic osteotomy with a small modification.[2] We performed a second crescentic osteotomy at the lateral side of the metatarsal for ease of manipulation.

The aim of this study was to compare the results of the modified crescentic osteotomy and distal soft tissuerelease procedures performed for military personnel. A distinguishing fact that must be emphasized in this study is that our patients were all young, healthy, active individuals.

Methods

Modified crescentic proximal metatarsal osteotomy and distal soft tissue procedures were applied to 49 feet of 41 patients with HV deformities between January 1998 and January 2003, at the Department of Orthopedics and Traumatology, Gulhane Military Medical Academy. All of the patients were male military personnel of different ranks; their mean age was 23 years (range, 20–43 years). The mean follow-up period was 25 months (range, 10–60 months). There were no cases with the finding of degenerative arthritis in the preoperative phase.

All of the operations were performed as primary procedures. The main symptom of the patients was persistent pain over the bunion for several years, despite conservative treatment. This procedure was not performed for any patient for only cosmetic purposes. The activity levels of the patients were low or moderate; there were no commandos, paratroopers, or Special Forces member.

Physical examination of all patients was performed in both sitting and standing positions. Patients were carefully evaluated for pes planus, Achilles tendon contracture, and hypermobility of the first ray. None of these problems was present in our cases. Range of motion of the first metatarsophalangeal (MTP) joint was

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also evaluated. Then, anteroposterior, lateral, and axial views (for the sesamoid position) were obtained with the patient in the weight-bearing position. HV angle, IM angle, position of the tibial sesamoid, and metatarsal lengths were measured in these views. The position of the tibial sesamoid was classified according to the classification described by Hardy and Clapham.[3]

Modified crescentic proximal metatarsal osteotomy and distal soft tissueprocedures were applied to the patients with incongruent MTP joints. Thirty-four of those patients had moderate deformity (HV angle of >30° and IM angle of >15°) and 15 had severe deformity (HV angle of >40° and IM angle of >20°).

Eight patients (11 feet) had painful plantar keratosis under the second and/or third metatarsal head before surgery. Of the 11 feet, only four had a metatarsal-shortening osteotomy in addition. The indications for a shortening osteotomy included metatarsalgia, tenderness, plantar keratosis, and the radiological criterion showing distances of >12 and >11 mm between the tips of the second and third metatarsals, respectively, when the tips of the 1–5 metatarsal longitudinal axis are joined.

During the postoperative phase (postoperative examinations were performed every month for the first 6 months, once every 3 months for the next 6 months, and later once every 6 months for each patient), patients underwent a clinical and radiological examination. They were also questioned regarding the presence of pain, the appearance of the foot, the ease when walking, and whether they could wear military boots.

All patients were evaluated according to the American Orthopedic Foot and Ankle Society (AOFAAS) forefoot scoring system. The mean preoperative score was 54.4. The AOFAAS scoring system is not military specific, but we did not find any military-specific scoring system in the literature.

Surgical Technique

With epidural or spinal anesthesia, the patient is positioned supine on the operating table and a tourniquet is applied from the supramalleolar region. We used the original three-incision technique described by Mann et al.,[1] but a single incision is thought to be less irritating for some surgeons. The initial skin incision is made at the dorsomedial aspect of the first MTP joint. The medial eminence is exposed and then removed. The second skin incision is made in the dorsal aspect of the first web space, and then soft tissues are released at the lateral side of the MTP joint. A third incision is made on the dorsal aspect of the base of the first metatarsal, over the extensor hallucis longus tendon. Because we were sometimes having difficulties while swinging the metatarsal shaft, we needed some kind of modification in the procedure. After crescentic osteotomy, at the central point of the proximal part, a second crescentic osteotomy is made with a sharp gouge, and a bone fragment with a 2- to 3-mm base at the lateral side of the metatarsal shaft is removed (Fig. 1). After the osteotomy is completed, the metatarsal shaft is reduced in a way that provides adequate correction, through the osteotomy site. The second osteotomy is not obligatory; if the surgeon has difficulty during the correction maneuver, then it can be easily performed. The tourniquet is released, bleeding control is achieved, and all incisions are closed with radiographic control.[4] Postoperatively, the foot placed in a compression dressing. The patient is permitted to walk in a postoperative wide shoe, with weight-bearing as tolerated. The sutures are removed approximately 12 to 14 days after surgery. Radiographic controls are obtained in the first and second month. The dressings are removed after 2 months. Range-of-motion exercises are encouraged. If there are any problems such as swelling or pain, then the patients are not obliged to perform these exercises. All of the patients were able to run 4 months after the operation.

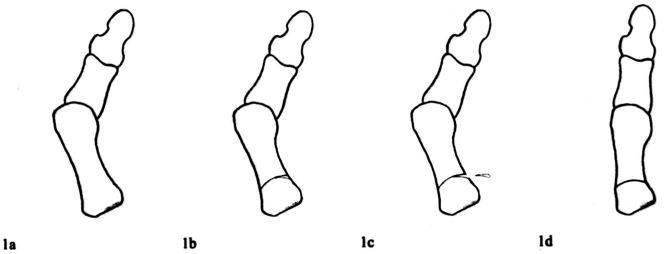


Fig. 1. Schematic illustration of the modification of the technique. a, HV deformity; b, creation of proximal crescentic osteotomy; c. removal of a bone fragment with a 2- to 3-mm base at the lateral side of the metatarsal shaft; and d, correction of the deformity.

Results

The mean preoperative score according to the AOFAAS forefoot scale was 54.4 (range, 20–75), and the postoperative score was 95.4 (range, 80–100). We obtained a correction of a mean of 41 points. Forty-six (93.8%) of 49 feet were free from pain at follow-up evaluations; for three feet, pain continued after surgery but was improved. Radiographically, all of the osteotomies except one were united solidly at 6 to 8 weeks. The mean HV angle was 39.4° preoperatively and 12.8° postoperatively; the mean IM angle was 15.9° preoperatively and 7.1° postoperatively. The HV angle was corrected by an average of 26.6°, and the IM angle was corrected by an average of 8.8°.

According to the grading system of displacement of the medial sesamoid (Hardy and Clapham classification), 8 feet were classified as grade III, 8 as grade V, 14 as grade VI, and 19 as grade VII preoperatively; 11 were classified as grade II, 17 as grade III, 11 as grade IV, 7 as grade VI, and 3 as grade VII postoperatively. Examples from our cases are presented in Figures 2, 3, and 4.

For two patients, there was a superficial wound infection at the incision site. Both patients were treated for infection with wound care and antibiotics. There was a delayed union in one



Fig. 2. Preoperative anteroposterior radiograph of the patient.

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Fig. 3. Postoperative anteroposterior radiographs of the right foot.

case. In that case, the osteotomy site was more distal to the normal one than it was supposed to be. We applied a cast and achieved a union at 3 months.

There was a gradual disappearance of keratoses during the postoperative period for four patients who had metatarsal shortening because of painful plantar keratoses. For seven feet that did not have shortening, patients reported no pain after the operation; keratoses was eliminated for five patients during the follow-up period.

All of the patients were satisfied with the appearance of their feet after surgery. Only one patient had a problem with walking. None of the patients had complaints about wearing shoes or boots. Hallux varus deformity, neurovascular injury, fixation failure at the osteotomy site, screw failure, plantar flexion or dorsal flexion deformity of the first metatarsal, and recurrence were seen in none of the patients postoperatively. All of the patients were able to return to their military duties.

Discussion

Although >100 surgical techniques for the treatment of HV deformity have been described, we found a limited number of techniques for first metatarsal proximal osteotomy for the treatment of moderate/severe HV. The reason for this is that, with the use of distal metatarsal osteotomies, significant metatarsus primus varus deformity could not be adequately corrected. Although open-wedge, closed-wedge, chevron, and oblique osteotomies are among the proximal metatarsal osteotomies, proximal



Fig. 4. Postoperative anteroposterior radiograph of the left foot.

crescentic osteotomy seems like a more popular method. Because of shortening of the first ray in closed-wedge osteotomy[5] and lengthening of the first ray in open-wedge osteotomy, increasing weight at the first MTP joint and instability and union problems are considered to be the disadvantages of these two techniques. Another technique, lapidus, is also recommended for HV with a hypermobile first ray.

In the literature concerning similar series of proximal crescentic osteotomies plus distal soft tissueprocedures, Mann et al.[1] reported union in all osteotomies performed on 109 feet of 75 patients treated with this technique. The HV angle was corrected by an average of 21° and the IM angle was corrected by an average of 8°, after a mean 34-month follow-up period. Reported patient satisfaction was 93%, and only minor complications such as varus, revalgus, and pin tract infection were noted. The loss of correction for the HV angle was 3.8° and that for the IM angle was 1.4° at a mean follow-up time of 5.5 years.[1]

Thordarson and Leventen[6] had a follow-up period of 28 months for 49 feet of 35 patients, and mean decreases from 37.5° to 13.8° in the HV angle and from 14.9° to 4.7° in the IM angle were observed. In the same study, although patient sat-

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isfaction was 93%, seven patients had symptomatic transfer lesions, two of which required metatarsal neck osteotomy.[6]

In the study by Zettl et al.,[7] 114 feet of 96 patients had a mean follow-up period of 26 months. Those authors also reported decreases in both HV angle and IM angle (mean decreases from 41.1° to 14.6° and from 17.8° to 7.8°, respectively). The best result in their series was 91%. There were eight cases of hallux varus and five cases of hardware failure complications.[7]

Okuda et al.[3] treated 47 feet of 33 patients, with a mean follow-up period of 48 months. Patient satisfaction was 81%, and those authors reported mean corrections from 38° to 13.8° in the HV angle and from 17.7° to 7° in the IM angle. There were only two cases of minimal hallux varus.[3]

In our study, there were mean decreases from 40° to 13° in the HV angle and from 15.6° to 6.7° in the IM angle, which was a result in concordance with the results of other studies of the same sort. We acknowledged 94% patient satisfaction.

Although our technique is not markedly different from that now published in the literature, we have managed to overcome locking at the crescentic osteotomy site during the correction phase, with the help of a small modification. This second crescentic osteotomy has not led to shortening, because the top part of the osteotomy does not change. Because we also have not experienced any problems concerning casting and union, we advise performing this small modification during surgery.

It is necessary to reestablish normal anatomical relationships in feet after surgery. Otherwise, we may have problems such as recurrence, unsatisfactory results, and transfer metatarsalgias.

In the literature, there are cases of development of hallux varus reported as the main complication of this type of osteotomy,[8] which we did not encounter in our study. There may also be complications at the osteotomy site because of loss of fixation and soft tissuerelease. The reason for failure cases is mostly loss of fixation at the osteotomy site. The main reasons for bad results are dorsiflexion of the first metatarsal and shortening. Transfer metatarsalgia develops because of shortening and loss of dorsiflexion.[9] We did not observe dorsiflexion and shortening in the radiographs obtained during the early postoperative period. However, these problems could appear later. To prevent this complication and to preserve the corrected position, it is advisable not to allow full weight-bearing until complete union is achieved. We did not observe correction loss at the osteotomy site for any of our patients, because we did not allow full weight-bearing unless union was seen radiologically, although the patients had permission to walk in a soft cast. There was one case of delayed union and two cases of infection in our series.

In conclusion, proximal crescentic osteotomy and distal soft tissuerelease are to be performed for the surgical treatment of moderate/severe cases of incongruent MTP joint HV. During surgery, there should be a second crescentic osteotomy to ease the process of releasing the shaft laterally. It is also advisable not to allow full weight-bearing until complete bony union is clearly seen on the radiographs, to prevent correction loss. Finally, our results are similar to literature reports.

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