THE TRANSPOSITIONAL BASE OSTEOTOMY: An Alternative to the Closing Base Wedge Osteotomy

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INTRODUCTION

The distal metaphyseal osteotomy for repair of hallux valgus deformity provides many advantages, including increased stability, and technical ease. However, the distal metaphyseal osteotomy does not adequately address the severe hallux valgus deformity. Throughout history, this inadequacy has stimulated the design of more proximally-based procedures, including the closing base wedge osteotomy.

The closing base wedge osteotomy became popular in the late 1960s and early 1970s, and has remained the cornerstone of treatment for the hallux valgus deformity associated with a high intermetatarsal angle. Although the procedure is extremely effective in addressing these more severe deformities, it is not without complications. Two frequent complications are shortening and postoperative elevatus of the first metatarsal. As our appreciation for the effects of unprotected weight bearing forces on bone healing and our knowledge of the hinge axis concept have evolved, this latter complication has been significantly lessened. Aside from these potential structural complications, the procedure and its associated internal fixation maneuvers are technically more demanding on the surgeon and should be reserved for those with increased skills and experience.

Several options to the closing base wedge osteotomy have been described. Some of the more popular alternatives include the crescentic base osteotomy, the Mau and Laudloff procedures, the Off-set V, the Z or SCARF bunionectomy, the opening metatarsal or first cuneiform osteotomy, and the Lapidus metatarsal-cuneiform arthrodesis. Although successfully used by their respective proponents, critical analysis of these procedures identifies several inherent weaknesses.

The traditional crescentic procedure uses a rotation maneuver of the distal segment on the proximal base to reduce the intermetatarsal angle. Due to its through-and-through nature, both medial to lateral and dorsal to plantar, it is a very unstable procedure. This instability is magnified by the design of the osteotomy itself. Due to the crescentic nature of the cut and its proximity to the metatarsal-cuneiform joint, placement of secure internal fixation can be quite challenging.

The Mau and Laudloff osteotomies are two other examples of rotational techniques used to address above-average intermetatarsal angle deformities. In contrast to the crescentic procedure which is a true base osteotomy, these two techniques are primarily diaphyseal. However, since the apex of rotation is positioned at the base, a significant amount of intermetatarsal angle correction can be achieved. Although they are unstable, by the nature of the through and through cut, these osteotomies can be very easily fixated with a variety of techniques.

A consideration with all of these rotational osteotomies is the inherent tendency to create an abnormal PASA deformity as the metatarsal head is pivoted laterally. The potential for creating this complication is obviously going to increase as greater intermetatarsal angles are challenged.

The off-set V osteotomy and the SCARF Z bunionectomy can be classified as transpositional corrections of the intermetatarsal angle. With these procedures, the metatarsal head is slid laterally on the proximal shaft in an effort to narrow the gap between the first and second metatarsals. The technical design of these osteotomies lend a significant degree of intrinsic stability against the forces of weight bearing. Their design also affords easy application of internal fixation. The obvious limitation to these techniques is the amount of lateral transposition that can be achieved. In order to address more severe intermetatarsal angles, the capital fragment must often be shifted 50% or greater. This can easily lead to inadequate bone to bone contact and instability of the osteotomy. In addition, these procedures can often be technically demanding to perform.

Several authors, most recently Duke[1,2,3] have taken the intrinsic stability of the SCARF design and used a rotation maneuver of the distal segment to afford a significant increase in the degree of potential correction. He essentially combined the rotation concepts of the Mau and Ludloff procedures with the SCARF bunionectomy to address more severe intermetatarsal angles. His initial study reports excellent results with minimal complications.

AUTHOR'S TECHNIQUE

The stimulus behind designing this procedure was to find a viable and predictable alternative to the closing base wedge osteotomy for increased intermetatarsal angles. As Duke pointed out in his recent publication, an ideal base osteotomy should be comprised of seven characteristics: 1) proximal locus of correction; 2) resist the stresses of weight bearing; 3) simple to perform; 4) simply and effectively fixated; 5) easily adjusted osteotomy; 6) versatility in correction; and 7) minimal surgical trauma.

The degree to which the closing base wedge osteotomy predictably addresses these seven characteristics is highly dependent on patient selection and the technical expertise of the surgeon. In the author's experience, the procedure has resulted in several predictable shortcomings. Most notably are the postoperative shortening and iatrogenic PASA deformities that are an intrinsic consequence of the osteotomy. In addition, the oblique nature of the Juvara type cut makes it an unstable procedure easily disrupted by the forces of weight bearing. Other concerns include the potential development of a postoperative elevatus deformity despite accurate intraoperative execution of the osteotomy. This latter finding may be an indication of ongoing boney adaptation occurring at the osteotomy site after weight bearing has been initiated.

The procedure is based on the concepts of the modified Austin bunionectomy as described by Kalish.[4] The procedure takes advantage of the intrinsic stability afforded by the chevron design while the long arm of the osteotomy allows placement of rigid internal fixation. In addition, the proximal location of the osteotomy allows a greater degree of correction for each degree of lateral transposition.

The surgical approach uses a long dorsal-medial incision over the entire first metatarsal shaft. (Figure 1) After standard dissection techniques are used to anatomically release all lat-

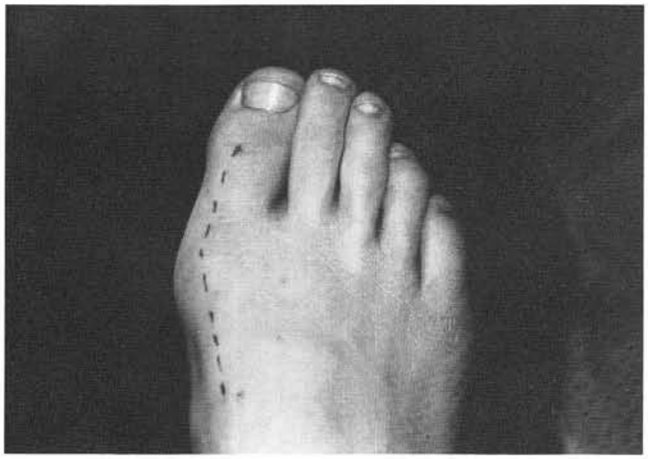

Figure 1. Standard dorsal-medial incision over the entire metatarsal shaft.

eral soft tissue contractures and remodel the dorsal-medial exostosis, attention is directed to the base where osseous correction is addressed.

Approximately 1 cm distal to the metatarsal-cuneiform joint, a proximally-based chevron cut is planned with the apex proximal and base distal. The arms of the base are approximately 55° apart and the plantar arm is slightly longer than the dorsal arm. (Figure 2) The procedure was initially performed with a long dorsal arm but was altered due to an increased number of wing fractures and a greater ease of transposition with the longer plantar arm.

Axis guide concepts used for bi-plane correction (most typically plantarflexion and lateral transposition) and flush osteotomy design are applied in identical fashion to those popularized in the distal Austin procedure. Upon completion of the medial to lateral cut, the osteotomy is transposed laterally reducing the intermetatarsal angle. (Figure 3)

Correction is initially maintained with a bone clamp, while permanent fixation is achieved with cortical screws directed from dorsal-lateral to plantar-medial. (Figure 4A,B) The amount of transposition typically does not go beyond 50% of the shaft diameter. In those cases where increased correction is desired, a combination of transposi-

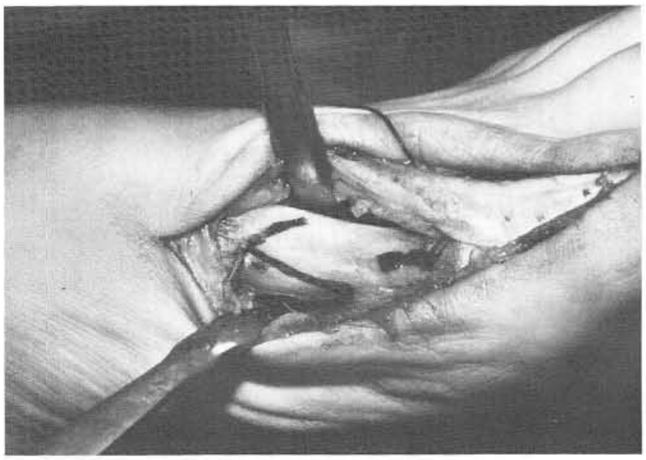

Figure 2. Proximal chevron cut with a long plantar arm.

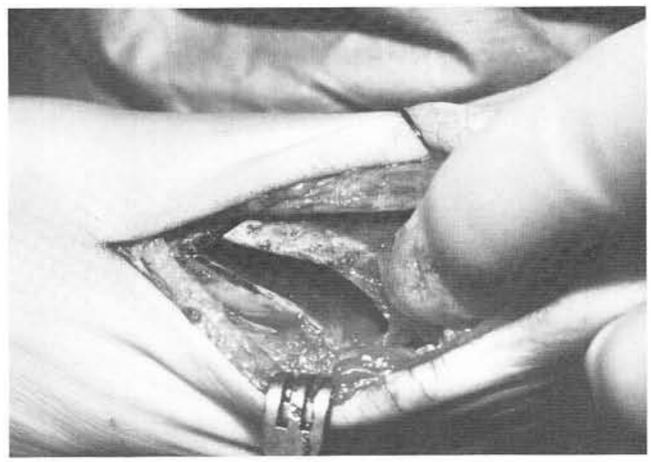

Figure 3. The distal fragment is transposed and, when needed, rotated on the proximal base.

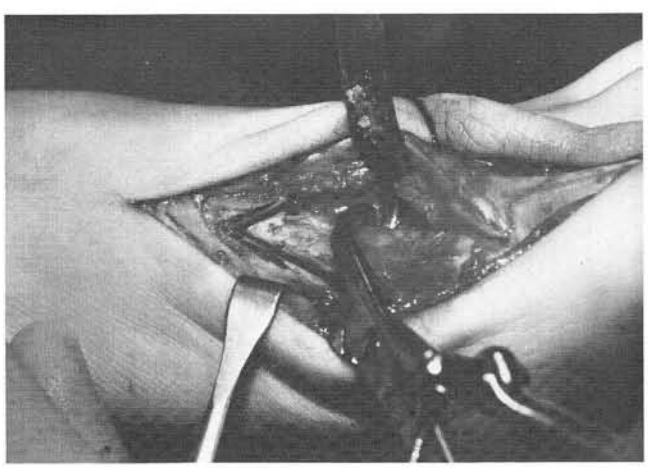

Figure 4A. The osteotomy is initially stabilized with a bone clamp.

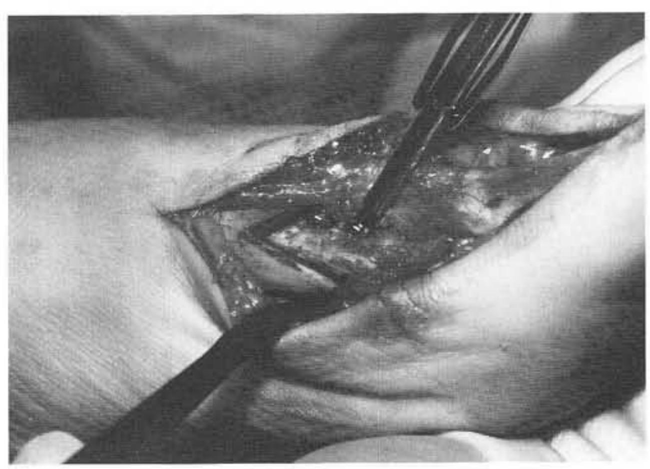

Figure 4B. Permanent fixation stabilizes the osteotomy with two 2.7 mm cortical screws from dorsal-lateral to plantar-medial.

tion and rotation is applied to the distal fragment. After accurate anatomic layer closure, a sterile dressing and below the knee cast are applied. The patient is kept non-weight bearing with crutches for 6 weeks prior to initiating unassisted ambulation.

RESULTS

Over the past 15 months, the author has performed this procedure on approximately 20 patients. The average age of the patients was 41, with a range from 17 to 67. The average intermetatarsal angle was 19°, with a range from 18° to 23°. Results in this initial patient population are very encouraging. Intermetatarsal angles were effectively reduced in all instances and complications were minimal. (Figures 5A, 5B) The most common shortcoming was a dorsal wing fracture seen in three patients. This fracture was not seen in the patient population treated with procedures using the long plantar wing.

In contrast to Duke's study, troughing of the distal and proximal segments was not seen. Absence of this complication allowed for more accurate osteotomy alignment and helped eliminate postoperative elevatus of the first metatarsal. Shortening of the metatarsal was minimal and essentially limited to the width of the saw blade.

SUMMARY

The transpositional base osteotomy offers an excellent alternative to the base wedge osteotomy when addressing hallux valgus deformities with high intermetatarsal angles. Predictable bi-plane corrections (typically transverse and sagittal) can be easily achieved with simple axis guide manipulations. Complications of excessive shortening and postoperative elevatus were not seen. The procedure also possess excellent stability, attributed to both the intrinsic design of the osteotomy as well as the application of rigid internal fixation. The procedure does require extensive soft tissue dissection (similar to all basal procedures) and initially can be technically challenging to perform. For these reasons, it is recommended that this procedure be practiced on cadaveric or saw bones prior to entering the operating room.

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Figure 5A. Preoperative x-ray. The preoperative intermetatarsal angle measured 21° degrees.

Figure 5B. Four month postoperative x-ray.