CHAPTER 25

Current Use Of The Oblique Base Wedge Osteotomy In Hallux Valgus Sugery

John A. Ruch, D.P.M.

The base wedge osteotomy has long been a recognized surgical procedure for correction of severe hallux valgus. Many modifications in technique and fixation have come and gone as the procedure has demonstrated fluctuations in its utilization and popularity over the years.

The transverse base wedge osteotomy, with various forms of wire fixation, was quite popular in the mid to late 1960s. Use of the procedure declined in the early 1970s as significant complications were identified, and as the popularity of distal metaphyseal osteotomies increased.

In the 1970s, complications associated with the base wedge osteotomy included shortening of the first metatarsal (Fig. 1). This radiographic finding was believed to be the cause of a variety of postoperative problems such as metatarsalgia, stress fracture, and other forefoot pathology. The base wedge technique fell out of favor for most surgeons until the mid to late 1970s with the introduction of rigid internal fixation techniques in foot surgery.

Figure 1. Classic shortening of the first metatarsal following base wedge osteotomy. This shortening is due to several factors including shortening of the bone from the osteotomy cut, resorption of bone because of secondary bone healing, and apparent shortening due to elevation of the first metatarsal.

With the introduction of scientific principles of bone surgery, several inherent pitfalls were identified in the base wedge osteotomy technique. The most significant problem that was identified turned out not to be shortening of the metatarsal, but rather elevation of the metatarsal as a result of the osteotomy technique, and further elevation due to weight bearing on a healing osteotomy (Fig. 2). Many authors have described the iatrogenic metatarsus primus elevatus as a result of failure to appreciate hinge mechanics. Elevation of the metatarsal also occurred because of postoperative weight bearing on the healing bone. This practice led to forced elevation of the metatarsal, and is now generally discouraged as a form of management for the base wedge osteotomy.

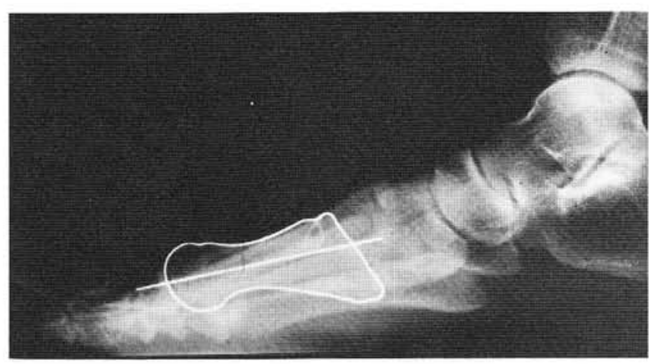

Figure 2. A lateral radiograph demonstrating elevation of the first metatarsal following base wedge osteotomy. This structural malalignment of the first metatarsal is responsible for a variety of postoperative complications, including lesser metatarsal disorders and hallux limitus.

John Shuberth was the first to identify and describe the hinge axis concept in execution of the base wedge osteotomy. The basic parameters for application of this principle include an axis which is perpendicular to the weight-bearing surface when viewed from a medial orientation (Fig. 3A).

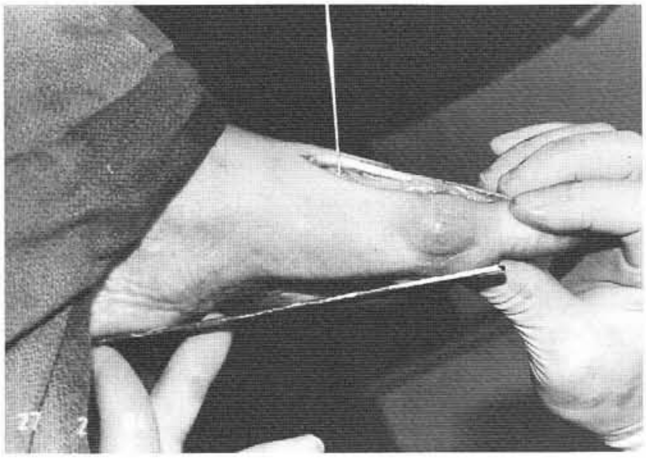

Figure 3A. A medial orientation of the foot demonstrating perpendicular alignment of the axis guide pin to the weight bearing surface of the foot.

Significant manipulation of the metatarsal can be accomplished by deviating the axis on the frontal plane (Fig. 3B). Lateral deviation of the superior pole of the axis creates a dorsal medial hinge, and results in plantarflexion of the metatarsal with closure of the osteotomy. This principle has been demonstrated mathematically by Tom Cain and other authors.

The hinge axis technique can be applied quite easily in surgery with the use of a Kirschner wire as an axis guide, or with more sophisticated instrumentation such as the Reese osteotomy guide.

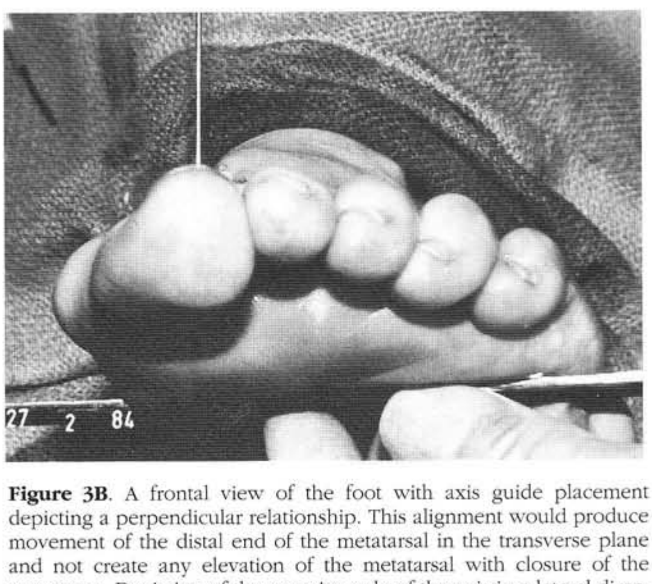

Figure 3B. A frontal view of the foot with axis guide placement depicting a perpendicular relationship. This alignment would produce movement of the distal end of the metatarsal in the transverse plane and not create any elevation of the metatarsal with closure of the osteotomy. Deviation of the superior pole of the axis in a lateral direction would introduce a moment of plantarflexion as the osteotomy is reduced.

TECHNIQUE UPDATE

The techniques of dissection, osteotomy execution, and the basic steps of internal fixation have been described quite thoroughly in the literature and expounded upon in an instructional film of the oblique base wedge osteotomy. The purpose of this paper is to discuss some of the more current modifications and updates in surgical technique.

Osteotomy Orientation

The most significant point to make with respect to the osteotomy includes the angle of the proximal arm of the wedge osteotomy (Fig. 4). This cut is the final angle of the osteotomy and is the arm to which intended internal fixation is visualized. The angle of this cut should be no greater than 45 degrees to the long axis of the metatarsal, and preferably a longer osteotomy which is deviated approximately 35-40 degrees from the long axis of the metatarsal.

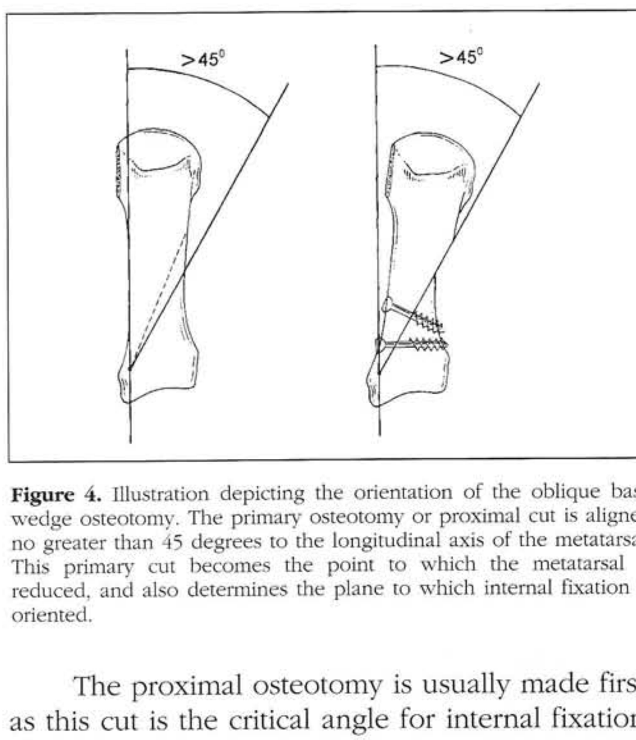

Figure 4. Illustration depicting the orientation of the oblique base wedge osteotomy. The primary osteotomy or proximal cut is aligned no greater than 45 degrees to the longitudinal axis of the metatarsal. This primary cut becomes the point to which the metatarsal is reduced, and also determines the plane to which internal fixation is oriented.

The proximal osteotomy is usually made first, as this cut is the critical angle for internal fixation. The second cut is made distal to the first cut, and can be oriented for varying degrees of wedge closure. A proximal osteotomy which is made greater than 45 degrees to the long axis of the metatarsal will result in a short osteotomy and make it difficult to fixate with two bone screws.

TWO SCREW FIXATION

The current technique for fixation of the oblique base wedge utilizes two bone screws. The author uses two 4.0 mm partially-threaded cancellous screws, while many other surgeons utilize various combinations of cortical and/or cancellous screws. Strain gauge studies have indicated that double-screw fixation is superior to a single screw. However, neither technique is secure enough to allow weight bearing. The two screw technique for fixation of the oblique base wedge osteotomy employs the European description or principle for fixation of a long oblique fracture.

The first screw is placed perpendicular to the long axis of the bone (Fig. 5). This screw is called the anchor screw and its primary purpose is to prevent shortening of the osteotomy if the cortical hinge should fail. A screw that is perpendicular to the long axis of the bone creates the shortest distance from the medial to the lateral cortex. If the cortical hinge should fracture and the distal metatarsal segment shorten or shift proximally on the proximal segment, the width between the medial and lateral cortex would increase. The placement of the anchor screw prevents this proximal shift by preventing an increase in diameter or distance between the medial and lateral cortex of the bone. (A screw perpendicular to the osteotomy allows proximal rotation and a loss of compression as the head of the screw shifts away from the medial cortex.)

The anchor screw is placed slightly superior and proximal to the medial center of the osteotomy (Fig. 6). As the screw is inserted, it is tightened to

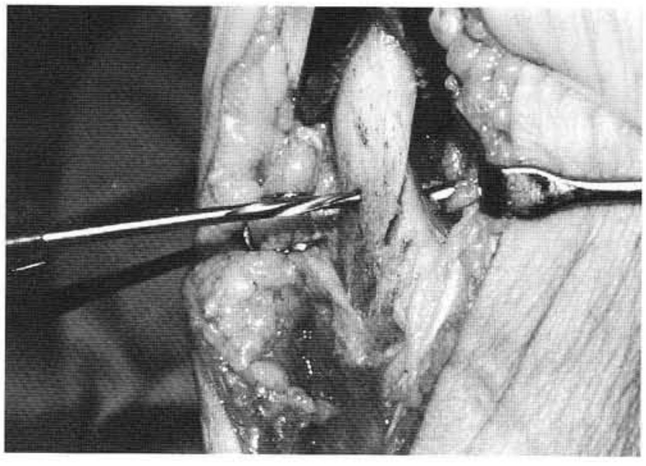

Figure 5. Transverse orientation of the initial anchor screw in the two screw technique for fixation of the oblique base wedge osteotomy.

only two-finger tightness. Over-tightening of this screw prior to insertion of the second or compression screw would cause a distal shift of the metatarsal segment and separation of the cortical hinge.

Once the anchor screw is in place, the second screw (compression screw) is inserted. This screw is placed perpendicular to the plane of the osteotomy. Its point of penetration in the medial cortex is slightly distal and inferior to the initial

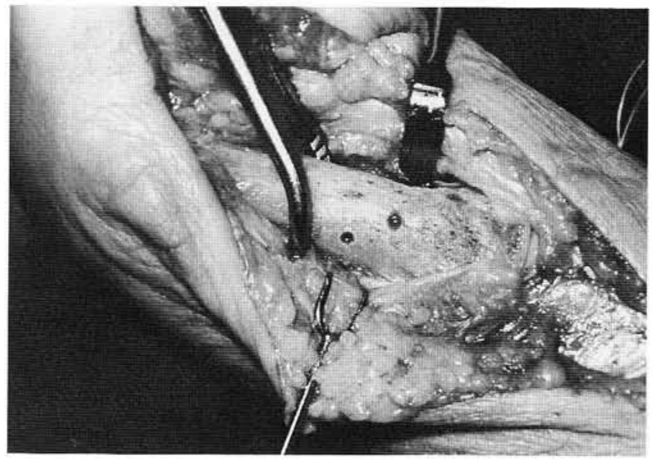

Figure 6. Medial view of the base wedge osteotomy demonstrating the sites for screw fixation. The proximal and superior drill hole is the site for the anchor screw, which is perpendicular to the long axis of the metatarsal. The distal and inferior drill hole is the site for the compression screw, which is oriented perpendicular to the osteotomy plane.

anchor screw. Care must be taken during countersinking and subsequent instrumentation to avoid a fracture between the screw hole sites. Once the compression screw is inserted and tightened to maximum compression, additional tightening of the anchor screw can be performed. Over the last ten years, this two screw technique has proven to be the most successful technique for internal fixation of the oblique base wedge, and is currently the standard technique used by members of Podiatry Institute (Figs. 7A, 7B).

POSTOPERATIVE MANAGEMENT

Postoperative management of the oblique base wedge osteotomy includes strict non-weight bearing for a minimum of six weeks. The patient is usually placed in a short-leg cast which may be bivalved. More cooperative patients, or patients who are able to ambulate safely with crutches, can be placed in a synthetic cast brace. Radiographic examination is recommended at three weeks, six weeks, and other

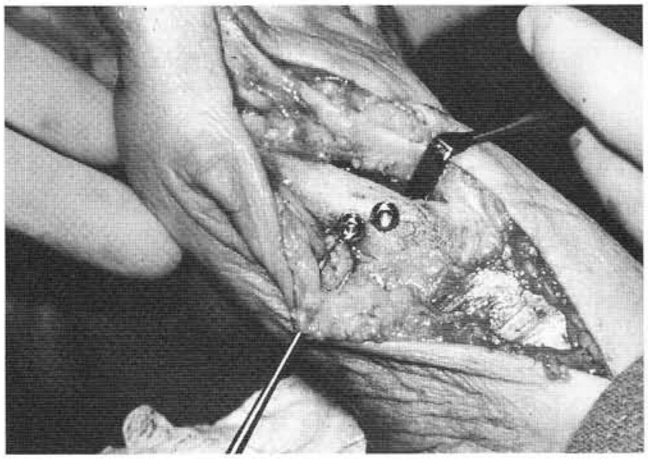

Figure 7A. Placement of the two cancellous bone screws for fixation of the base wedge osteotomy.

specific points in the postoperative course. The radiograph taken at three weeks is used to confirm surgical correction and to identify any shift in the position of the osteotomy which may have occurred as a result of early ambulation. The radiograph taken at six weeks postoperative is the benchmark by which subsequent films will be compared, once the weight-bearing process is initiated.

At approximately six weeks postoperative, the patient is fitted with a surgical shoe or walking cast brace, and is allowed to begin partial weight bearing. During this time, the patient is still using two crutches and should place 25-50 percent of body weight on the operated foot. This degree of weight-bearing is allowed for approximately one week, and can increase to one crutch support as long as the patient is experiencing no specific pain, increase in swelling, or localized symptoms at the site of the metatarsal osteotomy. Serial radiographs can be taken at seven or eight weeks, depending on the patient's course of activity and degree of symptoms.

Critical changes that may be identified if a complication occurs include alteration of the osteotomy site or shift of the fixation devices. An increase in lucency or obvious fracture of the cortical hinge would indicate movement. Motion at the osteotomy site or inadequate healing may also be detected by the shift of a fixation screw. Evidence that a screw is backing out, or any sign of erosion around the threads or shaft of the screw would also indicate motion. Bone callus is not likely to form early in the recovery period, and may be a later finding.

Figure 7B. A dorsoplantar radiograph depicting the desired orientation of the anchor screw and the compression screw.

If early evidence of delayed healing is identified, the complications of shortening and elevation can be avoided if the patient is returned to a non-weight bearing status which may include recasting. As long as the patient continues the weight-bearing process without complication, the degree of activity can be increased dependent upon their clinical symptoms. More serious complications of the base wedge technique include the usual complications of hallux valgus surgery, including hallux varus.

Complications associated with the osteotomy, especially a more proximal osteotomy, include delayed union and nonunion. These complications have been relatively rare due to the strict adherence to non-weight bearing and the close observation of the patient in the initial weight bearing phases.

Cast disease can be a significant problem postoperatively, especially in the obese postmenopausal female patient. The combination of casting, obesity, and lymphatic and venous stasis lead to prolonged edema following removal of the cast. Significant below-knee edema may persist for six to twelve months following this type of surgical procedure and postoperative management. The problem of cast disease can be minimized by early range of motion and a more aggressive therapy program in the postoperative period.

The oblique base wedge osteotomy continues to be the standard technique for correction of severe intermetatarsal angle deformities by members of the Podiatry Institute. Other techniques have been described and include aggressive transposition of the traditional or Kalish-Austin osteotomy, and modifications of midshaft transpositional osteotomies such as the scarf or Mau techniques. However, the oblique base wedge technique has been refined and standardized to the point that it has held-up over the years, and continues to be the procedure which faculty members utilize when the other modifications are not adequate to correct severe deformities.

This technique is not without its own unique complications and concerns. However, a thorough understanding of the surgical and mechanical principles, meticulous surgical execution and technique, and stringent postoperative management can lead to consistent success and an excellent surgical result.