

THE SAGITTAL Z-OSTEOTOMY

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Most procedures utilized within the realm of foot surgery have specific and fairly well-defined indications. However, on occasion one will find a procedure that is quite versatile and well-suited to a variety of problems. The sagittal z-osteotomy is one such procedure. It may be used for the correction of numerous derangements of the first metatarsal, and in some instances, those of the lesser metatarsals as well.

The sagittal z-osteotomy is easy to perform, lends itself to stable fixation, and provides correction in a number of different planes. Furthermore, this procedure allows the surgeon to temporarily adjust and readjust the degree of correction during surgery until the specific position is obtained. Wedge-type osteotomies may not afford this luxury. In the more traditional wedge-type procedures additional bone can be removed following the initial resection. However, the options for attempting to adjust an overly-generous amount of bone resection are limited.

MANIPULATIONS OF THE SAGITTAL Z-PROCEDURE

Sagittal plane correction is the dominant manipulation afforded with this procedure. The osteotomy may be rotated either dorsally or plantarly as desired. Therefore, the procedure is an acceptable means of addressing any sagittal plane deviation, be it inherited or due to previous surgery. The surgeons at the Podiatry Institute have primarily used this procedure to address iatrogenic metatarsus primus elevatus.

The other means of utilizing the procedure involves lengthening or shortening the osteotomy, with the former being employed with far greater frequency. As with sagittal plane correction, lengthening of the first ray is primarily used in cases of a shortened metatarsal following fracture or previous surgery. Traditionally, a bone graft with plate fixation has been employed for this purpose. However, grafting may require another procedure to harvest the bone. Even with the use of freeze-dried

bone, as with any bone graft, there are generally more risks involved. In most patients with intact sensation who undergo bone grafting of the first ray with plate fixation, the plate becomes a significant source of irritation requiring another procedure for its removal. The sagittal z procedure is not subject to the same concerns.

Lengthening of the metatarsal does come with a cost, primarily increased tension at the metatarsophalangeal joint level. This can create a symptomatic hallux limitus. There are two primary ways to overcome this problem, one being to plantarflex the distal aspect of the osteotomy in addition to distraction. However, in certain patients this may not be enough to overcome the tension placed on the joint. Thereafter, the surgeon may be required to perform some type of arthroplasty at the metatarsophalangeal joint level.

When sliding the metatarsal head distally, sufficient length must be provided to allow distraction of the osteotomy, as well as maintaining enough bone-to-bone overlap to accommodate two screws for fixation. Two points of fixation are required to prevent rotation of this osteotomy. Generally, 2 cm of overlap is adequate, so that the osteotomy must be at least this length with an additional amount, depending on the degree of distraction desired.

When distraction is performed, there will be a segment at each end of the bone where the metatarsal is only one-half width. Generally, this has not been a problem. However, one may fill the defect with bone if this is a concern. In instances where a resectional arthroplasty has been performed at the metatarsophalangeal joint level, the bone from the phalangeal base will suffice to fill the gaps. These graft segments are usually stabilized with 2.0-mm screws.

PROCEDURE

A long linear incision is made just medial to the extensor hallucis longus tendon. Appropriate releases and other measures are first addressed at the metatar-

Due to the patient's poor hallux position and complaint of joint pain, it was decided to surgically intervene in an attempt to salvage this unsatisfactory result.

The procedure of choice in this case was a total joint prosthesis. The device was a Bio-action implant⁹ which is a two component, non-constrained design. It features a cobalt-chromium metatarsal prosthesis, and a medical grade ultra-high molecular weight polyethylene (UHMWPE) proximal phalanx on a titanium base.

Adjunctive procedures included a Z-plasty lengthening of the extensor hallucis longus, and reattachment of the short flexor apparatus to the base of the proximal phalanx. Postoperative radiographs demonstrate correction of varus position of the hallux, and good range of motion (Figs. 3A, 3B). The patient was pain-free and satisfied with the result obtained.



Figure 3A. Dorsoplantar radiograph following salvage procedure utilizing a total joint prosthesis. The hallux position is now improved.

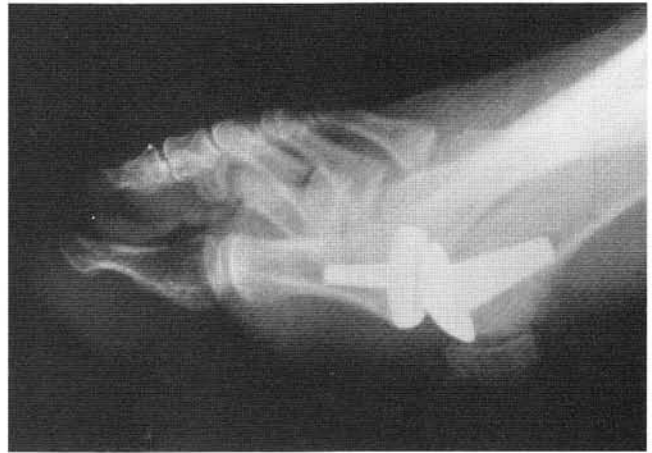


Figure 3B. Lateral radiograph following salvage procedure.

DISCUSSION

This case illustrates the progressive weakening of bone which occurs secondary to avascular necrosis. Subchondral collapse can occur under the stresses present in the first metatarsal head. Possibilities for salvage of this situation include joint prosthetic implant, or an arthrodesis procedure.

In the authors' experience, avascular necrosis is a rare occurrence. Implants provide a viable option for treating these cases. There is still disagreement as to the factors and their relative importance in the development of avascular necrosis of the first metatarsal head.

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sophalangeal joint. The periosteum is incised and separated from the medial aspect of the metatarsal shaft, and to a lesser degree, dorsally. The surgeon should attempt to preserve as much of the soft tissue attachment to the lateral aspect of the metatarsal as possible.

Two K-wires may then be inserted from dorsal to plantar in the shaft of the metatarsal to serve as an axis guide, and to ensure that the osteotomy will be of sufficient length. The distal transverse cut is preferably made from the central sagittal cut to

the lateral aspect of the metatarsal. The proximal transverse cut is made from the medial metatarsal cortex to the central osteotomy. Occasionally, one will have to cut through the periosteum at the distal lateral portion of the osteotomy. Otherwise, the soft tissue will prevent adequate distraction of the metatarsal head segment.

The osteotomy is then positioned to the new alignment, clamped, and evaluated. Any necessary change in the position can then be performed prior to inserting two screws for permanent stabilization.

CASE REPORTS



Figure 1A. Preoperative radiograph of hallux abducto valgus deformity.



Figure 1B. Dorsoplantar view of patient, 1 year following first metatarsal base osteotomy.



Figure 1C. Lateral view 1 year postoperative.

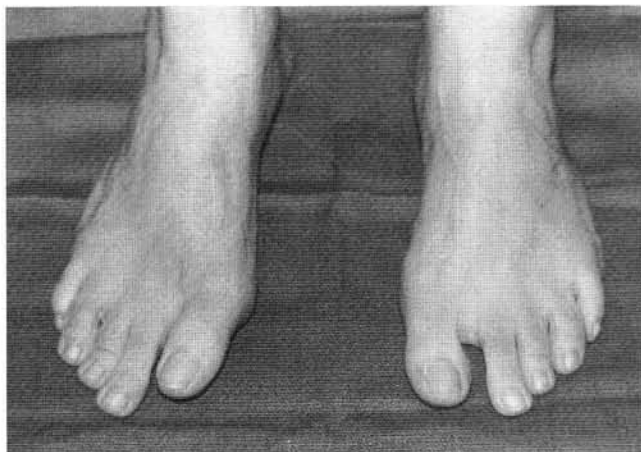


Figure 2A. The same patient as in Figure 1 with a primary complaint of pain beneath the first metatarsal head and an unstable gait.



Figure 2B. Notice that the hallux does not purchase the ground due to the extreme plantar displacement of the distal metatarsal.



Figure 3A. Intraoperative dorsoplantar radiograph following a sagittal z-osteotomy with fixation.



Figure 3B. Lateral intraoperative radiograph.

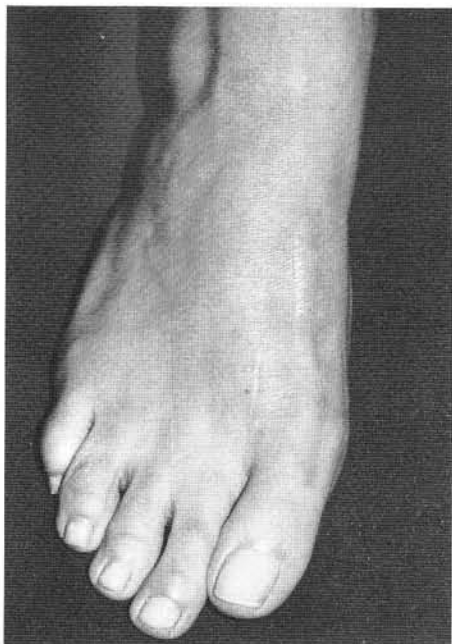


Figure 4A. Clinical appearance, 4 months postoperative.

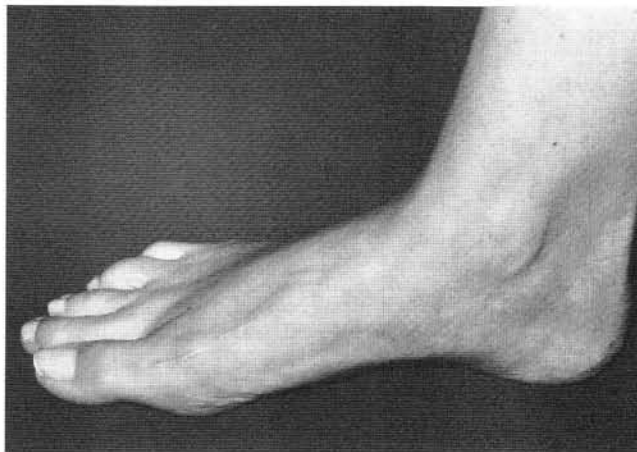


Figure 4B. Medial view, 4 months postoperative



Figure 5A. Radiograph of a young male patient with severe pain beneath the third metatarsal head, following second metatarsal fractures both distally and proximally.



Figure 5B. Appearance following sagittal z-osteotomy to lengthen and plantarflex the distal metatarsal.

CONCLUSION

The sagittal z-osteotomy is a versatile procedure which is used to address aberrations of the first ray alignment. Members of the Podiatry Institute have been using this procedure for over four years, with good results.