PROXIMAL OSTEOTOMIES FOR METATARSUS ADDUCTUS

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Metatarsus adductus continues to be a challenging deformity to treat. Considerable literature is available for both conservative and surgical approaches to correction, primarily dictated by the patient's age at the time of initial treatment. The surgical management of metatarsus adductus has evolved to performing multiple osteotomies at the metatarsal level, either in the form of a closing wedge, crescentic, or rotational (Lepird) cuts. Internal fixation is also varied, ranging from wires to screws, with reported stability and success.

Radiographic evaluation of metatarsus adductus is helpful in assessing the actual level of the transverse plane deformity. When assessing the degree of deformity, one needs to be careful to capture a true dorso-plantar (D-P) radiograph. A supinated D-P radiograph will highlight the plantar medial aspect of the metatarsals and accentuate metatarsal plantarflexion, giving the impression of a higher metatarsal adductus than actually present.

Many patients with a clinical and radiographic presentation of metatarsus adductus have been traditionally treated with panmetatarsal base osteotomies. In retrospective examination of preoperative radiographs, the actual level of deformity is often found at the tarsometatarsal level.

Ganley was the first to discuss this concept in detail, in which he isolated and examined first metatarsals in normal and metatarsus adductus patients. Often it was impossible to properly match the isolated metatarsal with the foot-type. In Ganley's discussion, he found the deformity to be within the Lisfranc's articular set angle (LASA), and advocated addressing the deformity at the lesser tarsus level. Although the first metatarsal is clinically and radiographically adducted and out of position, the metatarsal is not deformed. The deformation is more commonly found within the medial cuneiform. His recommendation was for proximal osteotomies and soft tissue releases in patients over the age of seven years, where structural maturity of the first metatarsal has occurred. (Table 1)

Table 1

GANLEY STAGING SEQUENCE FOR CORRECTION OF METATARSUS ADDUCTUS

Stage I: Opening wedge medial cuneiform osteotomy
Stage II: Soft tissue release as required, consisting of the plantar fascia, abductor hallucis, tibialis anterior and posterior tendons.
Stage III: Closing wedge cuboid osteotomy

Ganley supported the technique of an opening wedge medial cuneiform osteotomy with the following:

a) cuneiform osteotomies avoid the growth plate in the base of the first metatarsal.
b) A greater surface area of cancellous bone in the medial cuneiform provides a more rapid healing potential from surgical intervention.
c) The blood supply to the medial cuneiform is greater than the first metatarsal.

d) Proximal osteotomies provide a greater lever arm for transverse plane correction.
e) Proximal osteotomies correct the abnormal Lisfranc's articular set angle (LASA), which is commonly noted radiographically with metatarsus adductus.

Fowler et al. were the first to describe an open wedge osteotomy of the medial cuneiform in 1959. Hoffman et al. presented their experience in eighteen patients where an opening wedge osteotomy of the medial cuneiform was performed in patients with a residual clubfoot deformity. They performed a biplane osteotomy for the correction of forefoot adduction and equinus, and reported good to excellent results in 60-80% of the patients.

Proximal osteotomies for metatarsus adductus have been performed by members of the Podiatry Institute since the late 1980s. A closing wedge cuboid osteotomy is usually performed in conjunction with an opening wedge osteotomy of the medial cuneiform to affect structural correction of metatarsus adductus. (Figure 1) If correction is satisfactory after the cuboid closing wedge osteotomy is performed, then no further osteotomies are required.

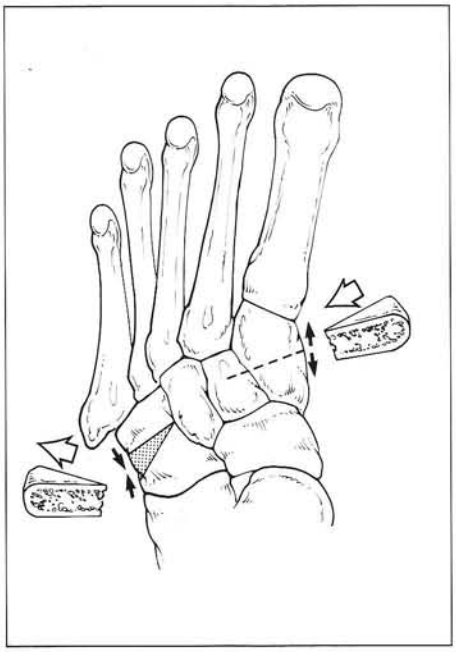

Figure 1. Closing wedge cuboid osteotomy in conjunction with an opening wedge osteotomy of the medial cuneiform for correction of metatarsus adductus.

SURGICAL TECHNIQUE

In this approach to treating metatarsus adductus, the cuboid osteotomy is the primary procedure. This will effectively shorten the lateral column of the foot and result in forefoot abduction. A curvilinear incision is centered over the lateral cuboid, and care is taken to avoid the lateral and intermediate dorsal cutaneous nerves. As dissection approaches the deep fascia, the extensor digitorum brevis muscle belly is encountered and reflected dorsally for exposure to the dorso-lateral cuboid. A laterally-based wedge of bone is then removed from the mid-substance of the cuboid, with the apex directed distal-medially toward the midpoint of the medial cuneiform. A minimal wedge of bone should be resected initially and reciprocal planing performed as needed.

Stable internal fixation and can be achieved with the use of hand or pneumatically driven staples (Blount staple, 3M Stapilizer). Anatomic layered closure is performed, with special care to avoid the sensory nerves in the subcutaneous layer.

In a situation where more aggressive correction is required, as in the mature adult foot, an opening medial cuneiform osteotomy is performed in conjunction with a cuboid abduction osteotomy. Incision and dissection for the medial cuneiform osteotomy is centered over the dorsal medial aspect of the bone. A linear incision is adequate for exposure to this area. Care should be taken to avoid the medial dorsal cutaneous and deep peroneal nerves, and the medial marginal vein. The tibialis anterior tendon will also require adequate retraction or temporary reflection for optimal exposure.

The medial cuneiform osteotomy is usually performed in the midpoint of the bone with the apex directed proximally towards the apex of the cuboid osteotomy. In directing the osteotomy laterally, it is important to avoid penetration into the second metatarsal base. The apex of the osteotomy often extends into the lesser cuneiform bones to affect greater transverse plane correction with insertion of the bone graft. A pair of osteotomes are used to hold the osteotomy open, while the correction is achieved and the size of the bone graft required is assessed. The bone graft is ideally autogenous corticocancellous bone, however allogenic bone has been used with good success.

Autogenous bone can come from two sources: the lateral cuboid closing wedge, or the iliac crest. Commonly, a mixture of autogenous cuboid bone and allogenic graft are utilized. Although internal fixation provides stability to the graft site, it is not usually required. The adduction tendency of the deformity applies solid compression to the graft, and provides stability to this site without fixation. The periosteum and deep fascia are closed over the graft site followed by superficial fascia and skin closure. Closed suction drains are also used to minimize hematoma and edema formation.

CLINICALLY ILLUSTRATED CASE STUDY

Figure 2. A 13 year old female patient with bilateral metatarsus adductus deformity, more apparent on the left foot. Note the rectus position of the first and second metatarsals.

Figure 3. Preoperative DP radiograph of the left foot.

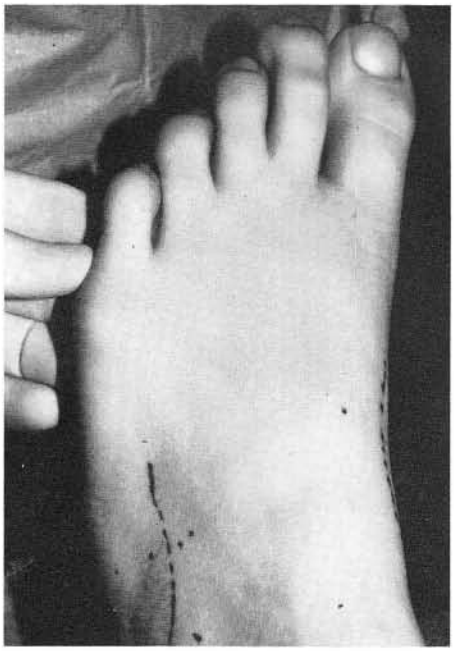

Figure 4. Preoperative view of the lateral incision overlying the cuboid.

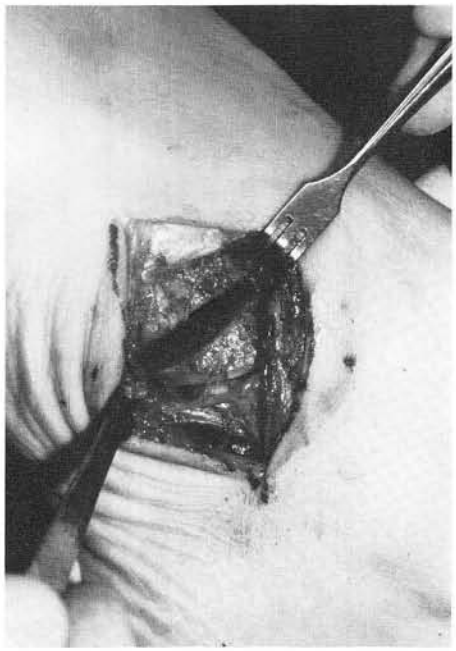

Figure 5. Exposure of the lateral cuboid after bone wedge resection.

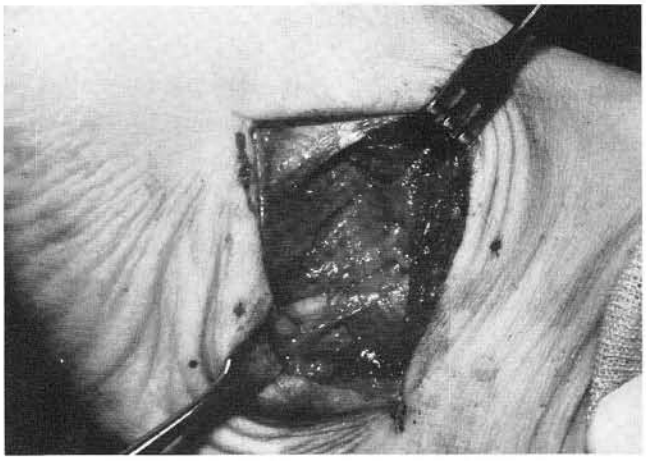

Figure 6. Flush apposition of the cuboid osteotomy with gentle abduction force.

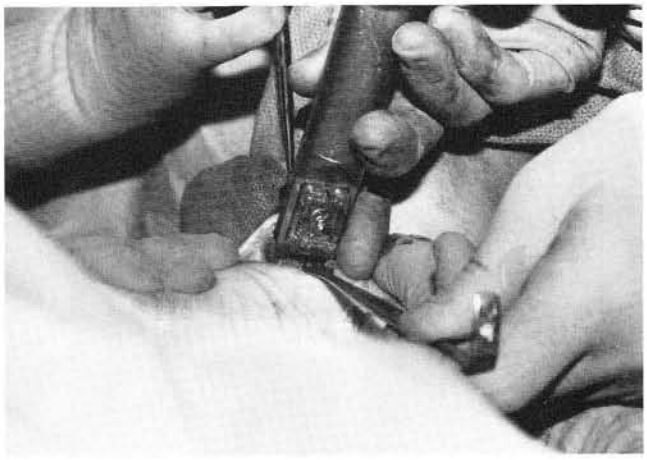

Figure 7. Stapilizer fixation of the cuboid osteotomy.

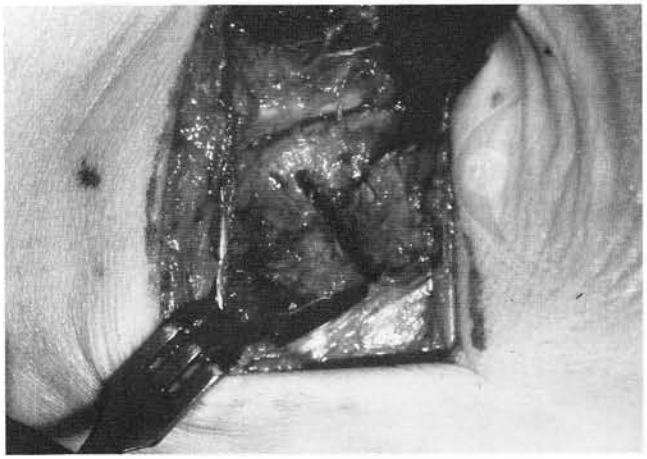

Figure 8. Satisfactory placement of one staple across the cuboid osteotomy.

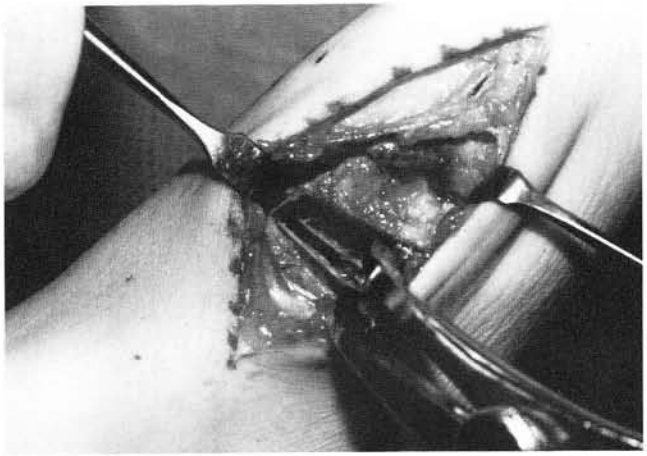

Figure 9. Approach to the medial cuneiform with the osteotomy penetrating into the lesser cuneiforms.

Figure 10. Intraoperative radiograph demonstrating position and the attainable correction with both osteotomies. A laminar spreader effectively opens the medial osteotomy.

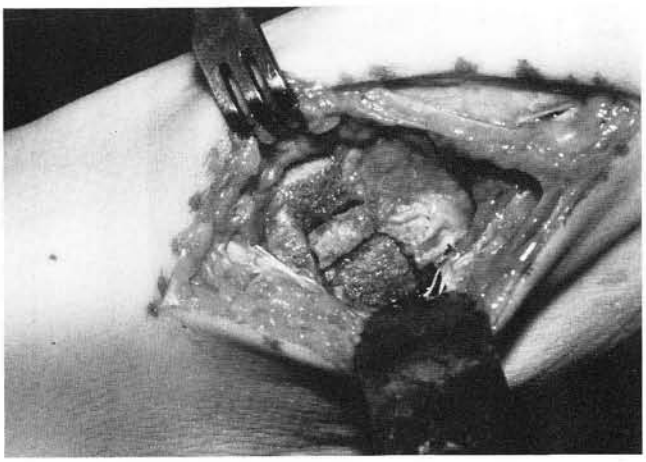

Figure 11. Grafting of the medial osteotomy is performed with both autogenous (cuboid) and allogenic bone. Internal fixation is usually not required for the medial side.

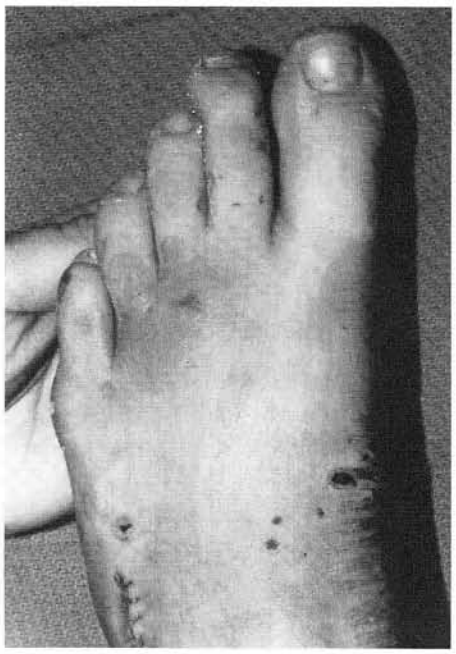

Figure 12. Appearance of the foot on postoperative day 3.

Figure 13. Postoperative DP radiograph of corrected metatarsal adductus deformity. The patient is protected in a below-knee Jones compression dressing.

Postoperative management consists of a Jones compression dressing, ice and elevation, for 3 to 5 days. A dressing change is then performed to assess edema and rule out early infection. The patient is monitored for 8 to 10 weeks in a non-weight bearing cast. Radiographic evidence of graft consolidation as well as lateral osteotomy healing is essential before weight bearing is initiated.

After the patient returns to weight bearing, an elastic bandage or elastic sleeve should be worn for two months. A neutral to slightly pronated orthotic device is used for 18 to 24 months.

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