Abduction of the first metatarsal to correct metatarsus primus varus and hallux valgus was first described by Albrecht in 1911. Lapidus in 1934 advocated fusion of the first and second metatarsals with the first cuneiform. Overall uses of the procedure since its initiation have been dedicated to hallux valgus with a relatively high intermetatarsal angle. Clark, Veith, Sangeorzan, and Hansen have utilized the Lapidus procedure for correction in postadolescent hallux valgus. Bacardi and Saffo have advocated the utilization of the procedure for severe metatarsus primus varus. The procedure has gained popularity in the past 10 years, perhaps because The Association for the Study of Internal Fixation (ASIF) techniques, with more precise placement of the distal first metatarsal and high fusion rates, have been used. Objectives of the procedure include reduction of the high intermetatarsal angle and stabilization of obliquity/hypermobility at the first metatarsocuneiform joint. Previous complications of the procedure included less than optimal position of the first metatarsal head, secondary to elevation, or nonunion, which may produce moderate to severe forefoot instability.

Patient selection varies with age; however, most procedures have been targeted to the adolescent-to-50-year-old population. In most instances, the patient complains of shoe-fitting difficulties as well as appearance problems, pain, ambulatory difficulties, and impingement syndromes to the lateral forefoot, including formation of metatarsalgia, hammer toes, and Morton's neuroma. Specific indications for the procedure include juvenile hallux valgus with obliquity or hypermobility at the first metatarsocuneiform joint, paralytic hallux valgus (either spastic or flaccid in nature), osteoarthritis, traumatic degenerative joint disease secondary to an old Lisfranc injury, severe adult hallux valgus with intermetatarsal angles exceeding 18° (Fig. 19-1), and as an ancillary procedure for the correction of flatfoot of an idiopathic nature or secondary to a posterior tibial tendon rupture, generalized ligamentous laxity, or medial column instability.

The procedure is usually combined with a distal first metatarsal procedure, including exostectomy, sesamoid release, distal or midshaft first metatarsal osteotomy, joint implant and proximal phalangeal techniques, including the modified Keller bunionectomy or Regnauld procedure.

Arthrodesis is used less frequently than proximal metatarsal osteotomies or distal osteotomies, which may be secondary to the complications encountered in performing the technique. Excess bone removal or elevation of the distal fragment will cause severe forefoot dysfunction, a result that is less than optimal. Patient selection is of paramount importance in the procedure. The long-term effects of fusion of the first metatarsocuneiform joint in the adolescent population are not specifically known at this time. The incidence of nonunion approaches 10 percent and is also a factor in increasing the complication rate with this procedure.

Specific preoperative criteria can be highlighted in three areas: (1) hallux valgus; (2) osteoarthritis of degenerative joint disease of the metatarsocuneiform articulation; and (3) as an adjunct procedure to increase
Hallux valgus-specific criteria include an intermetatarsal angle exceeding 18° and hypermobility or obliquity of the first metatarsocuneiform joint. The distal first metatarsophalangeal joint should have a hallux abductus angle exceeding 25°, with moderate to severe hallux valgus present. There is no contraindication in performing this procedure on an arthritic joint; however, ancillary procedures such as a Keller bunionectomy or Silastic prosthesis may be utilized in cases in which arthritis is present. Care must also be taken to assess the articular surface because in severe cases of hallux valgus, the functional articular surface is 20-30 percent of the total joint area. Repositioning in instances such as these may cause increased evidence of osteoarthritis and future disability.

Fusion of the first metatarsocuneiform joint is indicated in cases of degenerative joint disease or osteoarthritis (Fig. 19-2), which is often secondary to Lisfranc’s fracture/dislocation or overt injury to this area.

Distal medial column stabilization procedures are indicated by the use of this technique when there has been medial column stability secondary to paralytic dysfunction or tendon rupture.
been a disturbance to the medial column, secondary to a tendon injury such as a partial or complete rupture of the posterior tibial tendon or an overt or subtle Lisfranc’s derangement. Paralytic deformities that affect muscle tendon units surrounding this joint system are also indications for this procedure. Stabilization in the presence of spastic or flaccid paralysis of the external or intrinsic muscle groups is indicated for direct control of the unstable area.

Whether one fuses the joint for osteoarthritis or for correction of severe hallux valgus, two factors are of primary importance. The first is fusion. Throughout literature reviews, nonunion of the joint has been as high as 10 percent. Although most authors state that they have very little problem with nonunions in this area, the long-term effect can be disastrous. The second is exact placement of the metatarsal so that proper metatarsal declination is achieved. It is a common tendency to elevate the first metatarsal, thus imparting undue stress on the lateral metatarsals. The overall principles of the procedure have changed, especially with the introduction of small ASIF screws and plates. Crossed Kirschner wires (K-wires) were formerly the procedure of choice, with long-term non-weight-bearing for fusion. In the mid-1970s, screws became the procedure of choice, as advocated by Clark, Hansen, Veith, and others in the latter part of the 1970s and early 1980s. During the past 7 years, we have used a small plate combined with screw fixation to achieve more exact reduction (Fig. 19-3). The use of a soft template allows the proper declination to be imparted to the fusion site, and from this template, the plate can be prebent to achieve this process. The plate can also be utilized with or without a bone graft. Other technical considerations include protection of the medial nerve, which courses along the incision sites in many cases. Care also must be taken not to remove excess bone to avoid shortening with subsequent lateral forefoot dysfunction. When more than 2 mm of bone removal is anticipated, the utilization of a small bone graft from the medial cuneiform is extremely helpful.

**THE PROCEDURE**

The first metatarsophalangeal joint is generally exposed, and distal procedures are performed initially. If an osteotomy is performed or an implant is to be inserted, the cuts are made without fixation until the fusion site is stabilized proximally.

Before the proximal incision is made, the outline of the joint is marked with a skin-marking pencil. This allows the incision to be placed correctly and provides maximum exposure to the bean-shaped joint. The incision is made approximately 1 to 1.5 in. long dorsomedially, with great care being taken to protect the medial nerve. Care must also be exercised to preserve the attachment of the tibialis anterior, as well as the

![Fig. 19-3. Plate fixation of first metatarsocuneiform fusion.](image)
distal attachments of the posterior tibial tendon. A sharp incision should be made to the joint and a very sharp periosteal elevator utilized to elevate both the ligaments and the capsule from the articulation for later repositioning over the fusion site.

The area and amount of bone removed depend on the desired result. Generally, however, as little bone as possible is removed. Enough bone should be removed plantarly to allow some plantar flexion of the first metatarsal. A laminar spreader may be helpful in visualizing the plantar surface of this somewhat irregular bean-shaped joint. If failed reconstructive bunion surgery or severe intermetatarsal angle correction is necessary, 3-5 mm of bone graft may be necessary to avoid shortening. The bone can be obtained from the posterior iliac crest or as a small wedge from the first cuneiform. The graft should be wedged safe with the base directed dorsally. The metatarsal should be plantar-flexed in approximately 15°—20° of plantar flexion. When there is significant diastasis between the first and second metatarsals, the medial aspect of the second metatarsal metaphysis should be incorporated into the fusion.

Once the bone cuts have been made and the graft inserted (if necessary), a simple technique allows preliminary manipulation of the fusion site before final fixation is applied. We utilize this in not only first metatarsocuneiform, but also great toe joint fusions. The techniques involve driving a 0.45 or 0.62 K-wire through the fusion site and graft, if inserted. The distal metatarsal is then plantar-flexed and abducted the desired amount until correct positioning is achieved. Once this position is achieved, we use a small plate and one or two screws for fixation. We previously utilized a 2.7 or 3.5 semi-tubular plate to achieve rigid stability, but now use the titanium limited contact dynamic compression plate for this joint (Fig. 19-4). The plates are thinner, lighter in weight, and rigid, and can be bent more easily. In most instances, two holes are utilized for the cuneiform and two holes for the first metatarsal. As previously mentioned, the plate should be bent to approximately 15°-20° of plantar flexion, as well as the desired amount of abduction, to achieve correction. Sangeorzan, Veith, and Hansen advocate the use of 3.5-4.0 cortical screws for stabilization of the fusion site.3,4 One screw is used to stabilize the first metatarsocuneiform joint and the second to stabilize the first metatarsal against the medial aspect of the second metatarsal. We have also used this technique, but found that limited metaphyseal curvature on the bone may make insertion of these screws somewhat difficult. Other types of fixation that can be utilized are crossed K-wires and staples.

It is important to realize the dimensional analysis of this procedure. In cases of hallux valgus, the average intermetatarsal angle exceeds normal by 10°-12°. When the osteotomy is completed, the intermetatarsal angle should be reduced to less than this; this angle should be measured at the operative site to avoid overcorrection. It is also extremely important to achieve 15°-20° degrees of plantar declination of the distal first metatarsal. As mentioned before, this is best achieved by the use of a combination of plate and screw fixation techniques to achieve good alignment. Great care also must be taken to measure the length of the first metatarsal pre- and postoperatively, to assess
the amount of shortening that is likely to occur. Excess shortening of the first metatarsal can create an adverse biomechanical situation on the lateral forefoot, resulting in disability and pain. The key points of the procedure include protecting the medial nerve from transection or irritation, obtaining adequate position of the distal first metatarsal in plantar flexion and abduction if necessary, good compression across the osteotomy site (our preference is plates and screws), utilization of a bone graft when necessary to prevent shortening, and careful tissue handling to avoid necrosis and infection.

Potential intraoperative difficulties include damage to the neurovascular bundle, elevation of the first metatarsal, excess bone removal, and excessive soft tissue damage. Additional complications can occur distally where severe hallux valgus may render the first metatarsophalangeal joint (MPJ) cartilage less than optimum. Therefore, the patient should understand that ancillary procedures may have to be performed, including fusion or limited resection Keller bunionectomy, or first metatarsal osteotomy to achieve first MPJ mobilization. Care must be taken not to overcorrect the hallux so that a varus occurs. The procedure is extremely technically demanding and should be attempted only by a surgeon familiar with the area, and who has had some previous training in this technique. The criteria for excellent results, similar to those established by Bonney and McNab, include a normal intermetatarsal angle of approximately 8°, a normal hallux abductus angle of approximately 15°, elimination of pain at the joint site or first metatarsophalangeal joint, elimination of first-ray hypermobility, functional and cosmetic patient satisfaction, ability to wear normal shoe gear, and absence of stiffness of the first metatarsophalangeal joint.

Specific complications of this procedure include medial neuralgia, which has been mentioned in many studies because of the close proximity of the nerve medially. Great care must be taken to protect the nerve to avoid this complication. Nonunion has been mentioned in as many as 10 percent of cases by Clark, and in 6 of 54 feet by Saffo et al. Mauldin et al. reported 50 percent formation of plantar osteophytes at the fusion site (Fig. 19-5). Transfer lesions have been found in as many as 14 percent of the patients secondary to elevation or shortening of the first metatarsal. In 54 procedures, Saffo et al. found the average shortening of the first metatarsal to be approximately 6 mm. Other studies indicate elevation of the first metatarsal may occur in as often as 20 percent of the procedures. Other complications include hallux varus, noted in 15.7 percent of Mauldin's study (Fig. 19-6). Additional findings/complications include formation of plantar osteophytes between the first metatarsocuneiform plantar fusion site.

Other complications include fractured screws or plates. We have seen a 5 percent screw fracture rate in

Fig. 19-5. Potential nonunion of the first metatarsocuneiform joint.
oblique screws across the first metatarsocuneiform joint. A small percentage of plates will fracture. All plates and screws should be removed 6 to 12 months after surgery.

Specific Biomechanical Considerations

Fusion of the first metatarsocuneiform joint is believed to help prevent medial column collapse and hypermobility at the first metatarsal cuneiform joint. The proper performance of this technique will lead to increased stability during the midstance and toe-off phase of gait. If shortening or elevation occur, however, medial column rigidity is decreased, with subsequent increase in lateral forefoot pressure and the possibility of metatarsalgia or the formation of hammer toes or claw toes. Elevation of the first metatarsal may cause an iatrogenic primus elevatus leading to hallux limitus or rigidus.

Postoperative Care

Most authors prefer non-weight-bearing or limited weight-bearing for 6-8 weeks. It has been our experience to note that a total non-weight-bearing regimen should be enforced for the first 6 weeks after surgery, followed by an additional 2 weeks if necessary. After that time, the patient may start gradual touchdown during the next 2-3 weeks. After 3 months, intensive physical therapy may be initiated with walking, exercises, and gradual fitting into a normal shoe. It is not uncommon for mild to moderate edema to be present from 12 to 18 months with this procedure.

REFERENCES