

MEDIAL COLUMN FUSIONS

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INTRODUCTION

The surgical correction of the symptomatic flatfoot deformity presents the surgeon with many viable treatment options. Due to the variation in causative pathology and compensatory sequelae, no single procedure has been universally indicated for all patients. In the past, definitive treatment came in the form of the triple arthrodesis. Although often successful, the procedure necessitated sacrifice of motion at often asymptomatic or non-pathologic joints.

As our experience with and understanding of the pathological processes that contribute to the development of the condition have grown, so have the number of surgical procedures. Over recent years, numerous procedures directed at addressing the primary level of deformity have been advocated. Among the modalities gaining recent popularity are isolated arthrodesis procedures along the medial and lateral columns of the foot. Isolated fusions share the capacity for correcting abnormal alignment and restoring stability while possessing a number of distinct benefits over multiple joint fusions. In addition to limiting dissection, operating time, and associated morbidity, the ability to preserve non-affected joints is appealing. Furthermore, the ability to maintain motion in surrounding joints allows the patient to compensate for a loss of motion at the affected joint.¹ This paper will focus on two medial column arthrodesis procedures, talonavicular arthrodesis and naviculocuneiform arthrodesis, and their role in the treatment of the acquired flexible flatfoot deformity.

The four components of the acquired flatfoot commonly described are hindfoot valgus, forefoot abduction, forefoot supination, and midfoot sag.² Medial column fusions, when combined with appropriate ancillary procedures, can adequately correct most, or all, of these components. Criteria for performing medial column stabilizations are: age greater than 7 or 8 years; talonavicular or

naviculocuneiform fault on lateral radiograph; and a compensated forefoot varus. These procedures are generally contraindicated in the following conditions: fixed plantarflexed talus; bony equinus; tarsal anomalies; arthritis or arthrosis of the tarsal joints; excessive obesity; and a non-reducible deformity.³ It is also important to note that medial column fusions alone are not sufficient to correct the flexible flatfoot deformity, and are intended as adjunct procedures in its surgical management. Procedures to control abnormal pronation and to correct equinus, when present, should also be considered.

TALONAVICULAR ARTHRODESIS

Lowman, in 1923, was the first to use talonavicular joint fusion as a medial column stabilization procedure for flatfoot deformities.⁴ In addition to the fusion, Lowman advocated lengthening the Achilles tendon, rerouting the anterior tibial tendon under the navicular and attaching it to the spring ligament, and a desmoplasty of the talonavicular ligaments. Lowman cut a plantar medially-based wedge to plantarflex the medial column and correct any abnormal abduction of the forefoot.^{3,4} This procedure is indicated in patients with severe talonavicular joint fault. Even in these early experiences, a well documented complication is "tri-tarsal degenerative disease."³

Radiographic examination of the talonavicular joint should include anterior-posterior (AP) and lateral views. On AP view, the talonavicular joint should have 75% or greater articulation. The talocalcaneal angle should be 15 to 30 degrees by age four. On the lateral view, the talar declination should be below 30 to 35 degrees. The lateral view is also important for evaluating faults along the talonavicular joint. Symptomatic patients will have evidence of joint narrowing, subchondral sclerosis, and eventually osteophytic spurring.⁴

Inflammatory arthritis of the talonavicular joint is another indication for isolated arthrodesis. Chiodo and associates used isolated talonavicular joint fusions to treat inflammatory arthritis and obtained excellent results in 16 of 20 cases.⁵ Patients received significant pain relief with improved function. In addition, Ljung and associates performed 19 isolated talonavicular joint fusions on rheumatoid patients. These patients had relief of pain and showed no progression of hindfoot valgus during follow-up.⁶

Long-term studies have been conducted to follow the results of isolated talonavicular arthrodesis. One study by Fogel et al. followed 11 patients who had isolated talonavicular arthrodesis for talonavicular arthrosis from 1961 to 1979. The mean follow-up on these patients was 9.5 years. All patients in this study had satisfactory pain relief, however had difficulty walking on irregular terrain.⁷ In addition, these patients exhibited arthrosis of other tarsal joints not present prior to surgery. Gait analysis revealed significant reduction of subtalar motion due to the inability of the talar head to adduct and plantarflex on the navicular. The authors called this loss of stance-phase plantarflexion.^{7,8}

Another 10 year prospective study by Scranton focused on arthrodesis of the tarsus. He had 4 patients with talonavicular arthrodesis. All 4 patients rated a good result which was classified as no pain or minimum pain after heavy use, no deformity or minimal deformity, no callosities, no pseudoarthrosis, or joint degeneration. Although subtalar motion was present in these patients, they were diminished in comparison to the opposite side.⁹

A recent *in vitro* study by O'Malley et al., reinforced the notion that an isolated talonavicular joint fusion caused significant reduction in the motion of the subtalar joint. They performed selective hindfoot fusions and evaluated them radiographically. They found that a subtalar joint fusion was not adequate to correct flatfoot.¹⁰ In contrast, an isolated talonavicular joint arthrodesis was found to decrease motion at the subtalar joint. In fact, they found that an isolated talonavicular fusion affected the foot similar to a triple arthrodesis. Thus it was concluded that the talonavicular joint played a pivotal role in controlling the position of the hindfoot, including the valgus alignment of the calcaneus.

The talonavicular arthrodesis is effective at both reconstructing and stabilizing the medial arch, and at limiting excessive pronation at the subtalar

joint. The advantages of the talonavicular fusion are that it allows for correction of the deformity and stabilization of the instability at the focal point of both.² Fusion of the talonavicular articulation corrects both the sagittal and transverse plane deformities associated with the flexible flatfoot. The procedure also prevents excessive subtalar joint pronation; studies have shown that up to 80% of subtalar joint motion is eliminated with fusion of the talonavicular articulation.^{2,10,11} Furthermore, by limiting motion at the subtalar joint, it is felt that the talonavicular fusion can prevent further degenerative changes at the other tarsal joints.

Talonavicular arthrodesis is also indicated in patients with symptomatic flexible flatfoot that does not demonstrate arthritic changes at the subtalar joint. Some authors advocate talonavicular arthrodesis over subtalar arthrodesis for the correction of the symptomatic flatfoot; subtalar joint fusion does not appear to exert enough control over the midtarsal joint to effect correction of any forefoot deformity. Up to 50% of the motion at the midtarsal joint is maintained after subtalar joint fusion.⁶ Consequently, the adult acquired flatfoot secondary to posterior tibial tendon dysfunction (PTTD) has become the most common indication for isolated talonavicular arthrodesis.¹² Harper et al. reported on 30 talonavicular fusions for PTTD with a success rate of over 86%.²

NAVICULOCUNEIFORM ARTHRODESIS

In 1931, Hoke described a fusion of the navicular and first and second cuneiform joints for correction for the flexible flatfoot.¹³ He believed that the acquired flatfoot resulted in reduced efficiency of the tibialis anterior, tibialis posterior, and flexor hallucis longus muscles. Hoke's arthrodesis combined with a tendo Achilles lengthening functions to help convert the medial column into a rigid lever and to help decelerate pronation at the subtalar joint.

Butte also advocated the naviculocuneiform fusion for restoration of the medial longitudinal arch in the acquired flatfoot. His study indicated only a 50% success rate, however, he noted that the procedure was most successful when lateral radiographs showed a sag at the naviculocuneiform joint.⁴ Jack reported on results of naviculocuneiform fusion in 46 feet with an 82% success rate. Criteria for naviculocuneiform fusion in his study were based on radiographic evidence of

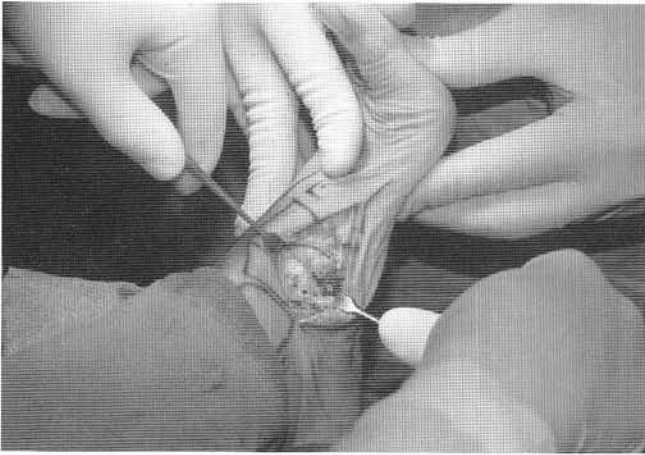


Figure 2. After preparation of the joint naviculocuneiform surface, dorsiflexion of the hallux will close down the joint for staple fixation.

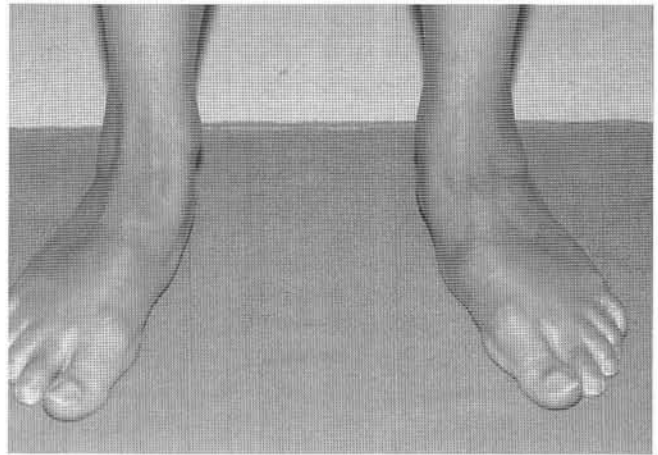


Figure 3A. Preoperative weightbearing examination of the left foot with significant collapse



Figure 3B. Postoperative AP radiograph of the left foot after MBA arthroereisis and naviculocuneiform fusion

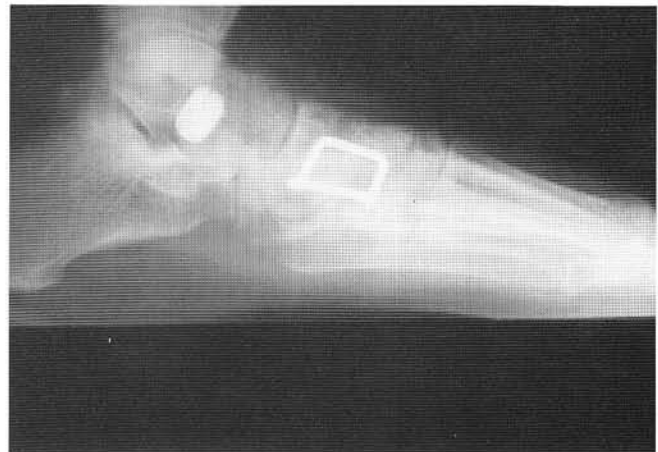


Figure 3C. Postoperative lateral radiograph.



Figure 3D. View of the foot at 9 months postoperative with good clinical alignment

to the direction of the joint surfaces. A plantarly based wedge is usually recommended for sagittal plane correction. Following removal of joint surfaces, hallux dorsiflexion and adduction of the foot will approximate the fusion surface in preparation for fixation. (Fig. 2)

With any type of flatfoot surgery, careful assessment of the equinus component should be performed. If detected, surgical lengthening of the tendo Achilles or gastrocnemius aponeurosis should be considered. Even if there does not appear to be preoperative equinus, this should be re-evaluated on the operating room table since the re-alignment of the foot during medial column fusion will often unmask or accentuate a primary or secondary contracture of the triceps surae.

Staple fixation is more than adequate for a naviculocuneiform fusion and usually 2 Blount staples are placed at 90 degree or divergent angles. Screws have been utilized, yet the angulation and depth of the joint requires precise techniques. Single or two screw fixation with 4.0mm screws or larger should be adequate. These both have to be

monitored with strict non-weightbearing for 6 to 10 weeks and serial radiographs to assess osseous union. Initial weightbearing should include protection of the site for several weeks with a fracture walker or similar device. Physical therapy is employed to help regain strength, increase mobilization and improve gait.(Fig. 3)

SUMMARY

Although the triple arthrodesis has been the traditional surgical approach for the adult flatfoot deformity, less aggressive single joint arthrodesis procedures are becoming increasingly more popular. These include the subtalar fusion, the calcaneocuboid distraction arthrodesis, and the talonavicular arthrodesis.¹ The author would like to submit that in the right clinical scenario the naviculocuneiform fusion combined most often with subtalar arthroereisis, tendo Achilles lengthening, and debridement or reinforcement of the tibialis posterior tendon is a viable treatment option. (Fig. 4)



Figure 4A. Preoperative AP radiograph of patient with significant collapse noted with painful flat-foot

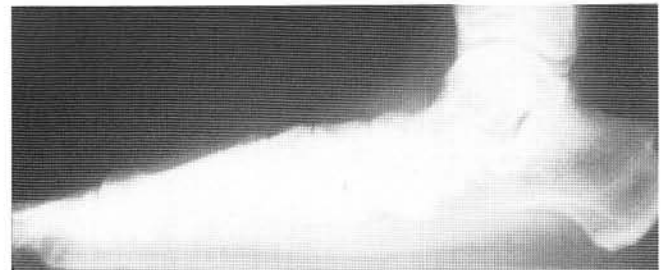


Figure 4B. Preoperative lateral radiograph



Figure 4C. Postoperative AP radiograph showing double joint fusion and combined fixation.

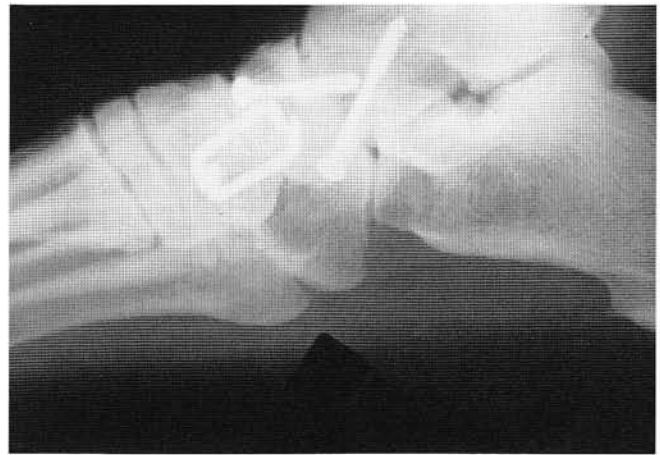


Figure 4D. Postoperative lateral radiograph



Figure 4E. View postoperative 1.2 years showing good clinical position. Note the TAL incision along the medial aspect of the Achilles.

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