CHAPTER **25**

EFFECT OF FLATFOOT CORRECTION ON LIMB LENGTH

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Podiatric physicians regularly evaluate and treat patients with flat feet. These patients are often difficult to treat conservatively on a long term basis because of their persistent pain. In adolescents, pes plano valgus often presents as a flexible deformity that can be treated conservatively with orthotics; however, conservative therapy often fails. In adults, pes plano valgus can lead to joint arthrosis which can then become a rigid deformity. At this point, surgical intervention will likely have to be attempted. Flatfoot patients are also affected by knee pain and low back pain. From a biomechanical standpoint, the flatfoot deformity can adversely affect the joints proximal to it. A common sequalae in pes plano valgus is that collapse of the medial longitudinal arch leads to internal rotation of the leg, forward list of the pelvis, and increased curvature of the lower spine. One or more of these locations can be involved with postural symptoms. Postural symptoms can include low-back pain and arthritis of the hip joint. The arthritis in the hip joint is a result of the lowering of the pelvis on the shorter side while walking. The coverage of the femoral head by the acetabulum decreases on the side with the longer limb.[1] Moreover, a unilateral deformity has a differential effect on limb length where the side with the collapsed arch has a decreased limb length. This can create a significant limb length discrepancy, which is a well-known and desirably avoided complication of hip and knee replacement surgery.

It is the authors' intent to investigate the effect of flatfoot correction on limb length and to quantify this effect by deformity classification and procedure selection. For simplicity sake, the authors categorize pes plano valgus as either flexible or rigid. Pediatric and adult patients can fit into either category. Flexible or moderate deformities are often approached with joint-sparing procedures or in combination with isolated fusions, while rigid or severe deformities are addressed through isolated or multiple fusion techniques. Nearly all patients have concomitant equinus contracture of the triceps surae and that is addressed through heel cord lengthening. Age specific considerations apply to the pediatric population in that a more severe deformity might be approached with aggressive joint-sparing procedures since further development can potentially aid in adjacent joint remodeling. One must understand the overall affect that the procedure may have on their patient. For example, for an adult with a unilateral flatfoot, correction of the deformity may prevent the onset of postural symptoms. However, in a child with a bilateral deformity, both sides are usually addressed surgically within the same year and postural symptoms are rarely aggravated.

In this study, the different types of procedures will be analyzed on their direct effect on the height of the talar dome. The change in the height of the talar dome is a direct correlation to the change in limb length. It is our hypothesis that in the pediatric population, the lateral column lengthening will result in an increase in the talar height. In the adult population, our hypothesis is that the isolated talonavicular arthrodesis and isolated STJ arthrodesis will affect talar height more than the triple arthrodesis. The patient population requiring a triple arthrodesis typically has a more rigid deformity and severe arthrosis precluding joint position realignment. In addition, resection of the STJ in a triple arthrodesis and shortening of the midtarsal joints has a more severe affect in shortening the foot, lever arm, and talar dome height. A series of patients will be selected based on the procedure chosen. Data collection will include: gender, weight, and type of procedure performed. X-rays will then be compared pre-operatively and post-operatively to measure the alteration in the talar height from the weight bearing surface (Figure 1). In the pediatric population, no measurements will be collected beyond six months due to increasing height that is inherent to a child's growth.

PEDIATRIC/FLEXIBLE PATIENT POPULATION

The main surgical option that exists for pediatric/flexible patient population is a lateral column lengthening using a calcaneal osteotomy and medial column enhancing procedure, such as medial column suspension or a Cotton osteotomy. The most frequently performed lateral

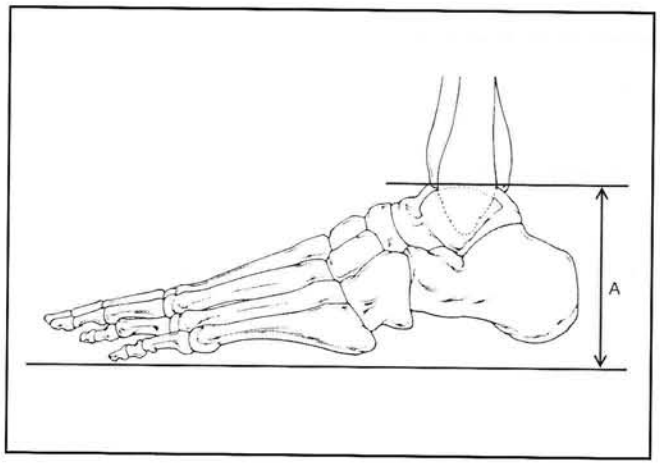

Figure 1. Diagram depicting the measurement taken on each patient's lateral radiograph.

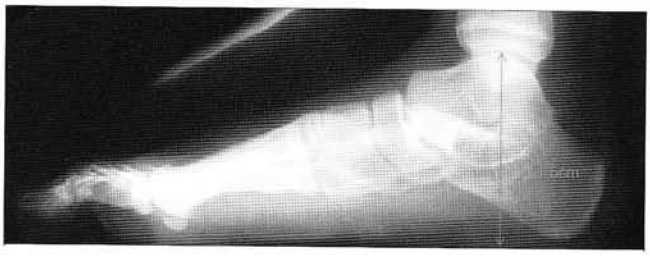

Figure 3. Postoperative view Evan's osteotomy +1.5cm

column lengthening procedure in the pediatric population is the Evans calcaneal osteotomy (Figures 2, 3). It results in a significant straightening of the lateral column and realignment of the midtarsal joint. The tension placed on the long plantar ligament provides significant arch elevation. And the increase in tension placed on the peroneus longus tendon, corrects the forefoot supination. The retrograde force on the rearfoot will increase the calcaneal inclination angle, correcting the rearfoot valgus deformity that is present. This increase in calcaneal inclination angle will lift the talus and therefore the height of the talar dome will increase. Likewise, medial column enhancing procedures address supinatus/varus, frontal plane instability. This has a retrograde effect on increasing talar declination and calcaneal inclination.

ADULT PATIENT POPULATION

In the adult population, collapsing pes plano valgus is frequently a result of posterior tibial tendon dysfunction or longstanding instability and joint arthrosis. Treatment depends on the stage of the disease and the severity of the symptoms. Surgical options include tendon transfers,

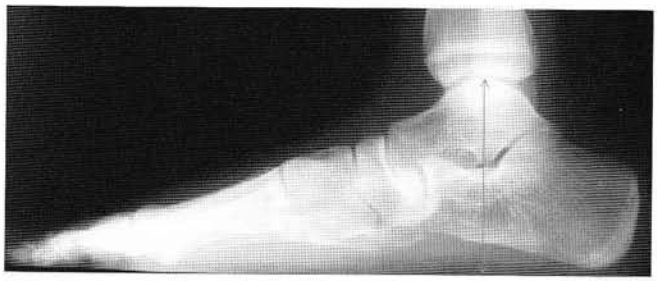

Figure 2. Preoperative view Evan's osteotomy.

calcaneal osteotomies, and rearfoot arthrodesis. With dysfunction of the posterior tibial tendon the subtalar joint everts, the medial arch collapses, the heel assumes a valgus position, and the foot abducts at the talonavicular joint. The major procedures that are performed for correction of this deformity address each area of dysfunction.

Although posterior tibial tendon dysfunction can be flexible or rigid, the surgeons involved in this paper perform procedures that involve joint fusion because of their long-term success. The procedure options include: isolated talonavicular arthrodesis, isolated naviculo-cuneiform arthrodesis, triple arthrodesis, isolated subtalar joint arthrodesis, and posterior tibial tendon enhancement. Harper et al[2] suggest isolated talonavicular arthrodesis. In a study consisting of 27 patients, 92% had good to excellent results. They use a standard medial incision to access the talonavicular joint, as well as assess the integrity of the posterior tibial tendon. Following adequate joint resection, the arthrodesis is performed using partially threaded screws (Figures 4, 5). They feel that there are several advantages to this procedure. One being the ability to evaluate the posterior tibial tendon and position the foot using only a single medial incision. They believe that this leads to less morbidity than the double arthrodesis of both transverse joints. A clinical photograph is seen in Figure 6 to demonstrate effects of the talonavicular fusion on limb length.

Another option is the triple arthrodesis (Figures 7, 8). This procedure was originally described by Ryerson in 1923.[3] It has gone through many modifications each offering an additional advantage. The four major goals of the procedure are: correction of the deformity, relief of pain, stabilization, and improved function. The advantage of this procedure versus the isolated talonavicular fusion is the ability to position the foot in the exact position the surgeon desires. However, it involves two incisions, with increased morbidity. The third main option for treating adult pes plano valgus is an isolated subtalar joint

Figure 4. Preoperative TN fusion.

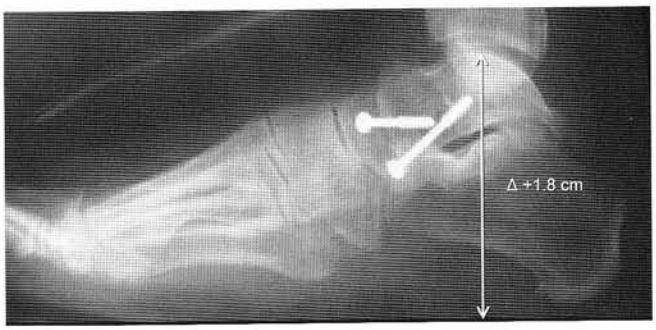

Figure 5. Postoperative TN fusion +1.8cm.

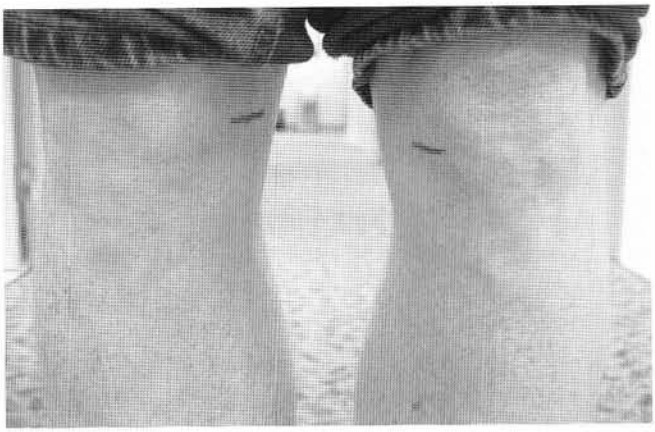

Figure 6. Clinical picture of leg length changes.

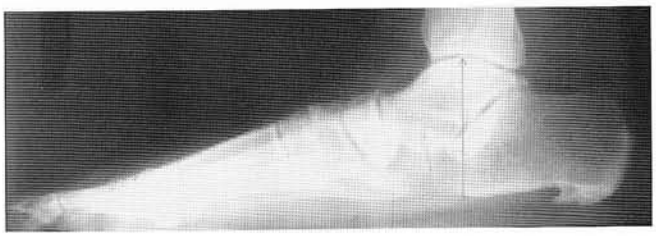

Figure 7. Preoperative view triple arthrodesis.

Figure 8. Postoperative view triple arthrodesis +0.8cm.

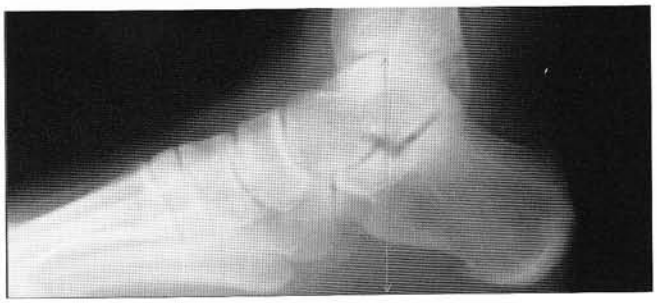

Figure 9. Preoperative view STJ arthrodesis.

Figure 10. Postoperative view STJ arthrodesis +1.2cm.

arthrodesis (Figures 9, 10). This procedure has been used in patients with both paralytic and nonparalytic pes valgus deformities. One concern of this procedure is the ability to restore the congruity of the talonavicular joint. However, in a study by Yu et al,[4] talonavicular congruity increased from 62% to 93%. After realignment of the subtalar joint, the axis of the midfoot assumes its oblique orientation, and is now restricted. And therefore, the foot is now a more functional structure. This procedure is most commonly performed utilizing a single lateral incision. And after adequate resection of articular cartilage the subtalar joint is most commonly fixated with a large cancellous screw. However, a double-screw technique can also be used. This provides greater rotational stability.

SUMMARY

Each procedure previously described can be used for the treatment of pes plano valgus. It is often the surgeon's preference what procedure is chosen. However, after performing this study, and evaluating the short and long term success of these procedures, the choice may be different. Although the change in talar height is not the ultimate marker for the success of a flatfoot procedure, it does significantly change the biomechanics of the patient's foot and leg. It must be understood that with the increase in talar dome height and the subsequent increase in limb length, the patient's chance of developing postural symptoms may decrease or increase. We believe this depends on whether the pes plano valgus deformity is unilateral, bilateral, acute, or longstanding. In adolescents, the deformity is often bilateral, and therefore correction may prevent future postural symptoms. However, in adults, the symptoms are commonly unilateral. And correction may lead to a mild correction of postural symptoms. The effect on postural symptoms can be aggrevated in the chronic flatfoot and improved in the acute to subacute scenario. It is our thought that with the knowledge of each procedures influence, the choice of procedure will be an easier one.

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