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# **Surgical Management of Posterior Tibial Tendon Dysfunction**

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## **Abstract**

Management of posterior tibial tendon dysfunction can be a controversial topic. Posterior tibial tendon dysfunction is a progressive deformity of the foot and ankle and can be very debilitating if not properly treated. The key to successful outcomes begins with a prompt diagnosis and staging of the deformity. Often the early stages of posterior tibial tendon dysfunction can be conservatively managed and progression can be halted before significant deformity ensues. Those that require surgical intervention can be treated with soft tissue balancing and osseous reconstruction. The focus of this chapter is to review the surgical options available for correction of posterior tibial tendon dysfunction.

**Keywords:** posterior tibial tendon dysfunction, flatfoot, pes valgus deformity, pes planus deformity, arthritis

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## **1. Introduction**

Pes valgus or flatfoot deformities are defined as a combination of forefoot abduction, rear-foot valgus and loss of the medial longitudinal arch [1]. A patient with a pes valgus deformity who was treated early typically response well to conservative management including orthotics, anti-inflammatory therapy, stretching to relieve equinus, immobilization and physical therapy. In certain patients this regimen can relieve symptoms and slow progression of the deformity.

Correction of valgus deformities is dependent on a number of factors; the most overriding being the severity of the deformity and the flexibility of the rearfoot, midfoot and forefoot. Other principles that guide procedure selection include the patient's activity level, age, pain

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and the etiology of the deformity. The main objective when treating these patients to relieve pain and manage progression of the deformity is by preventing excess pronation.

In adult patients the most common etiology of unilateral acquired adult pes valgus is secondary to insufficiency of the posterior tibial tendon, the most powerful inverter of the foot [1]. In addition, the posterior tibial tendon is an important stabilizer of the midfoot. Treatment of this disorder is dependent upon the stage of posterior tibial tendon dysfunction [2].

Surgical management is typically initiated once the patient has failed multiple conservative efforts. Generally, conservative treatment is unsuccessful in a patient with an unstable foot, rigid deformity or in those who develop arthritic changes secondary to a neglected, long-standing and poorly supported pes valgus foot-type. Dysfunction of the posterior tibial tendon can be divided into three stages [3]. A fourth stage of disease of the posterior tibial tendon was proposed by Kleman and Myerson [4].

Stage I of posterior tibial tendon dysfunction involves either tenosynovitis or tendonitis with no clinical deformity. The posterior tibial tendon remains intact and functional. Most often non-operative treatments include bracing, orthotics and taping. Stage II PTTD entails advanced disease of the tendon in which the posterior tibial tendon is no longer able to maintain the arch. Typically the foot is flexible in this stage and the valgus deformity can be passively corrected. Conservative measures, including bracing and orthotics, can be effective in treating this phase of the deformity. Surgical management typically involves soft-tissue balancing, a tendon transfer and/or joint-preserving osteotomies. In stage III the deformity becomes more rigid and joint degeneration becomes evident in the subtalar joint and transverse tarsal joints. Joint-preserving osteotomies are ultimately unsuccessful in treating this late stage due to the rigidity of the deformity. A rearfoot arthrodesis is often required to achieve proper alignment and support of the foot. Long standing stage III deformities can lead to subsequent ankle valgus. Ankle valgus can be described as stage IV PTTD and surgical correction needs to address the ankle with a rearfoot procedure in conjunction with soft-tissue reconstruction or, in more advanced cases arthrodesis/arthroplasty of the ankle. In this chapter the role of both soft tissue and osseous correction will be described in correction of posterior tibial tendon dysfunction.

## 2. Biomechanics & Pathophysiology

The posterior tibial tendon passes posterior and inferior to the medial malleolus and partially inserts on the plantar aspect of the navicular tuberosity. Distal to its partial insertion on the navicular tuberosity, the main tendon spreads out in an anteriolateral direction, and inserts onto the plantar aspect of the intermediate and lateral cuneiforms the cuboid and the bases of the second, third, fourth and sometimes fifth metatarsal. The function of the foot during ambulation is to act as a shock absorber. The foot functions most efficiently when it is in a tripod formation. The calcaneus is the posterior leg of the tripod while the first and fifth metatarsals are the anterior legs. The functional subtalar joint is composed of the articulation between the posterior calcaneal facet of the talus and the posterior talar facet of the calcaneus

and the talocalcaneal portion of the talocalcaneonavicular joint. The posterior tibial tendon passes posterior and medial to the axis of the subtalar joint. The tendon allows equal amounts of inversion and adduction of the foot during supination of the foot [5]. The midtarsal joint is made up of the calcaneocuboid and the talonavicular joint. This joint complex has two separate axes of motion, a longitudinal and oblique axis. The posterior tibial tendon exerts a force around the oblique axis which is primarily a plantarflexion and adduction force. It essentially has no force around the longitudinal midtarsal joint axis. The posterior tibial tendon produces a strong supinatory force at the subtalar joint at heel contact and during the midstance phase of gait. The tendon also decelerates internal rotation of the tibia and subtalar joint during early stance phase. The tendon will accelerate external tibial rotation during midstance and early propulsion [5]. By crossing the transverse tarsal joints, the posterior tibial tendon plays a role in enabling progression of the midtarsal joint from the unlocked to the locked position. Subsequently, the gastrocnemius complex acts on the calcaneus to supinate the rearfoot additionally, locking the midtarsal joint and allowing for efficient force of transmission for gait [1].

Once the rearfoot is tilted into a pronated position secondary to a diseased posterior tibial tendon, the subtalar joint is unable to maintain a stable configuration of the foot. With the rearfoot in a valgus position the Achilles tendon forces are redirected laterally, creating an eversion force to the rearfoot and adding to the loss of medial arch stability [1]. The Achilles tendon will exert increased stress at the talonavicular joint contributing to increased stress on the talonavicular capsule and spring ligament [1]. The force leads to the loss of the soft tissue restraint of the talonavicular articulation. The talar head will eventually become uncovered and peritalar subluxation will ensue leading to an abducted forefoot and a loss of the medial longitudinal arch. The midtarsal joint will function in an unlocked position and fail to progress to a locked position without adequate posterior tibial tendon function as well.

### **3. Preoperative evaluation**

The preoperative evaluation of the patient with PTTD involves both clinical criteria and radiographic evaluation. The clinician must determine if the pes valgus deformity is flexible or rigid. If the valgus deformity of the rearfoot is flexible, the presence of forefoot supinatus should be assessed as well. Forefoot supinatus is seen with ankle equinus and subtalar joint pronation. This forefoot deformity develops as a soft tissue adaptation in which the forefoot is inverted on the rearfoot due to calcaneal eversion. The patient will typically present with pain along the course of the posterior tibial tendon as it passes the medial malleolus toward its medial insertion at the navicular tuberosity. Tendon dysfunction can be evaluated with a heel rise maneuver in which the patient rises onto their forefoot. In a patient with a healthy posterior tibial tendon the heel rise can be completed without pain and inversion of the heel will be observed. Weight bearing radiographs of the ankle should be obtained in addition to radiographs of the foot. Peritalar subluxation can be appreciated on the AP view of the foot due to the dysfunction of the tendon at decelerating internal rotation of the tibia and subtalar joint during the early stance phase of gait. Ankle valgus is observed on the AP and mortise ankle views in late stage posterior tibial tendon dysfunction.

MRI is the study of choice to diagnose posterior tibial tendon tears. An area of hypovascularity along a segment of the tendon also may contribute to degeneration of the tendon. Frey et al. described the areas of vascularity of the posterior tibial tendon at the osseous insertion and the myotendinous junction. A zone of hypovascularity was identified posterior and distal to the medial malleolus. The combination of the avascular portion of the tendon and the chronic mechanical strain may be a predisposing factor to degeneration of the posterior tibial tendon [6].

Posterior tibial tendon injuries are classified into three types [7]. Type I represents incomplete tear with fusiform enlargement, typically a longitudinal split. An inhomogeneous signal intensity pattern can be appreciated with this type most often on T2-weighted images. Type II injuries are seen with an incomplete tear with decreased tendon caliber. A complete rupture of the tendon is classified as a type III injury. MRI can be a useful modality, however it is not a necessary study in later stages of posterior tibial tendon dysfunction which can be identified with plain films and clinical exam.

#### **4. Tenosynovectomy**

After a patient has failed multiple efforts at conservative care then in some situations a tenosynovectomy is indicated. The purpose of a tenosynovectomy is to eliminate inflammatory tissue that may contribute to further degradation of the tendon or worse rupture of the tendon. A patient requiring a tenosynovectomy is often in the early stages of posterior tibial tendon dysfunction and a deformity has not fully manifested itself. In more long standing cases there may be a valgus position of the rearfoot compared to the contralateral limb with a gastrocnemius or gastrosoleus equinus deformity. In these scenarios a corrective procedure may be indicated.

The incision is started from below the tip of the medial malleolus and extended to the navicular. Once the tendon sheath is identified it is opened and the inflamed synovial tissue is excised. The posterior tibial tendon is inspected for pathology. It is important to inspect the posterior surface of the tendon. Small tears can be debrided while larger tears must be debrided and repaired. Often significant tendon hypertrophy can be appreciated. A normal posterior tibial tendon is approximately three times the caliber of the flexor digitorum longus tendon. If the tendon is found to be pathologically enlarged then the tendon can be debulked. A 2-0 absorbable or non-absorbable suture can be used to repair the tendon. A running stitch imbricating the tendon followed by a buried knot can be performed. If the tendon deficit is significant following the debridement of diseased tissue then the tendon can be augmented with a bioengineered product. In addition a secondary procedure may be indicated in the case of severe tendon pathology. Depending on the degree of the repair the patient may be placed in a below knee fiber glass cast for 3-4 weeks followed by a transition to an aircast. The patient can then transition to normal supportive shoes.

#### **5. Evans calcaneal osteotomy**

This procedure was introduced in 1961 by Dillwyn Evans for patients with poliomyelitis and is now routinely used to correct flexible valgus deformities [7]. This procedure

primarily corrects in the transverse plane, but the argument has been made that it also works in the sagittal as well as the frontal plane. Typically those patients with a significant uncovering (greater than 50%) talonavicular joint and a flexible deformity. The procedure is typically reserved as first line therapy for pediatric pes planovalgus. One contraindication for an Evans calcaneal osteotomy is in patients with moderate to severe metatarsus adducts as lengthening their lateral column will unmask the patient's forefoot adduction.

An oblique incision is made over the lateral rearfoot from the anterior beak of the calcaneus distally and then extended proximally inferiorly to the inferior surface of the calcaneus. The incision is created 1 cm proximal to the calcaneal-cuboid joint. The extensor digitorum muscle belly is exposed and the peroneal tendons are reflexed inferiorly. A periosteal incision is then made 1 cm proximal and parallel to the calcaneal-cuboid joint. A pearl at this point in the procedure is to leave the periosteum of the calcaneal-cuboid joint intact to avoid disruption of the ligaments surrounding the joint. The osteotomy is made with a sagittal saw 1 cm from the calcaneal-cuboid joint. The osteotomy is started at the lateral wall of the calcaneus parallel to the calcaneal-cuboid joint. The lateral, dorsal and plantar cortices are cut, while leaving the medial cortex intact to create a hinge [7]. A distractor is placed into the osteotomy and the foot is evaluated [8]. Once the proper correction is achieved then structural allograft can be cut to insert into the osteotomy site. Adequate correction can be determined by relocation of the talonavicular joint. Typically a 1 cm allograft can be inserted, however the surgeon may take resorption of the graft into account when fashioning the appropriate size. The graft is carefully tapped into place and typically internal fixation is not required. The post-operative course involves 6 weeks of non-weight bearing in a cast followed by transition to weight bearing in an aircast. Graft incorporation can be variable based on the patient's age.

## 6. Medial displacement calcaneal osteotomy

Alfred Gleich first described calcaneal osteotomies for treatment of pes valgus in 1893. The purpose was to re-establish the calcaneal inclination angle [9]. This was accomplished with a medial closing wedge osteotomy with displacement of the posterior fragment forward, medially and plantarly. Koutsogiannis reintroduced the medial displacement calcaneal osteotomy through the posterior tuberosity in 1971 [10]. In 1996 Myerson proposed the use of the medial displacement osteotomy augmented by an FDL transfer for the treatment of PTTD [11].

The medial displacement calcaneal osteotomy is an effective procedure for correction of multiple types of deformities when rearfoot valgus is present. The intention of this varus producing calcaneal osteotomy is not only to regain normal rearfoot architecture, but also to salvage the utility of the Achilles tendon relative to the axis of the subtalar joint. Medial translation of the calcaneus restores the supinating moment of the Achilles tendon and realigns the axis of the subtalar joint. Regaining the powerful dynamic pull of the Achilles tendon is a significant advantage of this osteotomy.

The medial displacement calcaneal osteotomy is performed under general anesthesia using a thigh tourniquet. A 6 cm oblique incision is made one fingerbreadth posterior to the lateral malleolus. This will allow retraction of the peroneal tendons and sural nerve anterior within

the incision. The osteotomy is created using an oscillating saw. The cut is made perpendicular to the lateral border of the calcaneus and is inclined 45° to the plantar surface of the rearfoot.

In order to monitor the cephalic shift during medial translation of the osteotomy a marking pen can be used to draw the line of the osteotomy followed by a second line perpendicular to the anticipated osteotomy creating a cross in the center of the calcaneus. The perpendicular crossed line allows the surgeon to monitor cephalic shift of the posterior fragment during medial translation produced by the surrounding soft tissue structures, especially the Achilles tendon.

The osteotomy is started perpendicular to the lateral aspect of the calcaneus to prevent anterior or posterior translation of the fragment. Care is taken to avoid aggressively punching through the medial cortex with the oscillating saw. An osteotome can be used free the posterior section of the calcaneus upon completion of the cut.

Typically the osteotomy is translated 10–12 mm medially. It can be subjective to discern exactly how far to translate the calcaneal osteotomy to achieve the desired correction. Utilizing the surface anatomy can be particularly useful. Visualization of the knee helps in determining proper alignment [4]. In addition, taking a bisection of the heel plantarly and aligning it with a point on the anterior ankle between the medial and lateral malleoli. This point is generally located approximately 40–50% between the medial and lateral malleolus with 40% being closer to the lateral malleolus. This allows the surgeon to locate the moment arm between the weight bearing axis of the leg and the contact point of the heel in addition to correcting the valgus rearfoot.

Prepping of bilateral limbs may be beneficial if the contralateral limb has been successfully corrected previously. Intraoperatively on the already corrected limb a bisection of the heel is made parallel with a line on the anterior ankle using a marking pen. The surgeon then attempts to obtain a match on the surgical limb using these landmarks. This can be helpful in achieving complementary results between the two feet. Additional care should be taken not to over correct in this situation as the more symptomatic foot is typically treated first.

While translating the osteotomy, it is critical to be cautious of an over aggressive shift, which can lead to depression of the fragment analogous to troughing. Once the calcaneus is shifted, it is provisionally fixated and then permanently fixated with one 6.5 mm cannulated screw. The orientation of the fixation is typically introduced from inferomedial to anterolateral aiming toward the sinus tarsi. Having two points of temporary fixation can help to prevent rotation of the inferior fragment which can lead to a situation analogous to troughing of the calcaneus.

Resection of the overhanging lateral ledge of bone is important to prevent irritation on the surrounding soft tissues and sural nerve. A tamp and mallet can be used to dull the sharp lateral cortical edge. Closure of the deep and superficial fascia requires particular attention due to the medially shifted inferior portion of the heel. Care must be taken to approximate the soft tissues due to the modified position of the heel. A drain is placed before skin closure.

Radiographs are performed at 5 weeks at which time the patient is transitioned into an air-cast. Physical therapy is initiated between 6 and 8 weeks. Normal activities are permitted at 6 months.

## 7. Flexor digitorum longus tendon transfer

Stage II PTTD can be treated with an anastomosis and transfer of the flexor digitorum longus tendon and combined with one of the above calcaneal osteotomies and additional adjunctive procedures such as medial arch reconstruction.

Dissection is begun similar to a tenosynovectomy. If the tibialis posterior tendon has a mid-substance rupture, this is repaired in an end-to-end fashion or the degenerative tendon is excised and the defect is repaired. The FDL tendon is harvested inferior to the PT tendon between the abductor fascia and medial border of the foot at the level of the medial cuneiform. The FDL tendon is transected under direct vision proximal to the junction of the master knot of Henry. The tendon can then be secured under physiologic tension either with a drill hole in the navicular tuberosity or using a bone anchor or a biointerference screw. The tendon does need to be placed under considerable tension as it will stretch over time, however caution must be made not to over tighten the tendon as it can lead to subluxation of the tendon out of the tarsal tunnel.

The post-operative course is typically based on the adjunctive procedures performed along with the FDL transfer. Early rehabilitation is encouraged with isolated FDL transfers, although rarely is this procedure performed alone.

## 8. The Young's tenosuspension procedure

An alternative tendon transfer that is successful in treating PTTD is termed the Young. The Young's tenosuspension entails rerouting all or one-half of the anterior tibial tendon through a slot fashioned in the navicular. The tendon is not detached from its insertion at the medial-plantar aspect of the medial cuneiform-first metatarsal base. Rather, it is slipped into the navicular key-hole slot by supinating the foot and stretching the tendon plantarly and posteriorly creating a new insertion for the anterior tibial tendon into the dorsum of the navicular. The remainder of the tendon will function like a ligament to support the medial arch [11]. This procedure is typically more appropriate in patients with stage II PTTD when the posterior tibial tendon muscle is still functional and the valgus deformity is still flexible.

The incision is made from the medial malleolus along the medial foot distally toward the first metatarsal cuneiform joint. The incision is carried down through the superficial fascia. The tributaries from the medial marginal vein are ligated and the vein is retracted superiorly. The sheath of the posterior tibial tendon is identified and opened proximally too distally.

The anterior tibialis tendon sheath is then incised from its insertion distally. The tendon is incised in half in a longitudinal fashion. Dissection is then carried beneath the navicular tuberosity to allow for relocation of the anterior tibialis tendon. A drill hole or medium sized trephine is used to create hole in the navicular from a dorsal proximal to plantar distal direction. If a trephine is used the bone plug can be reinserted once the tendon has been translocated through the hole [12]. A saw is then used to make two parallel cuts from the medial aspect

of the navicular to the trephine or drill hole. The cuts are angulated from proximal to distal. Translocation of the tendon is accomplished using two pieces of moist umbilical tape around the anterior tibialis tendon for mobilization of the tendon. The foot is held in an adducted and plantarflexed position and the anterior tibialis tendon is manipulated using the umbilical tape into the slot. Care must be taken not to disrupt the integrity of the tendon during insertion of the tendon into the slot on the navicular. With the tendon locked in place, the periosteum is closed, reinforcing the tendon's new insertion into the dorsal navicular [11]. The wound is then closed. A below knee cast is applied for 4–6 weeks.

Adjunctive procedures can be performed including an advancement of the posterior tibial tendon, plication of the spring ligament and a transfer of the flexor digitorum longus tendon. The Young's tenosuspension has proven to be a technically difficult procedure, but lead to positive outcomes when used in conjunction with other soft tissues procedures to stabilize the medial column, particularly in a more flexible deformity.

## 9. Cotton medial cuneiform osteotomy

The cotton osteotomy is a procedure known best for its use in pediatric and adolescent flexible valgus deformities, and it is used for medial column collapse [14]. This procedure is rarely performed as an isolated flatfoot procedure and often is done in conjunction with an Evans calcaneal osteotomy or arthroeresis procedure. Forefoot varus or forefoot supinatus can become accentuated during the correction of a valgus deformity. The Cotton osteotomy corrects this deformity by plantarflexing the medial column, establishing an appropriate forefoot to rearfoot relationship [14].

The procedure is performed with the patient in a supine position. Typically, a gastrocnemius recession or tendo-achilles lengthening along with more proximal osseous or soft tissue procedures are performed first. A linear dorsomedial incision is made over the medial cuneiform. Care is taken to avoid the medial dorsal cutaneous and saphenous nerve. A periosteal incision is made medial to the extensor hallucis longus. The dorsal ligaments and anterior tibial tendon are avoided. The anterior tibial tendon will be medial to the osteotomy. C-arm can be useful to identify the location of the osteotomy. The osteotomy is best performed just proximal to the level of the second metatarsocuneiform joint as the adjacent joint aids in allowing easier mobilization and plantarflexion of the osteotomy. By placing the osteotomy just proximal to the osteotomy it prevents possible interposition of the graft into the second metatarsocuneiform joint. The transverse osteotomy is created using a sagittal saw. The osteotomy is made dorsal to plantar mirroring the first metatarsocuneiform joint. The plantar cortex is preserved. The medial and lateral cortex should be visualized prior to performing the opening the osteotomy to avoid an accidental fracture of the osteotomy site. Once the osteotomy is complete feathering using the sagittal saw may be necessary to allow distraction and opening of the osteotomy without compromising the plantar cortex. A lamina or pin-based distractor can be used to carefully dial the desired amount of first ray plantarflexion. The forefoot to rearfoot relationship can then be assessed prior to inserting the graft. The objective is to achieve equal

plantar surface contact with the first and fifth metatarsal heads. The graft is then fashioned appropriately and carefully tamped into place. The graft can be fixated with a k-wire, staple, screw or plate, however fixation is not always necessary. The post-operative course involves 6 weeks of non-weight bearing in a cast followed by transition to weight bearing in an aircast. As with the Evans calcaneal osteotomy graft incorporation can be prolonged in adult patients (12 weeks) compared to pediatric patients (8 weeks) [13].

## 10. Arthroeresis

Subtalar arthroeresis describes a procedure where a spacer is placed into the sinus tarsi, restricting pronation by limiting the contact of the lateral talar process against the calcaneal sinus tarsi floor, therefore maintaining a more neutral talocalcaneal joint [13]. The primary indication for this procedure is a frontal plane deformity; however, a small amount of correction can be achieved in the sagittal and transverse planes. The procedure is contraindicated if the midtarsal joint is unstable [15]. A distinct advantage of the arthroeresis procedure in the pediatric population is that the implant provides structural realignment of the rearfoot complex during skeletal growth, which may become permanent correction as the child reaches and surpasses skeletal maturity [13]. It is important to note that with realignment of the rearfoot utilizing an arthroeresis implant, as with any rearfoot procedure, it may uncover forefoot supinatus or forefoot varus which may need to be addressed as well.

## 11. Arthrodesis

Arthrodesing procedures are also used for treatment of PTTD. These procedures consist of the calcaneocuboid, talonavicular, subtalar and triple arthrodesis. The calcaneocuboid distraction arthrodesis was popular for a while, but is losing favor because of the increased incidence of nonunions and delayed unions and its inability to correct the deformity [15]. These joint destructive procedures are reserved for the rigid valgus foot type in which arthritis has become clinically and radiographically evident. In general, older patients and those who have more severe or rigid deformities secondary to PTTD are candidates for consideration of an arthrodesis. An isolated subtalar joint arthrodesis is not as effective for controlling midtarsal joint motion as other procedure and may not correct deformity in all flexible flatfeet. Yu et al. found that there was good correction of collapsing pes planovalgus deformity with an isolated subtalar joint arthrodesis [16]. The isolated talonavicular arthrodesis is indicated in a flexible flatfoot deformity when degenerative changes are not present in the subtalar joint. The talonavicular arthrodesis can prevent further degenerative changes because it significantly limits motion by 80–90% [15]. O'Malley showed that isolated fusion of the talonavicular joint is capable of correcting rearfoot valgus, forefoot abduction, forefoot supinatus and midfoot collapse [17]. The major complication of a talonavicular joint arthrodesis is a non-union. The triple arthrodesis is the gold standard in long-standing difficult rearfoot deformities, the role of more limited fusion procedures is controversial.

The technique for an isolated subtalar joint arthrodesis employs a lateral incision that runs from the tip of the fibula to the calcaneal-cuboid joint. The sural nerve, lateral dorsal cutaneous nerve and the peroneal tendons are protected during dissection. The subtalar joint is accessed with a vertical “L” incision over the extensor digitorum muscle belly. The joint is prepared typically using curettage. Access to the subtalar joint can often be difficult in an isolated procedure. Once the joint is prepared one or two large screws can be introduced from either the inferior lateral heel or from the talar neck across the posterior facet of the subtalar joint.

The talonavicular joint is approached through a longitudinal dorsomedial incision between the posterior tibial tendon and anterior tibialis. The talonavicular capsule is incised and the talonavicular joint is prepared using either curettage resection or saw resection. Exposure can be facilitated with a lamina spreader or a pin-based distractor. After the joint surfaces are prepared the joint is reduced and temporarily fixated. Once proper position is confirmed two large screws are passed from the navicular tuberosity through the talar neck and into the talar body.

A double or triple arthrodesis may be utilized in a stage III deformity or in some early stage IV deformities. The calcaneal-cuboid joint can be fixated with staples, screws or even a plate. Care must be taken not to over shorten the lateral column of the calcaneal-cuboid joint during joint preparation. Those patients with severe radiographic and clinical ankle valgus will often require a pantalar arthrodesis.

## 12. Conclusion

Tibialis posterior tendon dysfunction is a common foot and ankle deformity with various treatment options. Selecting the appropriate procedure and formulating a treatment plan based on the stage of the deformity can be difficult. It is important to understand the available surgical and conservative options for the proper treatment of each individual patient. Due to the progressive nature of this deformity; many patients will eventually end up requiring some form of surgical intervention. The surgeon must use caution when selecting the best procedure for each individual patient to fully address the deformity and prevent the need for future operations.

## Nomenclature

PTTD	posterior tibial tendon dysfunction
EDB	extensor digitorum brevis
FDL	flexor digitorum longus

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