

# A SUCCESSFUL CONSERVATIVE TECHNIQUE FOR THE TREATMENT OF IDIOPATHIC CLUBFOOT

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Congenital talipes equinovarus is characterized by the following findings:

1. Calcaneus is supinated underneath the talus
2. Talus and calcaneus are in equinus
3. Hindfoot is in varus
4. Soft tissue contracture (muscles and ligaments)
5. Medial subluxation of the navicular and the cuboid
6. Forefoot cavus

These deformities are not passively correctable. The severity of the deformities vary from foot to foot, but there are certain clinical findings that the clinician needs to be aware of. These clinical findings correlate with the most common classification systems and include:

1. Emptiness of the heel
2. Position of the lateral part of the head of the talus
3. Rigidity of the equinus
4. Presence of a posterior crease
5. Presence of a medial crease
6. Curvature of lateral border of the foot

An understanding of the pathoanatomy of the clubfoot deformity is paramount to understanding why so many surgical and non-surgical techniques have failed and why Ponseti's method has been so successful.

The deformities in clubfoot arise from both the malalignment of bones at the joint and also deformation of the bones themselves. The neck of the talus is short and deviated plantar-medially on the body of the talus. This directs the articular cartilage of the head of the talus in the same plantar medial direction. In addition, there is a varus deformity of the distal end of the calcaneus, creating a medial tilt of its articular surface at the calcaneal-cuboid joint. The subtalar joint complex is severely

inverted, a combination of internal rotation, supination and plantarflexion. In the clubfoot, the calcaneus is in plantarflexion, inversion and adduction under the talus, therefore, the calcaneus becomes locked underneath the head of the talus. The navicular is medially displaced, adducted, and inverted. Because of that, the distance between the navicular and the medial malleolus is reduced. The navicular articulates only with the medial part of the head of the talus. The cuboid is medially displaced and adducted. The cuneiform bones are also medially displaced and adducted, contributing to the metatarsus adductus. The first metatarsal is in more plantarflexion than the rest of the metatarsals, and it is this part of the deformity that causes the cavus of the foot. This is a very important point to understand. Even though the whole foot is in supination, the forefoot is actually pronated in relation to the hindfoot. This is analogous to wringing out a towel, with one part twisting around the other part. Ultimately this malposition of the bones also results in abnormal soft tissue structures. The tendons and ligaments, primarily in the posterior aspect of the ankle joint, become contracted.

With the understanding of the pathoanatomy of the clubfoot deformity, we can understand why traditional manipulation was unsuccessful. The standard for manipulation was developed by Kite in 1930. He believed that serial casting with a sequential reduction of the inherent deformities would allow complete correction. Specifically, the correction would start with abduction of the forefoot on the hindfoot. Once this aspect of deformity was deemed to be corrected, eversion of the rearfoot would be attempted. Finally, the equinus would be addressed once the foot was thought to be in the proper position. The technique would consist of abducting the forefoot, in its cavus position, on the rearfoot by placing the thumb at the calcaneal-cuboid joint to act as counter pressure. Once the desired level of abduction was achieved, the clinician would evert the calcaneus, thereby everting the

entire foot. Once the foot was plantigrade, manipulation was attempted to reduce and correct the equinus deformity. Flaws in this technique allow us to understand the predictable failure to achieve adequate, lasting correction.

Although Kite reported good results with his technique, few foot and ankle surgeons were able to even come close to matching his success. Most studies using Kite's technique report a 5-30% correction rate. This failure of conservative treatment eventually led to surgical methods as the predominant factor in creating the correction desired. The most common surgical corrections were popularized by Turco and McKay and involved a radical posterior medial release of tendons and ligaments around the ankle and subtalar joints. Surgery resulted in several complications including scarring and stiffness of the ankle joint with resultant limitation of ankle joint range of motion and decreased ankle strength.

Disappointed with the traditional treatments for clubfoot, Ponseti experimented with new casting techniques. He was disappointed with the amount of residual deformity, which he felt was inherent in other casting techniques. Primarily, the manipulation of the clubfoot using Kite's technique involved abducting the forefoot against counter-pressure at the calcaneocuboid joint, preventing abduction of the calcaneus, and thereby interfering with correction of the heel varus. Kite believed that the heel varus would correct simply by everting the calcaneus. However, Kite did not realize that the calcaneus could evert only when it is abducted and laterally rotated under the talus. Ponseti believed that Kite's technique inevitably resulted in under correction, rocker bottom deformities, and a high rate of recurrence. Instead he proposed that proper technique should apply counter-pressure on the talar neck, not the calcaneus by placing the thumb on the lateral talar neck and pressing medially while abducting the metatarsals.

The cavus deformity of the foot, which occurs because of pronation of the forefoot in relation to the hindfoot, is corrected by supinating the forefoot, which elevates the first ray, thereby placing the forefoot in proper alignment with the hindfoot. Because the cavus usually is not a fixed deformity at birth, correction usually occurs with the first cast.

Manipulation to correct the varus and adduction is performed by exerting outward

pressure on the metatarsals and applying counter-pressure on the lateral head of the talus. The foot is held in flexion and supination during this maneuver. When the navicular, cuboid and the entire forefoot are displaced laterally in relation to the head of the talus, the anterior portion of the calcaneus follows laterally, and the heel varus deformity spontaneously corrects because the calcaneus is no longer locked underneath the talus. In this position, dorsiflexion of the calcaneus and ankle joint is possible. Next, the equinus is corrected by performing a percutaneous tenotomy, however, the calcaneus must be free from underneath the talus to be able to allow the equinus to correct at the level of the ankle joint.

Although Ponseti does not believe aggressive surgical correction is necessary, he does perform a percutaneous tenotomy in about 90% of cases. When starting the correction, a long leg cast with external rotation is applied. Cast changes are performed weekly with an average of 3-7 casts needed to completely correct the deformity. When the foot has achieved approximately 70 degrees of abduction, the percutaneous tenotomy is performed. This is usually followed by an additional 3 weeks of casting. Afterwards, a foot abduction brace/Dennis-Browne bar is worn for 23 hours per day for 3 months, then used at night-time for about 3 years.

Ponseti has been using his technique for clubfoot correction for over 50 years and ultimately has been able to collect a large population in which to compare data. Most significantly, Ponseti observed that approximately less than 11% of all clubfeet treated with his casting methods required subsequent surgical correction via posterior-medial release. He also noted that the clubfeet were stronger and more flexible with better long term results than those using Kite's traditional method. Based on his results, Ponseti concluded that surgical correction could be avoided in the vast majority of idiopathic clubfoot deformities. Additionally, he observed that clubfeet that existed as part of a congenital syndrome were more recalcitrant to correction than those that were idiopathic. A key component to maintaining correction is the use of the foot abduction brace or Dennis-Browne bar. He found a high rate of recurrence of deformity in those patients whose parents were not compliant in either applying the Dennis-Browne bar as instructed or applying it correctly.

Although Ponseti himself does not use a

grading system to guide his treatment protocol, many others have found certain classification systems helpful in staging the correction appropriately. The classification by Pirani is useful for many practitioners who hope to match Ponseti's success. This system allows one to get an objective measurement of the foot, as well as measuring the progress of treatment, predicting the need and timing of the Achilles tenotomy, and judging recurrences.

Although Ponseti's technique has been established for many years, its universal acceptance has not been realized quickly. Kite's technique was considered the paradigm of conservative clubfoot management. The technique was straight forward, easily understood, and easy to perform. In contrast, Ponseti's technique requires more gentle and precise manipulation for which many practitioners may not readily have the patience or skill. Ponseti developed the technique in relative anonymity in the Midwest, and has had the arduous task of overcoming dogma that has existed for many years. Finally, the newer technique tends to be more time consuming with no extra compensation, save a better result. In general, the success of clubfoot management depends greatly on expectations from treatment, by both patients as well as the physicians. Ponseti realized that a clubfoot, even well corrected, will never appear normal. The foot will always be smaller with a smaller calf circumference as well. Many doctors are unrealistic in their attempts to create a normal foot, not appreciating that this is not possible. Fortunately, using the Ponseti technique to correct clubfoot deformity will give the patient a significantly better outcome.

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