PART 1

A Tale of Two Pathologies: A New Case Study on Congenital Talipes Equinovarus (CTEV)

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At one time, a diagnosis of Congenital Talipes Equinovarus (CTEV) was a nearly impossible situation to manage based on the manifestation. The condition is commonly known as club foot as the deformity makes the leg and foot look like a club. CTEV manifests from mild varus position to a significant pathology that can result in an inability to walk or even stand. Since the 1960’s, CTEV for the most part, is a manageable condition, with the introduction of the Ponseti Method. Serial casting, tendon releases and other associated surgical procedures, Denis-Browne splints and foot orthoses have made poor results of this condition almost non-existent.

CTEV is one of the most common congenital structural foot deformities in children. Its presentation is of a plantarflexed, inverted, and adducted position of the foot. At the nadir of the deformity is the talar neck, which is positioned in varus and plantargrade. In general there are two recognized types: those who respond to strapping or casting, and the resistant types that require surgical correction. To a new parent, this presents a serious emotional issue. Every parent dreams of a healthy, normal delivery of their child; to a parent whose child has CTEV, it is a nightmare, even if of the simple variety.

There is a long history of treating this condition going back to the ancient Greeks. The condition was first described by Hippocrates and was treated with manipulation. Plaster was first used by Guerin in 1836. A wrench invented by Thomas was introduced for forced manipulation and is only mentioned in the literature for its historical value as it was regarded as too brutal for use. In 1930, Kite described a modified wedge plaster modality that is occasionally used to this day. Surgical procedures were introduced in 1792. We have come a long way.

This topic will be a series of articles that will appear here and in other media over the course of the next year, tracking two different patients with two manifestations of CTEV nearly fifty years apart. Both are of the resistant variety and there are two very different outcomes.

Our first and original patient Albert was born in 1950 with a rather severe form of CTEV. We have already met him in a previous article. Without successful correction, adulthood presents a serious pressure problem on the plantar surface. Pressures are maldistributed across the lateral border of the foot and presents as serious callosities, often painful. Such is the case of Albert.

Our second and newest patient, Tommy, was born...
in 2002, also with a significant manifestation of CTEV. I met Tommy through his mom, who is a nurse at a nursing home I was working in. What started as an evaluation of mom turned into a request that Tommy be seen and possibly helped with pedorthic modalities.

Once Tommy arrived, the CTEV was pretty obvious. His mom said that before Tommy was born, he did not kick as often as her first son did. She also felt discomfort in her lower ribcage during the pregnancy. In some cases of CTEV, the foot can get trapped about the mother’s ribcage. Many CTEV births have a much lower rate of movement with reference to activity in the uterus than normal births.

Within a short time after birth, Tommy was beginning the serial casting that is standard protocol for management. He went through many months of cast changes and positioning changes as the casts were reapplied. Since the human foot at birth is mainly composed of cartilage, the feet maintained their relatively normal positioning through the process. As he grew out of the protocol for serial casts, he was put into standard straight last shoes attached to a Denis-Browne splint. Again, this is standard treatment protocol.

As a refresher, the Ponseti Method, is a treatment developed by Dr. Ignacio Ponseti in the 1950s, and repopularized in 2000 by Dr. John Herzenberg and NHS surgeon Dr. Steve Mannion. This manipulative treatment of the CTEV deformity is based on the inherent properties of the connective tissue, cartilage, and bone, which respond to the proper mechanical stimuli created by the gradual reduction of the deformity.

The ligaments, joint capsules, and tendons are stretched under gentle manipulations. A plaster cast is applied after each manipulation to retain the degree of correction and soften the ligaments. The displaced bones are thus gradually brought into the correct alignment with their joint surfaces progressively remodeled yet maintaining congruency. After two months of manipulation and casting the foot appears slightly over-corrected.

After a few weeks in splints however, the foot looks normal.

It is important to remember that proper foot manipulations require a thorough understanding of the anatomy and kinematics of the normal foot and of the deviations of the tarsal bones in the clubfoot. Poorly conducted manipulations will further complicate the CTEV deformity. The non-operative treatment will succeed better if it is started a few days or weeks after birth and if the podiatrist and/or pedorthist understand the nature of the deformity and possesses manipulative skill and expertise in plaster-cast applications.

This method was employed in Tommy’s course of treatment. Things were looking like Tommy was going to have a normal foot. However, looks can be deceiving, and this proved true here.

The ossification of the bones in the foot as Tommy was in the 3-4 year range spelled the beginning of the problems he would encounter. His feet, never completely in the correct anatomic position, began to lapse back into equinovarus. He was taken to pediatric orthopedic surgeons who charted a course of surgical corrections that were part of the standard protocol. (The sequella of these procedures will be discussed in future articles). As the surgeries began piling up, their successes were called into question. Tommy’s parents were very concerned that their son would not run, play and grow up with normal gait. Tommy was taken to see Dr. Ponseti prior to his death, where he recommended that Tommy be seen at a Shriner’s Hospital. His parents did just that where more surgery were performed that transformed the equinovarus into a calcaneovalgus with a very mobile ankle mortise.

Walking became difficult as Tommy tired easily and there was a significant amount of pain and discomfort in the foot and ankle region. His mom was getting worried as Tommy became more and more sedentary. A child ten-years old is far too young to attain couch potato status.

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While I was evaluating mom’s condition, she began talking about her son and his travails with doctors and orthotics. He has had plenty of devices over his young life, most of which were unable to restore stability, function and comfort to his feet. We have all had the experience of the “bag of orthotics” being dumped out on the floor when we see a patient who has been through it all. I had to visualize Tommy’s devices as his mom described them. Needless to say, my pedorthic juices began flowing and I was very anxious to meet this remarkable boy who wanted to walk. My chance would come about a week later.

My anticipation was of a very strange looking foot and an equally strange gait. Tommy’s look was nearly normal and the gait was really strange compared to others with CTEV. I was bound and determined to help this child out, especially to reach his goal to play soccer and do what every ten year old wants to do. No ten-year old should want to sit more than get out and play.

Some additional background information on Tommy needs to be mentioned. Tommy’s doctors have predicted that when he reaches adulthood, he will be six foot seven to six foot nine inches tall. Both mom and dad are very tall, and height runs in the dad’s family. His uncle is six foot seven with a size sixteen shoe. At present, he is in fourth grade and is the tallest boy in his class, and in most of the school. Because of his current height, people assume that Tommy is older. While he is very mature for his age, he still acts like a ten year old. It will be challenging for him to be in junior high and to be a child trapped into an adult sized body.

This is Tommy’s future. It is imperative that a suitable solution is found.

In the next installment, we will cover the similarities and differences in management from 1950 and 2002, as well as the technical details about surgery and management modalities. Stay tuned as we go through the year with Albert and Tommy and what pedorthics has done to improve their lives.


How The Ponseti Method isApplied to CTEV

Step 1:
The calcaneal internal rotation (adduction) and plantar flexion is the key deformity in CTEV. The foot is adducted and plantar-flexed at the subtalar joint, and the goal is to abduct the foot and dorsiflex it. In order to achieve correction of the CTEV, the calcaneum should be allowed to rotate freely under the talus, which also is free to rotate in the ankle mortise. The correction takes place through the normal arc of the subtalar joint. This is achieved by placing the index finger of the operator on the medial malleolus to stabilize the leg and levering on the thumb placed on the lateral aspect head of the talus while abducting the forefoot in supination. Forcible attempts at correcting the heel varus by abducting the forefoot while applying counter pressure at the calcaneocuboid joint prevents the calcaneum from abducting and therefore everting.

Step 2:
Foot cavus increases when the forefoot is pronated. If cavus is present, the first step in the manipulation process is to supinate the forefoot by gently lifting the dropped first metatarsal to correct the cavus. Once the cavus is corrected, the forefoot can be abducted as outlined in step 1.

Step 3:
Pronation of the foot also causes the calcaneum to jam under the talus. The calcaneum cannot rotate and stays in varus. The cavus increases as outlined in step 2. This results in a bean-shaped foot. At the end of step 1, the foot is maximally abducted but never pronated.

Step 4:
The manipulation is carried out in the cast room, with the baby having been fed just prior to the treatment or even during the treatment. After the foot is manipulated, a long leg cast is applied to hold the correction. Initially, the short leg component is applied. The cast should be snug with minimal but adequate padding. The person doing this procedure should paint or spray the limb with tincture of benzoin to allow adherence of the padding to the limb, or if preferred, apply additional padding strips along the medial and lateral borders to facilitate safe removal of the cast with a cast saw. The cast must incorporate the toes right up to the tips but not squeeze the toes or obliterate the transverse arch. The cast is molded to contour around the heel while abducting the forefoot against counter pressure on the lateral aspect of the head of the talus. The knee is flexed to 90° for the long leg component of the cast. The parents can soak these casts for 30–45 minutes prior
to removal with a plaster knife. The preferred method is to use the oscillating plaster saw for cast removal. The cast is bivalved and removed and then reconstituted by coating the 2 halves. This allows for monitoring of the progress of the forefoot abduction and, in the later stages, the amount of dorsiflexion or equinus correction.

Step 5:
Forcible correction of the equinus (and cavus) by dorsiflexion against a tight Achilles tendon results in a spurious correction through a break in the midfoot, resulting in a rockerbottom foot. The cavus should be separately treated as outlined in step 2, and the equinus should be corrected without causing a midfoot break. It generally takes up to 4–7 casts to achieve maximum foot abduction. The casts are changed weekly. The foot abduction (correction) can be considered adequate when the thigh-foot axis is 60°. After maximal foot abduction is obtained, most cases require a percutaneous Achilles tenotomy. This is performed in the cast room under aseptic conditions. The local area is anesthetized with a combination of a topical lignocaine preparation (e.g. EMLA cream) and minimal local infiltration of lidocaine. The tenotomy is performed through a stab incision with a round tip (#6400) Beaver blade. The wound is closed with a single absorbable suture or with adhesive strips. The final cast is applied with the foot in maximum dorsiflexion, and the foot is held in the cast for 2–3 weeks.

Step 6:
Following the manipulation and casting phase, the feet are fitted with open-toed straight-laced shoes attached to a Dennis-Brown bar. The affected foot is abducted (externally rotated) to 70° with the unaffected foot set at 45° of abduction. The shoes also have a heel counter bumper to prevent the heel from slipping out of the shoe. The shoes are worn for 23 hours a day for 3 months and are worn at night and during naps for up to 3 years.

Step 7:
In 10–30% of cases, a tibialis anterior tendon transfer to the lateral cuneiform is performed when the child is approximately 3 years of age. This gives lasting correction of the forefoot, preventing metatarsus adductus and foot inversion. This procedure is indicated in a child aged 2–2.5 years with dynamic supination of the foot. Prior to surgery, cast the foot in a long leg cast for a few weeks to regain the correction.