A History of Closed Methods of Treating Talipes Equinovarus

The first in a series of three articles by Janet McGroggan, joint winner of the Cosyfeet Podiatry Award 2009

Abstract

Inspiration comes from far flung places and for me this was in my living room watching Super Doctors, a series of programmes detailing the work of doctors who had gone over and above the call of duty, mavericks you might say. This particular episode covered the work of Stephen Mannion an orthopaedic surgeon who was treating Talipes Equinovarus (TEV) in Malawi using the Ponseti method of treatment.

I had never heard of this method nor, in my ignorance, of any non-surgical treatment of TEV. Either I was off that day or we did not cover it (I graduated in 2003). It seemed so simple that it was unbelievable and I wanted to know more. This series of three articles will take you from the history of closed TEV correction methods through the Ponseti method of treatment and my training and conclude with the question – Where are Podiatrists in all of this?

The anatomy and pathophysiology of talipes equinovarus is fascinating and the aetiology an enigma. Around the sixth to eighth week of gestation all foetal feet are turned inwards and the forefoot is in an inverted position. Throughout normal development the leg externally rotates and the foot everts into a normal foot.

This usually occurs during months three or four of gestation although it has been observed as late as month seven.[1]

As yet the aetiology of talipes is still uncertain however it is generally accepted that normal development is interrupted at some point typically before the 20 week scan and the congenital musculoskeletal abnormality results.[2] There is still speculation as to whether this interruption is genetic, neurological, vascular, developmental or positional.[3]

In the talipes foot the calcaneus decreases in size depending on the severity of the deformity, it is forced into a plantarflexed position under the talus which is also smaller. The talar neck is shifted medially and downwards and the navicular is also orientated medially and downwards however the cuboid is largely unchanged.[3] The cuneiforms are smaller and increasingly adducted in relation to the severity of the deformity. As the deformity increases in severity, the long axis of the first and second metatarsals decreases.[3,4] As a consequence of these positional anomalies the related articular surfaces are altered accordingly and a congruent subtalar joint is not possible.[5] There is also whole limb involvement in reduced tibial torsion and internal femoral rotation.

In their study of foetal talipes anatomy in 2006 Windisch et al dissected seven affected feet of aborted foetuses and compared them to normal feet of similarly developed foetuses. They looked particularly at articular surfaces, shapes and

angles of bones and their skeletal relationships and concluded that the tarsal bones, mainly the calcaneus, are the primary fault.[3] However in other research[4] the talus has been identified as the linchpin of the deformity and Bensahel[6] targets the midtarsal joint in the development of his treatment method.

In spite of disputed origins within the foot Windisch et al in a further study[1] concluded that soft tissue development was secondary to bony deformity. They identified fibrotic, retracted, short medial tissues with altered orientations. Laterally, tibialis posterior formed a thickened mass which divided off to its usual insertions and the calcaneofibular ligament was distorted depending on the severity of the deformity.

Typically the foot presents with ankle equinus, heel varus, mid foot cavus and forefoot adduction and if left untreated will cause deformity, stiffness, pain on walking, footwear difficulties and the likelihood of ulceration on pressure points caused by the deformity.[7]

As it affects 1.2 of every 1,000 live births, is bilateral in 50% of cases and has been depicted in ancient Egyptian and Indian art [7] it is no surprise that treatment has varied over the decades and from country to country. However it may be surprising that it is only in the last couple of decades and due to our increasing understanding of mechanical properties, anatomy and biomechanics that non-

surgical methods of treating talipes have become a successful and acceptable alternative to surgery.

In the 1800s the Thomas Wrench was used to forcibly correct talipes non-surgically. It was used on the mature limb and literally wrenched the foot into an abducted position tearing bone and tissue in the process. The device was modified by Starr in 1901. Starr appears to have a certain understanding of some of the elements of the deformity but not the mechanics of the foot as a functioning unit. This wrench was a steel device which attempted to correct the entire deformity with one outwards swing often tearing limbs or flesh.[8]

In 1928 Telson described a wrench he had devised in an attempt to provide a less brutal form of closed treatment. (See Figure 1) Telson was correct in theorising that in open surgery the surgeon must cut through tissues that are not part of the deformity in order to get to the bones and ligaments that need correction. This wrench, he felt, would reduce the forefoot varus allowing for the removal of the sub-astrangular wedge in open surgery to correct the rearfoot varus. He felt that the wrench would produce a better shaped foot and in his research his team did in fact find that they needed to perform less mid-tarsal wedgectomies.[9] The device produced a stiff painful foot was aesthetically acceptable.[10]

Whilst Telson did correctly identify the complexities of talipes surgery his approach of using a mechanical device capable of fracturing bones has unsurprisingly fallen by the wayside over the years.[8]

It was Kite who sowed the seeds for a gentler method of treatment in 1939. He detailed a manipulation and serial casting method which corrected the varus and equinus deformities separately rather than the foot as a whole. He recommended abduction of the forefoot against the calcaneocuboid joint to correct the heel varus and at the time quoted an 85% success rate. However the sequence actually blocks adduction of the calcaneus under the talus frequently causing 'rocker bottom deformity' and consequently up to 75% of patients required open surgery.[10,11]

The low success rates of closed methods of talipes correction and the introduction of anaesthesia and aseptic techniques meant that surgical correction of talipes became the mainstay. Surgeons began to set aside osteotomies in favour of extensive soft tissue releases in the 1970s such as a medial release of the subtalar joint, ankle and talonavicular joint. Procedures have varied through the decades however the complexity of the deformity means that there is not a single procedure which will correct all aspects of it, for example the medial release mentioned does not address the rearfoot valgus.[11,12] Long term results are frequently unfavourable and the feet produced are typically weak and stiff with large amounts of scar tissue which hinder further surgeries.[13]

The quest for a successful closed method of treatment continued and in the 1950s in Paris a quite brutal technique of forceful manipulation and taping feet into splints was used which was relatively unsuccessful unless the original deformity was mild. Henri Bensahel, an orthopaedic surgeon, saw that recurrences were common and the method was deemed harmful and scrapped.

Bensahel went on to develop the Functional Method also known as the French Functional Method or the Physiotherapy Method of treating talipes in the 1970s.[6] This method concentrates on the midtarsal joint and involves daily gentle manipulations of the affected tissues in the foot to stretch and strengthen the muscles. The limb is then taped and splinted. The majority of correction will happen within three months with full correction expected by five months. Parents continue the treatment at home until walking age and splints are worn until the child is three.[14] This method has been used worldwide since the 1990s with varying success rates. Parental compliance has been cited as one reason for the varying success rates due to the commitment to daily treatments and home treatment regime.[11]

Meanwhile in Iowa Dr Ignatio Ponseti an orthopaedic surgeon became frustrated with the results of the surgical treatment of talipes.[13] Between 1948 and 1956 he treated patients using what became known as the Ponseti method. The method requires an in depth knowledge of functional anatomy and details a

specific sequential manipulation method followed by serial casting (see Box 1).[15,16]

A key feature of the method is that it addresses the cavus deformity in the initial casts and this aligns the midfoot. The adductus and varus deformity of the heel is then corrected with progressive abduction of the forefoot using the talar head as a fulcrum. When these deformities are fully corrected a tenotomy performed under local anaesthetic may be necessary to correct the equinus.[17]

Around six casts will be required and treatment is weekly (See Figure 2). The casts consist of a thin layer of plaster of paris applied in two sections, from the toes to just below the knee allowing the foot to be held in the corrected position and then, holding the knee at right angles, the leg is gently rotated outwards to correct tibial torsion and plaster of paris applied from below the knee up to the top of the thigh.[14]

Ponseti and Smoley reported the results in the Journal of Bone and Joint Surgery in 1963. 67 patients totalling 94 feet were evaluated reporting 71% (*n=67)* as good, 28% (*n=26)* as acceptable and 1% *(n=1)* as poor. All feet treated presented initially as severe and rigid talipes equinovarus. 74 of the 94 reported feet underwent a tenotomy. Following the final cast, which if a tenotomy has been carried out will stay on for three weeks, the patient will wear a Denis-Brown splint full time for three months and then only at night and nap time until the child

is four years old (see figure 3). This phase is known as the boots and bar phase and is essential to prevent recurrence.

Ponseti recognised the importance of parent education in the success of his method. In general recurrence of the deformity shortly after successful casting was as a result of parental non compliance during the boots and bar phase of the treatment.[14]

The Ponseti method has emerged as the gold standard of treatment for talipes in the UK and is used even in cases where some surgery will still be required as it will reduce the complexity of the surgical procedure.[7] One factor in its success is early intervention. Most children will be treated within the first two weeks of life. At this point in skeletal development the bones in the foot consist largely of anlage, a cartilage. Anlage continues to ossify post natally leaving only a thin layer of cartilage at articular surfaces. If manipulation is carried out early enough the tarsal 'bones' are malleable enough to manipulate and congruent articular surfaces will develop post treatment.[2,15]

Conclusion

From 1963 when his 'results of treatment' article was published until 1995 Ponseti continued to write articles primarily on metatarsus adductus. His revolutionary treatment of TEV had not been accepted by the orthopaedic community. In 1995 Cooper & Dietz published the results of a long term follow

up of many of Ponseti's original subjects. The successful long term results and the increased use of the internet, which allowed parents to research treatments available to their children, threw the treatment into the limelight. Ponseti believed that many orthopaedic surgeons did not understand the concept of the deformity as triplaner and this is why it took so long for the treatment to be accepted.
The French Functional Method is also used today although it is less common in the UK due to the daily treatment routine and the lower success rates.

There are complexities to offering a closed method of treatment for TEV for example the long miles families have to travel weekly to clinics, family education and compliance. Research has been carried out to address these problems and will be discussed in article 3. In my next article I will be discussing my training in the Ponseti Method and going into detail as to what the treatment entails.

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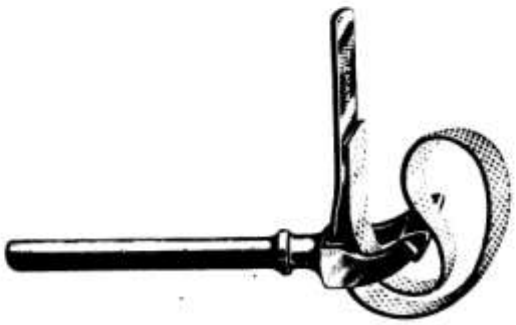

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