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The Ponseti Method for Clubfoot Correction

David M. Scher, MD

The Ponseti technique is rapidly becoming the most widely practiced method for initial treatment of congenital clubfeet in infants. It is an easy technique to learn and, when applied accurately, yields excellent results. It consists of gentle manipulation and casting of the feet at weekly intervals. The first cast is applied with the foot supinated and attention directed to elevating the first ray. Subsequent casts are applied to abduct the foot around the head of the talus, taking care never to directly manipulate the calcaneus. At the time of the final cast, the overwhelming majority of infants require a percutaneous Achilles tenotomy to allow sufficient dorsiflexion. The final cast remains in place for three weeks, at which time the infant is placed into a foot abduction orthosis. The orthosis is worn 23 h per day for 3 months and then at night for several years. Good results have been demonstrated at multiple centers and long-term results indicate that foot function is comparable with that of normal feet.

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Ignacio V. Ponseti can be credited with developing a comprehensive technique for treating congenital clubfoot in the 1940s.¹⁻⁴ This technique is based on his experiences with the myriad of treatments being applied at that time and his observations in the clinic and operating room, as well as his anatomic dissections and analysis by cineradiography. One of the major principles of this technique is the concept that the tissues of a newborn's foot, including tendons, ligaments, joint capsules, and unossified tarsal bones, will yield to gentle pressure over time. This process recently has been demonstrated by Pirani and coworkers, who used magnetic resonance imaging (MRI) to characterize the change in shape of the talus, navicular, calcaneus, and cuboid during the casting process.⁵ Furthermore, this general concept frequently is encountered throughout orthopedics, where it is implicated in the etiology of some conditions and used to treat others. The Heuter-Volkman law describes the process by which deforming forces can alter bone growth, such as is the case in Blount's disease. The Ilizarov technique takes advantage of the ability of soft tissues to yield to stretch and lengthen during limb-lengthening procedures and deformity correction. Using these principles and his understanding of clubfoot anatomy and kinematics, Dr. Ponseti began using this technique in 1948. Since that time, many publications by different centers have corroborated its success.⁶⁻⁸ By applying

these techniques to clubfeet within the first few weeks of life, physicians should be able to successfully correct most cases of clubfeet without resorting to major reconstructive surgery.

The treatment process using the Ponseti technique can be logically divided into 2 phases: the treatment phase during which time the deformity is corrected completely, and the maintenance phase, during which time a foot abduction orthosis is used to prevent recurrence. During each of these phases, attention to the details of the technique is essential. It has been shown that treatment errors can lead to iatrogenic deformities, incomplete correction and recurrences.⁹ The treatment phase should begin as early as possible, optimally within the first week of life. Gentle manipulations are performed followed by casting on a weekly basis. During these manipulations, the components of the clubfoot deformity are corrected simultaneously, except for equinus, which is corrected at the final cast application. Generally 5 to 6 casts are required to fully correct the foot and, in a large majority of cases (70% or higher) a percutaneous Achilles tenotomy is performed. At the end of casting, when the maintenance phase begins, the child must wear an orthosis that keeps the feet abducted and the ankle slightly dorsiflexed, according to a strict wearing protocol. Failure to use this type of device has been shown to be associated with recurrence of the clubfoot deformity.^{10,11}

Manipulation and Casting

The manner in which the foot is first manipulated and the first cast applied is one of the several unique elements of the

Division of Pediatric Orthopaedic Surgery, Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, NY.

Address reprint requests to David M. Scher, MD, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021. E-mail: scherd@hss.edu



Figure 1 The initial Ponseti cast. Note the inversion of the forefoot to match the heel position.

Ponseti technique that makes it quite distinct from other casting methods. The cavus is corrected with the first cast application by aligning the forefoot with the hindfoot. Even though the forefoot appears to be supinated with respect to the horizontal, it is in fact pronated with respect to the heel, because the heel is typically in more varus than the forefoot. This relative pronation of the forefoot with respect to the heel creates the cavus. This phenomenon has been likened to wringing out the foot as one would wring out a towel. Consequently, this component of the deformity can be corrected by supinating the forefoot to bring it in line with the heel and then elevating (ie, dorsiflexing) the first metatarsal (Fig. 1). In doing so, the cavus is corrected, typically after one cast (Figs. 2 and 3). In one's early experience with this technique, it usually is easiest to apply the cast in 2 stages, first a short-leg cast to just below the knee, which is then extended above the knee once the plaster sets. This method also is preferable in older children (ie, older than 2 to 3 months) who are stronger and less easily consoled during the casting. Ponseti emphasizes the importance of long-leg casts, which are essential in maintaining a strong external rotation force of the foot beneath the talus. Long-leg casts allows adequate stretching of



Figure 2 Before treatment, there is cavus present, characterized by a visible medial crease.



Figure 3 After the first cast, the cavus and crease are no longer evident.

the medial structures, especially the posterior tibial tendon and superficial deltoid ligament. Because of the cylindrical shape of an infant's leg, a short-leg cast cannot be adequately molded to prevent internal rotation of the foot.

One week after application, the first cast is removed and, after a short period of manipulation lasting approximately 1 min, the next toe-to-groin plaster cast is applied (Fig. 4). This manipulation and casting is focused on abducting the foot around the head of the talus. Care is taken to maintain the forefoot in a supinated position and to avoid imparting any pronation to the foot. With one's thumb on the head of the talus (left thumb for a right clubfoot and right thumb for a left clubfoot), the navicular can be felt reducing over the talar head during these manipulations. This maneuver should be practiced several times to both stretch the medial structures and also to know how the foot will be manipulated after the plaster is applied. Another crucial point in the Ponseti technique, which is radically different than the Kite technique, is that the heel is never directly manipulated. The kinematics of



Figure 4 The second cast is applied with the foot still supinated and the forefoot is abducted around the head of the talus.

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