

Ponseti's Treatment for Congenital Clubfoot (1963)

In 1963, Ignacio Ponseti and Eugene Smoley experimentally determined an effective and minimally invasive method of treating congenital clubfoot. Congenital clubfoot is a disorder in which a newborn's foot is rigidly turned inwards and upwards. During the early 1960s, orthopedists often relied on invasive surgical procedures to treat clubfoot. In Ponseti and Smoley's experiment, Ponseti and Smoley had a team of physicians treat patients with clubfoot using the Ponseti method, which consisted of manually manipulating each patient's foot into a more desirable position and subsequently casting each foot to heal in place. After following up with the patients for several years, Ponseti and Smoley concluded that the Ponseti method is an effective alternative to the more invasive surgical procedures that orthopedists had often relied on. Ponseti and Smoley provided physicians with a novel and minimally invasive method of correcting foot deformities to ensure that developing infants maintain healthy feet.

In 1963, Ponseti and Smoley both worked as orthopedic physicians at the State University of Iowa, later renamed Iowa State University, in Iowa City, Iowa. During the early 1940s, Ponseti had studied the effectiveness of specific surgeries that many US physicians used to treat patients with congenital clubfoot. Ponseti had found that those surgeries, which require bone to be removed from patient's feet, often caused patients lifelong discomfort and failed to prevent many patients from developing with malformed feet. To address the limitations of existing methods of treating clubfoot, in 1948 Ponseti devised a minimally invasive strategy for treating the deformity that was later called the Ponseti method. That year, Ponseti began a study to determine the effectiveness of the Ponseti method. He, along with Smoley, published results of the study in the 1963 edition of *Journal of Bone and Joint Surgery*.

In Ponseti and Smoley's study, the medical researchers observed the foot formation outcomes of infants that had clubfoot and that had been treated using the Ponseti method. Their study specifically included infants that were treated at the State University of Iowa, which had started uniformly applying the Ponseti method to all cases of congenital clubfoot in 1948. The patients ranged from one week to six months old at the time of initial treatment, and the average age of the patient was one month. Ponseti and Smoley claimed that they were interested in severe cases of deformity. From their observations, they excluded patients that had already received some form of prior treatment for clubfoot, as well as patients that had other disorders, so that they could attribute any effects resulting from the method to the method itself and not other causes.

Between 1948 and 1956, the State University of Iowa treated 322 patients, sixty-seven of which Ponseti and Smoley included into their study. Physicians at the university manually manipulated each patient's foot and then cast each foot to gradually reposition the bones, muscles, and connective tissues of the foot into a more normal and functional position. The physicians left each cast on their patients for around a week, and to ensure complete correction of any deformities, the physicians repeated the process multiple times throughout each patient's course of treatment. On average, the treatments lasted a total of 9.5 weeks. Additionally, patients were given splints, which on average they wore for 21.5 months. Ponseti and Smoley followed up with patients for five to twelve years. During that follow-up period, Ponseti and Smoley examined changes in the feet of the affected patients as they matured. The researchers also addressed any recurrences in which a previously affected foot had returned to its deformed position.

Ponseti and Smoley observed that over half of the patients with club feet that were treated in their study had experienced at least one recurrence. On average, those reoccurrences occurred when patients were two and a half years old. The researchers reported that most of those occurrences

were able to be treated through conservative treatments, such as casting and splinting. However, a small portion of the reoccurrences required tendon surgery.

To address why some patients had reoccurrences, Ponseti and Smoley observed which patients had recurrences of the deformity. The researchers found that such recurrences were not due to insufficient or ineffective treatment, which the researchers argued was a common misconception that doctors attributed to the Ponseti method. Ponseti and Smoley reported that recurrences occurred for two main reasons. Either the initial case was extremely severe, or the parents of the affected children were not cooperative and stopped using splints too early.

Ponseti and Smoley also observed that eighteen percent of patients had a secondary reoccurrence, ten percent had a third reoccurrence, and one percent had a fourth reoccurrence. Ponseti and Smoley reported that half of the feet with a third recurrence of deformity were able to be treated by casting the foot into place two to three more times. Half of the feet had more severe recurrences, and, except in one case, were able to be corrected by tendon surgeries. The one patient that had a fourth reoccurrence did not achieve remission from congenital clubfoot.

To assess the overall effectiveness of the Ponseti method, Ponseti and Smoley observed how well patients could move their feet and used X-ray imaging to view how their patients' feet had formed. The researchers categorized the treatment results as "good," "acceptable," or "poor" based on three main criteria. The criteria were how far up the patient could flex his or her toes, how far outward the patient's heel rolled, and how far inward the front of the foot angled. "Good" results included all patients with little to no deviation, and the authors deemed results "acceptable" when a slight deformity persisted that was not great enough to cause disability in the patient. The authors labeled only the one foot with "poor" results following four recurrences without successful correction.

Ponseti and Smoley observed which deformities the Ponseti method was best at fixing. They found that it was easiest to correct the inward twist of the front of the foot. In most cases, the physicians had successfully used the first cast to straighten the foot. The researchers also observed that when the ankle turned so that the soles of the foot faced each other patients had a "good" rate of seventy-four percent. The other twenty-six percent of patients with that deformity had an "acceptable" positioning following treatment. Lastly, patients with deformities that involved the front of the foot twisting inwards had a seventy-seven percent "good" success rate, while twenty-two percent of patients had an "acceptable" level of residual deformity. One foot remained severely turned inwards despite treatments and the results were labeled as "poor."

Ponseti and Smoley concluded that the Ponseti method was an effective method to correct clubfoot deformities. Out of the ninety-four feet belonging to sixty-seven patients with one or two club feet, only one foot did not exhibit good or acceptable treatment outcomes after a follow-up period of five to twelve years. For the remaining ninety nine percent of patients, the Ponseti method proved effective for the correction of most aspects of deformity, although some patients required additional non-invasive procedures on their tendons.

Ponseti and Smoley further concluded that doctors must apply the Ponseti method to cases of congenital clubfoot as early as possible because the tissues in the feet harden and become more rigid with development. Early treatment increases the likelihood that the treatment can be completed before the growth and hardening of the infant's joints and tendons begins to interfere with the process. The researchers suggested physicians using the Ponseti method should first work to flatten the high arch present in most club feet, and then they should push the heel inwards and toes outwards from the body's midline to straighten the foot. Ponseti and Smoley also supported the Ponseti method's use of manipulations and casting, as they did not do any damage to the infant's skeleton.

While some patients did not require any supplemental treatments to the manipulations and casting, Ponseti and Smoley reported that the Ponseti method allows for some noninvasive surgical procedures on the tendons of the foot and ankle if the tendons are resistant to the basic Ponseti method. The researchers emphasized that those treatments can be beneficial to supplement the casting and manipulations. In their study, physicians had performed minor surgeries on tendons in about eighty percent of feet. None of the surgeries performed in the study included removing bone to correct for the congenital clubfoot deformity, which at the time of the study was most doctors' standard treatment procedure for congenital clubfoot.

Lastly, Ponseti and Smoley addressed the main difficulties in treatment, which are the corrections needed to keep the heel from rolling outwards and the front of the foot from tilting inwards. They stated that increased vigilance with the splint schedule would prevent the deformities from arising again in milder cases, and tendon procedures may be necessary to prevent recurrences in the more severe cases.

At the time of Ponseti and Smoley's publication of the study, their article received little attention from the medical community. According to scholar Frances Luttkhuizen, a majority of physicians disregarded the effectiveness of the Ponseti method because invasive surgical procedures were considered more modern. However, as the demand for less risky and invasive procedures to treat clubfoot increased decades later, Ponseti and Smoley's study became widely recognized.

Ponseti and Smoley's study helped reinforce the efficacy of what later became known as the Ponseti method for treating congenital clubfoot. As of 2017, the Ponseti method remains the most widely-used treatment method for infants with congenital clubfoot. Physicians and researchers continue to emphasize the importance of adhering to the methods Ponseti devised over fifty years ago for the best treatment outcomes for affected infants.

Sources

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