

## Research Paper

# Comparison Between the Outcome of the Standard and Accelerated Ponseti Casting Methods for Correcting Congenital Talipes Equinovarus Deformity



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## ABSTRACT

**Background:** Congenital talipes equinovarus (CTEV) is a prevalent congenital foot deformity. The Ponseti method is a non-surgical treatment for clubfoot, which entails a sequence of casts and braces. The accelerated Ponseti method is a modified version of the standard Ponseti method, involving more frequent cast changes.

**Methods:** A total of 60 patients with idiopathic congenital talipes equinovarus (CTEV) under the age of one were carefully chosen and assigned to two groups of A (standard) and B (accelerated). The Pirani score was used to evaluate each clubfoot before applying a cast. In group A, above-knee casting was performed once a week, while in group B, it was done twice a week.

**Results:** The study involved 60 children with a total of 75 feet. The results indicated a shorter treatment duration with the accelerated Ponseti method, while the occurrence of skin complications was comparable between the two methods.

**Conclusion:** In conclusion, both the accelerated and standard Ponseti methods are equally effective in correcting clubfoot. The accelerated method offers the advantage of reducing the overall treatment duration and has clear benefits, while no notable difference is observed in skin complications between the two methods.

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## 1. Introduction

**C**ongenital talipes equinovarus (CTEV) is a common foot deformity characterized by four components, midfoot cavus, forefoot adductus, hindfoot varus, and hindfoot equinus. While various conservative and surgical options exist for managing clubfoot, it is advisable to initiate treatment soon after birth using conservative methods. Several nonsurgical treatment approaches are being employed, with reported success rates ranging from 10% to 63% [1]. CTEV presents with varying degrees of rigidity that cannot be corrected passively [2]. The objective of treatment is to correct all aspects of the deformity, allowing the patient to have a pain-free, plantigrade foot with good mobility, no calluses, and no need for modified footwear. Neglected clubfoot can result in pain and disability [3]. The incidence of clubfoot varies globally [4]. The causes of clubfoot are not well understood but may involve genetic factors [5].

The Ponseti method, which involves weekly manipulations and casting, has been widely accepted as the preferred treatment for clubfoot in the global orthopedic community over the past two decades. This method has shown excellent long-term outcomes and has successfully reduced the need for surgery in 98% of children [6]. The Ponseti method consists of two distinct phases, the corrective phase and the maintenance phase. In the corrective phase, the foot is manipulated and then placed in a cast. The cast maintains the achieved stretch in tight structures, allowing for soft tissue remodeling and correction of bone positions in the foot [7]. Sequential correction of the midfoot cavus, forefoot adductus, and hindfoot varus is performed around the talus [8]. To correct the remaining hindfoot equinus deformity, a percutaneous Achilles tenotomy is usually performed, followed by three weeks of casting to aid in the healing process [7]. The maintenance phase involves the use of an orthosis regime to prevent recurrence. The foot abduction orthosis is used for 23 hours a day during the first three months, and then during sleep at night until the age of five [7]. The foot abduction orthosis plays a critical role in preventing relapse in clubfoot and its effectiveness has been well-documented. An accelerated version of the Ponseti method has been developed, in which the standard weekly plaster change is increased to twice a week. This accelerated method has demonstrated equal effectiveness in achieving correction while reducing the duration of plaster use and the overall treatment time by half. This significant advantage can lead to improved compliance [9]. The Pirani score is widely used as a classification system to assess the severity of clubfoot based on clinical examination [10]. This scoring system has shown

good interobserver reliability and reproducibility [9]. The Pirani score ranges from 0 to 6 while 0 indicates a normal foot and 6 indicates a severe deformity. Compliance with treatment protocols is a common challenge in any treatment regimen. For families of low socioeconomic status, long-distance travel and staying away from home and work make it difficult to attend foot clinics, which is also a problem in other developing countries [11].

This study assessed the outcomes of the corrective phase (manipulation and casting) for clubfoot, following the guidelines of the Ponseti method. Furthermore, the study was conducted to evaluate the effectiveness of shorter treatment duration, to identify the most efficient and cost-effective strategies to manage these patients.

### Objectives

This study aims to compare the efficacy and occurrence of skin complications in the management of CTEV using the accelerated Ponseti casting method versus the standard Ponseti casting method.

## 2. Methods

### Inclusion criteria

The study included the following eligible patients:

1. Infants aged 1 year or younger with idiopathic CTEV.
2. Pirani score >1.

### Exclusion criteria

The following criteria were considered for exclusion:

1. Clubfoot associated with neurological abnormalities and multiple contractures.
2. Syndromic clubfoot.
3. Secondary clubfoot.
4. Previously operated patients.
5. Previous casting in other centers.

The patients were randomly assigned to group A (the standard Ponseti) and group B (the accelerated Ponseti). The degree of deformity for each foot was assessed using the Pirani scoring system. Sequential manipulations and castings were performed according to the recommendations of Ponseti et al. [12].

In the standard Ponseti group, each foot underwent weekly manipulations, and corrective above-knee casts were applied with the knee flexed at 90°. In the accelerated group, each foot was manipulated twice a week at fixed intervals. All children received outpatient treatment, and a therapist performed all the castings.

Caregivers were educated about potential casting complications and were advised to remove the cast themselves or seek assistance at a nearby hospital if necessary. Once 70° of foot abduction was achieved, ankle dorsiflexion was assessed. If dorsiflexion beyond 15° could not be achieved, a percutaneous Achilles tendon tenotomy was performed. The total number of castings required to achieve the desired correction of 70° of foot abduction relative to the leg was recorded.

### Statistical analysis

Statistical analyses were performed using chi-square tests and t-tests. All statistical analyses were performed using SPSS software, version 20.  $P < 0.05$  was deemed statistically significant.

### 3. Results

This study was a prospective study, and the sample size was determined based on a review of previous literature and studies. A total of 60 children (75 feet) of both genders participated, 36 boys and 24 girls. Among them, 30 children (39 feet) were treated using the standard Ponseti method, and 30 children (36 feet) were treated using the accelerated Ponseti method. The average age at presentation in the accelerated group was 1.23 months, while in the standard group, it was 1.11 months. In the standard Ponseti group, 9 children had bilateral clubfoot, 12 had unilateral clubfoot on the left side, and 9 had unilateral clubfoot on the right side. The mean age at presentation was 2.64 months. The mean number of casts required before achieving 70° of foot abduction relative to the leg was 5.25 in the standard Ponseti group and 5.19 in the accelerated Ponseti group. However, no statistically significant difference was observed in the number of cast applications between the two groups ( $P > 0.05$ ).

The mean Pirani score at presentation was 4.86 in the standard Ponseti method and 4.73 in the accelerated Ponseti method. At 70° of foot abduction relative to the leg, the mean Pirani score was 1.19 in the accelerated Ponseti group and 1.2 in the standard Ponseti group. The mean number of days in the cast was 18.16 days in the accelerated group and 36.79 days in the standard group. The total treatment duration in the accelerated Ponseti

group was significantly shorter compared to the standard Ponseti method group ( $P < 0.01$ ). Percutaneous Achilles tenotomy was required in 65% of feet in the accelerated group and 58% in the standard group. The incidence of skin complications was 20% in the standard method and 16% in the accelerated Ponseti group, without a statistically significant difference observed between the two methods ( $P > 0.05$ ).

### 4. Discussion

CTEV is a prevalent foot anomaly in children [13]. To address this, Ponseti developed a serial manipulation and casting method for congenital clubfoot, to achieve a functional, plantigrade foot without major surgical intervention. Morcuende et al. conducted an early review of the accelerated Ponseti, retrospectively analyzing 230 patients (319 clubfeet). They compared five-day casting with seven-day casting and found comparable outcomes in both groups [8].

Harnett et al. further accelerated the plaster change to three times a week and compared it to the weekly plaster change in their study involving 40 patients (61 feet). The initial median Pirani score was 5.5 in the accelerated group and 5 in the standard group. The Pirani score in the accelerated group decreased by an average of 4.5 and in the control group by 4.0. The authors concluded that three-weekly plaster change was as effective as weekly plaster change and offered definite advantages [9].

In our study, we treated clubfoot cases using both the standard and accelerated Ponseti methods, which involved changing the plaster twice a week on fixed days.

We utilized Pirani's scoring system to evaluate the treatment efficacy of the accelerated Ponseti method described in the literature [14], comparing it to the standard Ponseti technique with weekly plaster changes for correcting clubfoot deformity. It is essential to note that this study focused solely on the treatment phase and did not include the maintenance of corrected clubfoot using a foot abduction orthosis.

A significant limitation of this study was the need for extended follow-up to assess recurrence and long-term issues in patients' later lives. The maintenance phase, involving the proper use of the foot abduction orthosis, is crucial to prevent a recurrence. Failure to adhere to the bracing program increases the risk of relapse.

If the long-term outcomes of the accelerated Ponseti method are comparable to those of the standard approach, it can offer numerous benefits to patients. The accelerated method reduces the number of days that the child spends in plaster, providing parents with a faster treatment alternative. Furthermore, it reduces the likelihood of plaster slippage and allows for more intensive education on the importance of orthosis, with more frequent visits over a shorter period [15]. Studies have reported osteopenia following immobilization in above-knee plasters, but these results resolved within a few months after plaster removal [16]. The accelerated method may further mitigate this issue.

The reduced plaster duration offers clear advantages for both patients and caregivers. It minimizes the overall time the lower limb is immobilized and enables early detection of pressure sores or skin rashes. Prolonged immobilization-related effects, such as tissue disuse atrophy, are also avoided.

The current literature provides strong evidence supporting the efficacy of the accelerated Ponseti method in correcting deformity. Additionally, it offers increased convenience for caregivers, as the treatment period is shortened, reducing the need for extensive travel and time away from home and work, particularly in developing countries. This issue, in turn, leads to cost savings and potentially improves compliance with the accelerated Ponseti method.

## 5. Conclusion

The Ponseti method is widely recognized as the standard treatment to manage idiopathic CTEV and provides excellent outcomes. This study indicates that maintaining the efficacy of this method, changing plaster casts twice a week, leads to faster correction. The results demonstrate that both the standard Ponseti method and the accelerated Ponseti method yield comparable functional outcomes for clubfoot treatment. The accelerated approach provides the added benefits of reducing the number of plaster days and achieving faster correction without significant differences in skin complications between the two methods. The results demonstrate that both groups exhibited similar outcomes in all aspects. Based on these results, we conclude that the accelerated Ponseti method, with plaster changes twice a week, is as effective as the standard Ponseti method for treating idiopathic CTEV while maintaining a similar rate of skin complications. Future studies, including large-scale randomized control trials conducted at multiple centers, may be necessary to further validate the results.

## Ethical Considerations

### Compliance with ethical guidelines

The study was approved by the Ethical Committee of **Ahvaz Jundishapur University of Medical Sciences** (Code: IR.AJUMS.REC.1396.1059), and informed consent was obtained from all caregivers.

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### Authors' contributions

Conception and design: Hamid Reza Arti; Data collection and analysis: Hamed Bahrami Yarahmadi; Writing—original draft: Ali DavarPanah; Writing—manuscript: Sam Bemani; Final approving: All authors.

### Conflict of interest

The authors declared no conflict of interest.

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