

# Outcomes of Congenital Talipes Equinovarus Treated with Ponseti Method

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## ABSTRACT

**Introduction:** Idiopathic clubfoot or congenital talipes equinovarus is characterized by an excessively turned-in foot and a high medial longitudinal arch is the commonest congenital foot deformities having 1 in every 1000 children born worldwide. Though described long back, there has been an interest towards Ponseti method of conservative treatment of clubfoot recently. Our study was aimed to assess the efficacy of Ponseti technique in correcting congenital talipes equinovarus deformity of foot.

**Material and methods:** 65 patients were enrolled in the study out of which 47 patients were available for final follow-up. All patients presenting with CTEV with age up to 2 years were included and patients more than 2 years, operated cases and syndromic clubfoot were excluded. We treated all patients with Ponseti method of serial casting and tenotomy.

**Results:** Out of the total 65 feet studied, 42 feet (64.62%) required tendo achilles tenotomy and 23 feet (35.38%) were treated with casting alone and tenotomy was not required. In our study, there were 8 cases of relapses (12.31%). Out of these, 7 were idiopathic and 1 was syndromic. Out of these 8 relapses, 2 required repeat tenotomy and 6 were treated with casting as per ponseti technique. Complications due to plaster were minimal in our study. Incidence of rocker bottom feet in our study is nil because of dedicated clubfoot manipulation in clubfoot clinic and patients were followed up regularly.

**Conclusion:** To conclude, this study showed that clubfoot deformity can be managed successfully provided the technique and details of manipulation described by Ponseti are followed strictly and patients can be followed up regularly by a team of dedicated orthopedic surgeons.

**Keywords:** Congenital Talipes Equinovarus; Clubfoot; Pirani Score; Ponseti Method

## INTRODUCTION

Congenital talipes equinovarus (CTEV), commonly called clubfoot, is a congenital condition with deformity and was described by Hippocrates in the year 400 BC.<sup>1</sup> Congenital talipes equinovarus (CTEV), also known as congenital clubfoot detected in one in every 1,000 live births and is one of the most common birth defects involving the musculoskeletal system.<sup>2</sup> Clubfoot may be associated with myelodysplasia, arthrogryposis or multiple congenital abnormalities but is most commonly an isolated defect and considered idiopathic.<sup>2</sup>

Surgeons have struggled over the years to identify the best method of treatment for the congenital clubfoot deformity. Early attempts at primarily nonoperative strategies relied on forceful manipulation. The first nonoperative treatment was proposed by Hippocrates in 400 BC when he recommended

gentle manipulation followed by splinting. Plaster casts were used to treat clubfoot when guerian introduced the plaster of Paris in 1836. kite was the first to recommend gentle manipulation and cast immobilization. The success rate varies from a high of 90% found by kite to a low of 19% found by fripp and shaw

The ponseti method involves serial manipulation, a specific technique of cast application, and a possible percutaneous tendo Achilles tenotomy. It is reported to provide a lower complication rate, less pain and better function as the patient ages as compared to operative treatment.

Surgery for clubfoot deformity is usually reserved for cases which don't respond to conservative treatment, in relapse cases or when children present late with rigid deformity.

This study was undertaken to determine the early results following the ponseti technique in a consecutive series of patients following in a dedicated clubfoot clinic. The aim is to highlight the pitfalls and problems which can compromise a satisfactory clinical outcome.

This study intended for evaluation of results of ponseti technique for congenital talipes equinovarus, to statistically analyze sex predilection, etiology associated with congenital talipes equinovarus, to assess the efficacy of ponseti method in correction of congenital talipes equinovarus, valuation of complications, recurrence or failures associated with ponseti method and to find reasons for non compliance with treatment

## MATERIAL AND METHODS

A prospective study was done in Department of Orthopaedics, SMIMER, *Surat*, Gujarat, India on 65 patients who were enrolled in the study, out of which 47 patients were available for final follow-up.

**Inclusion criteria:** All patients presenting with CTEV with age up to 2 years

### Exclusion criteria

- Age >2 years

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- Those who refused to provide informed consent
- Operated cases
- Syndromic club foot

**Pre-operative Assessment:** Pirani scoring and detailed physical examination and history regarding presence of syndromic club foot.

**Radiological assessment-** For detecting radiologically visible deformities

**Method of correction:** All the patients were treated with the Ponseti Method, according to this sequence: corrective manipulations, serial casting, tenotomy and bracing.

**Treatment Regimen:** Guidelines of the treatment were:

1. All the components of clubfoot deformity are corrected simultaneously except the equinus, which is finally corrected at the last.
2. Cavus is the result of pronation of foot in relation to the hindfoot. It is corrected as the foot is abducted in supinated position of forefoot and thereby placing it in proper alignment with the hindfoot.
3. While the whole foot is held in supinated position, it is gradually and gently abducted under the talus which is held secured against rotation in the ankle mortise by applying counter pressure with the thumb over the lateral aspect of the head of the talus. The heel varus and supination of foot will automatically get corrected when the entire foot is fully abducted under the talus. The foot should never be everted.

Finally, the equinus is corrected by dorsiflexing the foot. The tendo Achilles subcutaneous tenotomy may be required to facilitate this correction.

The Ponseti method was used at our institution according to the following regimen. Treatment was in 2 stages: Correction of the deformity by weekly serial casting and maintenance of that correction by bracing.

Treatment is started as soon as possible after referral, preferably shortly after birth, as soon as the skin permits, and consists of gentle manipulation of the foot and the serial application of long leg plaster cast without the use of anesthesia, as described by Dr Ponseti (Figure-1).

**Method of POP Application:** The mother and the surgeon should make the baby comfortable the baby should be kept on one end of the table to provide space for the mother and the assistant on the other side. The baby should be fed before manipulation. Mother should be allowed to remain close to the baby during all manipulations and plaster application.

The foot is manipulated first approximately for 1 to 2 minutes before application of plaster cast. During plaster application, the assistant holds the leg with one hand and toes with thumb and index finger of the other hand, maintaining the knee in 90 degree flexion. A 2 inch or 3 inches wide soft roll depending upon the age is applied starting at toes and proceeding upward to the upper thigh. Care should be taken so that the cotton roll should cover half of the width to get double thickness over the skin and especially over the heel.

Extra cotton should be avoided rather proper moulding should be done to avoid loosening of plaster cast. The cotton should be applied snugly over the foot and ankle and loosely over the calf and thigh to avoid extra pressure (figure-2).

A 2 inch, 3 inch or 4 inch wide plaster bandage depending on the age of the child is wrapped snugly over the foot and ankle for better moulding and loosely over calf and thigh to avoid extra pressure on muscles. The plaster is started from toes and is extended below the knee. While the assistant holds the foot, the orthopaedic surgeon applies the below knee plaster first. The toes are covered by the assistants thumb and finger so that the plaster bandage covers the thumb to prevent crowding of toes. Now the surgeon takes over the foot from the assistant for correction and proper moulding especially over the arch of the foot and heel. The plaster is properly moulded around the malleolus and the heel. After moulding and setting of below knee cast, plaster cast is extended above knee just below the groin with knee in 90 degree flexion. Serial plasters are applied at 1 week interval. The previous casts were removed in the hospital just prior to the next cast application.

In all patients, the cavus is corrected first by supinating the forefoot and dorsiflexing the first metatarsal to correct the varus and adduction, the foot in supination is abducted while counter pressure is applied with the thumb against the head of the talus which makes this method differ from that of the Kite where the lever fulcrum is at calcaneocuboid joint.

After achieving adequate abduction, decision to perform Achilles tenotomy was taken depending upon the Pirani Score vis a vis when Hind foot Score > 1, Mid foot Score < 1 and the head of talus is covered. It was done under local anesthesia. After tenotomy, the cast was applied with feet on 70 degrees of abduction and 10 to 15 degrees of dorsiflexion (Figure-3,4).

This last cast was kept for 3 weeks and then the baby was shifted for bracing in Steenbeek Splint; 23 hrs a day for the first 3 months and then 14 hours a day during sleep time for 3 years. After every cast, patient was evaluated for any swelling or discoloration of the toes. For the purpose of our study, in view of the study duration, we presented the result up to minimum of 6 months i.e., correction and a part of maintenance, though follow up would continue till the completion of bracing (Figure-5).

## STATISTICAL ANALYSIS

The Wilcoxon test for paired samples ( $p$ -value  $\leq 0.0001$ ) was used to interpret the data.

## RESULTS

In our study, we studied 47 patients with 65 feet presenting with congenital talipes equino varus, up to 24 months of age without history of previous surgical treatment, irrespective of the etiology be it idiopathic or syndromic and those who gave consent to participate in the study. In all 53 patients were registered with 6 patients were lost to follow up.

Total number of patients registered	53
Total number of patients lost to follow up	6
Total number of patients studied	47
Total number of bilateral patients	18
Total number of unilateral patients	29
Total number of feet (n)	65(36+29)

Out of 47 patients studied, 37 were males and 10 were females; 41 were idiopathic and 6 were syndromic. All syndromic patients were clinically diagnosed as arthrogyrosis multiplex congenita. One patient had developmental dysplasia of hip with congenital dysplasia of ipsilateral knee with congenital talipes equinovarus. In this case extra strength was given to the knee in first 2 cast till congenital dysplasia of knee was corrected

Out of the 47 patients registered, 15 right-sided, 14 left sided and 18 were bilateral, thereby accounting for total 65 feet. Mean age of presentation was 5.70+<sub>0.602</sub> months. Youngest age of presentation was 1<sup>st</sup> day and Maximum age of presentation was 23months. In our study we started casting as soon as possible after birth. 55.3% patients presented with up to 3 months of age. 14.9% presented between 4 to 6 months 17% between 7 to 12 months and 12.8% between 13 to 24 months.

In our study, mean number of casts applied was 4.93 plus or minus 1.07 with the range of 2 to 8.

Severity	
Mean midfoot pirani score at the time of first presentation	2.18
Mean hindfoot pirani score at the time of first presentation	2.5
Mean Dimeglio score at the time of First presentation	16.75

Out of the total 65 feet studied, 42 feet (64.62%) required tendo achilles tenotomy and 23 feet (35.38%) were treated with casting alone and tenotomy was not required.

In our study, there were 8 cases of relapes (12.31%). Out of these, 7 were idiopathic and 1 was syndromic. Out of these 8



Figure-1: Picture showing AP and Lateral views of Plasters applied sequentially to patient



Figure-2: Plaster of Paris



Figure-3: Instruments used for Tenotomy



Image-5: Steenbeek splint



**Figure-4:** Steps of Tenotomy

relapses, 2 required repeat tenotomy and 6 were treated with casting as per ponseti technique. Mean duration of follow up in our study was 13.6 months. Minimum duration of follow up was 6 months and maximum was 20 months.

Plaster Complication	
abrasions due to plaster cutting	3
plaster sore	1
swelling and discoloration of toes	1

## DISCUSSION

The clubfoot deformity has been known since time of Hippocrates and is well documented in article "Concepts of causation and principles of treatment."<sup>12</sup> Even today clubfoot is the commonest congenital foot deformity that is seen by orthopedic surgeons.

To prevent this abnormal development from further progression, several treatment regimens have been described from time to time. Tendoachilles lengthening has been a common procedure in the past. However recently, the work of various authors specially Ponseti have emphasised the importance of nonoperative manipulation of foot and casting to prevent further progression of deformity and to correct it. Hiram Kite in 1930 showed that foot can be corrected through serial manipulation and immobilization in cast. Kite's method was studied by Ponseti who had opportunity to observe his method in 1960. Ponseti concluded that the clubfoot deformities are interdependent and must be corrected simultaneously to obtain good results. The French method for nonoperative correction of clubfoot was also conceived in 1970 by Masse and by Bensahel and colleagues.<sup>26</sup> It consisted of daily manipulation of newborn clubfoot. Ponseti's guidelines for method of clubfoot treatment have already been described in the earlier part of this work.

Karaski<sup>27</sup> in 1989 studied 323 children from 1970 to 1987. In his work, percutaneous tendo Achilles tenotomy was necessary in 50% children. In our study, percutaneous tendo achilles tenotomy was needed in 42 feet out of 65 which comes to 64.62 which almost is comparable with Karaski's work. Ponseti's original work mentions the incidence of tenotomy at 70% which is slightly more than our series.

The average number of casts in our series has been 4.93 whereas in Ponseti's original work, it has been 5.4. In the

study of Alok et al<sup>28</sup> (2008) average number of casts needed was 6 which almost correspond with our study. In our study, recurrence rate of deformities was 12.31% whereas in the study of Alok et al<sup>28</sup>, it was 21.3%. This can be attributed to the longer duration of follow up in that series.

In our study there has been only one case of pressure sore which comes out to be 1.54%. In a study done by Atul Bhaskar<sup>29</sup> et al, there was 1 case out of 66 feet studied which developed pressure sore (1.52%) which is almost equal to our study.

Incidence of rocker bottom feet in our study is nil because of dedicated clubfoot manipulation in clubfoot clinic and patients were followed up regularly. The incidence of rocker bottom as reported by Koureas G et al<sup>30</sup> in a study of 715 patients (1120 clubfeet) 23 patients (36 feet: 3.2%) developed rocker bottom deformity.

## CONCLUSION

Our study aimed at achieving maximum correction in shortest possible time by using Ponseti's manipulation and casting as a method of treatment of congenital talipes equinovarus. The study has justified that Ponseti method of manipulation and casting is an effective method to manage Congenital Talipes Equinovarus upto 2 years of age provided the technique and details of manipulation described by Ponseti are followed strictly and patients can be followed up regularly by a team of dedicated orthopedic surgeons.

## ABBREVIATIONS

CTEV - Congenital talipes equinovarus; POP – Plaster of Paris

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