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## Standard and accelerated ponseti technique in management of idiopathic congenital talipes equinovarus: A comparative study

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### Abstract

**Introduction:** Congenital talipes equinovarus (CTEV) is one of the most common deformities of foot and ankle. Incidence of CTEV is around 1 in every 1000 live births. Males are affected twice as often as females. Bilateral deformities occur in 50% of cases and in unilateral cases, right foot has predominance. Components of Congenital talipes equinovarus are cavus, forefoot adduction, hindfoot varus, ankle equinus. Goal of clubfoot management is to produce and maintain a painless, functional, mobile and callosity free, normal shoeable foot. In an accelerated ponseti technique, cast is applied twice weekly on fixed days instead of one week. This study compares the results of Standard Ponseti technique with Accelerated Ponseti technique in management of idiopathic CTEV.

**Materials and Methods:** A hospital based prospective randomized comparative study was conducted in the Dept. of Orthopaedics of Silchar Medical College, Silchar, Assam from 1<sup>st</sup> June 2020 to 31<sup>st</sup> May 2021. Total of 50 cases were selected randomly, randomization was done, 25 were treated by Standard Ponseti and 25 were treated by Accelerated Ponseti technique.

**Results:** Mean Pirani score at presentation in standard Ponseti group was  $5.25 \pm 0.76$ , and in accelerated Ponseti group it was  $5.37 \pm 0.65$ , with p-value indicating that two groups did not have significant difference. In standard Ponseti group, the treatment time in plaster ranged from 28-56 days, and in accelerated Ponseti group it ranged from 14-31 days.

**Discussion:** Modification in frequency of casting has shown that the efficacy remains unchanged but correction of deformity occurs in a shorter span of time. Reduction in duration of treatment will help to improve compliance among parents.

**Conclusion:** Ponseti method has shown good results in idiopathic as well as syndromic CTEV. This Study shows that Accelerated Ponseti method is equally effective as Standard Ponseti method in treatment of idiopathic CTEV with the benefit of reduction in treatment time.

**Keywords:** CTEV, ponseti casting, pirani score

### Introduction

Congenital talipes equinovarus (CTEV) is one of the most common deformities of foot and ankle <sup>[1]</sup>. Incidence of CTEV is approximately 1 in every 1000 live births <sup>[2]</sup>. Males are affected twice as often as females. Bilateral deformities occur in 50% of cases and in unilateral cases, right foot has predominance <sup>[3]</sup>.

The equinovarus deformity is classified into congenital and acquired. The congenital equinovarus deformity can be idiopathic and non-idiopathic types. The non-idiopathic type include deformity occurring in genetic syndromes, teratological anomalies, neurological disorders (spina bifida) and myopathies.

Components of CTEV are cavus, forefoot adduction, hindfoot varus and ankle equinus. A variety of classification systems based on clinical examination have been used, the most widely used being that of Pirani scoring system, which has been shown to have good interobserver reliability and reproducibility <sup>[4]</sup>. The clinical assessment and progress of treatment by Ponseti casting is done by Pirani scoring system. It is helpful to use this scoring system and document the results every time the feet are examined; before the treatment, during the correction phase, during the brace application and at later checkups. Many methods have been described for the correction of deformity starting from bandages in Hippocrates time,

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splinting, binding, casting, posteromedial release of soft tissues, bony procedures and arthrodesis. The management of congenital talipes equinovarus has been transformed in the last two decades as surgical correction has been replaced by the non-surgical Ponseti method [5]. Goal of clubfoot management is to produce and maintain a functional, painless, plantigrade, mobile, callosity free, normal shoeable foot.

The standard Ponseti technique uses serial application of weekly plaster casts to gradually correct the deformity. In an accelerated Ponseti technique, cast is applied twice weekly on fixed days instead of one week. This study compares the results of Standard Ponseti technique with Accelerated Ponseti technique in management of idiopathic CTEV in children less than one year of age.

**Materials and Methods**

**Study design:** Hospital based prospective randomized comparative study

**Study location:** Department of Orthopaedics of Silchar Medical College and Hospital, Silchar; Assam.

**Study Duration:** 1<sup>st</sup> June 2020 to 31<sup>st</sup> May 2021

**Sample size:** 50 CTEV cases

The inclusion criteria were age less than 1 year, presence of unilateral or bilateral idiopathic CTEV, patients of either ex

and parents of the child giving consent to take part in the study.

The exclusion criteria were; having age more than 1 year, earlier treated with plaster cast application or any other method, earlier operated for clubfoot, atypical, syndromic or secondary clubfoot, parents of the child not giving consent to take part in study.

The materials required were Plaster of Paris and cotton roll for cast application, and for percutaneous tenotomy local anaesthesia, betadine solution, sterile syringe, 11 number surgical blade and sterile gauge were required.

By doing this study it will be possible to compare the average number of plaster casts required during treatment by both techniques and also the duration of plaster casts required in treatment by both techniques.

Total of 50 cases were selected randomly, randomization was done, 25 were treated by Standard Ponseti and 25 were treated by Accelerated Ponseti technique. The Standard Ponseti technique uses serial application of weekly plaster casts to gradually correct the deformity. Age and sex of patient, side of involvement, Pirani score at presentation and subsequent visits, number of casts required and treatment time till tenotomy or correction of equinus without tenotomy were recorded for all patients in both the group.

**Table 1:** Pirani classification

Assigned	Normal	Moderately abnormal	Severely abnormal
Score	0	0.5	1
Hindfoot	Posterior crease	Fine creases that do not alter the contour	One or two deep creases that do not alter the contour
	Rigidity equinus (maximal dorsiflexion)	Normal	Less than normal but >90°
	Empty heel	Calcaneal tuberosity is easily palpable	Heel pad somewhat empty
Midfoot	Curve of lateral border	Ruler from hindfoot touches head of fifth metatarsal	Ruler from hindfoot touches base of fifth metatarsal
	Medial crease (in corrected position)	Fine creases that do not alter the contour	One or two deep creases that do not alter the contour
	Talar head coverage	Navicular is completely reducible	Partial reduction
			Deep creases that change the contour
			>90°
			No bony prominence palpable in heel pad
			Ruler from hindfoot touches hindfoot only
			Deep creases that change the contour
			Easily palpable talar head with medial subluxation of the navicular

**Pirani scoring system:**

Six physical parameters were assessed. Score 0, 0.5 or 1 were given to each of the six parameters according to the severity of contracture. Total score was between 0 and 6.

**Ponseti method**

All patients were treated using Ponseti method of manipulation and casting. Before application of cast, gentle manipulation of foot for atleast one minute was done. A thin layer of cotton roll was applied. Cavus was first corrected by supinating the forefoot, to bring it in line with the hindfoot, and dorsiflexion of the first metatarsal. The order of correction by serial manipulation and casting is; first, the correction of forefoot cavus and adduction, next is the correction of heel varus and finally the correction of hindfoot equinus.



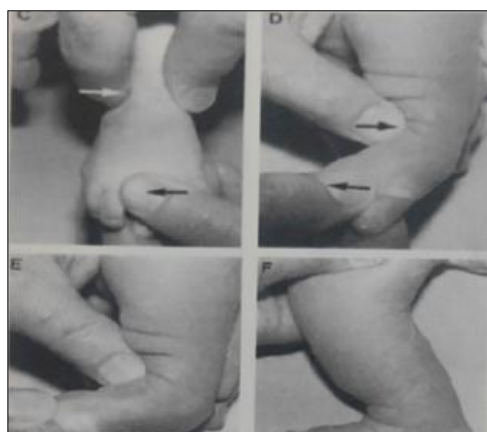
**Fig 1:** Cavus Correction by dorsiflexion of forefoot



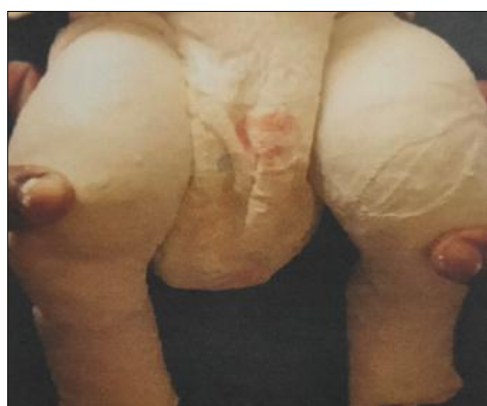
**Fig 2:** Cast applied for cavus correction

Each cast holds foot in the corrected position allowing it to reshape gradually. First a shortleg cast was applied to just below the knee and then it was extended above to the groin to convert it into toe-to-groin cast. Gentle moulding was done and fingers were moved constantly to avoid excess pressure over one area. The toes were exposed to look for any signs of ischemia, and parents were educated about the complications like cyanosis, swelling and excess cry.

In next visits, the first cast was removed and after one minute of manipulation, correction of adduction and varus was done by abducting the foot with head of talus as fulcrum with care to maintain the supinated position of the forefoot.



**Fig 3:** Manipulation with lateral talar head as fulcrum



**Fig 4:** Second casting

In subsequent visits, manipulation and casting was continued to abduct the foot gradually with lateral part of head of talus as fulcrum. The thumb was never rested over lateral aspect of head of talus for a long time. Ankle and malleoli were gently

moulded. During these manipulations, forefoot abduction and supination correct the talonavicular subluxation, and also calcaneus abducts and everts



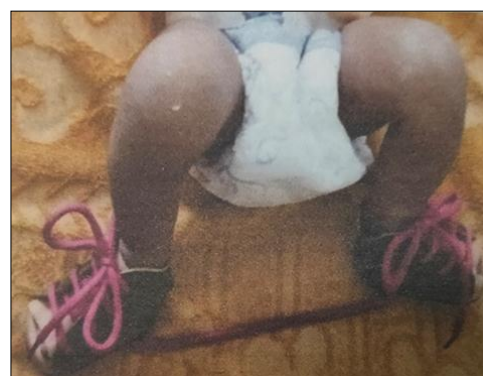
**Fig 5:** Casting done to abduct the foot gradually in subsequent visits

### Percutaneous tenotomy

Before the application of final cast, most infants require percutaneous Tendo Achilles tenotomy to gain adequate lengthening of the Achilles tendon and prevent the rocker bottom foot deformity. When hindfoot score was one or more, midfoot score of less than one and lateral part of head of talus not palpable, decision to perform percutaneous tenotomy was taken.

The baby was laid supine with legs externally rotated. The skin was prepared with betadine solution, local anaesthesia was given. The assistant hold the ankle in dorsiflexion. About 1 cm above the calcaneus, the scalpel blade was inserted from the medial side of Achilles tendon with the sharp side of blade in proximal direction. The blade was rotated gently to completely cut the tendon. A 'pop' was felt. Immediate dorsiflexion of foot was possible. This indicate that complete cut of Achilles tendon has been done. Sterile gauze was placed and plaster cast applied with abduction of 70° and dorsiflexion of 15° for 3 weeks. The final plaster is removed after three weeks and foot abduction brace is given to the child.

After correction of deformity (with/without tenotomy), Steenbeek foot abduction brace is used in all patients, in 70° external rotation and 15° dorsiflexion. In unilateral foot involvement, the normal foot is in 40° of external rotation. The brace was worn for 23 hours a day for first 3 months after casting and then during night and nap time for 12-14 hours a day for 3-4 years.



**Fig 6:** Steenbeek foot abduction brace worn by a patient in study

### Follow up

The patients were reviewed 14 days after the application of Steenbeek foot abduction brace to note compliance issues and then reviewed monthly. At 3 months, the night and nap time protocol of using the brace was advised. The size of brace was assessed and brace was changed if required. The parents were counselled to continue the brace as advised and the chances of

relapse due to non compliance with the use of brace were explained. Relapse cases were noted and manipulation and casting was done or tenotomy done if required.

**Accelerated Ponseti casting-clinical images**



Bilateral CTEV 1<sup>st</sup> Visit      3 Weeks after Tenotomy



Follow up after 9 months

**Observations**

**Table 1:** Showing Tenotomy requirement among the CTEV cases

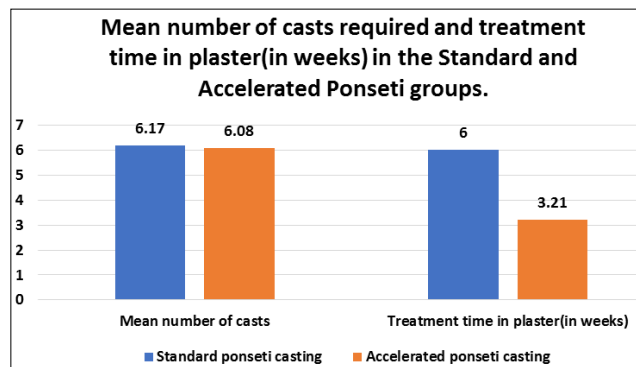
Group	Tenotomy required	%
Standard ponseti	29 out of 34 feet	85.29%
Accelerated ponseti	32 out of 36 feet	88.88%

**Table 2:** Showing the number of cases in Standard and Accelerated ponseti casting method

	Standard Ponseti group	Accelerated Ponseti group
Number of cases	25	25
Number of feet	34 (12 B/L and 10 U/L)	36 (13 B/L and 10 U/L)

**Table 3:** Showing treatment duration in both groups.

Standard ponseti group			Accelerated ponseti group		
Treatment time in plaster (days)	No. of feet	%	Treatment time in plaster(days)	No. of feet	%
28	3	8.82%	14	3	8.33%
35	8	23.52%	17	7	19.44%
42	14	41.1%	21	15	41.66%
49	7	20.58%	24	7	19.44%
56	2	5.88%	28	3	8.33%
			31	1	2.77%
Total	34	100%	Total	36	100%



**Graph 1:** Showing mean number of casts required and treatment duration in both groups

**Results**

In this prospective study, total 50 patients (70 feet) with idiopathic CTEV were included. 25 patients (34 feet) were treated by Standard Ponseti technique (once weekly casting) and 25 patients (36 feet) were treated by Accelerated Ponseti technique (twice weekly casting on fixed days). Patients were treated and followed up in Out Patient Department of Orthopaedics, Silchar Medical College and Hospital. Mean Pirani score at presentation in standard Ponseti group was 5.25±0.76, and in accelerated Ponseti group it was 5.37±0.65, with p-value indicating that two groups did not have significant difference. In standard Ponseti group, the treatment time in plaster ranged from 28-56 days, and in accelerated Ponseti group it ranged from 14-31 days.

**Discussion**

The Ponseti method has attained wide popularity in last 2 decades and is currently accepted as the optimal treatment for congenital clubfoot deformity [6]. The Ponseti method requires serial corrective casts. Dyer *et al.* [7] stated that Pirani scoring is reliable, has a good interobserver reliability. Harnett *et al.* [8] Modification in frequency of casting has shown that the efficacy remains unchanged but correction of deformity occurs in a shorter span of time. Reduction in duration of treatment will help to improve compliance among parents. Elgohary *et al.* in their study found that the mean duration from start of correction till tenotomy or correction of equinus was 33.36±6.69 days (range 21-42 days) for traditional ponseti group and 18.13± 3.02 days (range 11-22 days) for Accelerated Ponseti group.

**Summary**

The mean Pirani score at presentation in Standard Ponseti group was 5.25±0.76, and in Accelerated Ponseti group it was 5.37±0.65, with p-value indicating that the two groups did not have significant difference in their mean Pirani score at presentation. In Standard Ponseti group, the treatment time in plaster ranged from 28-56 days, and in Accelerated Ponseti group it ranged from 14-31 days. Percutaneous tenotomy was done in 29 out of 34 feet in standard Ponseti group, and 32 out of 36 feet required tenotomy in accelerated Ponseti group. P value indicating that the two groups did not differ with rate of percutaneous tenotomy. Relapse of forefoot adduction and equinus deformity occurred at 6 months follow up in 3 feet each in Standard and Accelerated Ponseti group.

**Conclusion**

Ponseti method has shown good results in idiopathic as well as syndromic CTEV. This Study shows that Accelerated Ponseti method is equally effective as Standard Ponseti method in treatment of idiopathic CTEV with the benefit of reduction in treatment time.

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