



EFFECTIVENESS OF PRE-CASTING STRECHING IN PONSETI METHOD OF CLUB FOOT MANAGEMENT.

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Abstract

Background: Congenital clubfoot is among the most frequent forms of pediatric musculoskeletal deformities, and if left untreated, results in lifelong disability. The most effective treatment is the Ponseti method, where high rates of correction are achieved via serial castings. Nevertheless, there are differences in the total number of casts needed and in the duration of the treatment. To improve the pliability of the soft tissues so that a quicker correction of the deformities and better results of the treatment can be achieved, pre-casting stretching procedures have been suggested as a method of treatment.

Objectives: to analyses the efficacy of pre-casting stretching on improvement of clinical outcomes, reduction of casting requirements, and faster initial clinical improvement of infants using the Ponseti method for the treatment of Congenital Clubfoot.

Methodology: A prospective study focused on 100 babies suffering from idiopathic congenital clubfoot and was conducted on a comparative basis. The study participants were split into two groups. The first group was treated using the Ponseti technique in conjunction with pre-casting stretching, while the second group was treated with the Ponseti technique in isolation. Stretching was done before each cast was put on. The outcomes of interest were the degree of deformity correction, frequency of casts used, and whether there was a need for percutaneous Achilles tenotomy.

Results: The study population had a mean age of 3.2 ± 1.4 months at presentation. Infants receiving pre-casting stretching demonstrated faster correction and required fewer casts compared to the control group. Improvement in correction milestones was observed earlier in the stretching group. Statistical analysis showed a significant difference in treatment outcomes between groups ($p < 0.05$). Baseline demographic variables were comparable, indicating minimal confounding.

Conclusion: Inserting pre-casting stretching as an adjunct to the Ponseti technique is effective. As this is a low-risk manoeuvre, if started early, it can minimise casting burden, expediting corrections and improving overall treatment efficiency.

Keywords: Congenital clubfoot; Ponseti method; Pre-casting stretching; Pediatric orthopedics

Introduction:

Congenital Clubfoot, also known as congenital talipes equinovarus, is a congenital musculoskeletal deformity affecting about 1-2 infants for every 1,000 live births. The condition involves a complex three-dimensional deformity, which can include equines, Varus, cavus, and adduction of the forefoot. Without treatment, clubfoot can cause significant pain, abnormalities, and social stigmas that can greatly affect a person's quality of life. Due to the consequences of untreated clubfoot, it is imperative to treat the condition as early and effectively as possible, as this will help achieve a plant-grade, pain-free, and functional foot [1,2]. In recent decades, the Ponseti technique has become the best approach for idiopathic congenital clubfoot. This technique is delivered through gentle weekly manipulations, followed by a plaster cast, and then corrective sequence manipulations of deformity components. [3]. If done appropriately, Ponseti has a 90% correction rate with functional outcomes in the long term that are much better than those of extensive surgical interventions. Due to how cost-effective and minimally invasive the technique is, it has been successfully implemented in low- and middle-income countries as well [4]. This success has been consistent and sure. Yet, medical practitioners can and should expect some infants to spend more time in the treatment, get more casts, and perhaps get an early percutaneous Achilles tenotomy to correct the condition adequately. Considerable deviation has been caused by the age at presentation, the extent of the defect, the level of fascial restriction, cooperation, and skilful performance of the manipulation. A true understanding of each element in the Ponseti protocol has proved problematic [5]. Passive stretching before casting has been suggested as a minor addition to the classic Ponseti approach. Stretching helps to increase soft tissue pliability, lower muscle-tendon stiffness, and enhance the efficacy of the manipulation before the casting of the foot. It is theorised that the deformity will be more completely and quickly corrected, fewer casts will be required, a tenotomy will be unnecessary, and there will be more positive feelings about the procedure from the caregivers. Stretching is low in cost, low in risk and very easy to do in daily practice [6]. Still, the clinical value of stretching before casting is debatable. It has broad clinical support, although some simply use classic manipulation as described by Ponseti. More clinical control is required to determine whether stretching before casting adds clinical utility to the manipulation [7]. The purpose of this study is to determine whether stretching before casting adds value to the Ponseti method in babies with idiopathic congenital clubfoot. Analysing the differences in outcomes from corrections, the number of casts needed, and the early clinical responses of infants who had pre-casting stretching and those who did not, this research seeks to provide evidence-based recommendations to enhance the management of clubfoot [8,9].

Research Objectives:

Evaluating the effectiveness of the pre-casting stretching in improving the overall outcomes of correction, decreasing the number of casts needed, and improving the timeliness of response to treatment in infants with congenital clubfoot undergoing Ponseti management.

Materials and Methods:**Study Design & Setting:**

This study is performed in orthopedic department khalifa gul Nawaz teaching hospital ,a tertiary care teaching hospital over 3 months from 15 December 2024 to 15 February 2025

Participants:

100 infants with a primary diagnosis of idiopathic congenital clubfoot. In addition to unilateral cases, all bilateral cases were included in the study. Eligible cases were infants who presented to the study site within the first six months of life and had not received any prior interventions. Active parental and/or legal guardians' written informed consent was secured before study enrollment.

Sample Size Calculation:

Utilising effects found in past research with a confidence interval of 95% and power of 80%, a sample size of 100 patients was determined. By allocating patients equally into two groups, an adequate statistical assessment of comparative results was achieved.

Inclusion Criteria:

- Babies under 6 months old
- Uncomplicated clubfoot
- If they have one foot or both
- No previous clubfoot intervention

Exclusion Criteria:

- Issues related to the syndromic or neuromuscular clubfoot.
- Clubfoot that has been previously treated or is recurrent.
- Congenital limb anomalies that are related.
- Parental non-consent.

Diagnostic and Management Strategy:

Clinical diagnosis was done with attention to the aspects of the deformity. Patients were treated using the Ponseti technique. The control group was only given manipulation and casting. The participants of the intervention group were given routine pre-casting stretching before every casting.

Statistical Analysis:

The data were examined using the 24.0 version of SPSS. Continuous data were described using the mean and standard deviation, while categorical data were displayed as frequency and percentage. Independent t-test and chi-square were used, and a p -value < 0.05 was considered statistically significant.

Ethical Approval Statement

Ethical approval for this study was obtained from the Medical Director, Khalifa Gul Nawaz Teaching Hospital, MTI Bannu. The research titled “Effectiveness of Pre-Casting Stretching in the Management of Congenital Club Foot by Ponseti Method” was approved.

Results

100 infants were included in the study, with a mean age of 3.2 ± 1.4 months at presentation. Both study groups were comparable in terms of age, sex distribution, laterality, and severity of deformity. Infants in the pre-casting stretching group demonstrated faster correction of deformity components and required a significantly lower number of casts compared to those treated with the Ponseti method alone. Early achievement of abduction and dorsiflexion milestones was more frequently observed in the stretching group. Statistical analysis revealed a significant difference between the two groups regarding the number of casts required ($p < 0.05$). No procedure-related complications were observed in either group.

Intervention Outcome

The intervention involved gentle stretching of the clubfoot deformity in the opposite direction, akin to stretching one's own thumb. This was performed by the researcher for 5 minutes, with 5 sets of stretches, prior to cast application as part of the Ponseti method.

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (n = 100)

Variable	Pre-Casting Stretching Group (n = 50)	Control Group (n = 50)	<i>p</i> -value
Mean age (months)	3.1 ± 1.3	3.3 ± 1.5	0.48

Male sex, n (%)	32 (64%)	30 (60%)	0.68
Female sex, n (%)	18 (36%)	20 (40%)	—
Unilateral clubfoot, n (%)	28 (56%)	26 (52%)	0.69
Bilateral clubfoot, n (%)	22 (44%)	24 (48%)	—

Values are expressed as mean $\pm$ standard deviation or frequency (percentage). There were no statistically significant differences in baseline demographic or clinical characteristics between the two groups, indicating appropriate comparability.

Table 2. Comparison of Treatment Characteristics Between Study Groups

Parameter	Pre-Casting Stretching Group	Control Group	<i>p</i> -value
Mean number of casts required	5.2 $\pm$ 1.1	6.8 $\pm$ 1.4	<0.001
Duration of casting (weeks)	5.6 $\pm$ 1.2	7.1 $\pm$ 1.5	<0.001
Percutaneous tenotomy required, n (%)	18 (36%)	27 (54%)	0.04

Infants receiving pre-casting stretching required significantly fewer casts and shorter treatment duration. The need for Achilles tenotomy was also lower in the stretching group, with statistically significant differences observed.

Table 3. Early Correction Outcomes in Both Groups

Outcome Measure	Pre-Casting Stretching Group (n = 50)	Control Group (n = 50)	<i>p</i> -value
Early correction achieved, n (%)	44 (88%)	36 (72%)	0.03
Mean time to correction (weeks)	5.4 $\pm$ 1.0	6.9 $\pm$ 1.3	<0.001
Residual deformity at cast removal, n (%)	6 (12%)	14 (28%)	0.04

Early correction refers to achievement of acceptable foot abduction and dorsiflexion without residual caves or Varus. The pre-casting stretching group demonstrated significantly better early correction outcomes.

Table 4. Overall Intervention Outcomes and Safety Profile

Outcome	Pre-Casting Stretching Group	Control Group	<i>p</i> -value
Successful correction, n (%)	46 (92%)	39 (78%)	0.03
Complications (skin irritation/slippage), n (%)	3 (6%)	4 (8%)	0.70
Treatment discontinuation, n (%)	1 (2%)	3 (6%)	0.31

Successful correction was defined as a plant grade, flexible foot at the end of casting. Pre-casting stretching improved overall success rates without increasing complications, confirming its safety and clinical benefit.

Discussion:

Clubfoot is one of the most successfully treated congenital musculoskeletal deformities when using the Ponseti method and managing the condition early. There is still considerable variation in treatment and outcomes, though in terms of duration, number of casts, and whether a sternotomy is needed [10].

The purpose of the research was to determine the effectiveness of stretching before the Ponseti casting technique and whether structured stretching before casting improved outcomes, decreased treatment burden, and reduced the need to cast. The most significant outcome of the stretching technique was a reduction in the number of casts needed, and stretching before casting allowed earlier milestones to be reached compared to those treated with the Poinsettia method alone [11]. These outcomes imply that the stretching technique improves the compliance of soft tissues, thereby enabling better and faster manipulation of the deformity components. Importantly, the stretching technique was safe to use and did not increase the risks of poor outcomes [12]. Therefore, the stretching technique is clinically proven to be of benefit. These outcomes support the findings of recent research conducted in the last five years that highlight the value of soft tissue flexibility in achieving the Ponseti technique. For instance, Sharma and co-authors conducted a prospective cohort study and found that stretching exercises adjacent to casting reduced the number of casts needed and improved the rate of correction. The same findings were obtained by Khan et al [13]. Pre-manipulation gentle stretching, particularly in infants under three months, enabled earlier corrections of cavus and adduction, as evidenced by [14]. This coincides with our findings, namely that infants who are stretching are infants who are presenting before three months. On the other hand, additional stretching has been critiqued, as evidenced by studies that suggest that Ponseti manipulation, when done correctly, should suffice. For instance, Lee et al. [15] concluded that correction rates were statistically similar in those that did and did not stretch. However, the bulk of their work focused on the long-term outcome of their corrections rather than the timely correction of the outcome. Our response to the literature, noting the time to respond to treatment, the burden of casting, and the time to correction, is equally important. This is particularly true in resource-poor settings [16]. Recent randomised and quasi-experimental studies have shown that a decreased number of casts results in treatment adherence, decreased treatment costs, and decreased patient risk for complications related to casts. The absence of the need for percutaneous Achilles 'tenotomy in the stretch group in our study is evident and speaks towards the role of stretching in the decrease of posterior soft tissue resistance. Ahmad et al have also documented similar declines [17]. Furthering our understanding of the research by D. Oliveira et al., who suggest improvements in Initial Dorsiflexion are a particular positive consequence of the earlier of the two periods of casting. An additional point is the practicality of having the flexibility to implement a routine practice procedure of stretching before casting [18]. Stretching is a slight alteration of the protocol; it is non-invasive and requires no additional materials. Studies of low- and middle-income countries have noted that even simple protocol changes that improve efficiency are very beneficial in practice, especially when they are cost-neutral (or cost-positive). The additional stretching offered in these studies is especially flexible and useful in the practice of the Ponseti clinics when clinic visits are at a premium (limited visits) and when the prospective patient volume is high [19]. Like in all studies, the scope of the study is limited. In this study, the focus, by its very nature, is on short-term outcomes and no attention is given to the very important factors of long-term outcomes in determining the rate of Relapse – the rate at which previously corrected deviations again go uncorrected (Relapse) – in the rate of compliance [20]. It is accepted that even though outcome-related factors of the sample were determined to be satisfactory, there will still be a very positive outcome if a study could be conducted which was multicentrically larger in size. In this study, D. Oliveira et al. leaned toward the positive (the positive is relatively unarguable) in relation to the pre-casting.

Limitations:

While this study focused primarily on early outcomes from the correction and had quite a short follow-up period, the limitations applicable to this study include its single-centre design and a lack of assessment on long-term outcomes such as brace compliance, rates of relapse, and functionality. As well, with no attempt at randomisation, the findings may lack adequate diversity.

Conclusion:

Adjacent to the Ponseti Approach, the complementary pre-casting extremity stretching is beneficial and safe for the correction of congenital talipes equinovarus. It minimises the number of corrective

casts needed, and while increasing the rate of correction, no additional complications arise, which assures expedited clinical adoption for use in infants who present early.

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