



TO EVALUATE RESULT OF PONSSETI TREATMENT IN IDIOPATHIC CLUB FOOT BEYOND FIVE YEARS

Orthopaedics

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ABSTRACT

Background: Congenital talipes equino varus (CTEV) is the most common congenital deformity related to orthopedics, Ponseti casting is considered as the best method to treat children with idiopathic club foot. the objective of this study was to access the growth pattern in children of idiopathic club foot treated by Ponseti method after they are 5 year of age in terms of difference in length of feet compared with aged matched normal child foot length for bilateral cases and difference between normal and affected foot in unilateral cases. **Methods:** In this cohort study of prospectively collected data of patients above age of 5 years of idiopathic club foot treated by Ponseti method and come for follow up at saint Stephan's hospital from September 2020 to September 2021. 100 patients are selected and after measuring their foot length from heel to toe in centimeters comparison in foot length of bilateral cases with age matched normal child foot length and comparison of foot length between affected and normal feet in unilateral cases done using paired t test. Measurement of cavus in these children is also done using planter arch index by podogram using ink print method. **Result:** In unilateral cases the mean length of affected foot is 20.2 ± 2.06 cm and that of normal feet is 20.9 ± 1.98 cm where as in bilateral cases the mean length of both feet is 20.708 ± 1.65 cm compared to mean length of age matched normal children which is 21.55 ± 1.604 cm. T value between affected and contralateral normal foot was 0.301 which was not significant ($P=0.757$), While t value of affected foot with age matched normal foot in unilateral cases was significant ($t=4.9$, P value <0.001). T value between bilateral limbs and age matched normal feet was also found significant ($t=4.67$, $P<0.001$). 16 patients have cavus out of 100 and their mean PAI 0.6 whereas 84 patients without cavus have PAI of 1.3 with standard deviation of 0.12 and 0.32 respectively and T value of 29.48 and P value of <0.01 . **Conclusion:** There is difference in the length of CTEV foot compared to foot of aged matched normal children in both unilateral and bilateral cases which is roughly about 1 cm. in unilateral cases the difference in length of affected and normal feet is not significant and it is less than 1cm. patients having cavus have value of planter arch index less than 1 and it is statistically significant with p value of <0.01 .

KEYWORDS

INTRODUCTION-

Worldwide approximately 1×10^5 new cases of clubfoot are added each year.^{1,2} The incidence is approximately 1 in 1,000 live births. Males are more commonly affected than females and up to 50% of cases are bilateral.⁴ parents of these patients are very much curious about the sizes of their child feet after they grow up. **Ignacio Ponseti** developed and refined his treatment method for clubfoot in the late 1940s. The method was developed in part as a response to the observation that patients treated with extensive surgeries for clubfoot often developed painful feet with residual deformities over time.⁵ we conducted this study to see the effect of growth on the length of feet of these children when they come for follow up after 5 year of age. Normal foot size is not achieved by the Ponseti method of treatment but Fulton et al. suggested that it achieves a near normal anatomic foot as compared to surgical treatment.⁶ The clubfoot information on the several internet sites still describe the affected foot to be on average $1-1\frac{1}{2}$ size smaller.⁷ we calculated foot length of these children treated by Ponseti casting when they come to follow up at our clinic after they are 5 year of age and make comparison between foot length of affected and unaffected feet in unilateral cases and compare foot length of bilateral cases with that aged matched normal child foot length. we also compare the length of affected foot in unilateral cases with that of unaffected foot.

MATERIAL AND METHODS-

Ethical approval was granted by scientific research committee of saint Stephan hospital tis hazari New Delhi 110054. annexure attached.

Study Design-

Our study is an observational prospective study of 100 patients of idiopathic club foot who are treated by Ponseti casting method and come to saint Stephan hospital tis hazari Delhi in department of orthopaedics during a time period of September 2020 to September 2021.

Patient Selection

all children of idiopathic club foot treated in this hospital and are willing to take part in study are included, only those children have been taken in study in which brace have been discontinued and no surgical

procedure has been done except tenotomy. cases of syndromic or secondary club foot, patients who had surgery of soft tissue release or surgery for any bony procedure other than tenotomy and those unwilling to take part in study are excluded.

Outcome Measurements

All patients treated in this hospital for idiopathic club feet and coming for follow up will be evaluated based on the inclusion and exclusion criteria. Information is gathered about laterality of their feet (unilateral or bilateral), number of cast applied during treatment, their age, age of first presentation to hospital, tenotomy required or not, need of redotenotomy. whether their club foot is typical or atypical and recurrence. Measurement of foot length was taken in centimetres from heel to tip of great toe in both unilateral and bilateral cases after dividing the children as per their age and comparison is made between foot length of age matched normal child⁹ also comparison is made between foot length of affected and normal foot of unilateral cases. Podograms of all the patients who took part in the study are taken by ink print method and planter arch index is measured. planter arch index is measured by drawing a tangential line connecting the edges of the medial forefoot and heel region, the midpoint of this line is calculated. from this marked point a perpendicular line is drawn crossing the foot print the same procedure is repeated at heel region for heel tangency point. the width of the central region of the foot print is considered as 'A' and width of the heel region is considered as 'B' planter arch index is obtained by diving value A/B.^{10,11}

Statistical Analysis

Sample Size Formula = $(Z\text{-score})^2 \times P \times (1-P) / (\text{margin of error})^2$
 $= Z^2 \times P(1-P) / d^2$

The sample size for our study is based on a study conducted by **Shylaja DK et al**⁸, who reported the prevalence of club foot as 1.9 per 1000

P = Prevalence of the club foot = 0.19

$(1-P) = 0.81$

$d = 0.08$ (8%)

Based on the formula given above, using the mentioned values the sample size required is

$$= (1.96)(1.96) * (0.19)(1-0.19) / (0.08)^2 \\ = 1.96 * 1.96 * 0.19 * 0.81 / 0.0064 \\ = 92$$

Thus assuming 95% confidence interval the proposed sample size for this study is 92

Here by adding 10% error approximate sample size for the ease of calculation is 100

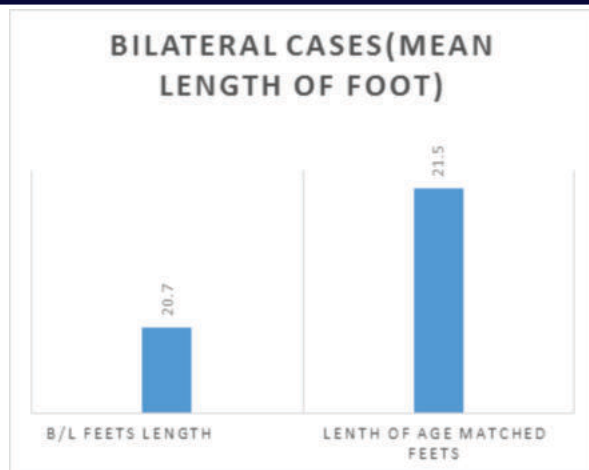
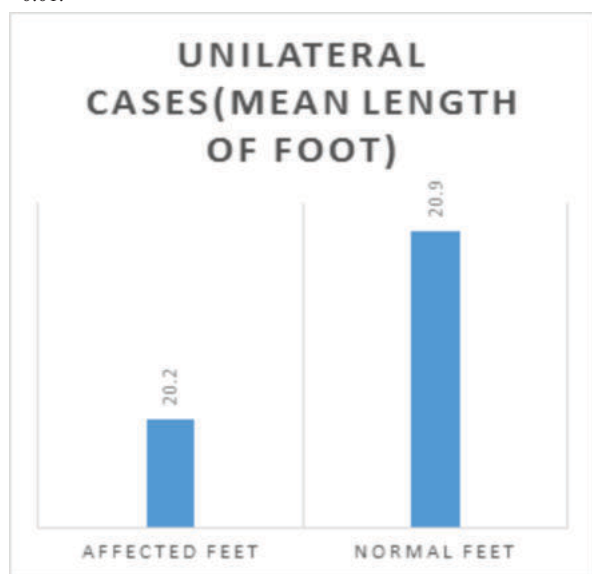
Sample size was calculated by assuming at the most 5% risk, with minimum 80% power and 5% significance level (significant at 95% confidence level). We are assuming that a 95% confidence level, 0.80 probability of success.

The Sample Size Was Considered 100 For The Study.

Data was compiled and entered in Microsoft excel. Statistical analysis was performed by the SPSS program for windows, version 17.0 (SPSS, Chicago Illinois). Continuous variables are presented as mean $\pm$ SD and categorical variables are presented as absolute numbers and percentage. Data were checked for normality before statistical analysis. Categorical variables were analysed using either the chi square test or fisher exact test. Appropriate tests (as t test) were applied where ever required.

RESULTS-

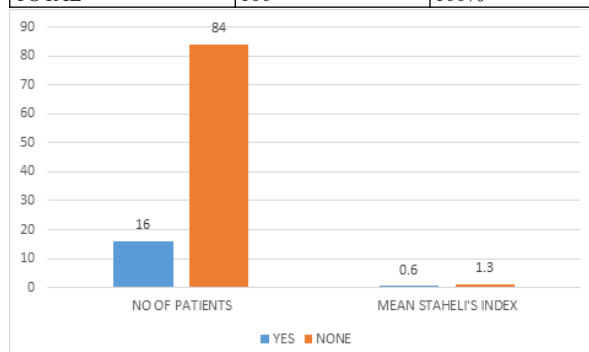
In this study we took 100 idiopathic club foot patient, out of which 70% were male and 30% female, most of the children (41 out of hundred, 41%) belongs to 5-7-year age group and three children were more than 10 years, Unilateral club feet was found in 30 % cases while 70% had bilateral club feet. Total idiopathic club feet patient were 100 , out of which atypical were 17 i.e. 17%, out of 100 patients 36 patients shows recurrence and need more number of cast mean 16.11 compared to non-recurred 64 patients that is 10.32 mean number of cast , out of 100 patients tendo Achilles tenotomy was done in 87 patients and 13 patients not required tenotomy , the patients in which tenotomy not done mostly recurred, there is a significant co-relation between TA tenotomy and recurrence with p value <0.05. The mean length of affected foot in unilateral cases is 20.2 ± 2.06 cm compared to mean length of unaffected foot which is 20.9 ± 1.98 cm. whereas mean length of B/L feet are 20.708 ± 1.65 cm. compared to 21.55 ± 1.604 cm which is length of feet of age matched normal children. t value between affected and contralateral normal foot was 0.301 which was not significant ($p=0.757$), while t value of affected foot with age matched normal foot in unilateral cases was significant ($t=4.9$, p value <0.001), T value between bilateral limbs and age matched normal feet was also found significant ($t=4.67$, $p<0.001$). 16 patients have cavus out of 100 and their mean PAI 0.6 whereas 84 patients without cavus have PAI of 1.3 with standard deviation of 0.12 and 0.32 respectively and T value of 29.48 and P value of <0.01. patients having cavus have value of planter arch index less than 1 and it is statistically significant with p value of <0.01.



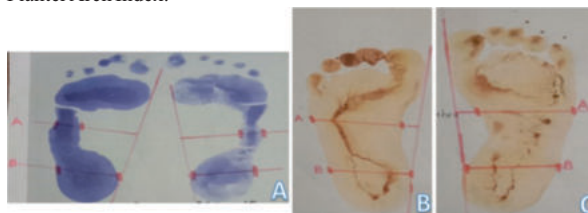
Graph 1 & 2. Correlation Between Difference In Length Of Unilateral And Bilateral Club Feet With Compared To Age Matched Length Of Feet.

Table 1. Age Distribution Of Children With Club Feet

AGE GROUP	NO OF PATIENTS	PERCENTAGE
5-6 YEAR	30	30%
6-7 YEAR	11	11%
7-8 YEAR	27	27%
8-9 YEAR	18	18%
9-10 YEAR	11	11%
MORE THAN 10 YEAR	3	3%
TOTAL	100	100%



Graph 3.: Correlation Between Cavus And Recurrence Measured By Planter Arch Index.



Picture 1 Depicting Staheli's Index, Measured By Calculating Planter Arch Index Dividing A/B It Is Less Than 1 In Feet Having Cavus Shown In Fig A, Fig B And C Showing Planter Arch Index More Than 1 And Showing Difference In Feet Length In A U/I Case.

DISCUSSION-

The Ponseti technique has been available for more than 50 years, but only Ponseti and colleagues have reported long-term follow up. In our study, the average age of presentation was 6.1 weeks with most common age of presentation being 1 to 5 weeks which was low as compared to study done by **Rohit Malhotra et al¹²** and **M Changulani et al¹³**. **Rohit Malhotra et al¹³** found the average age of presentation as 4.03 months, with the most common age at presentation being ≤ 4 months, while **M. Changulani et al¹³**, who treated 66 patients with 100 idiopathic clubfeet using the Ponseti method and reported the mean age at presentation of 12 weeks or three months (1 to 60 weeks). In this study children were in age group of 5.5 years to 15 years of age with most children 30% in 5-6 year age group, and 3% children are in more

than 10-year-old age group. In our study out of 100 idiopathic club foot patients 70 are male and 30 are female which give a ratio of 2.33:1, while in study done by **Rohit Malhotra et al**¹² 180 cases (63.33%) in males and 176 (36.67%) in females, with a male to female ratio of 1.02. **M. Chhangulani et al**¹⁵, found that 50 patients (75.75%) were males and 16 patients (24.24%) were females [24]. The percentage of male and female patients in study done by **R Malhotra et al**¹² and **M Chhangulani et al**¹⁵ was comparable to our study. In this study out of 100 patients (17%) that is 17 have atypical clubfoot and remaining 83 patients (83%) have not atypical club foot which is similar to study done by **Ponseti et al** in which a small percentage of idiopathic clubfeet are classified as atypical. In Ponseti's series 6.5% of idiopathic clubfeet were atypical and 68% of these occurred in boys¹⁴. As regards laterality, in our study 70% cases had bilateral club foot while 30% had unilateral club foot which was contrary to study done by **R Malhotra et al**, who found bilateral club foot less as compared to unilateral club foot. In study by **R Malhotra et al** 166 cases (46.67%) had bilateral clubfoot and 190 cases (53.33%) had unilateral clubfoot (106 right-sided and 84 left-sided).

These findings for laterality was contrary to other studies done by **Ponseti et al**, **Christian et al**, and **Pavone et al**. [7,24–27] (Table 2).

The findings of our study was similar to studies done by **A Bhaskar and P Patni et al**, **Lehman et al**, and **Changulani et al** in which bilateral club foot was not less as compared to unilateral club foot.

Table 2 – Comparison Of Laterality With Other Studies

Studies	Unilateral (%)	Bilateral (%)
Ponseti et al	40(60%)	27(40%)
Pavone et al	50(61%)	32(39%)
Lehman et al	15 (50%)	15(50%)
Christian et al	70 (60%)	46 (40%)
Changulani	32(48%)	34 (52%)
R Malhotra et al	190 (53.33%)	166 (46.67%)
A Bhaskar and P Patni et al	18 (20%)	73 (80%)
Our study	30 (30%)	70 (70%)

In our study 87% of children required tenotomy. While in the literature of **Herzenberg et al**¹⁵, approximately 90% of children undergoing Ponseti treatment need a tenotomy [17]. In study by **R Malhotra et al**, 309 feet (77%) required tenotomy to correct the equinus deformity whereas 47 feet (23%) required only casting to the equinus deformity.

The results of our study were comparable to those of **Herzenberg et al**¹⁵, **R Malhotra et al**¹², the mean total number of casts applied in our study was 10.32 while in study by **R Malhotra et al**¹² the mean total number of casts were applied up to the final follow up to correct the deformity was 6.9 which was contrary to our study. Also contrasting results for cast was observed in studies by **Changulani et al**¹⁵ which is 6 casts. In the study conducted by **P Santhanam et al**¹¹ and **P Rithanya et al**¹⁰ the plantar arch index in flat feet patient is more than 1.15 and the patients with normal feet have plantar arch index of 1.4 which is calculated by Staheli index and it is similar to our study in which mean PAI in normal feet and feet with Cavus was 1.3 and 0.6 respectively. In study conducted by **Anil Agrawal et al**¹⁶ found bilateral feet similar in size among themselves. Bilateral feet were significantly smaller than age matched unaffected feet in length (0.8 cm). While in our study this difference was 0.7 cm and the findings were similar to the study conducted by **Anil Agrawal et al**¹⁶.

Unilateral affected feet and contralateral unaffected feet shows no significant difference in study conducted by **Anil Agrawal et al**¹⁶ which was similar to our study. Also, in our study length difference between unilateral affected foot and age matched unaffected foot was significant similar to that of **Anil Agrawal et al**¹⁶. Similar finding was found in study done by **Evgenia Manousaki***, **Anna-Clara Esbjörnsson**,¹⁷.

CONCLUSION

On the basis of this study it is concluded that TA tenotomy rates must be increased in public health programmes to prevent recurrence, there is difference in the length of CTEV foot compared to foot of aged matched normal children in both unilateral and bilateral cases which is roughly about 1 cm. in unilateral cases the difference in length of affected and normal feet is not significant and it is less than one cm. this difference in length of foot is either due to intrinsic defective growth of bone and soft tissue or due to effect of casting is a lacuna in

field of research and need further study, planter arch index in feet having cavus is <1 and can be done using podogram and ink print method.

Ethics Statement-

Ethical approval was taken from institutional ethics committee.

Patient Consent Statement-

Informed patient consents were taken prior to the study.

Conflicts Of Interests- Nil

Funding- Nil

Author Contribution-

Dr Vishwa Rewal had made a substantial contribution to the concept or design of the article, the acquisition, analysis, and interpretation of data for the article; & Dr Dhwani Joshi had drafted the article or revised it critically for important intellectual content.

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