



Interobserver reliability of foot bimalleolar angle in different pirani scores for the treatment of congenital talipes equino varus

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Congenital talipes equino varus is one of the most common musculoskeletal deformity and to classify the severity of deformity Pirani score, Dimeglio classification, Harrold and Walker system are available, but they lacks objectivity. Foot bimalleolar (FBM) angle, is a simple objective method of assessment of deformity. The interobserver reliability of FBM angle is not studied yet. A prospective study was done including 150 clubfoot classified in 3 groups according to Pirani score: Group I (0-2.0), Group II (2.5-4.0) and, Group III (4.5-6.0). Pirani scoring was done by one observer & FBM angle calculated by 3 other observers. Intraclass correlation coefficients (ICC) and their 95% CI were used. ICC was 0.75, 0.74 ($p < 0.05$) & 0.54 ($p > 0.05$) i.e. excellent, good and fair in Group I to III respectively. Interobserver reliability improves from fair, good and excellent with treatment. Hence FBM angle is a good objective method of assessment of deformity.

Keywords: CTEV ; foot bimalleolar (FBM) angle ; interobserver reliability ; Pirani score.

INTRODUCTION

Congenital talipes equino varus (CTEV) is one of the most common congenital abnormality of musculoskeletal system. Its incidence ranges from

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0.64/1000 to 6.8/1000 live birth among different population (2).

There are various clinical methods available in the literature to classify the severity of deformity, for documentation and for follow up like, Pirani score (5,9), Dimeglio score (4), Catterral (3) and, Harrold and Walker classification (6). However all these methods lacks objectivity.

FBM angle is an objective method to measure the severity of CTEV. It is also a combined indirect indicator of forefoot adduction and hindfoot varus and has normal value of 82.50 in infant (7,8). FBM angle has been correlated with Pirani score in literature (1), however its interobserver reliability has not been studied yet. Hence this study was undertaken.

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MATERIALS AND METHODS

The current study includes 150 children with CTEV which were divided into 3 groups on the basis of Pirani score: Group I (Pirani score 0-2.0), Group II (Pirani score 2.5-4.0) and Group III (Pirani score 4.5-6.0). Each group had 50 feet respectively. Clinically deformity was recorded with Pirani score by one observer and FBM angle was calculated by three other observer.

Children from 0-1 years of age of either sex with CTEV of any etiology were included. Children who were surgically intervened for CTEV except for percutaneous tenotomy were excluded. The Pirani score was documented by one qualified observer.

Three independent observers (one senior resident and two post graduates) drew the podogram of the affected foot on an A4 sized paper as per standard technique (8). The medial and lateral malleoli were marked at the same time. On each podogram, the long axis of the foot was drawn by taking the second toe and the most convex part of the heel as the two reference points. This line was intersected by a line joining the two malleolar points. The anteromedial angle at the intersection was taken as the FBM angle (Fig.1, fig.2 & fig.3). FBM angle was calculated from the podogram taken by them and a gap of 2 manipulations and casting was given for the same foot for repeat observation.

RESULTS

A total of 150 clubfeet were included for analysis. All tracings of feet were classified into Group I, II and III according to Pirani scoring 0.0-2.0, 2.5-4.0 & 4.5-6.0 respectively. Intraclass correlation coefficients (ICCs) and their 95% CI (confidential interval) were used to summarize the interobserver reliability of single measurements, using the two way random effect model. An ICC of 1 means perfect reliability and ICC of 0 means the opposite. Statistical analyses were conducted using SPSSv2.2 and p value <0.05 was considered statistically significant. We have calculated the sample size on the basis of Null hypothesis that is the ICC=0.6. So the p value of each ICC was compared considering ICC as 0.6.

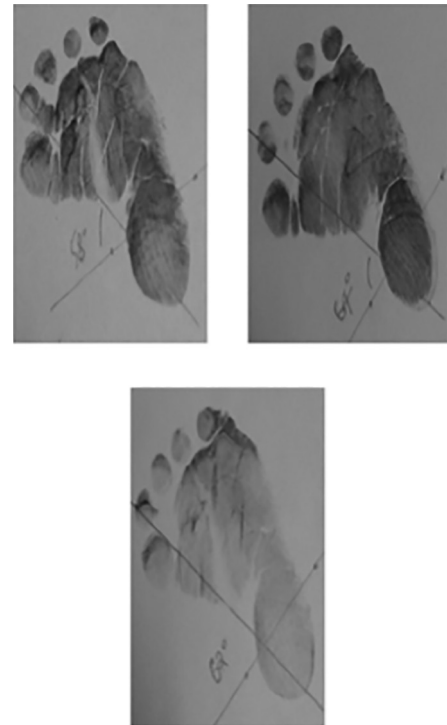


Fig. 1. – Showing calculation of foot bimalleolar angle (FBM) on Podograms



Fig. 2. – Showing calculation of foot bimalleolar angle (FBM) on Podograms

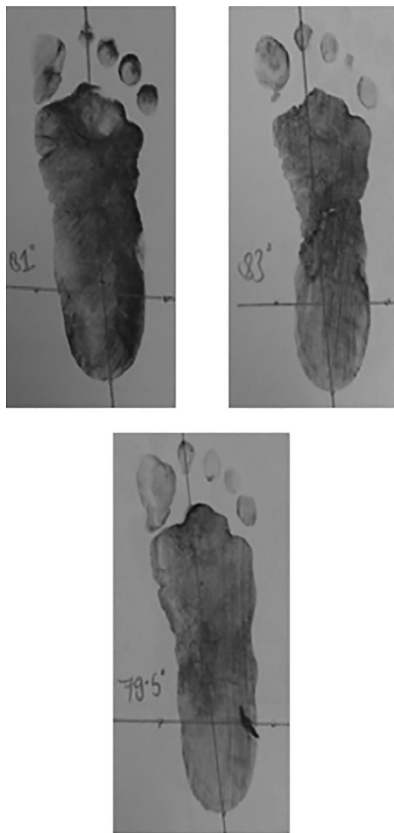


Fig. 3. – Showing calculation of foot bimalleolar angle (FBM) on Podograms

Mean FBM angle in group I, II and III by three different observers (Table I).

In Group I intraclass correlation coefficient among observer 1, observer 2 and, observer 3 was 0.754(95% [CI]:0.642-0.842) with p value<0.05 which is statistically significant and level of agreement is excellent as per criteria of ICC.

In Group II intraclass correlation coefficient among observer 1, observer 2 and, observer 3 was 0.742(95% [CI]:0.626-0.834) with p value<0.05 which is statistically significant and level of agreement is good as per criteria of ICC.

In Group III intraclass correlation coefficient among observer 1, observer 2 and, observer 3 was 0.549(95% [CI]:0.390-0.691) with p value>0.05 which is statistically not significant and level of agreement is fair as per criteria of ICC (Table II & fig. 4).

Table I. — Mean FBM angle in group I, II and III by three different observers

Group	Observer	Mean FBM angle (in degree)
I	Obs_1	81.06 SD 3.16
	Obs_2	80.73 SD 3.34
	Obs_3	81.05 SD 3.35
II	Obs_1	68.92 SD 4.35
	Obs_2	69.72 SD 4.23
	Obs_3	69.93 SD 4.69
III	Obs_1	63.44 SD 3.50
	Obs_2	64.13 SD 3.24
	Obs_3	64.26 SD 3.57

Table II. — Intraclass correlation coefficient among observer 1, observer 2 and, observer 3 in Group I, Group II and, Group III is as following (considering Null hypothesis ICC=0.6)

Group	Observers	ICC	Inter-Observer Reliability	p value	Remarks
Group I	Obs_1 vs Obs_2 vs Obs_3	0.754	Excellent	<0.05	Statistically Significant
	Obs_1 vs Obs_2 vs Obs_3	0.742	Good	<0.05	Statistically significant

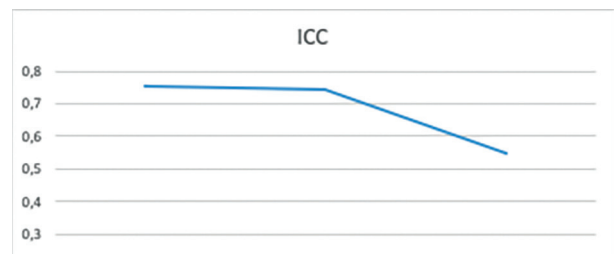


Fig. 4. – Intraclass correlation coefficient among observer 1, observer 2 and, observer 3 in Group I, Group II and, Group III is as following (considering Null hypothesis ICC=0.6)

DISCUSSION

There exist a lacunae in literature regarding objective method for assessment of deformity and subtle corrections during treatment of CTEV. The ideal grading system for club foot on a severity scale should be easy to learn, reproducible, should give an objective assessment of deformity and should have least inter and intraobserver variation.

Hence in present study interobserver reliability of FBM angle in different Pirani score was studied.

Pirani score is a reliable and accepted method of clinically assessing the amount of deformity present in a clubfoot. It is based on 3 clinical signs of midfoot and 3 clinical signs of hindfoot (5,9). However Pirani scoring system is not sensitive to subtle changes in deformity since there are only three levels of scoring 0, 0.5, and 1 (8).

Foot bimalleolar angle quantifies CTEV deformities, which is also an indicator of assessing calcaneal rotation. It is a combined indirect indicator of forefoot adduction and the hindfoot varus, however it does not give account to the equinus of hindfoot which is being addressed by Pirani score (7). It is a simple, cost-effective objective method of assessing deformity correction in CTEV requiring only sheet of paper and ink pad for documentation (8).

In this study FBM angles were measured in each group, classified according to Pirani score, by three different observers. Mean FBM angle in Group I, II and, III were 80.95o, 69.3o and 63.6o respectively.

In current study 3 observers of two different level of seniority were used. One observer was senior resident and another two observers were postgraduate students however level of seniority do not play a role in interobserver variation of FBM angle and there are no similar study available to compare.

Intraclass correlation coefficient (ICC) are 0.754, 0.742 and, 0.549 in Group I, Group II and Group III respectively. ICC is statistically significant in Group I & II as $p > 0.05$ but in Group III it is statistically not significant as $p < 0.05$. So in Group I interobserver reliability is excellent, in Group II it is good and in Group III it is fair as per the ICC criteria.

The data of our study suggest that feet with higher Pirani score had less interobserver reliability possibly because of difficulty in taking footprint in

severely deformed foot by different observers. As treatment progresses, deformity of foot improves which leads to ease in taking footprint by different observers and interobserver reliability also improves.

Hence foot bimalleolar angle is a simple, reliable and objective method to assess the severity of deformity in CTEV and to assess correction of deformity with treatment and follow up in different Pirani score in treatment of CTEV.

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