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EVALUATION OF PONSETI'S TECHNIQUE FOR CONGENITAL TALIPES EQUINO-VARUS BY DIMEGLIO CLASSIFICATION

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Abstract:

Background: Idiopathic congenital talipes equinovarus (club foot) is a common foot deformity and satisfactory results obtained by Ponseti's technique although various classification system has been given to quantify and to describe the outcome of deformity. Reliability of Dimeglio classification is established to assess deformity.

Materials & Methods: 49 patients children with club feet with 73 feet who were presented within 12 months of their life with virgin feet, they classified by Dimeglio classification. All of them treated with weekly manipulation and casting with Ponseti's technique. Their responses were recorded by Dimeglio classification. Feet were graded in mild, moderate, severe and very severe variety.

Results: Out of 73 feet, 33 feet were moderate, 36 feet were severe and 04 feet were very severe. 63 feet were corrected and 10 fails to correction by Ponseti technique. All moderate feet corrected by Ponseti's technique whereas all very severe feet required surgery. Tenotomy required in 54 feet. Requirement of tenotomy increase proportionately by higher Dimeglio score. Number of casts also increased with increment of Dimeglio score and severity of feet.

Conclusions: Dimeglio classification is a valid and reliable system for clubfoot classification. The scores correspond to severity of clubfoot, scores depend upon the rigidity or flexibility of foot, defines initial severity, help to monitor the efficacy of treatment, predict the outcome of treatment, help in modification of treatment plan.

Key words: *Congenital talipes equinovarus, clubfeet, Ponseti's technique, Dimeglio classification.*

Introduction

Idiopathic Clubfoot is one of the oldest and commonest congenital deformities of mankind, ever since man has adopted the erect posture. Despite the advances in the treatment of clubfoot deformity, till now there is no widely accepted method to classify the initial characteristics and severity of the clubfoot. Thus any attempt to improve treatment or measure outcome is hampered by the lack of a uniform method to describe accurately and consistently the deformity.[1]

A clinical classification composed of specific, well described, objective physical examination finding is necessary to quantify the severity of this complex deformity. Of the several classification systems, the Dimeglio system[2] and Pirani[3] score, both through enough to define the deformity.[1]

The Ponseti technique of club foot management has been shown to be effective, producing better results and fewer complications than traditional surgical methods. The deformity is reduced by weekly manipulation and plaster casting.[4] Most club feet also require a percutaneous Achilles tenotomy. Correction is maintained by a system of boots and a bar. Recent studies suggest that the Ponseti technique can be successful in up to 98% of feet.[5]

This study was done to evaluate the Ponseti's technique[6] for treatment of congenital talipes equino-varus, using Dimeglio Classification system.

Material And Methods

This study was done at Clubfoot clinic, J. A. Group of Hospitals and G. R. Medical College, Gwalior. We have included 73 feet in 49 patients less than 12 month age who presented with untreated feet between July 2011 to June 2013. We have included all patients of clubfoot who have presented within 12 months of life with virgin/untreated feet and without any other major neuromuscular anomaly.

Each registered patient was given a 'Clubfoot clinic number', and a detailed personal history was recorded including the age, sex, father's and mother's name, address, date of first reporting, age at reporting, detailed history of previous treatment, etc. A thorough general and local examination was carried out and deformity was scored according to the Dimeglio's classification system at each visit before applying cast. The score was plotted against the time and the trend of score was noted with reference to effect of manipulation done with Ponseti's technique.

A clubfoot clinic card containing all the required information was issued and pamphlets containing all the required information in the local languages about the deformities were given to the patient's attendant. The patients was followed up and assessed on weekly basis in the clubfoot clinic. Depending upon the response of the deformity to serial casting by Ponseti's technique, as evident by graph obtained by plotting score against time since institution of treatment, the treatment was either continued or modified according to the need. The response to various modifications was also noted.

Once correction of the deformity attained, maintenance cast was followed by Denis Browne splint (in children who had not started taking weight on lower limbs) or Modified CTEV shoes (in children who had started taking weight on lower limbs). All patients on Denis Browne Splints were eventually given modified CTEV shoes as soon as they start taking weight on lower limbs.

Dimeglio classification: - This classification consists of four essential parameters, each assessed by applying a gentle correction force and scoring the amount of residual deformity from 0-4 points. Thus in the worst cases, a foot will receive a total of 16 points based on stiffness. One point is added for each of four "Perjorative elements". Once a total score is calculated each foot can be graded I-IV.

Dimeglio classification:-

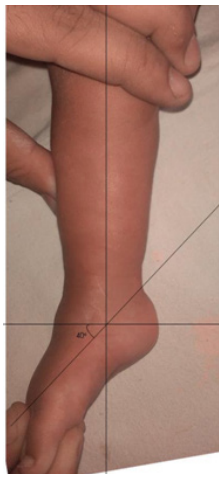
1. "Essential Parameters":- Examiner Applies A Gentle Corrective Force And Records –
   - (a) The Equinus Deviation In Sagittal Plane (0-4 Points)
   - (b) Varus Deviation In Frontal Plane (0-4 Points)
   - (c) Derotation Of The Calcaneo-Forefoot Block (0-4 Points)
   - (d) Forefoot Adduction In The Horizontal Plane (0-4 Points)
2. Reducibility (Equinus, Varus, CFF Derotation, Forefoot adduction)
   - a. 90 to 45^0 — 4 points
   - b. 45 to 20^0 — 3 points
   - c. 20 to 0^0 — 2 points
   - d. 0 to- 20^0 — 1 point
   - e. $> -20^0$ — 0 point

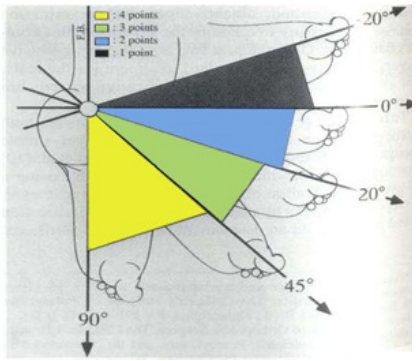
   Total from essential parameters 0-16 points
3. Further pejorative elements :
   - Posterior crease 1 points
   - Medial crease 1 points
   - Cavus 1 points
   - Poor muscle condition 1 points
4. Grades
   - Grade I, benign feet, score 0-5
   - Grade II, moderate feet, score 5-10
   - Grade III, severe feet, score 10-15
   - Grade IV, very severe feet, score15-20

This classification system, derived by Dr. A. Dimeglio is based on the description of clubfoot as a 3 dimensional deformity.

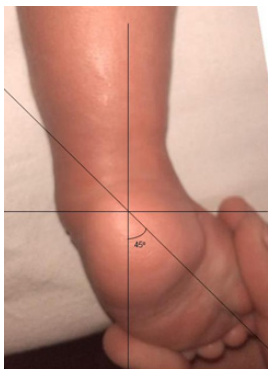
Primary parameters

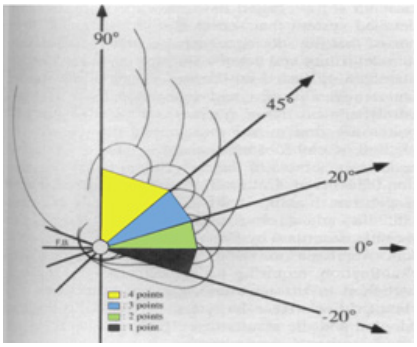
1. Equinus deviation in sagittal plane. (figure 1a,1b)



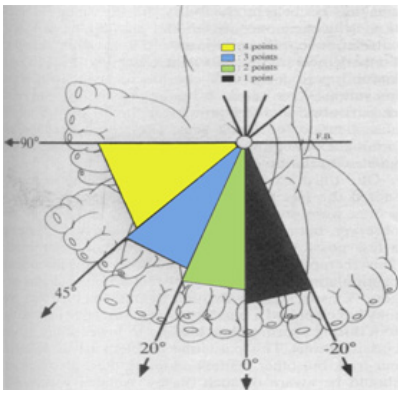


2. Varus deviation in the frontal plane. (figure 2a, 2b)

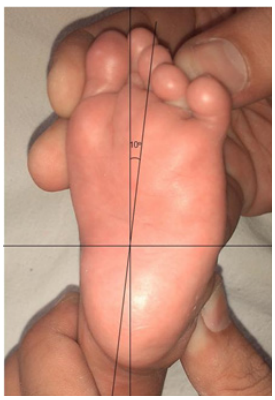


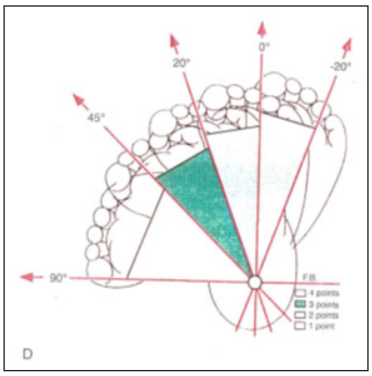


3. Derotation of the calceneo fore-foot block in the horizontal plane. (figure 3a, 3b)



4. Adduction of the forefoot relative to the hind foot in the horizontal plane. (figure 4a, 4b)





- Thus 4 parameters must be assessed in terms of reducibility.
- Reducibility must be test gently, without forcing the foot.
- A score is assigned to each of the 4 parameters on a 4 point scale

Score has taken at each visit before Appling cast and foot was categories in grades in mild grade score 0-5 was put, 6-10 score were categories in moderate, 11-15 were categories in severe, 16-20 score were categories in very severe grade. After each cast score were taken and graph was plotted between score and time.

Ponseti method: All patients were examined and evaluate by Dimeglio classification. All patients were initially treated with Ponseti method. The casting was started as soon as the skin condition of child allows the casting. Meanwhile parents were taut the manipulation and advice to do every time when baby breast feed. In the Ponseti method above knee casts were applied in 90^0 flexion of knee. All manipulation done by using head of the talus as fulcrum and force was applied at the head of first metatarsal. First deformity to correct was cavus followed by adduction and varus and lastly equinus. Casts were change weekly and score were noted.

To correct the cavus head of first metatarsal is lift and forefoot made to come in line with hind foot. After

this step parents may be apprehensive because foot looks more deformed but it is an essential step to unlock the mid-foot. The feet were then gradually abducted by using counter pressure on head of talus and force at the head of first metatarsal. During these manipulation heel was never directly manipulated but because of coupling of talo-navicular. Calcaneo-navicular and subtalar joint abduction manoeuvre also corrected the hind foot varus. This was appreciated by gradual medial to lateral movement of tendoachillis. When forefoot abduction and heel valgus has been Achieved dorsiflexion of hind-foot was assessed. If foot was not able to be brought into neutral position that is 0^0 (equinus deviation in saggital plane = 1) tendoachillis tenotomy was done. After tenotomy above knee cast were applied in 70^0 of abduction and 15^0 of dorsiflexion. Cast was removed after three weeks and Denis Browne splint applied 23 hours per day until patient is not walking then CTEV shoe were given and Denis Browne splint were applied only night time.

Results

This study has been done in the period of July 2011 to June 2013. A total 49 untreated patients who were presented at age of <12 month and 73 clubfeet included in our study. 5 patients in our series were having other associated congenital anomalies. 01 was presented with urogenital abnormality, 01 with congenital dislocation of hip, 01 with syndactily, 01 with polydactily and last one was presented with constriction bands of lower limb which was away of foot.

In our study out of presented patients 31 were male and 18 were female. 24 patients affected bilaterally while 25 were affected unilaterally, out of 25 patients with unilateral deformed foot 12 patients were having deformity of left feet while other 13 with right side.In our series almost $2/3^{rd}$ patients that are 32 of 49 were presented < 2 month of age and rest of 17were presented between 2 month – 12 month of age. We have compare (Table No. 1) severity of deformity according to Dimeglio score in between the patients who were presented < 2 month of age and who were presented their after that is in between 2 month – 12 month of age. Out of total 50 feet (32 patients) who were presented <2 month of age, 27 feet were moderately affected (score 6-10), 19 feet were severely affected (score 11-15) and 04 feet were very severely affected (score 16-20). Out of total 23 feet (17 patients) who were presented <2 month of age, 06 feet were moderately affected (score 6-10), and other 17 feet were severely affected (score 11-15).

Table No. 1 :
Initial score versus age

Score	Number of feet <2 month	Number of feet >2 month
06-10	27	06
11-15	19	17
16-20	04	00
Total	50	23

On performing chi- square test the difference become significant (p value < 0.05) to show that early presented feet were less severally affected than late presented feet but the sample size was less and very severe feet were producing a bias in study.

Table No. 2:
Score verses treatment modalities

Score	No of feet	Treated with tenotomy	Treated without tenotomy	Posterior release	Posterior and medial release
0-5	00	00	00	00	00
06	03	00	03	00	00
07	00	00	00	00	00
08	06	02	04	00	00
09	18	16	02	00	00
10	06	06	00	00	00
11	08	08	00	00	00
12	13	13	00	00	00
13	04	04	00	00	00
14	04	02	00	02	00
15	05	03	00	00	02
16	02	00	00	00	02
17	02	00	00	00	02
18	02	00	00	02	00
19	00	00	00	00	00
20	00	00	00	00	00

We also compare score vs treatment modality Table No. 2. In 73 feet mean Dimeglio score were 11.19. 09 Feet which could be corrected without tenotomy mean score was 7.55.Of 54 Feet which required tenotomy the mean score were 10.90. Of 10 feet which could not be corrected by Ponseti's technique mean score was 16.In 63 corrected feet by Ponseti's technique mean score was 10.43.This shows that Dimeglio classification very effectively gives an indicator of treatment modality required in the individual foot dependency on its Dimeglio classification. Eaten Segev et al (2005)7 though have used Dimeglio classification but have not correlated score with treatment modality.

Table No. 3: Score verses no. of cast application in tenotomy group

Score	3 cast	4 cast	5 cast	6 cast	7 cast	8 cast	9 cast	10 cast
06	00	00	00	00	00	00	00	00
07	00	00	00	00	00	00	00	00
08	01	00	01	00	00	00	00	00
09	01	04	10	01	00	00	00	00
10	00	00	04	01	00	01	00	00
11	00	00	04	04	00	00	00	00
12	00	00	03	10	00	00	00	00
13	00	00	00	03	00	00	00	01
14	00	00	00	00	02	00	00	00
15	00	00	00	00	00	01	02	00
16	00	00	00	00	00	00	00	00
17	00	00	00	00	00	00	00	00
18	00	00	00	00	00	00	00	00

Table No. 4: Score verses cast in non tenotomy group

Score	3 cast	4 cast	5 cast	6 cast	7 cast	8 cast	9 cast	10 cast
06	02	01	00	00	00	00	00	00
07	00	00	00	00	00	00	00	00
08	00	02	00	00	02	00	00	00
09	00	00	00	01	01	00	00	00
10	00	00	00	00	00	00	00	00
11	00	00	00	00	00	00	00	00
12	00	00	00	00	00	00	00	00
13	00	00	00	00	00	00	00	00
14	00	00	00	00	00	00	00	00
15	00	00	00	00	00	00	00	00
16	00	00	00	00	00	00	00	00
17	00	00	00	00	00	00	00	00
18	00	00	00	00	00	00	00	00

In tenotomy group of 54 feet the average cast per feet was 5.65 (table no. 3).9 Feet who did undergo tenotomy required 45 total cast and the average cast was 05 per feet (table no.4). In our series the group's total 350 casts were applied in corrected 63 feet by Ponseti's technique and the applied average casts per feet were 5.56. Ningthoujam Jungindro Singh et al[8] They treated 107 feet, 97 corrected feet mean cast were 7. P. J. Dyer[9] et al (2006) in 70 full corrected feet mean cast were 5.31, number of cast for nontenotomy group was 3.63 and for tenotomy group mean number of cast were 5.31. In our study mean no. of cast were 5.56. Number of cast for nontenotomy group was 5 and for tenotomy group mean no of cast were 5.65. In our series we found that patients who had lower Dimeglio score could be corrected with less no of cast (Table No. 3 and 4) as compared to patients with higher score (more deformed). The initial Dimeglio score and number of cast show positive correlation using spearman correlation test [Correlation is significant at the 0.01 level (2-tailed)] in both patients who corrected with tenotomy or without tenotomy.

Table No. 5: Type of feet and correction method

Type of Feet (Dimeglio score)	Total feet	Corrected by Ponseti's technique without tenotomy	Corrected by Ponseti's technique with tenotomy	Failed by Ponseti's technique & required surgery
Moderate (06-10)	33	09	24	00
Severe (11-15)	36	00	30	06
Very Severe (16-20)	04	00	00	04
Total	73	09	54	10

In our study we have compare the correction method and type of feet according to Dimeglio classification (Table No. 5). In our study all 73 feet were initially treated with Ponseti's technique and serial cast were applied, decision of tenotomy was made when all other deformities has been corrected and isolated equines left. The feet that were not responding to Ponseti's technique surgery was done. In our study out of 73 feet 63 were (86.30%) corrected with Ponseti's technique, 9 were corrected without tenotomy and 54 feet required tenotomy. All other 10 feet who were failed to Ponseti's technique required surgery. All 33 moderate types of feet corrected with Ponseti's technique 24 feet require tenotomy and 09 were corrected without tenotomy. In 36 sever type of feet 30 were corrected with Ponseti's technique and tenotomy were require in all feet. Other 06 feet were treated with surgeries. Whereas all 04 very severe feet failed to correct with Ponseti's technique and required surgeries subsequently

In our study in all moderate feet were corrected with Ponseti's technique and some of them without tenotomy but in severe feet all correctable feet required tenotomy, some severe feet were not correct by Ponseti method, all very severe four feet failed to correct by Ponseti's technique. On performing chi-square test the difference was significant (p Value<0.05) but the sample size was less. Changulani M et al[10] in 100 feet 96 completed treatment with requirement of tenotomy in 85 feet (88.54%), 4% of feet primarily failed to correct by Ponseti's technique. Eaten Segev et al[7] in their study 48 feet treated with Ponseti's technique, tenotomy was performed in 47 feet. In 45 feet (94%) were fully corrected and 3 feet (6%) required more extensive surgery. Ningthoujam Jungindro Singh et al[8] in their series they treated 107 feet, 97 feet (90.67%) responded to treatment and 10 feet (9.34%) failed to correct. Out of total107 feet tenotomy was performed in 87 (81.31%) feet. R A Agrawal et al[11] reported 96.7% success rate in their series.

P. J. Dyer et al[9] used Pirani score and found a definitive correlation between the severities of the disease as assessed by Pirani score to be defiantly correlated to the no of cast application. Similarly in their study a higher Pirani score for hind foot were associated with increased changes of patient's requirement of tenotomy. However they also found that low score did not exclude the possibility of tenotomy. In present study a low score was constantly associated with the ability for correction without tenotomy. However the sample size being less further studies may require. Atul bhasker at el[12] in their study they correlated severity of foot measure with Pirani scoring system for requirement of tenotomy but they have not come out with very definite conclusion. R A Agrawal et al[11] classified feet by Dimeglio classification system in their series of 60 feet, moderate feet were 3(5%), severe feet were 17(28.33%) and very severe were 40 (66.67%). By contrast in our study of 73 feet, 33 feet (45.20%) were moderate, 36 feet (49.32%) severe and 04 feet (5.48%) very severe. Majority 69 feet (94.52%) were moderate and severe and only 4 feet (5.48%) were very severe.

Scher DM at el[13] also compared the Pirani and Dimeglio classification and found that both systems had a link between higher score and requirement of tenotomy. During the course of the treatment when the parents present with their deformed children, they are very anxious and want to know the course of treatment. The Dimeglio classification can be used effectively to forecast the approximate number of casts, required to be applied. Whether the child will require tenotomy or whether the child will require more extensive surgical treatment. Also the scoring system can help in predicting duration of treatment. In our series we had 3 cases of relapse of clubfeet. At the end of the treatment their scores showed full correction (Dimeglio score was 2 or less) but recurrence had occurred, while a no. of corrected clubfeet at the end of treatment had similar scores but went on to have plantigrade feet. Thus it seems that though Dimeglio classification is a good system for evaluating the initial deformity and determining the modality of treatment, but Dimeglio classification of treated club foot (end result) does not correlate well with final outcome regarding relapse. This was also pointed out by Henneke et al.[14]

Conclusion

73 feet in 49 patients were included in our study aimed at evaluating of Ponseti's technique for congenital talipes equino-varus by Dimeglio classification. Out of which 32 patient were presented with in 2 month of their life, 31 were males and 18 were females, 25 were unilateral and 24 were bilateral cases. Out of 73 feet, 33 feet were moderate, 36 feet were severe and 04 feet were very severe. This study has done from August 2011 to July 2013. Mean follow up of 6 months maximum follow up 1 year and 3 month and minimum of 3 month.

All virgin idiopathic clubfoot patient presented within one year of life were included in our study. The patients were classified and scored by

Dimeglio classification. On each visit score were taken and graph were plotted against time. In all feet treatment was started with Ponseti's technique. All response and Dimeglio score were taken before application of cast. If score were falling we consider feet were correcting but if score becomes steady we had consider candidate for other intervention. Persistent higher score of equinus deviation in saggital plane was indication for tenotomy. While feet having persistent higher score varus deviation in frontal plane and equinus deviation in saggital plane along with higher score in Derotation of the calceneo forefoot block in the horizontal plane or Adduction of the forefoot relative to the hind foot in the horizontal plane were the candidate for posteromedial soft tissue release. Feet having persistent higher score varus deviation in frontal plane and equinus deviation in saggital plane were treated with posterior release. After correction all feet were given either Denis Browne splint or foot abduction orthosis for maintenance.

We concluded that

1. Younger (<2 month) patients had lower score compare to older child (>2month).
2. Treatment should start as early as possible because patients presented early show a sharp decline in their score. Whereas feet were having higher scores when they come late and took more time to correct.
3. Patients of fewer score required less intervention and cast and very less number of feet went for surgery.
4. Feet having persistent higher score of equine deviation in sagittal plane should be treated with tenotomy, persistent higher score of equine deviation in sagittal plane with persistent higher score of varus in frontal plane should treated with posterior release. Feet having persistant higher score varus deviation in frontal plane and equinus deviation in saggital plane along with higher score in derotation of the calceneo forefoot block in the horizontal plane or Adduction of the forefoot relative to the hind foot in the horizontal plane were the candidate for posteromedial soft tissue release.
5. Dimeglio classification is a valid and reliable system for clubfoot classification because:

a. The scores correspond to severity of clubfoot.
b. Scores depend upon the rigidity or flexibility of foot.
c. Defines initial severity.
d. Help to monitor the efficacy of treatment.
e. Predict the outcome of treatment.
f. Help in modification of treatment plan.

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