

Value of Dimeglio Scoring System During Ponseti Correction of Congenital Talipes Equinovarus Deformity

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ABSTRACT

Background: When it comes to assessing the severity of an isolated clubfoot deformity and its response to therapy, the Dimeglio scoring system is universally accepted.

Objective: The aim of the current work was to increase the knowledge about application of dimeglio scoring system during Ponseti correction of clubfoot.

Patients and Methods: On the basis of a Randomized clinical research, at Zagazig University Hospital Orthopedic Department, and Alhawary general hospital, Benghazi, Libya, we recruited 12 patients aged lower than 1 year having idiopathic clubfoot treated using ponseti technique in duration from January 2021 to October 2021.

Results: There was a statistically significant decreases in Demiglio score among cases did not need tenotomy compared to cases needed it at all times of follow up. Also, there was a statistically significant decrease in score when comparing 1st & last read in cases needed tenotomy by 89.03% and in cases did not need by 94.26 percent. The different readings of Demiglio score had accuracy 100%, 100%. 91%, 83.3% & 100% respectively in prediction of not needing tenotomy among the studied cases.

Conclusion: It could be concluded that in terms of dependability, the Dimeglio scoring system is clinically relevant and may be simply used in clinical practice. The Dimeglio score is practical, easy to use, and applicable in children also above the age of 1.5 years old.

Keywords: Ponseti Correction, Congenital Talipes Equinovarus, Dimeglio Scoring

INTRODUCTION

As one of the most prevalent skeletal deformities, Idiopathic Congenital Talipes Equinovarus (clubfoot) is one of the most frequent congenital skeletal deformities. It occurs in one to two out of every thousand live births. The male-to-female ratio is two to one ⁽¹⁾.

Idiopathic clubfoot is a mystery. The precise causes of the clubfoot are still matter of debate. Main pathological changes include that talar neck is medially and plantarly deviated, and the talar body is laterally rotated, calcaneus is in varus and rotated medially around talus ⁽²⁾.

Myelodysplastic syndromes, arthrogyriposis, and various congenital abnormalities can all cause talipes equinovarus deformity, however it is more usually an isolated birth defect and is believed to be idiopathic ⁽³⁾.

In order to assess a patient's condition before to treatment and monitor treatment progress, severity classification is critical. Pirani and Dimeglio scoring systems are two classifications that can be easily employed in clinical practice ⁽⁴⁾.

One of the most frequently acknowledged scoring systems for assessing the severity of an isolated clubfoot deformity and monitoring treatment progress is the Dimeglio scoring system ⁽⁵⁾.

The management of clubfoot deformity has been changed in the last two decades from surgical correction (posteromedial soft tissue release) to the non-surgical Ponseti method ⁽⁶⁾.

For the treatment of clubfoot, the Ponseti method has been found to be the most effective; this includes manipulation, serial casting, and bracing ⁽⁷⁾.

The aim of the current work was to increase the knowledge about application of dimeglio scoring system during Ponseti correction of clubfoot.

SUBJECTS AND METHODS

This randomized clinical trial study included a total of 12 patients with idiopathic clubfoot managed with ponseti technique, attending at Orthopedic Department, Zagazig University Hospital, Egypt, as well as Al-Hawari General Hospital, Benghazi, Libya. This study was conducted between January 2021 to October 2021.

Ethical Consideration:

When all participants' parents completed informed permission papers and submitted them to the research ethics committee at Zagazig University and Alhawary General Hospital, the study was permitted (ZU-IRB#6689). Ethics guidelines for human experimentation were adhered to in accordance with the Helsinki Declaration of the World Medical Association.

The Ponseti procedure was used to treat idiopathic clubfoot in children younger than one year of age.

Exclusion Criteria: Ponseti-corrected patients who had previously undergone surgery, residual talipes-



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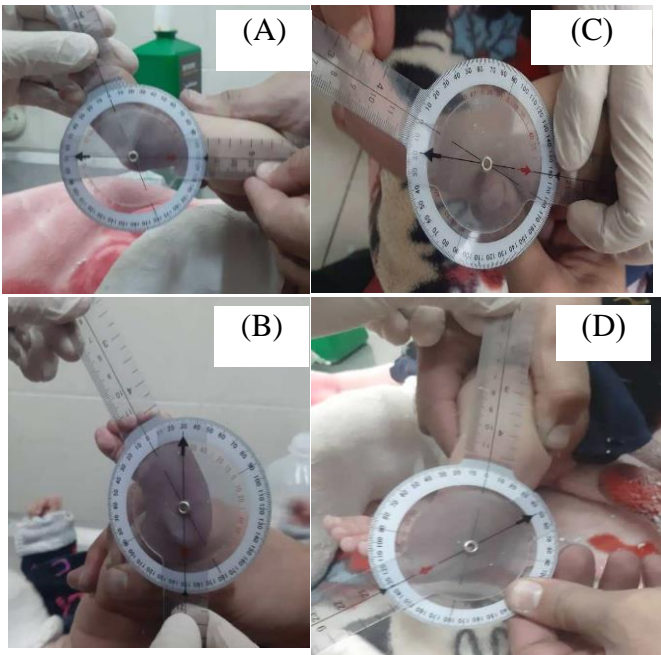
equinovarus syndromic condition after ponseti technique were excluded from the study. We also eliminated patients who had recurrence following surgery.

All patients were subjected to:

1. Complete history taking, especially family history for clubfoot and other congenital diseases.
2. Complete general and clinical examination performed by the referring surgeon; corrective manipulation of the foot was used to evaluate its mobility. Foot was evaluated if manual reduction was possible or not.
3. The Ponseti technique was used to manipulate and cast the babies. To keep track of how Ponseti was progressing, we used the Demiglio score throughout the entire course. If a tenotomy was required, it was done.

Technique:

Scoring: At the beginning, during, and at the end of treatment (every week), we used the Dimeglio score to assess the severity of the deformity; A-equinus ,B-varus, C-adduction, D- derotation around talus ,was assessed based on a scale from 0-20 points.



Prior to the application of each cast, the foot is manipulated.

Putting in the padding: Using only a small layer of cast padding, you can mould the foot to your desired shape. During cast application, hold on to the toes of the affected foot to keep it in the most proper posture possible.

Placing the cast:

In order to have a proper fit, start with the lower leg and work up. Three to four rotations around the toes is a good starting point, and then work your way up the

leg from there. It's best to spread the plaster evenly. Add a bit of strain to the plaster above the heel by twisting it a little bit. Plaster should be wrapped around the "holder's" fingers while the foot is held by the toes to allow plenty of room for the toes to spread out.

The process of molding the cast:

The plaster should not be used as a tool to fix the problem. Don't exert too much pressure. To avoid pressure sores on the skin, we did not apply persistent pressure with the thumb over the head of the talus; rather, we pressed and released repeatedly. The plaster was molded over the talus while we hold the foot in the precise posture. When molding our left hand,we keep in mind that our thumb is moulding over the talar head, while our index finger is moulding above their heel . To prevent flat foot or rocker bottoms, the arch was well contoured. The adjustment is being held in place by the index finger of the right hand. The calcaneus was not under any stress. The calcaneus is neither manipulated or cast during the procedure. It's essential that mold making be a dynamic process; Avoid applying too much pressure to a single spot by moving your fingers regularly. Molding can be done while the plaster is setting up and hardening.

Extending the cast to thigh:

To prevent skin irritation, use a lot of cushioning on the inner thighs. In order to increase the strength of the cast and prevent it from building up in the popliteal fossa, which makes it more difficult to remove, the plaster can be laid back and forth over the anterior knee.

Follow up; by using of Demiglio scoring system we were monitoring the progress of treatment by Ponseti technique.

Statistical analysis

The independent t-test (t) and the Mann-Whitney (MW) tests were employed to compare parametric and non-parametric data, respectively, in the analysis of the differences between the groups. Proportions were compared using the Chi-square test (x²). P value 0.05 was considered statistically significant (S). It was judged highly significant (HS) when the P value was 0.001 and non-significant (NS) when the P value was >0.05.

RESULTS

Age of the studied cases ranged from 4 to 14 days with mean 7.75 days. Regarding sex distribution 50% were male (6 cases), and 50% were female (6 cases). This table1 shows that 50% of the studied cases (6 cases) had lesion in left side, 33.3%(4 cases) had it in right side and 16.7% (2 cases) had bilateral lesions.75% (9 cases) of the studied cases needed tenotomy while 25%(3cases) not need.

There was a statistically significant decreases in Demiglio score among cases post treatment compared to pretreatment with % of reduction 92.46% (Table 2).

There was a statistically significant improvement in grade post treatment compared to pre, also there was a statistical significance increase in frequency of soft-soft cases post treatment compare to pretreatment (Table 3).

There was a statistically significant decreases in Demiglio score among cases not need tenotomy

compare to cases need it at all time of follow up. Also, there was a statistical significance decrease in score when comparing 1st & last read in cases need tenotomy by 89.03% and in cases not need by 94.26% (Table 4).

Different readings of Demiglio score had accuracy 100%, 100%. 91%, 83.3% & 100% respectively in prediction of not needing tenotomy among the studied cases (Table 5).

Table (1): Age, sex, Side of lesion, and need for tenotomy among the studied cases:

| Variable | (n=12) | |
|-------------------|-----------|------|
| Age: (day) | | |
| Mean ± SD | 7.75±2.96 | |
| Range | 4-14 | |
| Variable | N | % |
| Sex: | | |
| Male | 6 | 50 |
| Female | 6 | 50 |
| Side: | | |
| Right | 4 | 33.3 |
| Left | 6 | 50 |
| Bilateral | 2 | 16.7 |
| Tenotomy: | | |
| Not need | 3 | 25 |
| Done | 9 | 75 |

Table (2): Demiglio score among the studied cases:

| Variable | Pre (n=12) | Post (n=12) | t | P | % of reduction |
|---------------|------------|-------------|--------------|------------------|----------------|
| Score: | | | | | |
| Mean ± SD | 14.33±1.97 | 1.08±1.38 | 47.55 | <0.001 | 92.46% |
| Range | 11-17 | -1-4 | | ** | |

Table (3): Patient grade and reducibility before and after treatment among the studied cases

| Variable | Pre (n=12) | | Post (n=12) | | Mc | P | |
|---|------------|----|-------------|-----|----|-------------|------------------------|
| | N | % | N | % | | | |
| Grade: | | | | | | 4.15 | <0.001 ** |
| I (Benign) | 0 | 0 | 12 | 100 | | | |
| II (Moderate) | 0 | 0 | 0 | 0 | | | |
| III (Sever) | 6 | 50 | 0 | 0 | | | |
| IV (Very sever) | 6 | 50 | 0 | 0 | | | |
| Reducibility: | | | | | | 4.15 | <0.001 ** |
| >90% soft-soft resolving | 0 | 0 | 12 | 100 | | | |
| >50% soft-stiff reducible partially resistant | 0 | 0 | 0 | 0 | | | |
| >50% stiff-soft resistant partially reducible | 6 | 50 | 0 | 0 | | | |
| <10 stiff-stiff resistant | 6 | 50 | 0 | 0 | | | |

Mc: McNemar test

Table (4) Demiglio score among the studied cases according to tenotomy need.

| Variable | Tenotomy (n=9) | No tenotomy (n=3) | t | P |
|-----------------------------|--------------------|--------------------|-------------|---------------|
| 1st read: | | | | |
| Mean ± SD | 15.22±1.3 | 11.67±0.58 | 4.47 | 0.001* |
| Range | 13-17 | 11-12 | | |
| 2nd read: | | | | |
| Mean ± SD | 12.33±1.32 | 9±0 | 4.23 | 0.002* |
| Range | 10 – 14 | 9-11 | | |
| 3rd read: | | | | |
| Mean ± SD | 9±1.23 | 6.33±0.58 | 3.55 | 0.005* |
| Range | 7 -11 | 6-7 | | |
| 4th read: | | | | |
| Mean ± SD | 6±1.41 | 3.33±0.58 | 3.1 | 0.01* |
| Range | 4-8 | 3-4 | | |
| Last read: | | | | |
| Mean ± SD | 1.67±1 | -0.67±0.58 | 3.76 | 0.004* |
| Range | 1-4 | -1-0 | | |
| F | 397 | 609 | | |
| P | <0.001** | <0.001** | | |
| % of reduction | 89.03% | 94.26% | | |

Table (5): Validity of Demiglio score in prediction of outcome among the studied cases:

| Time | Cut off | AUC (95%CI) | Sensitivity | Specificity | PPV | NPV | Accuracy | P |
|----------------------|---------|---------------|-------------|-------------|------|------|----------|--------------|
| 1 st read | 12.5 | 1 (1-1) | 100% | 100% | 100% | 100% | 100% | 0.01* |
| 2 nd read | 9.5 | 1 (1-1) | 100% | 100% | 100% | 100% | 100% | 0.01* |
| 3 rd read | 7.5 | 0.98 (0.91-1) | 100% | 89% | 75% | 100% | 91% | 0.02* |
| 4 th read | 4.5 | 0.96 (0.86-1) | 100% | 77% | 60% | 100% | 83.3% | 0.02* |
| 5 th read | 0.5 | 1 (1-1) | 100% | 100% | 100% | 100% | 100% | 0.01* |

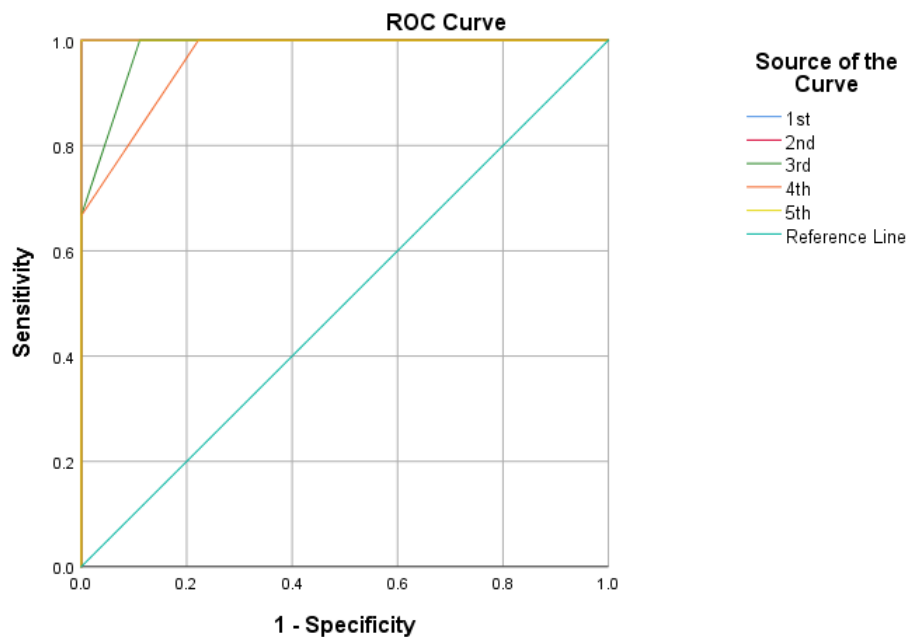


Figure (2): Roc curve for validity of Demiglio score in prediction of outcome among the studied cases.

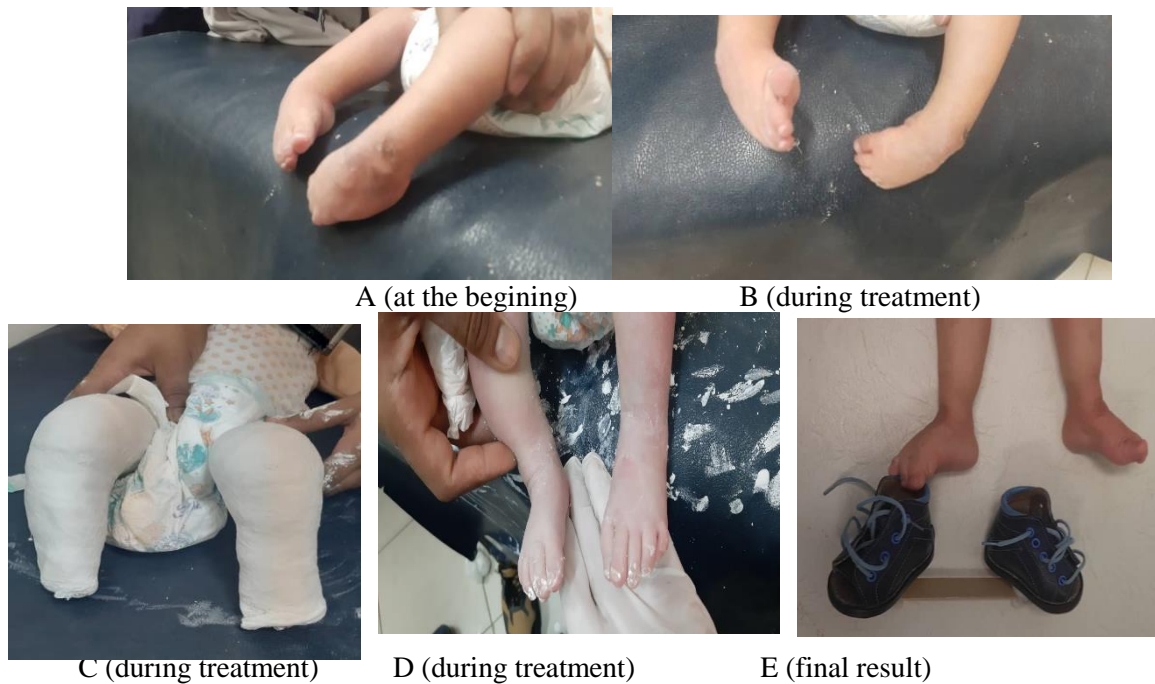


Figure (3): Male patient 1weeks old at time of presentation has bilateral idiopathic club foot. Serial casting by ponseti method had been done since time of presentation. Five casts had been used, scoring by dimeglio at 1st casting was 16 points, at 2nd was 13 points, at 3rd was 10 points, at 4th was 5 points and at 5th was 1 point. Deformity was fully corrected at the age of 7 weeks when cutaneous needle tentomy was performed under local anesthesia then above knee cast was applied for 3 weeks followed by wearing the brace.

DISCUSSION

In an effort to forecast which feet may need additional treatment, doctors have looked for indicators. In the past, the Pirani and Dimeglio clubfoot scores were the most commonly used⁽⁸⁾. In terms of assessing severity, the grading methods are appropriate, but the clinical findings have not been highlighted as a predictor of additional operative intervention. Ponseti suggested for the physical examination of newborn clubfoot, but many orthopedic surgeons still rely on imaging tools such as ultrasound and radiography to make decisions. Several studies have shown that children with clubfoot can have accurate radiographic measures taken of their feet⁽⁹⁾.

In the current study the mean age was 7.75 days, ranged from 4-14 days. Regarding sex distribution 50% were male and 50% were female.

Chang et al.⁽¹⁰⁾, reported that one foot from each of 12 patients was used in the experiment. Eight boys and four girls were in the group. The patients who began the Ponseti technique had an average age of 37.3 ± 39.9 days.

Our findings showed that 50% of the studied cases had lesion in left side, 33.3% had it in right side and 16.7% had bilateral lesions.

Shinde et al.⁽¹¹⁾ reported that 18 (60%) cases were bilateral, while 12(40%) were unilateral. The clubfoot was commoner on the left side (58.3%).

While **Sharma et al.**⁽¹²⁾ reported that 44 of the 66 cases had both parties involved. The right side

was more frequently engaged in unilateral situations (14 occurrences, 64 percent)

The current study showed that 75% of the studied cases needed tenotomy while 25% not need.

Sharma et al.⁽¹²⁾ found that tenotomy was required in 84 feet, 76.3 percent of the time, whereas 26 feet (23.7 percent) did not require it.

A statistically significant drop in Demiglio scores was seen in the current investigation among patients. when compared to the patients that require tenotomy at all times of follow-up. Also, there was a statistical significance decrease in score when comparing 1st & last read in cases need tenotomy by 89.03% and in cases not need by 94.26%.

Derzsi et al.⁽¹³⁾ found that there was a significant difference before and at 6 months after therapy regarding Dimeglio score.

Lampasi et al.⁽¹⁴⁾ found that There was a strong correlation between the Dimeglio score and the number of casts ($r = .73$; p value .0005). The Dimeglio score was found to have a substantial impact on the results of multiple linear regression. The number of casts was predicted by several subcomponents, including hindfoot score, midfoot score, varus, and muscle abnormalities.

Kiradiya et al.⁽¹⁵⁾ less casts were needed to repair individuals with lower Dimeglio scores compared to higher-scoring patients (more deformed). It appears that the number of cast members and Dimeglio score have a positive link using a Spearman correlation test. tenotomies and

tenotomies without tenotomies were equally effective in both cases.

The current study showed that different readings of Dimeglio score had accuracy 100%, 100%, 91%, 83.3% & 100% respectively in prediction of not needing tenotomy among the studied cases.

Lampasi et al. ⁽¹⁴⁾ found that Dimeglio performed slightly better in forecasting the need for tenotomy based on receiving operator curve (ROC) analysis. The ROC curve analysis showed that the (AUC =.92; 95 percent CI.84–1.0; Sign. .0005) had a little higher performance in predicting the requirement for tenotomy (P.<0.0005).

Sayit and Sayit ⁽¹⁶⁾ Dimeglio scores for males alone were observed to be 14.6 ±1.51 before therapy and 4.71 ±0.85 after treatment. A significant difference (P <0.5) was seen between the Dimeglio scores of the females alone before and after treatment: 15.17± 1.63 and 4.92 ±1.05, respectively.

Tahririan et al. ⁽⁹⁾ found that The Dimeglio score cut-off point for predicting recurrence was 17.5, with a sensitivity of 66.7 percent and a specificity of 61.3 percent. There are 66.7 percent more cases of repeating the same symptoms than there are non-recurrence cases that fall within this cut-off point.

As **Tahririan et al.** ⁽⁹⁾ the Dimeglio score was significantly different between the recurrence and non-recurrence groups (P 0.0031). This means that the impact of initial scorings on the recurrence of clubfoot was unaffected by age or gender.

CONCLUSION

It could be concluded that for congenital idiopathic clubfoot, the Ponseti technique is safe and successful and significantly reduces the need for substantial corrective surgery. One of the most critical steps in the treatment of the Achilles tendon, the percutaneous tenotomy, is performed.

The severity of the deformity has little bearing on the number of casts required, but the younger the patient, the fewer castings are required. There is an average 2-year follow-up period when the patient's range of motion is close to normal after a two-month therapy period. The final appearance of the feet was well-received by the 13 patients' parents in the majority (87 percent). Using clinical grading, it is possible to forecast how the treatment will go. Using the Dimeglio and Pirani grading systems, one may determine how effectively a foot has been corrected as well as the disease's prognosis. With strong intra-observer and inter-observer reliability, therapeutic relevance, and ease of use in clinical practise, the Dimeglio scoring system has gained widespread use. Children above the age of 1.5 years can benefit from the Dimeglio score, which is straightforward to apply.

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