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Ponseti casting for clubfoot - fiberglass or plaster casting?

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ABSTRACT

Background: Various cast materials have been used to manage idiopathic club foot by Ponseti method of serial casting and bracing each material have its advantage and disadvantage.

Objectives: To compare between two cast materials used to treat idiopathic clubfoot in response to the number of casts required in achieving correction, the need for tenotomy, and skin problems that can result from using these materials.

Methods: Patients were randomized to fiberglass cast group and plaster cast group. The outcome measures were: the number of casts required to obtain clubfoot correction, need for Achilles tenotomy, and skin problems that are associated with the use of different cast materials

Results: We enrolled 33 children in the study with 40 clubfeet. 22 (55%) clubfeet were randomized to fiberglass and 18 (45%) to plaster casts. Taking in consideration that bilateral feet have the same cast material for correction. There was a significant difference in the number of casts required for clubfoot correction between the two groups ($p=0.005$). Tenotomy was performed in 19 (47.5%) clubfeet with no significant association between tenotomy and cast material groups. Skin problem occurred in 8 (20%) clubfeet during the process of their correction.

Conclusion: The historical plaster of Paris remain to be the material of choice which can be used for correction of clubfeet by Ponseti method.

Keywords: clubfoot, Ponseti method, fiberglass cast, plaster of Paris cast.

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Introduction:

Clubfoot (congenital equinovarus) is a common congenital deformity that affects more than 100,000 live births annually with approximately 90% of these in low and middle income countries. It is a complex deformity with four components: ankle equines, hind foot varus, forefoot adduction and mid foot cavus. ^(1,2) In 1963 Ponseti developed a method of treating clubfoot which is now considered to be the gold standard of treatment with a successful rate of about 95%, it is cost effective, less invasive, and has lower risk of complications than surgical treatments. It consist of weekly serial manipulations and above knee casting . After cast correction of the cavus adductus and varus component of the deformity a percutaneous Achilles tenotomy is required. ⁽³⁾

One of the primary decisions the provider has to make when applying a cast is what material to use. The two types that are traditionally used are fiberglass and plaster casts. ⁽⁴⁾

The historical standard for club foot immobilization has been plaster of Paris POP it has been praised for its mold ability however, it can be heavy, with a poor resistance to water. When a cast becomes wet, numerous complications can occur which include skin maceration, infection and destruction of the structural integrity of the cast. ⁽⁴⁾

Alternative cast materials used in conjunction with the Ponseti method have been considered. ⁽⁵⁾

Fiberglass materials have been previously used for clubfoot correction and the treatment of resistant metatarsus adductus with success. Fiberglass casting materials were introduced in the 1970s and have the advantages of radiolucency, lighter weight, improved durability, faster curing time and cleaner application. ⁽³⁾

The purpose of our study is to compare between two cast materials used to treat idiopathic clubfoot in response to the number of casts required in achieving correction, the need

for tenotomy, and skin problems that can result from using these materials.

Methods:

Between Apr.2015 to May 2018 thirty eight children with clubfoot were received at the orthopaedic consultation clinic at Alnuman teaching hospital. Five children were excluded from the study. The exclusion criteria were: children more than one month of age, children with neurological clubfoot or clubfoot part of other syndromes, children who received treatment at another center. Leaving a total number of thirty three children with total of forty clubfeet to be enrolled in this prospective randomized trial. When a child had bilateral clubfeet both feet were treated with the same cast material in order to increase the acceptability of the trial to the parents.

Parents of the children who were enrolled were given information about the nature and the duration of treatment. Casting was initiated at the first clinical visit and subsequently at weekly intervals using serial manipulation and above knee casting according to Ponseti method. Pirani scoring was obtained to assess the severity of the deformity, and pictures of the affected foot/feet were taken at every visit. After each cast removal the mother is instructed to do physiotherapy, massage with olive oil to the affected foot for at least 30 min.

The outcome variables in this study was the number of casts required for correction of the club foot deformity achieved. the need for percutaneous tendo Achilles tenotomy, complication related to cast material.

Results:

Thirty eight children with clubfeet were initially assessed for eligibility in the study. Five children were excluded for various reasons. Of the thirty three children 7 children have bilateral clubfeet giving rise to forty clubfeet to be enrolled in the study taking into consideration that children with bilateral clubfeet have the same type of cast for the right and left side. 22

(55%) clubfeet were randomized to fiberglass and 18 (45%) to plaster casts.

The mean initial Pirani score was (4.5909±1.21) for the fiberglass cast while it was (3.944±1.096) for the plaster cast group with no significant difference between the two groups (p=0.86) (table 1).

There is statistically significant difference (P=0.005) between the mean total number of casts required for the fiberglass group (12.318±3.496) and plaster group (9.00±3.447) (table 1). The range of total number of casts required in fiberglass group was (8-17) and (4-14) for plaster group (Figure 1).

Table 1 Pirani score⁽¹⁾

Pirani score	
1	Posterior crease
2	Empty heel
3	Rigid equinus
4	Medial crease
5	Curvature of the lateral border
6	Position of talar head

Minimal total score is 0 and the maximum total score is 6

Table 1. Mean Pirani score, mean number of casts, and tenotomy done among plaster and fiberglass groups

	No. of cases	Mean Pirani score	Mean no. of casts	tenotomy
Plaster	18	3.944±1.096	9.00±3.447	7
Fiberglass	22	4.5909±1.210	12.318±3.496	12
		P=0.86	P=0.005	X ² =0.324

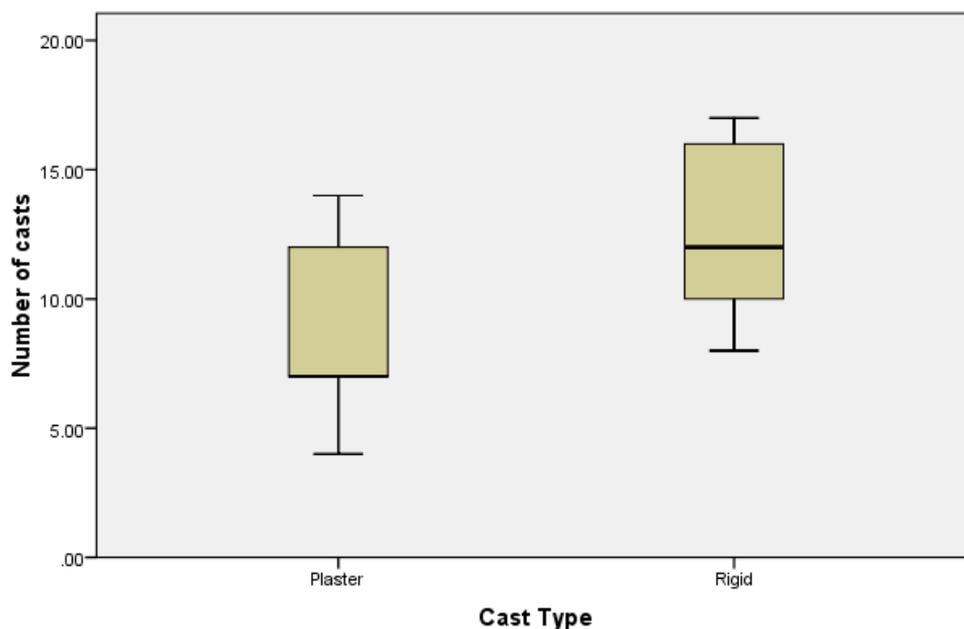


Figure 1 showing range of required casts for plaster and rigid groups

Tenotomy for Achilles tendon was performed in 19 (47.5%) cases, 12 cases (54.5%) were in the fiberglass group while 7 cases (38.8%) were in the plaster group with no significant association between tenotomy and cast type ($X^2=0.324$).

Twelve clubfeet in the fiberglass group required tenotomy of the Achilles tendon their mean Pirani score was (5.458±0.782) and the mean number of casts required for their correction was (14.75±2.767)

There is significant difference in the mean Pirani score and mean number of casts required in relation to tenotomy done in fiberglass group. In addition, There is strong positive relationship between total Pirani score and number of casts required in fiberglass group ($r=0.916/P<0.01$).

with significant relation ($P<0.05$) between fiberglass group and cases that required tenotomy of Achilles tendon (Table 2).

Table 2. Mean Pirani score and number of casts in relation to tenotomy done among fiberglass group

Tenotomy	No of cases	Mean Pirani score	Mean no. of casts	Correlation
Yes	12	5.458±0.782	14.75±2.767	r=0.835/P<0.05
No	10	3.55±0.643	9.4±1.349	r=0.31/P=0.031
		P<0.01	P<0.01	

Seven club feet in the plaster cast group required tenotomy of the Achilles tendon their mean Pirani score was (5.142±0.556) while the mean number of casts required for their correction was (12.857±1.57).

There is significant difference in the mean Pirani score and mean number of casts required in relation to tenotomy done in plaster

group. In addition, there is strong positive relationship between total Pirani score and number of casts required in plaster cast group($r=0.926/P<0.01$)

with significant relation ($P<0.05$) between Plaster group and cases that required tonotomy of Achilles tendon (table 3).

Table 3. Mean Pirani score, mean number of casts in relation to tenotomy among Plaster group.

Tenotomy	No of cases	Mean Pirani score	Mean no. of casts	Correlation
Yes	7	5.142±0.556	12.857±1.57	Non significant
No	11	3.181±0.462	6.545±1.29	r=0.738/P=0.01
		P<0.01	P<0.01	

There is significant positive relationship between Pirani score and total number of casts required ($r=0.915$, $P<0.005$) (Figure 2).

Skin problems occurred in 8 (20%) cases, in which 5 (22.7%) cases in fiberglass group suffered from skin abrasions at the edge of cast

and at knee flexor crease, while 3 (16.6%) cases in plaster group suffered from skin irritation and redness (table 4). There is no statistically association between cast type and the complications due to casts ($P=0.709$).

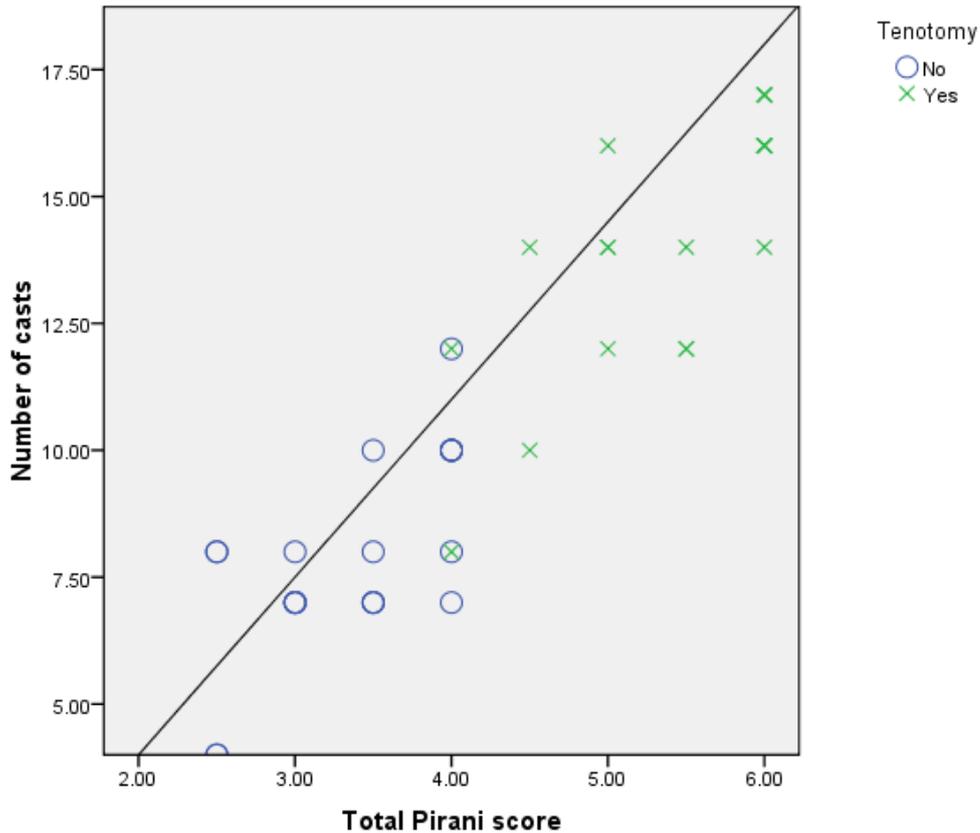


Figure 2 scattered diagram showing the correlation between Pirani score and number of casts required in relation to tenotomy.

Type of cast	Noncomplicated cases	Complicated cases	Total
Fiberglass	17	5	22
Plaster	15	3	18
	32	8	40

Discussion:

In 1963 Ignacio ponseti proposed treating clubfoot by serial manipulation and casting followed by maintenance phase of bracing (1) Many authors have highlighted the safety and

efficacy of this method even in patients with delayed presentation or complex deformity different cast materials were used to treat this deformity. (6) The purpose of our study is to compare between two cast materials used to

treat idiopathic clubfoot in response to the number of casts required in achieving correction, the need for tenotomy, and skin problems that can result from using these materials.

To ensure adequate correction, cast material should provide both molding ability and stiffness. Theoretically, a more rigid casting material would allow for more rapid correction.

⁽³⁾ Schmidt et al found that 72h of drying produced the optimal properties of POP, while Berman et al found that fiberglass cast had reached 75% of its 5 day strength within an hour of drying.⁽⁵⁾ Several technical points concerning casting clubfoot have been emphasized by Ponseti. Cast molding over the lateral aspect of the talar head is one of the tents in achieving correction of the mid foot and hind foot. Ponseti also suggested providing adequate posterior molding superior to the calcaneus to help prevent cast slippage. ⁽³⁾ In the present study the mean of fiberglass casts were (12.318 ± 3.496) ranging between (8-17) while that of the POP group was (9.00 ± 3.447) ranging between (4-14) with a significant difference between the two groups ($P=0.005$)

At the initiation of our study and to predict the likely number of casts required to correct the deformity and to assess the exact point of transition from treatment phase of casting to maintenance phase of bracing we relied solely on Pirani score aiming to get a Pirani score of zero or just close to zero. But now we agree with Mansoor et al ⁽¹⁾ in that Pirani score of 0.5-1.5 with dorsiflexion of 15° and abduction of 70° is sufficient to initiate the bracing phase. ⁽¹⁾ In the present study there was no significant difference in the Pirani score of our two groups

Cooper et al have shown that percutaneous tenotomy of tendo Achilles performed during the first few months of life is a benign procedure with no long term effect on muscle strength

Changulani et al found positive correlation between the initial Pirani score and the need for tenotomy and the total number of casts required to correct the

deformity. ⁽⁷⁾ In the present study There was a significant difference in the mean Pirani score and mean number of casts required in relation to tenotomy done in both the fiberglass cast group and in the plaster cast group. In addition, There was a strong positive relationship between total Pirani score and number of casts required in both groups ($r=0.916/P<0.01$), ($r=0.926/P<0.01$) respectively.

In a study done by Davis 60% of the clubfeet managed by serial casting needed tenotomy. ⁽⁸⁾ in our study tenotomy was performed in 19 clubfeet (47.5%), this might be due to the early initiation of casting in our study which was in the first 3 weeks after delivery.

In our study tenotomy of Achilles tendon was performed in 19 (47.5%) cases, 12 cases (54.5%) were in the fiberglass group while 7 cases (38.8%) were in the plaster group with no significant association between tenotomy and cast type ($X^2=0.324$).

When a cast becomes wet numerous complications can occur which include skin, maceration infection and disruption of the structural integrity of the cast. Although education of the family regarding the importance of protecting their cast and keeping it dry is paramount, the incidence of wet cast still continues to be problematic.

skin problems that resulted from wet casting occur in 3 children managed by plaster casting while skin problem that resulted from sharp edge of the fiberglass cast occurred in 3 children. Thickness of the cast dullness of the blades and amount of cast padding are resonance for thermal injuries. ⁽⁴⁾ in the present study 8 (20%) children have skin problems, 5 (62.5%) occurred in fiberglass group and 3 (37.5%) occurred in plaster group.

Conclusion:

The historical plaster of Paris remain to be the gold standard for the management of clubfoot by Ponseti method due to its high mold ability as compared to the fiberglass cast.

Recommendations:

Further studies to compare the two materials by taking older age children are recommended.

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