

İdiopatik Pes Ekinovaruslu Hastalarda Ponseti Yöntemiyle Tedavi Sonuçlarımız

Treatment Results of the Ponseti Method in Patients with Idiopathic Pes Equinovarus

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ÖZ

GİRİŞ ve AMAÇ: Congenital clubfoot (pes equinovarus) tedavisi, günümüzde modern tedavi yöntemi Ponseti tarafından tanımlanan yöntemle, seri manipulasyon ve alçılama ile yapılmaktadır. Ortopedi de alçılama materyali olarak sıklıkla klasik beyaz alçı (plaster of paris=POP) ve daha nadiren fiberglass (SRF) alçı kullanılmaktadır. Çalışmanın amacı ponseti yönteminin ve bu 2 materyalin etkinliğini değerlendirmek ve birbirlerine üstünlüklerini belirlemektir.

YÖNTEM ve GEREÇLER: 2006-2008 yılları arasında 16 hastanın 27 ayağı değerlendirilmeye alındı (12 erkek 4 kız) hastalar 2 gruba ayrıldı. 1. gruptaki 9 hastanın 16 ayağına klasik beyaz alçı (Plaster of Paris) 2. gruptaki 7 hastanın 11 ayağına sentetik soft cast alçı (SRF) uygulandı. Yöntemin etkinliği alçı materyallerinin özelliği ve komplikasyonlar değerlendirildi. Pirani ve Dimeglio skorlarına bakıldı.

BULGULAR: Tedavi öncesi 12.81 olan ortalama Dimeglio skoru tedavi sonrası 2.56 olarak tespit edildi. Pirani skoru tedavi öncesi 4.125 iken tedavi sonrası ortalama değer 0.531 bulundu. Ortalama takip süresi 18 ay. Her 2 grupta klinik skorlarda istatistiksel olarak anlamlı düzelme tespit edildi ($p < 0.05$) 1. grupta (POP) 3 ayakta cilt basısına bağlı yaralanma görüldü.

TARTIŞMA ve SONUÇ: Ponseti tekniği ile her 2 alçı materyali ile ayak deformitelerinde düzelme ve klinik skorlarda anlamlı iyileşme elde edilmiş olup. İki grup arasında istatistiksel anlamlı fark tespit edilememiştir ($p > 0.05$). Fiberglass sentetik alçı ile daha az basınca bağlı cilt yaralanması görülebileceği tespit edilmiştir.

Anahtar Kelimeler: ponseti, pes equinovarus, alçılama

ABSTRACT

INTRODUCTION: Congenital clubfoot (pes equinovarus) treatment is currently applied with serial manipulation and plaster casting with the modern treatment method described by Ponseti. In orthopaedics, the plaster cast material used is usually the classic white plaster (plaster of Paris; POP) and more rarely semi-rigid, fiberglass (SRF). The aim of this study was to evaluate the efficacy of these two materials in the Ponseti method and to identify the advantages of each.

METHODS: A total of 27 feet of 16 patients (12 male, 4 female) treated between 2006 and 2008 were included for evaluation. The patients were separated into 2 groups, as Group 1 with 16 feet of 9 patients applied with POP, and Group 2 with 11 feet of 7 patients applied with SRF. The efficacy of the two methods was evaluated in respect of the properties of the cast materials and complications. The Pirani and Dimeglio scores were examined.

RESULTS: The mean Dimeglio score was 12.81 before treatment and 2.56 after treatment. The mean Pirani score was 4.125 before treatment and 0.531 after treatment. The mean follow-up period was 18 months. A statistically significant improvement in clinical scores was observed in both groups ($p < 0.05$). In 3 feet in Group 1 (POP), skin pressure sores were observed.

DISCUSSION and CONCLUSION: Significant improvements in clinical scores and correction of the foot deformity were seen with both plaster cast materials using the Ponseti technique. No statistically significant difference was determined between the two groups ($p > 0.05$). It was determined that less skin pressure injury could be seen with fiberglass synthetic plaster cast.

Keywords: Ponseti Method, Pes equinovarus, casting

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INTRODUCTION

The congenital clubfoot deformity of idiopathic pes equinovarus (PEV) is a commonly seen skeletal system anomaly, which requires orthopaedic follow-up from birth and for which the treatment is still controversial (1). The Ponseti method has become one of the leading methods used in the treatment of congenital PEV.

The aim of PEV treatment is to obtain a foot with close to normal anatomy that is pain-free, provides sufficient mobility and allows the patient to wear normal shoes. Early treatment is of great importance. There are various conservative treatment methods, such as the continuous passive movement treatment, developed in France (2), manual correction, bandaging and plaster casting. The successful results in the last 20 years in the long-term follow-up of the Ponseti method of correction and plaster casting, have started to attract the attention of orthopaedists (3, 4, 5, 6). However, there is no consensus in literature on the type of cast to be used. Just as there are authors who recommend the use of classic white plaster of Paris cast (3), there are those who have reported that a synthetic soft cast is advantageous (4, 7, 8), and others who have stated that there is no difference (9). While a classic plaster cast has the advantages of low cost and ease of moulding (9, 10, 11), a fibreglass cast is radiolucent and the risks of thermal burn and skin injury are lower (5, 10).

The aim of the current study was to investigate the effect on the clinical scores of the effectiveness of the Ponseti method and the effect on the results of two different plaster cast materials in patients with congenital PEV.

METHODS

The study included 27 feet of 16 patients diagnosed with congenital PEV between April 2007 and July 2009. All the patients were treated with the Ponseti method. The patients comprised 12 males and 4 females with a mean age of 6 months (range, 5 days- 3.5 years) (Table 1).

Patients were excluded if they had previously undergone surgical treatment, if they had arthrogriposis, myelomeningocele or a deformity

associated with other etiologies. Of the 16 patients, 3 had been applied with unsuccessful plaster casting.

Table 1. A general view of all the characteristics of the patients

Pt No	age (mths)	Gender	Duration of plaster cast (wks)	Dimeglio - pre	Dimeglio- post	Pirani- pre	Pirani- post	Achilles tenotomy	Plaster cast type	Skin injury
1	0-1	Male	6	15	3	4.0	0.5	No	SRF	No
2	7	Male	7	11	2	3.0	0.0	Applied	SRF	No
3	0-1	Female	6	16	3	5.0	1.0	Applied	Classic POP	Yes
4	0-1	Male	7	16	2	5.0	0.5	Applied	Classic POP	Yes
5	10	Male	6	8	2	2.5	0.0	Applied	SRF	No
6	24	Female	8	10	4	4.0	1.5	Applied	Classic POP	No
7	0-1	Male	6	12	1	4.0	0.0	Applied	SRF	No
8	0-1	Male	5	8	2	2.5	0.5	Applied	Classic POP	Yes
9	0-1	Male	7	16	2	5.0	0.0	No	SRF	No
10	42	Male	8	10	4	3.5	1.5	No	Classic POP	No
11	0-1	Male	5	12	3	4.0	1.0	Applied	Classic POP	No
12	0-1	Male	6	14	2	04.5	0.5	Applied	Classic POP	No
13	0-1	Male	6	13	3	4.0	0.0	Applied	Classic POP	No
14	0-1	Female	6	14	2	4.5	0.0	No	SRF	No
15	0-1	Female	7	16	3	5.0	1.0	Applied	SRF	No
16	0-1	Male	6	14	3	5.5	0.5	Applied	Classic POP	No

Informed consent was obtained from the parents or legal guardians of all the study participants. The patients were randomly separated into 2 groups. Classic white plaster of Paris casts were applied to 16 feet of 9 patients in Group 1. Synthetic casts (Scotch-cast Soft Cast Casting Tape 3M) were applied to 11 feet of 7 patients in Group 2 (Table 2).

Table 2. Distribution of the types of plaster casts used in the treatment of the patients

	Type of plaster cast			
	Number	%	Valid %	Total %
SRF	7	43.8	43.8	43.8
Classic POP	9	56.2	56.2	100.0
Total	16	100.0	100.0	

At the first presentation and subsequent follow-up examinations, the patients were evaluated according to the Dimeglio classification (2) and the Pirani deformity score (13). The response to treatment was evaluated using these classifications. According to the Dimeglio classification, in Group

1, 2 (13%) feet were evaluated as grade 4, 10 (54%) as grade 3, and 4 (33%) as grade 2. In Group 2, the feet were evaluated as 1 grade 4, 8 grade 3, and 2 grade 2. Treatment was started immediately on first presentation (Figure 1).



Figure 1. Bilateral PEV in a 2-week old infant

In keeping with the manipulations of the original technique (13-17), the deformity correction of the Ponseti method was started with the cavus component. The 1st metatarsal was forced into dorsiflexion to obtain forefoot supination (Figure 2). Then, to correct adduction and varus, by applying opposing pressure with the thumb to the talus head in the supination position, the foot was brought into abduction. After correction of varus and adduction, to correct the final equinism, dorsiflexion was applied to the ankle. Forced and hard movements were avoided in the manipulation.



Figure 2. Application of the first soft cast made by forcing the foot into supination

After gentle manual correction for 2-3 mins, a long leg plaster cast was applied under polyclinic conditions. The plaster casts were removed once a week by soaking in warm water with vinegar, then the subsequent plaster cast was applied immediately. In patients with limited dorsiflexion and those where Achilles tension could be felt manually, it was decided to perform percutaneous

Achilles tenotomy. The plaster cast was applied bringing the foot into dorsiflexion of up to 15°. After tenotomy, the plaster cast remained for 3 weeks in both groups (Figure 3).



Figure 3. External rotation and dorsiflexion applied to a patient in the 6th plaster cast

To prevent recurrence after removal of the final plaster cast, specially made shoes were mounted on a Denis-Browne Bar (DBB) to hold the foot in 70° abduction and 15-20° dorsiflexion (Figure 4). The special shoes used were open-toed, with non-slip insoles, flat soles and velcro fasteners to prevent the foot slipping out. The DBB was used for the full day for 3 months and thereafter for 16-18 hours per day. After 1 year, it was used during sleep for 3-4 years. During the day, normal shoes enclosing the ankle were worn.



Figure 4. Image of the Denis-Browne Bar orthosis in the 6th month

Statistical analysis

The evaluation of the parameters used in the study was made using SPSS v16.0 software. As the final stage of the statistical analyses, paired

comparisons of the results of the Student's t-test and Mann Whitney U-test were made to determine whether or not there was a statistically significant difference. A value of $p < 0.05$ was accepted as statistically significant.

RESULTS

The mean Dimeglio score was determined as 12.81 before treatment and 2.56 after treatment. The mean Pirani score was determined as 4.125 before treatment and 0.531 after treatment (Table 3). In Group 1, the Pirani score decreased from mean 4.18 to 0.56 and the Dimeglio score from 13.00 to 2.64. In Group 2, the Pirani score decreased from mean 4.10 to 0.51 and the DiMeglio score from 12.66 to 2.51. The mean follow-up period was 18 months (range, 5.5-26 months). The mean age of the patients at the final follow-up examination was 21 months (range, 10-48 months).

Table 3. Correlations of the pre and post-treatment Dimeglio and Pirani scores				
Measurement of the correlation				
	R	R Squared	Eta	Eta Squared
Dimeglio-pre	0.884	0.781	0.942	0.887
* Pirani-pre				
Dimeglio-post	0.805	0.647	0.823	0.678
* Pirani-post				

Percutaneous Achilles tenotomy was applied to 18 feet of 12 patients. In the group applied with semi-rigid fibreglass (SRF) cast, despite initial correction of the deformity in all feet, recurrence of the deformity occurred in 1 patient, who could not comply with the foot abduction orthosis. Correction was obtained with 3 applications of casting and re-application of the brace. No skin injury was observed in any patient and there was no requirement for wide surgical loosening.

In the plaster of Paris (POP) cast group, in 3 feet, an interval of mean 1 week was given in the casting treatment because of skin problems. When these skin problems resolved, casting was again applied and it was attempted to correct the deformity. There were no indications for surgery in

the short-term in any patient. In 1 patient, despite sufficient correction, dynamic forefoot supination developed at the end of 2 years, so tibialis anterior transfer was applied. In 4 feet of 3 patients, dynamic forefoot adduction was observed in the long-term. No problems were observed in these cases related to straightness, flexibility or shoe-wearing.

DISCUSSION

Congenital PEV constitutes the majority of foot deformities in children (1, 4, 18). The aim of PEV treatment is to obtain correction of all the components of the deformity, to provide a painless foot with plantigrade movement that does not necessitate special shoes (4, 19). Conservative treatments are primary in PEV treatment (20, 21). It is extremely difficult to apply surgical intervention to newborn infants. Currently, the Ponseti method is a conservative method with proven effectiveness reported in literature (4, 11, 14, 15). Although correction with various methods is still a matter of debate, long-term results in literature have defined the Ponseti method as the best method (18).

With increasing use throughout the world of the Ponseti method in recent years, success rates have been reported as 95% by Eberhardt (22), 93% by Radler et al (14), and 97% by Bor et al (15) by adding Achilles tenotomy to all the cases with insufficient treatment in major pressure points from 3 months. Ponseti et al (16) obtained 96% success with a mean of 5 plaster casts in cases defined as complex, with rigid equinus, and severe plantar flexion of all the metatarsals and fibrotic bands.

In a 2001 study by Bursali in Turkey, success was achieved in all primary cases and in 75% of cases for whom treatment was started after referral from other centres (23). Göksan treated 42 feet of 29 patients and reported 95% success. While all feet were corrected initially, recurrence of the deformity developed in 12 (39%) patients who could not comply with the abduction brace (4). Successful initial correction rates were reported by Herzenberg et al as 100% and by Morchunde et al as 98% (5, 6). Cangulani et al achieved correction in 89% without the need for surgical treatment, and reported that in 70% of the patients with recurrence,

the Denis-Browne orthosis had not been used (24). Abdelgawad et al treated 137 feet with the Ponseti method and achieved 93% success in a 2-year follow-up period. Of the patients who later developed recurrence, it was shown that two-thirds had not complied with the orthosis and had not used it regularly (25).

Of the 16 patients in the current study, the deformity was initially corrected in all. At the end of 6 months, recurrence of the deformity was observed in one foot of one patient. It was learned that the DBB had not been used regularly for this patient. The treatment method was continued with repeated casting and the deformity was corrected after 3 casts.

In the past, many authors have used classic white plaster casts in the Ponseti method. However, because of medical problems such as skin irritation and thermal injury, and parents requesting a lighter plaster and having cosmetic concerns, there arose a need for the use of different plaster casts in these children (10). In a recent study on this subject by Hui et al, classic plaster casts and fibreglass plaster casts were compared. No significant difference was found between the groups in respect of the number of plaster casts required for correction or in skin injuries, whereas the requests of the family were seen to be for fibreglass casts and it was reported that this should not be ignored (9, 10). Pitner et al reported better results for the classic white plaster cast in a similar study, but reported greater levels of patient and family satisfaction with the fibreglass cast during treatment (11). In the current study, the number of plaster casts necessary for correction was determined to be mean 6 (range, 5-8) POP and mean 6.3 (range, 5-8) SRF, with no statistically significant difference determined between the groups ($p>0.05$) (Table 3). In the classic POP group, skin injury related to the plaster cast was observed in 3 patients ($p<0.05$).

In a study by Terrazas et al (26), comparison was made of cases where the cast was removed one night before applying the next cast and those where the subsequent cast was applied immediately. Both the treatment duration and the number of plaster casts were determined as 2-fold greater in the group with plaster cast removal the night before. In the

current study, the casts were removed by soaking in warm water before immediately applying the next cast. No motorised plaster cutter was used.

Conservative treatment with the Ponseti method can be considered as 2-stage treatment. The first stage is serial casting and the second stage is the brace treatment. In the current study, recurrence was determined in 1 patient who did not show compliance with the orthosis treatment.

LIMITATIONS

The weaknesses of the study are retrospective, the number of patients and the duration of follow-up is low.

CONCLUSION

The Ponseti method is an effective method in the treatment of congenital pes equinovarus. Successful results can be obtained with the conservative Ponseti method without the risk of adhesions or the complication of recurrence caused by extensive surgical interventions. Both plaster cast materials can be applied with the same efficacy in the method, and whereas the classic plaster of Paris cast can be more easily moulded, there is a greater risk of the development of a thermal effect and pressure sores.

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