

Use of the Foot Abduction Orthosis Following Ponseti Casts

Is It Essential?

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Abstract: The purpose of this study was to evaluate the need for the use of a foot abduction orthosis (FAO) in the treatment of idiopathic clubfeet using the Ponseti technique. Forty-four idiopathic clubfeet were treated with casting using the Ponseti method followed by FAO application. Compliance was defined as full-time FAO use for 3 months and part-time use subsequently. Noncompliance was failure to fulfill the criteria during the first 9 months after casting. Feet were rated according to the Dimeglio and Pirani scoring systems at initial presentation, at the time of FAO application, and at 6 to 9 months of follow-up. At the time of application, no significant differences in scores were found between the groups. At follow-up, the compliant group's scores were significantly ($P < 0.01$) better than those of the noncompliant group. From the time of application to follow-up, for the compliant group, the Dimeglio scores improved significantly ($P = 0.005$). For the noncompliant group, the Dimeglio scores deteriorated significantly ($P = 0.001$). The feet of patients compliant with FAO use remained better corrected than the feet of those patients who were not compliant. Proper use of FAO is essential for successful application of the Ponseti technique.

Key Words: clubfoot, Ponseti, casts, orthosis

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Most orthopaedic surgeons agree that the initial treatment of clubfoot should be nonoperative, consisting of serial casting. The Ponseti technique involves serial manipulation and casting of the feet, with or without an Achilles tenotomy, followed by the use of a foot abduction orthosis (FAO) for maintenance of the correction.⁷ Several studies have shown the efficacy of this technique in both the short and the long term.^{1,3–8} Most of these studies reported that the FAO was crucial for maintaining the correction, but its effect has not yet

been studied. The purpose of the present study was to evaluate the need for the FAO after Ponseti casts.

MATERIALS AND METHODS

Between January 2000 and August 2001, 30 consecutive children (20 boys, 10 girls), less than 6 months of age, with 44 idiopathic clubfeet were treated at the Clubfoot Center of the Center for Children, NYU Hospital for Joint Diseases. The mean age at presentation was 5.2 weeks (range 0.5–20). The right side was affected in 10 patients and the left in 6; 14 patients had bilateral involvement.

All patients had a detailed history and physical examination at presentation, along with clinical photographs and radiographs of their feet for documentation of the severity of the deformity. At each visit, all of the feet were scored using the Dimeglio system² and the Pirani system.⁶ The feet were treated strictly adhering to the technique described by Ponseti. All casts were long-leg casts, applied from the toes to the groin, and were changed weekly. The first cast was applied in supination, correcting the relative pronation of the forefoot and plantarflexion of the first ray. The feet were gently manipulated each week before placing them in casts with progressively increasing forefoot abduction, ensuring that the heel was free to rotate out of its varus position. This was continued until the hindfoot varus was corrected. At this point, the dorsiflexion at the ankle was assessed and a percutaneous Achilles tenotomy was performed in the clinic under local anesthesia if the dorsiflexion was found to be less than 15 degrees. The final, 3-week cast was then applied in 15 degrees of dorsiflexion and the foot abducted 70 degrees. This cast was removed at the end of 3 weeks and the patient was fitted with the FAO.

This orthosis consisted of a metal bar with two custom-fitted straight-last shoes attached to its ends (MJ Markell Shoe Co, Yonkers, NY), separated by a distance adjusted to 1 inch more than the width of the shoulders. The affected feet were turned out 70 degrees and the unaffected feet were turned out 45 degrees, as recommended by Ponseti.⁷ A 15-degree dorsiflexion bend was also built into the ends of the bar (Figs. 1 and 2).

The FAO was prescribed for full-time use (approximately 23 hours a day) for the first 3 months after casting and then part-time wear (nighttime and naptime) subsequently for up to 3 years. To be considered compliant, patients had to use the FAO at least 23 hours per day during the “full-time” period and at least 8 hours per day during the “part-time” period.

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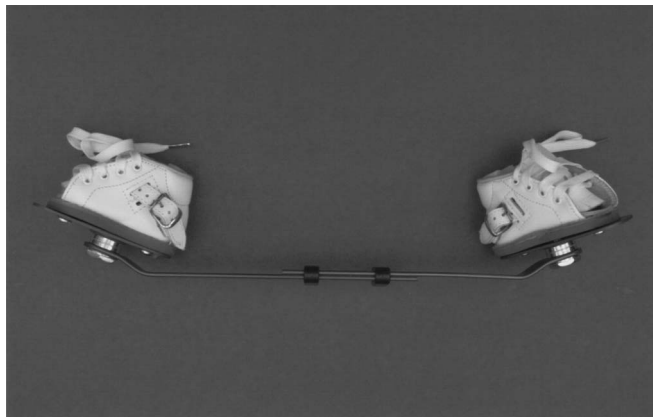


FIGURE 1. The foot abduction orthosis.

Noncompliance with the FAO was defined as the inability to fulfill the above criteria within the first 9 months of application of the orthosis.

RESULTS

Of the 30 patients treated, 21 (70%) patients (30 feet) were compliant and 9 (30%) patients (14 feet) were noncompliant with FAO use. The ratio of boys to girls in each group was 2:1, with 14 boys and 7 girls in the compliant group and 6 boys and 3 girls in the noncompliant group. The mean age at initial presentation was 4.4 weeks (range 0.5–20.0) in the compliant group and 7.1 weeks (range 2.0–20.0) in the noncompliant group; this difference was not statistically significant ($P = 0.24$). Follow-up data were obtained at the most recent visit, among the compliant patients, and at the time recurrence was first recognized, among the noncompliant patients. The mean age at follow-up was 11.3 months for the compliant group and 8.8 months for the noncompliant group; this difference was statistically significant ($P = 0.02$).

The scores at initial presentation in each group are shown in Table 1. Using the Mann-Whitney test, no sta-

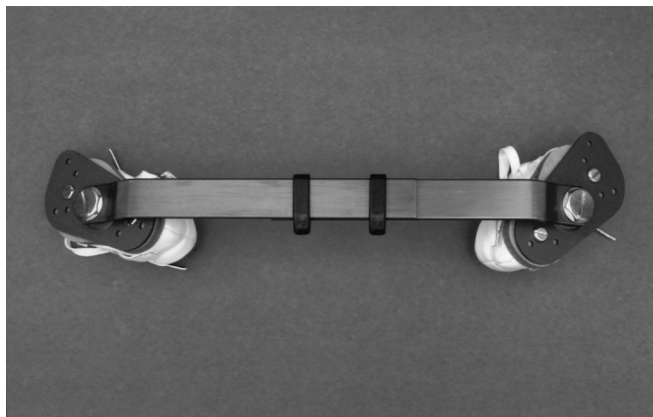


FIGURE 2. View of the foot abduction orthosis from below. The bar is set for a patient whose right foot is a clubfoot and whose left foot is uninvolved.

TABLE 1. Comparison of Scores of Compliant vs. Noncompliant Feet at Initial Presentation

Scoring System	Compliant Group	Noncompliant Group	P Value*
	Median (Range)	Median (Range)	
Dimeglio	14.5 (9–19)	16.0 (8–19)	0.12
Pirani	5.0 (2.5–6.0)	5.5 (3.0–6.0)	0.27

* $P < 0.05$ significant.

tistically significant difference in severity was found between the two groups at initial presentation for either of the scoring systems. The mean number of casts required for correction was similar ($P = 0.17$): 5.3 (range 3–8) in the compliant group and 5.9 (range 4–9) in the noncompliant group. In the compliant group, Achilles tenotomy was performed in 20 feet (66.7%); 10 feet did not need the tenotomy (33.3%). In the noncompliant group, 9 feet (64.3%) needed a tenotomy and 5 feet (35.7%) did not. The comparison of the distribution of the feet with tenotomies and without tenotomies, using the chi-square test, showed no significant difference ($P = 0.88$) between the two groups.

At the time of FAO application, the Mann-Whitney test showed no significant difference in scores between the compliant and the noncompliant groups with either of the scoring systems (Table 2). At 6 to 9 months of follow-up (or earlier if recurrence was observed), however, the scores in the noncompliant group were significantly worse than those in the compliant group for both scoring systems (Table 3).

On further analysis of each group, using the Wilcoxon signed ranks test to compare the scores from the time of FAO application to the 6- to 9-month follow-up (Table 4), the Dimeglio scores for the compliant group improved significantly ($P = 0.005$). In the noncompliant group, the scores deteriorated, with statistically significant deterioration ($P = 0.001$) in the Dimeglio score. This indicated that the feet in the compliant group at least maintained their correction or even improved, while the feet in the noncompliant group deteriorated.

In the noncompliant group, six feet (43%) maintained the correction despite being noncompliant and needed no further treatment. Eight feet (57%) needed further treatment, which consisted of recasting with reapplication of the FAO in six patients and recasting with Achilles tendon lengthening (one tenotomy, one z-lengthening) and reapplication

TABLE 2. Comparison of Scores of Compliant vs. Noncompliant Feet at Time of FAO Application

Scoring System	Compliant Group	Noncompliant Group	P Value*
	Median (Range)	Median (Range)	
Dimeglio	3.5 (1.0–7.0)	4.0 (0.0–7.0)	0.33
Pirani	0.5 (0.0–2.0)	0.8 (0.0–2.0)	0.06

* $P < 0.05$ significant.

TABLE 3. Comparison of Scores of Compliant vs. Noncompliant Feet at 6 to 9 Months of Follow-Up

Scoring System	Compliant Group	Noncompliant Group	P Value*
	Median (Range)	Median (Range)	
Dimeglio	1.0 (1.0–8.0)	6.0 (4.0–15.0)	0.001
Pirani	0.5 (0.0–1.0)	1.0 (1.0–6.0)	0.006

*P < 0.05 significant.

of the FAO in two patients. Of these, four were compliant with the FAO and showed improvement in scores, one was noncompliant again and showed deterioration of scores again, and three feet were lost to follow-up. The number of patients in these groups was too small for statistical analysis. None of the patients in the compliant group required further treatment.

DISCUSSION

The Ponseti technique has been shown to be effective at both short- and long-term follow-up.^{1,3,5–8} The proper use of this technique can be logically divided into two phases. The first is the correction phase, during which the deformity is corrected by serial manipulation and casting. The second phase is the maintenance phase, during which the correction obtained by the casts is maintained in the growing foot. During this phase there is a risk of recurrence that persists over the first several years of life.⁷ When a recurrence occurs, it often requires additional treatment, which may consist of further casting or surgery. To minimize the recurrence rates, Ponseti recommended that once the correction was obtained with the casts, the feet should be placed into the FAO, which should be used for 3 to 4 years.^{5,7,8} Following these instructions clearly demands a lasting commitment on the part of the parents. It usually entails extra time each night at bedtime to apply the shoes and often requires skillful negotiations with an obstinate toddler to allow this. If parents are to tolerate and comply fully with this sometimes-challenging prescription, it is important that its impact be documented and quantified.

We found a significant rate of noncompliance (30%) among our first patients treated with the Ponseti technique. This prompted us to study the effects of not complying with the use of the FAO to better understand its impact on the outcome.

On the analysis of the patients in the noncompliant group, we found that six of the nine became noncompliant within the first 6 months of application of the FAO. The remaining three were found to be noncompliant at the 6- to 9-month visit. Six of the 14 feet needed no further treatment and continued to maintain their correction. Of the remaining eight feet, six were recasted and restarted on the FAO. Two feet needed an Achilles tendon lengthening; this was a percutaneous tenotomy in one case and an open z-lengthening in the other due to the patient’s advanced age. All these feet were subsequently restarted with the FAO.

In the group that was recasted and restarted with the FAO, one patient (two feet) was lost to follow-up, and one was noncompliant again and had deterioration in scores again. One patient was compliant with the FAO for 13 months after being restarted on it and then became noncompliant again; however, his correction continues to be maintained. The remaining four feet were compliant and showed an improvement in the scores, which is being maintained. Although the numbers in this group were too small for statistical analysis, it reinforces our impression that compliance with the FAO is important for maintenance of the correction.

One shortcoming of this study was the fact that the compliance was measured on the basis of the history obtained from the parents. Although the data were collected prospectively, its accuracy relied on reporting from the parents, which could be flawed. Another limitation of this study is clearly the duration of follow-up. Although we were able to recognize the early recurrences in the noncompliant group, it is possible that recurrences could occur later on in the compliant group, either during the period of part-time use of the bar or after the bar is discontinued. Finally, the measures obtained described only the position and flexibility of the feet; this does not necessarily reflect the patients’ function or satisfaction with the treatment.

Our study looked at results in compliant and non-compliant patients. At the initiation of treatment, the groups were comparable. All feet had the same treatment, including a similar number of casts and tenotomies. They had similar scores when they were placed in the FAO, but patients who were not compliant with the recommended use had significant deterioration of their scores. In contrast, the feet of the compliant patients stayed well corrected and even showed some improvement. We therefore feel that the proper use of the FAO is essential for the treatment of idiopathic clubfeet using the Ponseti technique and is clearly warranted, despite the demands it places on the parents.

TABLE 4. Change in Score from Time of Application to 6 to 9 Months of Follow-Up

Scoring System	Compliant Group			Noncompliant Group		
	Application	Follow-up	Change*	Application	Follow-up	Change*
	Median	Median	Median (Range)	Median	Median	Median (Range)
Dimeglio	3.5	1.0	+1.5 (–6 to 6)† (improved)	4.0	6.0	–1.5 (–15 to 2)† (worsened)
Pirani	0.5	0.5	0.0 (–0.5 to 1.5)	0.8	1.0	0.0 (–6 to 1.5)

*Change = Score at application – score at follow-up.
 †P < 0.05 significant.

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