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A Comparison of Two Nonoperative Methods of Idiopathic Clubfoot Correction: The Ponseti Method and the French Functional (Physiotherapy) Method

By B. Stephens Richards, MD, Shawne Faulks, RN, CNS, Karl E. Rathjen, MD, Lori A. Karol, MD, Charles E. Johnston, MD, and Sarah A. Jones, PT, MSPT

Investigation performed at the Texas Scottish Rite Hospital for Children, Dallas, Texas

Background: In the treatment of idiopathic clubfeet, the Ponseti method and the French functional method have been successful in reducing the need for surgery. The purpose of this prospective study was to compare the results of these two methods at one institution.

Methods: Patients under three months of age with previously untreated idiopathic clubfeet were enrolled. All feet were rated for severity prior to treatment. After both techniques had been described to them, the parents selected the treatment method. Outcomes at a minimum of two years were classified as good (a plantigrade foot with, or without, a heel-cord tenotomy), fair (a plantigrade foot that had or needed to have limited posterior release or tibialis anterior transfer), or poor (a need for a complete posteromedial surgical release). Two hundred and sixty-seven feet in 176 patients treated with the Ponseti method and 119 feet in eighty patients treated with the French functional method met the inclusion criteria.

Results: The patients were followed for an average of 4.3 years. Both groups had similar severity scores before treatment. The initial correction rates were 94.4% for the Ponseti method and 95% for the French functional method. Relapses occurred in 37% of the feet that had initially been successfully treated with the Ponseti method. One-third of the relapsed feet were salvaged with further nonoperative treatment, but the remainder required operative intervention. Relapses occurred in 29% of the feet that had been successfully treated with the French functional method, and all required operative intervention. At the time of the latest follow-up, the outcomes for the feet treated with the Ponseti method were good for 72%, fair for 12%, and poor for 16%. The outcomes for the feet treated with the French functional method were good for 67%, fair for 17%, and poor for 16%.

Conclusions: Nonoperative correction of an idiopathic clubfoot deformity can be maintained over time in most patients. Although there was a trend showing improved results with use of the Ponseti method, the difference was not significant. In our experience, parents select the Ponseti method twice as often as they select the French functional method.

Level of Evidence: Therapeutic Level II. See Instructions to Authors for a complete description of levels of evidence.
The Ponseti method consists of weekly manipulation and casting of the clubfoot until the foot is externally rotated. This usually requires three to five cast changes. Once external rotation is achieved, a percutaneous tenotomy of the heel cord is performed, usually in the clinic, to gain dorsiflexion of the ankle, and a final cast is worn for three weeks. A brace to maintain correction is then fitted and worn as described by Ponseti.

The French functional method consists of daily manipulations of the newborn's clubfoot, stimulation of the muscles acting on the foot to maintain the reduction achieved by the passive manipulation, and temporary immobilization of the foot with nonelastic adhesive strapping. The daily treatments are continued for approximately two months and are then progressively reduced. Improvement occurs within the first three months of treatment and is achieved at a rate slower than with the Ponseti method.

Despite different approaches to the correction of the deformity, both methods have been shown by magnetic resonance imaging to be effective in achieving and sustaining bone and joint alignment in the foot. Both methods have demonstrated satisfactory short-term outcomes with a reduction in the need for extensive surgery. Neither has been shown to be superior, and we know of no study that has directly compared the clinical outcomes of the two methods in patients treated at one center.

We began using the French functional method in 1996 after having received formal training from Professor Alain Diméglio and his physical therapy staff. In 1999 to 2000, after the orthopaedic staff from our institution received formal training from Professor Ignacio Ponseti, we began using the Ponseti casting method. Subsequently, both treatment techniques have been utilized regularly for nonoperative correction of clubfoot deformity at our institution.

The purpose of this study was to compare prospectively the clinical outcomes in patients with an idiopathic clubfoot deformity treated at one institution by either the Ponseti casting method or the French functional method. Our goals were to determine (1) the initial correction achieved with each method, (2) the frequency of relapses that occurred, (3) whether one method achieved better clinical outcomes after a two-year minimum follow-up period, and (4) whether rating the severity of the clubfoot deformity before treatment was predictive of the clinical outcome after a minimum follow-up of two years.

Materials and Methods

The design of this investigation was a prospective, nonrandomized, parent-selected treatment study to compare two methods of nonoperative treatment of clubfoot deformity. After institutional review board approval was received in February 2001, all patients under three months of age with a previously untreated idiopathic clubfoot deformity were prospectively enrolled into the study, and their data were added into our clubfoot research database. Teratologic and paralytic clubfoot deformities were not included. At the initial presentation of the patient and family to the clinic, a thorough objective discussion was undertaken between the treating orthopaedic surgeon and the parents during which time both treatment methods were described in detail in a nonbiased fashion. We had initially planned to randomize the patients into either the Ponseti casting method or the French functional method. However, because of transportation and distance concerns that precluded daily visits for some families, randomization was not possible as there would have been substantial loss of patients from the French functional method group as daily treatments are required. Therefore, after being educated about both treatment methods, the parents selected the program for their child. The treatment programs were then carried out at the same pediatric orthopaedic hospital. Physicians manipulated and positioned the feet for all plaster casts for the Ponseti method, while the physical therapists performed the serial manipulations, taping, and splitting of the feet in patients who were treated with the French functional method. Once treatment was started, adherence to the protocol for each method was strict until correction of the foot was achieved. Seven orthopaedic surgeons were involved with the treatment of the patients who are included in this study.

On completion of the Ponseti cast treatments, all infants were placed in an abduction orthosis (open-toed straight-last shoes with a Denis Browne bar) to prevent recurrence of the deformity. Detailed instructions for brace wear, including assessment of the skin condition, were discussed with the parents. The brace was worn full-time for three months, with a return visit each month, and then at nighttime until the age of two years (with return visits scheduled every three months). To ensure maximum parental compliance, the nurse coordinator's contact information was provided and, if a visit was missed, the family was contacted by telephone or certified mail.

For those treated with the French functional method, continued follow-up was regularly undertaken by the physical therapists with visits to the orthopaedist every three months. After correction of the foot was achieved, the taping was continued by the parents and an Aquaplast splint (Patterson Medical, Bolingbrook, Illinois), fashioned by the therapist, was used to maintain the corrected position. If visits were missed, the family was contacted by telephone or certified mail.

Prior to the initiation of any treatment, all feet were rated, with use of the clubfoot severity scale described by Diméglio et al., by either orthopaedic surgeons or physical therapists experienced with the rating system. The Diméglio scale ranges from 0 to 20, with 0 indicating a normal foot. A clubfoot deformity with a rating of ≤5 was classified as benign; 6 to 10, as moderate; 11 to 15, as severe; and 16 to 20, as very severe. No foot in this study had the initial severity rated as benign. The Diméglio severity scale has been shown to be reliable and reproducible in previous intraobserver and interobserver studies. Therefore, no further efforts were made within our institution to test the rating system for intraobserver or interobserver reliability, or reproducibility.

Patient outcomes were defined as good (a plantigrade foot achieved either with or without a percutaneous heel-cord tenotomy), fair (a plantigrade foot that required, or was scheduled for, a limited posterior release, a tibialis anterior tendon transfer, and/or a lateral column shortening), or poor (a plantigrade foot that...
required, or was scheduled for, a complete posteromedial release). With regard to those with a fair outcome, a limited posterior release was performed, if needed, when persistent ankle equinus remained despite a previous percutaneous heel-cord tenotomy. The tibialis anterior tendon transfer was performed when there was persistent, strong, active supination of the foot. The lateral column shortening was performed for persistent forefoot adduction and was not accompanied by a medial release. These procedures may have been performed individually, or in combination.

For a patient to be included in this study, a minimum of two years of clinical follow-up was required. A total of 267 feet in 176 patients treated with the Ponseti method and 119 feet in eighty patients treated with the French functional method met the inclusion criteria and are reported in the present study. The Results section includes the analysis of all 386 feet in these 256 patients. The fact that 130 of the 256 patients had bilateral clubfoot was recognized, and analyses with use of both feet and with only the most severely affected foot were performed. The analyses for the two approaches are contrasted in the Results section.

An additional fifty-seven patients (seventy-seven feet) with idiopathic clubfoot deformity would also have qualified for inclusion in this study but were lost to follow-up before reaching the two-year minimum follow-up requirement. The reasons included not returning despite our repeated attempts to contact them (forty-eight patients), moving out of state (seven patients), changing physicians (one patient), and death unrelated to the clubfoot deformity (one patient). The data on these patients are not reported in the present study; however, at the time of the last recorded visit, seventy-three of these seventy-seven clubfoot deformities had achieved satisfactory initial correction and had an early outcome rated as good.

We evaluated compliance with the bracing protocol following cast treatment because it is the most important risk factor for relapse. Previous investigators have defined noncompliance as complete discontinuation of the brace, as not wearing the brace for the number of hours prescribed, and as anything less than full-time brace use for three months followed by at least nine months of nighttime and naptime use. Acknowledging that the reliability of determining compliance is questionable when it is based on parent reporting, we defined noncompliance as not wearing the brace for at least 75% of the number of hours prescribed, as reported by the parents.

Statistical Analysis

The Fisher exact test methods for contingency tables were used to compare distributions of proportions between two groups. Simultaneous 95% confidence intervals for differences in rates were calculated for pairs of groups. For comparison of the means of two groups, the Satterthwaite version of the two-sample t test was used so that equal variances would not be required. For comparison of the means of three groups, a one-way analysis of variance was run, and Tukey multiple comparisons were performed to create confidence intervals for pairwise differences. Ninety-five percent confidence intervals of all relevant differences were calculated, whether a difference was or was not significant. A p value of <0.05 was required for significance.

Results

The patients were followed for an average of 51.4 months (range, twenty-four to seventy-nine months). The Diméglio clubfoot severity score averaged 12.1 (range, 7 to 19) for the Ponseti group and 12.8 (range, 7 to 18) for the French functional group. As this difference was not significant (p = 0.28; 95% confidence interval, −1.6 to 3.0), both groups were considered to be similar before treatment.

Of the 267 feet treated with the Ponseti casting method, 73% (194) received a primary percutaneous heel-cord tenotomy to achieve ankle dorsiflexion. One hundred and eighty-three of the 194 tenotomies were performed during the initial cast treatment program. The remaining eleven primary tenotomies were performed following recasting for a relapse. A secondary percutaneous heel-cord tenotomy was performed in twenty-one feet that experienced a relapse. In the 119 feet treated with the French functional method, 32% (thirty-eight) received a percutaneous heel-cord tenotomy. Of the thirty-eight percutaneous tenotomies performed in the French method, fourteen were performed within the first three months of treatment, twelve were performed between four and six months of treatment, and twelve were performed at seven months of treatment or later. The reason for the delay in performing the tenotomies in many patients is that the initial protocol of the French physiotherapy program intentionally avoided lengthening of the gastrocnemius-soleus complex to preserve strength.

Initial Correction to a Plantigrade Foot Position

Ponseti Casting Method

When the cast treatments of the 267 feet were completed, the initial correction rate was 94.4%, with 252 feet considered by the treating physicians to have sufficient correction to allow application of the brace (shoes with the Denis Browne bar). Of the fifteen feet that had not achieved satisfactory initial correction, eight were changed to the French functional method because of difficulties encountered with the Ponseti casting method (i.e., circulation compromise when the cast was applied to the foot following heel-cord lengthening or an inability to achieve sufficient dorsiflexion even after heel-cord lengthening), five failed because casts could not be kept on the feet, and two failed because the parents removed the casts and did not allow recasting. The eight feet in which the treatment was changed to the French functional method were considered to have early acceptable results, but only two continued with good outcomes. Therefore, of the fifteen feet that did not achieve satisfactory initial correction, thirteen required surgery to achieve a plantigrade foot position (the outcome was fair for two and poor for eleven feet).

French Functional Method

Within the first three months of treatment, the initial correction rate for the 119 feet was 95%, with 113 feet considered to have achieved satisfactory initial clinical correction. Two of the six feet that failed initial correction were changed to the cast program because of slow progress. These two feet achieved satisfactory initial correction but later had a relapse. All six feet
that failed initial correction eventually required a posteromedial release.

During the study period, percutaneous tenotomy was infrequently performed in the 119 feet managed with the French method. The small number (thirty-eight feet) that had a heel-cord tenotomy had responded poorly to the stretching program. No significant difference in outcome was detected among the feet that had a tenotomy within the first four months of treatment, the feet that had a tenotomy after four months of treatment, or the feet that had no tenotomy.

Relapses Following Initial Correction

Ponseti Casting Method (Fig. 1)

As noted above, satisfactory initial correction was obtained in 252 of 267 feet. However, ninety-three (37%) of the 252 feet had a relapse within the first two years to a position that was not considered acceptable. Of the ninety-three feet, forty-five were again treated with use of the Ponseti program, twenty-two had nonoperative treatment with the French method, and the other twenty-six feet were thought by the treating physician to need surgical correction (the outcome was fair for nine and poor for seventeen feet). Of the forty-five feet that were again treated by Ponseti casting, forty-two responded well. Three of the forty-five feet were deemed to need surgery (the outcome was fair for one foot and poor for two feet). Of the forty-two feet that responded to a second series of Ponseti casting, twenty-two again had a relapse because of a lack of brace compliance. Twelve of the twenty-two feet that had a second relapse were treated with surgery (the outcome was fair for seven and poor for five feet). Five of the twenty-two feet were changed to the French method (the outcome was good for two feet, fair for two feet, and poor for one foot). Five of the twenty-two feet were treated with a third series of Ponseti casting. Of the five feet, two responded well to casting and three had a relapse and needed surgery (the outcome was fair for one foot and poor for two feet).

Of the twenty-two feet that relapsed following primary treatment with the Ponseti method and were changed to the French method of treatment, eleven had a good outcome and eleven required operative intervention (the outcome was fair for eight and poor for three feet).

One hundred and fifty-nine of the 252 feet that had achieved initial correction did not relapse during the first two years of follow-up. Of the 159 feet, three subsequently had a recurrence of the deformity after the brace was discontinued when the patients were two years old. These three feet required operative correction (the outcome was fair for two feet and poor for one foot).

Although 94.4% (252) of the 267 clubfeet treated with the Ponseti method initially achieved correction sufficient for brace application, relapses occurred over time despite intense parent education and efforts by the medical team. As noted
Comparison of the Ponseti Method and the French Functional Method

With an average of 51.4 months of follow-up, the feet managed with the Ponseti method demonstrated a trend toward a better clinical outcome compared with those managed with the French functional method (p = 0.31) (Table I). Good outcomes were slightly more common in the Ponseti treatment program. This higher proportion is thought, in part, to be due to the higher frequency of primary heel-cord tenotomies that were performed in the Ponseti program. However, the difference between good outcomes, as well as fair and poor outcomes, for the two methods was not significant. More posterior releases were required in the group managed with the French physiotherapy method over time because of persistent ankle equinus (fewer percutaneous heel-cord tenotomies were performed in this group). This finding was reflected in the higher percentage of fair outcomes in the French functional program. Poor outcomes (the need for a posteromedial release) occurred with the same frequency (16%) in both groups.

Comparisons of Outcomes on the Basis of the Clubfoot Severity Rating Before Treatment

Outcomes for both methods of treatment were analyzed for each of the pretreatment initial severity scores (moderate, severe, or very severe)\(^2\). The clinical outcomes for the feet treated with the Ponseti method and for the feet treated with the French functional method are shown in Tables II and III, respectively. Ninety-five percent confidence intervals on the differences between the percent outcomes for the two methods are provided in Table III. The majority of feet in both treatment groups fell initially within the severe subgroup, followed by the moderate and very severe subgroups.

For patients in the moderate subgroup, clinical outcomes were nearly identical between the two treatment methods (p = 0.92), as was true for the severe subgroup (p = 0.15). For patients in the very severe subgroup, there was a trend toward more favorable clinical outcomes in the feet treated with the Ponseti method but it was not found to be significant (p = 0.19), likely because of the limited number of feet in the French subgroup.

When the subgroups (moderate, severe, or very severe deformity) were compared with one another within each treatment method, they were found to be significantly related to the overall clinical outcomes (p = 0.01 for the Ponseti method and p = 0.002 for the French method). The more severely involved the foot, the higher the likelihood of a worse outcome. For the Ponseti group, the differences in outcomes were sig-

### Table I: Outcomes Two Years or More After Treatment of Clubfoot Deformity with the Ponseti or French Method

<table>
<thead>
<tr>
<th>Treatment*</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponseti method (no. of feet)</td>
<td>193 (72%)</td>
<td>32 (12%)</td>
<td>42 (16%)</td>
</tr>
<tr>
<td>French method (no. of feet)</td>
<td>80 (67%)</td>
<td>20 (17%)</td>
<td>19 (16%)</td>
</tr>
<tr>
<td>95% confidence interval for differences in rates between the Ponseti and French methods</td>
<td>−5% to 15%</td>
<td>−3% to 14%</td>
<td>−8% to 9%</td>
</tr>
</tbody>
</table>

*The group managed with the Ponseti method included 267 feet in 176 patients, and the group managed with the French method included 119 feet in 80 patients.
significant when the feet with a moderate deformity were compared with the feet with a very severe deformity ($p = 0.003$) and when the feet with a severe deformity were compared with the feet with a very severe deformity ($p = 0.02$), but not when the feet with a moderate deformity were compared with the feet with a severe deformity ($p = 0.31$). For the French functional group, the differences in outcomes were significant when the feet with a moderate deformity were compared with the feet with a very severe deformity ($p = 0.002$) and when the feet with a severe deformity were compared with the feet with a very severe deformity ($p = 0.003$), but not when the feet with a moderate deformity were compared with the feet with a severe deformity ($p = 0.198$).

**Compliance with Bracing in the Ponseti Method**

When questioned by a nurse, parents reported the brace was used <75% of the prescribed time for 153 (61%) of the 251 feet (information was not available for one foot). This occurred despite repeated frequent emphasis placed on the importance of brace wear and descriptions of why bracing was necessary. Not infrequently, the parents responded that bracing made the child fussy or limited their movement. The clinical outcomes of these 153 feet are shown in Table IV. Those who complied with the prescribed brace wear program had a significantly different outcome pattern than those who were not compliant ($p < 0.0001$). The 95% confidence intervals show that the compliant patients were more likely to have good and fair outcomes, but there was no significant difference in the rates of poor outcomes. Nevertheless, two-thirds of the feet for which brace wear was deemed to have been noncompliant experienced good outcomes after a minimum follow-up of two years.

For twenty-three feet that had not been compliant with brace wear, less external rotation was placed into the brace in an effort to improve tolerance (eight of these feet had had recasting because of a relapse). Twenty of these twenty-three feet remained noncompliant with brace use despite the decreased external rotation. Nevertheless, eighteen of the twenty-three feet had a good outcome and two had a fair outcome.

Another twenty-three of the 251 feet were transitioned to taping and splinting as they did not tolerate bracing following the casting. Five of the twenty-three feet had severe skin problems with use of the brace. Of these twenty-three feet, twelve had a good outcome, eight had a fair outcome, and three had a poor outcome.

**Correlated Data for Patients with Bilateral Clubfoot**

For the 130 patients with bilateral clubfoot deformity, 93% had similar initial severity scores (a difference of 2 points) for both feet. Eighty-eight percent of them had the same outcome (good, fair, or poor) in both feet. Two sets of analyses were carried out, one with all 386 feet (as presented above) and one with only 256 feet. In the latter case, the second foot with the worst initial severity score was used in the analyses. If both feet had identical initial severity scores, one foot was randomly selected. The results for the two sets of analyses were nearly identical. The primary reason for this is that the percentage of

<table>
<thead>
<tr>
<th>Initial Severity</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate (n = 22)</td>
<td>19 (86%)</td>
<td>1 (5%)</td>
<td>2 (9%)</td>
</tr>
<tr>
<td>Severe (n = 85)</td>
<td>58 (68%)</td>
<td>16 (19%)</td>
<td>11 (13%)</td>
</tr>
<tr>
<td>Very severe (n = 12)</td>
<td>3 (25%)</td>
<td>3 (25%)</td>
<td>6 (50%)</td>
</tr>
</tbody>
</table>

95% confidence interval for differences in rates between the Ponseti and French methods:
- Moderate: −34% to 42%
- Severe: −7% to 25%
- Very severe: −5% to 35%

<table>
<thead>
<tr>
<th>Duration of Brace Use</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;75% of time prescribed (n = 98)</td>
<td>89 (91%)</td>
<td>5 (5%)</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>&lt;75% of time prescribed (n = 153)</td>
<td>101 (66%)</td>
<td>25 (16%)</td>
<td>27 (18%)</td>
</tr>
</tbody>
</table>

95% confidence interval for differences in rates between group with compliance of >75% and group with <75%: 8% to 34%, 5% to 31%, −14% to 20%
patients with bilateral clubfoot deformity within each treatment group was nearly the same. Of the 176 patients treated with the Ponseti method, 51.7% had bilateral clubfoot deformity. Of the eighty patients treated with the French functional method, 48.8% had bilateral clubfoot deformity. As a result, neither treatment method gained a statistical advantage by having more patients with bilateral clubfoot deformity, particularly since both feet in each patient with bilateral deformity were essentially identical in terms of severity. We believe that including all 386 feet in the Results section is more representative of the overall clinical presentation.

Discussion

This study provides further confirmation that the return to nonoperative primary treatment for clubfeet in recent years has been warranted, regardless of whether the Ponseti method or the French functional method is utilized. Although the approach to the correction of the clubfoot deformity varies with each method, a high percentage of idiopathic clubfoot deformities can be corrected without the need for extensive surgery.

We found that the initial correction rates of the clubfoot deformities were high with both methods (94.4% with Ponseti
casting and 95% with the French functional method). This is consistent with the recent literature in which several short-term studies with use of the Ponseti method found initial correction rates in the range of 90% to 100%\(^{13,18,19}\). Recently, at an international symposium in Iowa on the management of clubfeet, numerous papers noted initial correction rates of >95% with use of the Ponseti technique. When all of the cases presented at that meeting were totaled (almost 10,000), the overall initial correction rate was 94.8%\(^{17}\). Therefore, it appears reasonable that the clinician should expect that the idiopathic clubfoot deformity in an infant can be corrected initially with use of nonoperative methods, acknowledging that there will be some exceptions.

On the other hand, maintenance of correction has proven to be more challenging. Ponseti outlined a program to use after cast treatment, which consists of bracing the feet in the externally rotated position full-time for the first three months and then at nighttime and during naps until the child is two to four years of age. Numerous reports have listed noncompliance with this program as the primary reason for the occurrence of relapses, and the present study substantiates that fact\(^{1,3,5,18,19}\). Providing assistance to the parents and other caregivers in an effort to achieve maximum compliance with the bracing program has been emphasized at our institution, and it includes having the clinic nurse and the orthotist give clear instructions on brace wear and provide contact information should the parents need advice or assistance. Frequent follow-up is undertaken, with families returning to clinic appointments every month during the three-month period of full-time brace wear and then quarterly during the part-time brace wear. Telephone calls are made and certified letters are sent when appointments are missed. The introduction of a removable Denis Browne bar makes it easier to put shoes on and off and theoretically reduces possible skin complications. The bar has a spring-loaded latch, which locks into the reciprocating attachment on the sole of the shoe (Figs. 2-A and 2-B). Problems that are encountered with shoe wear, such as blisters or the foot slipping out of the shoe, are addressed immediately. If deep blisters preclude the use of bracing, correction is maintained with use of taping or splinting until braces can be resumed. Despite this proactive follow-up program, we found that over time bracing was used <75% of the prescribed time in 61% of the feet, and this noncompliance probably contributed to the 37% prevalence of relapses in our patients treated with the Ponseti method. However, as 66% of the feet in the group considered to be noncompliant obtained a good outcome, we remain uncertain as to what the minimal amount of time actually spent in braces is needed to achieve a successful outcome. We continue to encourage parents to follow Ponseti’s recommendations through the first two years of the child’s life.

With the French method, the patient is closely followed by the physical therapist in a fashion similar to that described above for the Ponseti method. The orthopaedist sees the child every month during the early treatment period and then quarterly once the maintenance program is initiated. The success of the French method is dependent on the parents who must learn the technique and reliably perform the stretching, taping, and splinting on a daily basis for up to two years. Despite the substantial effort to train parents to the task, we still experienced relapses in 29% of the clubfeet treated with this method. Overall, 33% of the patients treated with this method required operative intervention. However, this represents an improvement from our earlier experience with the French method in which 29% of the feet required posterior releases and 20% required posteromedial releases\(^{13}\).

We found that incorporating the techniques of both methods in the same patient was helpful in several situations. For example, after the first several years of this study, it became clear that avoiding an early heel-cord tenotomy in all patients treated with the French method resulted in a persistence of a mild midfoot rocker-bottom deformity in some patients. Although the initial correction clinically appeared satisfactory, as these children approached eighteen months of age, or older, it was evident that a posterior release was needed. As a result, later in this study, percutaneous heel-cord tenotomies followed by three weeks of casting (as performed commonly in the Ponseti method) became more common. Likewise, a number of feet treated with the Ponseti method could not tolerate the corrective shoes following the cast program but did tolerate the taping program to maintain their correction. This crossover between methods has proven beneficial and will continue to be used when appropriate.

It is important to acknowledge that some patients with a clubfoot deformity either do not respond to nonoperative treatment or undergo a relapse of the deformity despite additional attempts at nonoperative treatment. When this occurs, a posteromedical release is needed to achieve and maintain a plantigrade foot. In this study, 16% of the patients underwent a posteromedical release. Other investigators have reported the need for either a posterior release or the more extensive posteromedial release in 24% of patients treated with the Ponseti method\(^{14}\). The need for a posteromedical release in other short-term reports has been noted to be very low, but, as shown in this report, is likely to increase as follow-up is extended\(^{13,18-19}\).

Studies on the French method in the literature have found that the need for extensive releases is even greater than that reported for the Ponseti method\(^{13,15,16}\).

The present study also demonstrated the value of rating the severity of the clubfoot deformity before treatment. Using the Diméglio scale, we found that the outcomes varied depending on the initial severity of the deformity. As would be expected, the feet with moderate deformity had the best outcome and were followed, in order, by those with severe and very severe deformities. This was consistent in both treatment methods. This information may be helpful in the initial discussions between physicians and parents when treatment options are considered.

Finally, when these two methods were directly compared, we identified a trend toward better results with use of the Ponseti method (Table 1). Unlike in the Ponseti treatment program, early heel-cord tenotomy was not performed regularly in the French functional program. This difference in the treatment methods may account for the above-mentioned trend, as those with persistent ankle equinus ultimately required a posterior release to achieve a plantigrade foot. As we now perform percutaneous heel-cord tenotomy routinely in the French
method, the differences shown between the two nonoperative methods in this report may diminish.

We continue to offer both methods to parents of these infants as we have found a high level of enthusiasm for each treatment program. In our experience, the Ponseti method is selected twice as often as the French method, with the selection frequently based on parental time and travel and/or transportation considerations, as well as on the increased expense associated with the greater frequency of visits required with the French method.12

References


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