Early results of a physiotherapist-delivered Ponseti service for the management of idiopathic congenital talipes equinovarus foot deformity

We studied 24 children (40 feet) to demonstrate that a physiotherapist-delivered Ponseti service is as successful as a medically-led programme in obtaining correction of an idiopathic congenital talipes equinovarus deformity. The median Pirani score at the start of treatment was 5.5 (mean 4.75; 2 to 6). A Pirani score of ≥5 predicted the need for tenotomy (p < 0.01). Of the 40 feet studied, 39 (97.5%) achieved correction of deformity. The remaining foot required surgical correction. A total of 25 (62.5%) of the feet underwent an Achilles tenotomy, which was performed by a surgeon in the physiotherapy clinic. There was full compliance with the foot abduction orthoses in 36 (90%) feet. Continuity of care was assured, as one practitioner was responsible for all patient contact. This was rated highly by the patient satisfaction survey.

We believe that the Ponseti technique is suitable for use by non-medical personnel, but a holistic approach and good continuity of care are essential to the success of the programme.

The standard treatment of an infant with a congenital talipes equinovarus deformity has undergone a dramatic change over recent years, with a marked swing away from the aggressive surgical approach that frequently seemed to follow the ‘traditional’ splinting regimens, towards an aggressive but still conservative method of management: the Ponseti technique.4

Recent publications5-8 confirm that success with this technique can be achieved outside its centre of origin. Obtaining good to excellent results, however, requires an understanding of the original description of the method of manipulation, casting and the use of orthotic supports,4,9,10 and an adherence to modifications of the technique that reduce the relapse rate and allow its use in a greater variety of age groups and aetiologies.11

Performed properly, the major resource required by the Ponseti technique is the time of a suitably-trained and experienced practitioner. In developed countries, traditionally this time has been supplied by paediatric orthopaedic surgeons with the assistance of paediatric orthopaedic surgeons with the assistance of physiotherapists, clinic nurses, platter technicians and orthotists as appropriate. However, the Ponseti technique has been successfully introduced into developing nations where medical personnel are in short supply, as shown by the Uganda and Malawi Club Foot Project. The results of the programme in Malawi,12 where the treatment is conducted by trained but non-medical orthopaedic clinical officers, showed that initial good correction was achieved in 98% of feet, with only 2% of treated feet requiring surgical correction. However, follow-up studies in such countries are difficult, and the authors made no comment on relapse rates.

In the current National Health Service (NHS) the time of an orthopaedic surgeon is relatively expensive and sometimes in short supply. The aim of this prospective study was to ascertain whether, in a central London NHS teaching hospital setting, the results from a physiotherapist-delivered Ponseti service could equal those obtained and reported by medically-trained personnel.

Patients and Methods

Since January 2003, all referrals to the senior author (DE) at the Royal Free Hospital pertaining to the management of a non-syndromic congenital talipes equinovarus deformity have been directed to a physiotherapist (NS). The physiotherapist is a clinical specialist with previous experience and training in neurodevelopmental paediatrics. In addition, she had worked with the senior author for a period of five years before the development of the Ponseti service, during which time she was respon-
sible for overseeing the pre- and post-operative care of babies with a congenital talipes equinovarus deformity. In 2002 she attended a Ponseti Technique Training Course.

During the initial consultation, an appropriate medical history was taken and a general clinical examination performed by the physiotherapist. Occasionally, an antenatal consultation took place. The treatment options were explained. If the family were in agreement with the Ponseti philosophy and treatment schedule as outlined in Table I, treatment was commenced within seven days.

Between January 2003 and October 2005, 41 feet in 25 children were seen and assessed. All feet had an idiopathic congenital talipes equinovarus deformity, although one also had a mild form of amniotic band syndrome. The first patient entered into the Ponseti programme defaulted early. Her parents accepted the treatment philosophy, but after application of the first cast they obtained another opinion and opted to follow the more conventional route (at that time) of ‘modified Ponseti splinting’, culminating with a peritalar release at eight months of age. The following results refer to the remaining 40 feet in 24 children (Table II). The median age at initial consultation and onset of treatment was 3 weeks (mean 4.3; 1 to 12).

All feet were scored using the Pirani method (Columbia Clubfoot Score)\(^13\) at presentation and at each subsequent attendance. In addition, during the second year of the programme an assessment of dorsiflexor/evertor muscle function was documented using a scoring system modelled on the Pirani scale (Table III).

Manipulation and casting was performed on a weekly basis by the physiotherapist, assisted by a qualified junior colleague, during progressive correction of the foot deformity. Once hyperabduction of the forefoot had been obtained, any residual equinus (defined as < 10˚ of dorsiflexion) was corrected by a percutaneous Achilles tenotomy. All tenotomies (except the two most recent cases performed by RB) were performed by the senior author (DE). An appropriate explanation of the surgical procedure was given to the parents and a consent form signed.

The tenotomies were performed in the physiotherapy clinic room. The first six were performed using only an injection of local anaesthetic (2 ml 1% lignocaine). Subsequent tenotomies were performed after the application of Ametop (local anaesthetic; Smith & Nephew, Hull, United Kingdom) cream alone.

Subjectively, the surgeon and physiotherapist considered that both methods gave similar overall pain relief, but for the surgeon, palpation of the tendon was easier without the local anaesthetic infiltration. A size 15 scalpel blade was used to perform the tenotomy through a stab incision on the medial aspect of the tendo Achilles. The wound was closed with a steristrip. All parents were advised to contact

### Table I. Physiotherapist-delivered congenital talipes equinovarus Ponseti programme

<table>
<thead>
<tr>
<th>Initial discussion of treatment options</th>
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<tr>
<td>Weekly manipulations and plaster applications (telephone call 24 hours after application of first plaster cast)</td>
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<tr>
<td>Achilles tenotomy as required, followed by a plaster cast for three weeks</td>
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<tr>
<td>Fitting of ‘boots and bars’ foot abduction orthoses (FAO) for full-time use</td>
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<tr>
<td>Telephone call and/or physiotherapy clinic review 24 hours after application of FAO</td>
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<tr>
<td>Review appointment one week after provision of FAO</td>
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<tr>
<td>Review appointment one month after provision of FAO</td>
</tr>
<tr>
<td>Review appointment three months after provision of FAO; change of regimen to night- and nap-time use only</td>
</tr>
<tr>
<td>Three-monthly physiotherapy clinic appointments until four years of age, to assess and to score foot shape and function, and change/alter FAO as necessary</td>
</tr>
<tr>
<td>Orthopaedic clinic review offered at six and 12 months</td>
</tr>
<tr>
<td>Orthopaedic assessment at two years for standing anteroposterior and lateral radiographs</td>
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Parents were encouraged to book additional clinic appointments to address any concern.

Open access to orthopaedic clinic was provided if required.

### Table II. Demographics of the children

| Number of feet:patients | 40:24 |
| Unilateral:bilateral (patients) | 9:15 |
| Males:females (patients) | 16:8 |
| Left:right (feet) | 18:22 |
| Median (range) age at presentation in wks | 3 (mean 4.3; 1 to 12) |
| Mean (range) number of casts per foot (no tenotomy group) | 3 (1 to 5) |
| Mean (range) number of casts per foot (tenotomy group) | 6 (3 to 10) |
| Mean (range) duration of follow-up in mths | 20.3 (6 to 36) |

### Table III. Dorsiflexor/evertor muscle function

<table>
<thead>
<tr>
<th>Grade</th>
<th>Muscle activity*</th>
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<tr>
<td>0</td>
<td>Sustained/normal toe dorsiflexion and foot eversion</td>
</tr>
<tr>
<td>0.5</td>
<td>Some toe dorsiflexion and/or foot eversion</td>
</tr>
<tr>
<td>1</td>
<td>No toe dorsiflexion or foot eversion</td>
</tr>
</tbody>
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* toe dorsiflexion and foot evertor movement noted in response to stroking the sole or the dorsum of the foot
the physiotherapist if there was any bloodstaining of the plaster cast.

Regardless of whether the foot had required a tenotomy or not, the regimen outlined in Table I was adhered to, with orthopaedic review encouraged at six and 12 months. Pirani scores and dorsiflexor/evertor muscle function were documented at every attendance. Radiological assessment was performed by obtaining standing anteroposterior and lateral radiographs when the child was two years of age (or earlier if there was any clinical concern).

All families were given information sheets including contact telephone numbers, and open access to either the paediatric orthopaedic clinic or to the physiotherapist was provided in cases of parental concern. A parent support group was also formed and informal meetings were encouraged. Apart from the tenotomy itself, all other interventions and patient contact were carried out by the physiotherapist, with the help of a junior colleague at the time of application of the plaster casts. An annual audit of parent satisfaction was carried out, and improvements to the service made where possible.

Results
Overall foot correction was obtained with a mean of five casts (1 to 10), and 25 feet in 16 children required an Achilles tenotomy. The median Pirani score at presentation for those feet requiring a tenotomy was 5.5 (mean 5.4; 4 to 6), compared with a median of 3.5 (mean 3.7; 2 to 6) for those not requiring tenotomy. A Pirani score of ≥ 5 at presentation was associated with the need for a tenotomy. Children who did not require a tenotomy (n = 15), needed a mean of 3 casts (1 to 5) to obtain full correction, whereas those having a tenotomy (n = 25) required a mean of 6 casts (3 to 10) plus the post-tenotomy cast.

At presentation of the 19 feet in which a dorsiflexor/evertor score was documented, only seven had poor muscle function. Two children (three feet) had undergone prior treatment in the form of splinting or casting.

Complications. At the time of the tenotomy no significant bleeding was noted and no bloodstaining of the cast occurred. There were no infections and no plaster sores. Only two of 197 casts applied needed to be changed early, one because the foot slipped and one because the cast split.

Failures. One child, whose father had had an excellent result following surgical release of a unilateral congenital talipes equinovarus deformity, was removed from the Ponseti programme immediately after undergoing the Achilles tenotomy, and did not wear his foot abduction orthosis. The foot relapsed and he underwent a limited open posterior release at the age of eight months.

Function. All remaining 23 children completed a minimum follow-up of six months. Of the 20 children aged 12 months or more, 15 are walking (mean age at walking 14.7 months; 11 to 18), three are cruising (walking around holding onto furniture) and two show a generalised developmental delay that requires physiotherapy input. At the latest follow-up (mean 20.3 months; 6 to 36) the median Pirani score was 0.5 (mean 0.75; 0 to 2). Assessment of the dorsiflexor/evertor muscle function had not changed with correction of the foot deformity, and three of 19 feet continued to have no active dorsiflexion or eversion.

Relapses. Two children (three feet) were only partially compliant with the foot abduction orthosis regimen and these were the only cases where there was a deterioration of the Pirani score with time (Table IV). No repeat plastering was required.

Radiological assessment. Eight children with ten affected feet had undergone radiological assessment at two years and all showed a satisfactory talocalcaneal relationship in both the anteroposterior and the lateral planes.

Patient satisfaction. In January 2004, at the end of the first year of this service, a patient satisfaction study was carried out. A total of 85% of the families gave a satisfaction rating of very high or high, with dissatisfaction being reserved for problems with the orthopaedic clinic. During this year the majority of patients had defaulted from the orthopaedic clinic appointments. In the survey, the ‘long wait’ to see the doctor and the ‘busy feel’ of the clinic were given as reasons for lack of attendance. As a result of this survey, the clinic appointments were made optional. Subsequent to this change, only one family had attended the six- or the 12-month appointment and then only for reassurance purposes. In January 2005 a second survey was performed, when patient satisfaction with the service was rated very high or high by all the families. Continuity of care was rated as ‘very important’ by all families. In the free text sections, the reassurance and the advice from the physiotherapist regarding motor development while the child was wearing the foot abduction orthosis was appreciated. No further adjustments or changes to the service have been made as a result of this survey.

Discussion
This was a small study, with a short follow-up, representing the learning curve of a clinical specialist physiotherapist in...
applying the Ponseti technique to children with idiopathic congenital talipes equinovarus deformities but with encouraging early results. Correction was achieved in all feet. Full correction was not maintained in four feet in three children owing to non-compliance with the foot abduction orthosis. One of these feet required a surgical release. In the published series success is defined as treatment that avoids a surgical soft-tissue release, and thus our success rate is 97.5% (39 of 40 feet), a figure that compares favourably with other series that quote success rates of 83% to 98%.7-9,11,12,14

Success rates have improved with modifications to the manipulation and casting technique, and this has encouraged physicians to expand the indications for the use of this treatment method.11 Many recent published series include a greater range of patients, including older children, the child with failed previous conservative treatment including prior Achilles tenotomy, and the child whose foot deformity is part of a generalised disorder.6,11,15 The severity of the deformity at presentation is not always stated. We do accept that this study included only idiopathic club feet. They presented early and had not been treated previously. We also agree that they were perhaps the feet most likely to obtain a successful result, but our median Pirani score of 5.5 (mean 4.75) suggests that they did have a severe deformity and all achieved correction. The mean number of casts per foot was in keeping with other studies.11,14,16 An accelerated programme that reduces the time between cast changes does reduce the total length of time in casts, but not necessarily the number of casts needed.14 Our overall tenotomy rate was low but not in the sub-group with a Pirani score > 5.

Recent publications5,6,11,16 have stressed the importance of compliance with the full Ponseti programme in terms of the continued use of the foot abduction orthosis in order to maintain the good results achieved by the manipulation/casting part of the programme. Non-compliance with the splinting programme is the most significant risk factor for recurrence of deformity.5 In other areas of the literature17-19 there is evidence to suggest that continuity of medical care improves compliance with treatment methods. Continuity of care correlates with increasing trust in the physician, as assessed by the Stanford Trust Study, and is related to the parent’s belief that the practitioner can and does care for more than just a single part of the child.20 We believe that the most important aspect of our programme is that all the care is delivered by a single practitioner, who knows the family and the child well at the time of application of the orthoses. The same practitioner is then actively involved in helping the child and the family cope with the prolonged treatment regimen, and is also able to give advice on developmental aspects of care and general health issues. In order to maintain this continuity, occasional alterations to the treatment programme were made to cope with absence of the physiotherapist. For example, a splint would not be applied to a child if the physiotherapist was unavailable for advice over the subsequent few days. We do appreciate that such one-to-one care may be difficult to maintain with service expansion, but we believe that it is essential to the success of the programme.

In the NHS setting, specialist medical time is often an expensive and scarce resource. Prior to the development of this physiotherapist-delivered Ponseti service, the management protocol for a congenital talipes equinovarus deformity at our hospital involved physiotherapy stretching and strapping, provided by the community services and overseen by the hospital physiotherapist, with a surgical release in those who failed to obtain a plantigrade and functional foot. With the increasing popularity of the Ponseti technique many surgeons have found that it is no longer necessary to perform many soft-tissue releases. However, their time is still taken up with the conservative management of these cases. With our physiotherapy-delivered service, the medical input is limited to one 45-minute session per patient (uni- or bilateral cases). Specialist physiotherapist resources are also scarce and their time should also be respected, but children with a congenital talipes equinovarus deformity are an important and challenging group to treat, and senior input is often required.

Our study agrees with the findings of Scher et al.21 who suggest that those feet presenting with a Pirani score of > 5 are highly likely to need an Achilles tenotomy. They also require more cast changes, and so the surgeon can to an extent be forewarned when they will be required. Our hypothesis had been that dorsiflexor/evertor muscle function would correlate with the risk of dynamic deformity once walking was established, and might predict the need for a tendon transfer. Currently, there is no suggestion that the three feet with a dorsiflexor/evertor score of 1 have a more dynamic deformity than those with a score of 0. With longer follow-up we hope to be able to study this further.

In the developing countries, tenotomies are undertaken by non-medical personnel.12,13 In the United Kingdom, although there has been an expansion in the use of surgical care practitioners, it may be difficult to develop acceptable guidelines for the training and supervision of non-medically trained personnel to perform an Achilles tenotomy on an infant. A large-gauge needle has been used to release tendon sheaths in the hand22 and has also been described for the tendon Achilles as a modification of the Ponseti technique.23 Perhaps such a technique may be more suitable and applicable for the non-medically trained personnel.

Our early results with a physiotherapist-delivered Ponseti service for the management of idiopathic congenital talipes equinovarus deformity are as good as those from other published series using medical personnel.7-9,11,14 We would agree with Tindall et al12 that “the Ponseti method is readily transferable to non-doctor practitioners”, but we believe that this philosophy should be followed in developed countries as well as the less developed ones. The most important factor is that these practitioners are appropriately trained and experienced. We believe that there is addi-
tional benefit in providing a service that emphasises total continuity of holistic patient care delivered by a single practitioner performing all interventions, apart from the tenotomy.

The authors thank Mr R. Brueton FRCS for allowing us to include two of his patients in this study, and for discussing his personal experiences of the Uganda and Malawi Club Foot Project with us.

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References