Ponseti management of clubfoot after walking age

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Background
The Ponseti method for the treatment of clubfoot has been shown to be effective in children up to 1 year of age, but the literature on its efficacy in older clubfoot patients still remains sparse. Even with this effective method, late-presenting cases are still challenging.

Objective
The purpose of this study was to evaluate the corrective effect of the Ponseti method on different components of clubfoot after walking age and to find how the patient's age relates to this correction.

Patients and methods
From 2005 to 2010, 17 feet of 12 patients with clubfeet were treated by the Ponseti method in Benha University and in pediatric specialized hospitals, with a mean age of 16 months (range 11–26 months). The mean follow-up period was 24 months (range 13–37 months). All patients were evaluated before and after treatment for the Dimeglio score. The corrections for each component of the deformity were analyzed separately.

Results
All deformities showed significant correction. Improvements for each separate component (varus, medial rotation of calcaneopedal block, and adductus) were found to be statistically significant. Painless, supple, plantigrade, and cosmetically acceptable feet were achieved in 14 (82%) clubfeet.

Conclusion
The Ponseti method is an effective method in correcting the deformities of clubfoot, even after walking age.

Keywords:
ponseti method, clubfood, children

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Introduction

With an incidence of 1–2 per 1000 live births, clubfoot is one of the commonest congenital deformities. Clubfoot is a major structural deformity that is easy to diagnose; however, late-presenting cases can still be a problem, especially in developing countries, because of poor access to health facilities. The goal of the treatment is to correct all components of the deformity so that the patient has a pain-free, plantigrade foot with good mobility, without calluses and without the need to wear special or modified shoes. There is a strong agreement that initial treatment of clubfoot should be nonoperative, especially in early cases. Nonoperative treatment of clubfoot provides a lower complication rate, less pain, and higher function compared with operative treatment [1–4]. The preferred method is manipulation and application of a plaster cast at weekly intervals. There are also reports favoring intense physiotherapy and strapping [5]. Of the conservative methods, the casting and manipulation method described by Ponseti had the greatest impact on the treatment of clubfoot, markedly reducing the need for extensive surgery [1,2,6]. Manipulation and serial application of casts, supported by limited surgical intervention, yielded satisfactory results in the great majority of patients [2,3,7–9]. Conservative methods should be initiated as early as possible to use the advantage of favorable fibroelastic properties of newborn feet. Ponseti states that the first 3 months offer a 'golden opportunity' to skilled and well-informed surgeons for correction of clubfoot [6,9]. The Ponseti method of casting is reported to have 100% success with babies younger than 7 months old [10] and to be effective in treatment of children up to 12 months of age [9]. Although there has been a great shift from extensive surgery to conservative methods, the success of treatment for late-presenting cases is not yet clear. The aim of this study was to evaluate the corrective effect of the Ponseti method after walking age and to examine how this method alters the separate components of clubfoot and whether the child's age is related to this correction.

Patients and methods

A total of 17 feet of 12 patients with late-presenting clubfoot treated with the Ponseti method from June 2005 to December 2010 in Benha University and pediatric specialized hospitals were included. Patients

with arthrogryposis, other congenital anomalies, or neuromuscular clubfeet were excluded from the study. Patients were physically examined, and the Dimeglio scores were recorded before treatment [11,12]. The mean age of the patients at presentation varied from 11 to 26 months (average 16 months). Ten of the patients were male and two were female; five of the patients were bilateral. The total number of castings per foot was 10 (range 8–12 casts). The average time for cast renewal was 7.8 days (range 6–10 days) for all patients. After the casting was completed, percutaneous Achilles tenotomy or posterior release was performed in all feet.

For the treatment, the manipulation and casting technique described by Ponseti was strictly applied to all patients. All deformities, except equines, were corrected simultaneously.

Correction of the relative pronation of the first metatarsal and cavus was carried out by supinating the foot maximally; this brought the first metatarsal in line with varus hindfoot. While performing this maneuver, dorsiflexion was carefully avoided. After hindfoot and forefoot came to proper alignment, adduction was corrected by abducting the supinated foot by applying counter pressure with the thumb pressing to the lateral aspect of the head of the talus. Feet were gradually abducted until they became plantigrade. As described by Ponseti, during this process, the head of the talus is covered by the navicular, supination of the foot decreases, and calcaneus abducting with cuboid simultaneously everts correcting the hindfoot varus. After the correction of foot adduction and heel varus, we tried to correct equinus. Percutaneous Achilles tenotomy or posterior release was performed in all patients. An above-knee plaster was applied to all patients. Casts were changed at varying intervals between 6 and 10 days; the duration was longer in older children.

Long-leg cast was applied in full correction for 3 weeks after tenotomy. Subsequently, the patients were fitted with a foot-abduction brace for 3 months on full-time basis — that is, 23 h a day. The foot-abduction brace consisted of a Dennis Browne bar and straight-end shoes. The shoes were turned to 70° of external rotation in bilaterally affected children and to 70° of external rotation for the clubfoot and 45° of external rotation for the normal foot in unilaterally affected clubfoot. After 3 months, foot-abduction braces were worn by these patients during nap time and night only. All patients were followed up at 3-month intervals after the completion of the manipulation and casting therapy.

Compliance was assessed as reported by the parents, and all children were compliant with the brace.

Results

All feet were evaluated according to the Dimeglio scoring system before and after the completion of treatment. The Dimeglio scoring system evaluates equinus, varus, and medial rotation of the calcaneopedal block, adductus, presence of posterior crease and medial crease, and cavus as the components of the deformity. Each component of the deformity was recorded to analyze the efficiency of treatment. The final Dimeglio score was applied at the most recent visit of the patient.

The Dimeglio score [Table 1] was improved in all feet significantly (P = 0.0001). In all, 16 feet (94.1%) were evaluated as grade 3 and one foot (5.9%) as grade 4 before treatment. In the last evaluation, 14 feet (82.3%) were scored as grade 1 and three feet (17.7%) as grade 2 [Table 2].

Equinus

All equinus deformities were corrected with treatment. A child's age was not significantly associated with the correction of the equinus deformity.

Varus deformity

Varus deformity was found to be significantly improved in all patients. The varus deformity was scored as 2 points in 11 feet (64.5%) and as 3 points in six feet (35.5%). After treatment, the scores improved to 0 point in 10 patients (58.8%) and 1 point in seven patients (41.2%) [Table 3].

Medial rotation of the calcaneopedal blocks

The improvements before and after treatment were significant. Medial rotation of the calcaneopedal block was graded as 3 in seven feet (41.2%) and as 2 in 10 feet (58.2%) before treatment, and these scores improved to 0 in nine feet (53%) and 1 in eight feet (47%) [Table 4].

Adductus

The improvements before and after treatment were statistically significant. All feet were scored as 3 and then improved to 1 in 11 feet (64.7%) and to 2 in six feet (35.3%) [Table 5].

Posterior crease, medial crease, cavus

Posterior crease, medial crease, and cavus, which were present in all feet, disappeared after treatment.

No recurrence was noted during the first follow-up — that is, 3 months after the percutaneous tenotomy. On subsequent follow-up, two patients (three feet) were found to have recurrence of deformity.

Table 1 Dimeglio classification scoring system

Rating	4	3	2	1	0
Equinus	45–90° pltf	20°–45° pltf	20 pltf–0°	0°–20° dorsx	>+20° dorsx
Varus	45–90 var	20°–45° var	20 var–0°	0°–20° vlg	>20° vlg
Supination	45–90 sup	20°–45 sup	20 sup–0°	0°–20° pron	>20° pron
Adductus	45–90° add	20°–45° add	20 add–0°	0°> to <20 abd	>20° abd
Posterior crease	—	—	—	Yes	No
Medial crease	—	—	—	Yes	No
Cavus	—	—	—	Yes	No
Deviant muscle function	—	—	—	Yes	No

abd, abduction; add, adduction; dorsx, dorsalflexion; pltf, plantarflexion; pron, pronation; sup, supination; var, varus; vlg, valgus.

Table 2 Evaluation of the patients before and after treatment according to the Dimeglio scoring system

Grade	Before treatment	After treatment
	Feet (%)	Feet (%)
1	0	14 (82.3)
2	0	3 (17.7)
3	16 (94.1)	0
4	1 (5.9)	0

Table 3 Varus before and after treatment

Grade	Before treatment	After treatment
	Feet (%)	Feet (%)
0	0	10 (58.8)
1	0	7 (41.2)
2	11 (64.1)	0
3	6 (35.5)	0

All the varus components improved to 0 or 1 point from 2 or 3 points.

Table 4 Medial rotation of calcaneopedal block before and after treatment

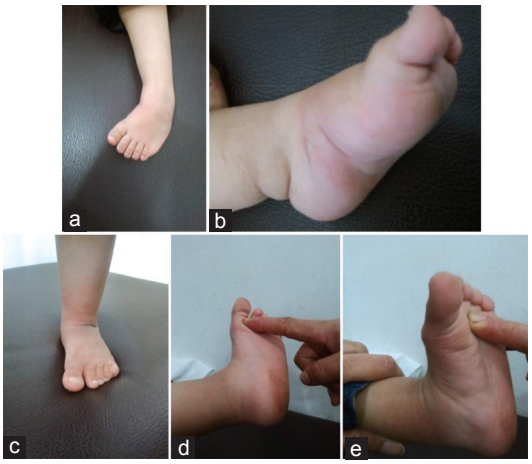
Grade	Before treatment	After treatment
	Feet (%)	Feet (%)
0	0	9 (53)
1	0	8 (47)
2	10 (58.8)	0
3	7 (41.2)	0
4	0	0

Table 5 Adductus before and after treatment

Grade	Before treatment	After treatment
	Feet (%)	Feet (%)
0	0	11 (64.7)
1	0	6 (35.3)
2	17 (100)	0
3	0	0

One patient (two feet) had isolated equinus recurrence, whereas the other patient had recurrence of adduction deformity [Figs 1 and 2].

Figure 1



Treatment result of late-presenting child (24 months) after 4 months treatment with the Ponseti method. (a, b) Before treatment and (c–e) after treatment.

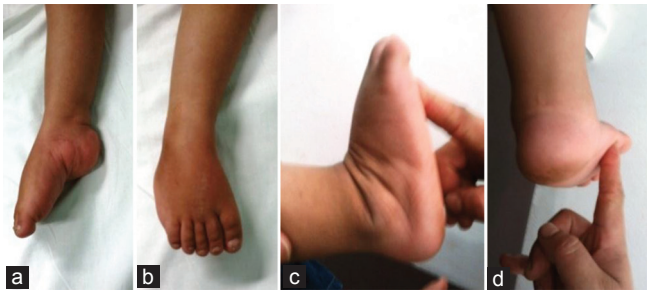
Discussion

The Ponseti method has been shown to effectively correct congenital idiopathic clubfoot in many series, with a success rate of over 90% in young children [11]. However, a review of the literature shows very little about the effectiveness of this method in children after walking age. Morcuende *et al.* [1] reported that 95% of idiopathic clubfoot could be corrected with the use of the Ponseti method, without any need for extensive corrective surgery, and stated that there was no increased difficulty in correcting the deformity in children up to 2 years of age or in patients who previously had a nonsurgical corrective attempt [1]. Although they did not mention the age of their patients at the beginning of therapy, they were 26 months of age on average during the last follow-up.

In this study, we tried to evaluate the efficacy of the Ponseti method in older children who had an average age of 16 months. Our findings showed significant improvement in all patients, despite their age.

In this study, all patients responded initially to the Ponseti method of cast application and achieved painless, supple, plantigrade, and cosmetically acceptable feet within a reasonable period of time

Figure 2



Late-presenting child (19 months). Before (a, b) and after (c, d) treatment with the Ponseti method.

(mean period of immobilization in cast was 8.9 weeks) without causing much disturbance in social and occupational life of patients and parents. Moreover, most of the parents were satisfied with the end results achieved. No complication was recorded during the study by cast, tenotomy, or tendon lengthening.

No recurrence was noted during the first follow-up — that is, 3 months after tenotomy. On subsequent follow-up, two patients (three feet) were found to have recurrence of deformity. One patient (two feet) had isolated equinus recurrence, whereas the other patient had recurrence of adduction deformity.

In cases of recurrence of equinus, repeat percutaneous tendoachilles tenotomies were performed. One foot achieved a satisfactory amount of dorsiflexion and the other one underwent posterior release to obtain a satisfactory amount of dorsiflexion. The remaining patient (one foot) underwent repeat Ponseti's method of treatment and percutaneous tenotomy and he responded well to the treatment but underwent tibialis anterior transfer to third cuneiform for dynamic supination. Noncompliance to foot-abduction brace was the reason found to be responsible for the recurrence of deformity in these patients. Parental low educational and socioeconomic status was found to correlate with noncompliance to foot-abduction brace. Both parents of these two patients were illiterate and belonged to very low socioeconomic level.

Bor *et al.* [13] treated 23 infants (36 feet) with recurrent clubfoot who were advised to have posteromedial release by their original orthopedists. Patients' age ranged between 3 and 9 months with an average of 5 months. After treatment, only one infant (2.9%) needed posteromedial release surgery. The cases of ankle equines were corrected with Achilles tenotomy or posterior release. Bor and colleagues proclaimed that, although starting at an older age group has certain disadvantages such as diminished remodeling capacity of small bones, orthopedists need not be discouraged from treating late-presenting clubfoot nonoperatively. Bor and colleagues also stated that an attempt at the Ponseti treatment does not preclude subsequent treatment with extensive posteromedial release surgery. Although their study does not use a deformity-based classification for the evaluation of results, it is clear that they reached the treatment goals. In our study, on analyzing the deformities with the Dimeglio classification system, we reached a similar conclusion that the Ponseti method diminishes the amount of deformity even after walking age.

Ponseti described the characteristics and treatment results of complex idiopathic clubfeet [14]. Clinically, complex clubfeet are defined as having rigid equinus, severe plantarflexion of all metatarsals, a deep crease above the heel, a transverse crease in the sole of the foot, and a short and hyperextended first toe.

Lourenço *et al.* [7] reviewed 17 children (24 feet) with congenital idiopathic clubfoot who presented after walking age and who had undergone no previous treatment. All were treated with the method described by Ponseti, with minor modifications. The mean age at presentation was 3.9 years (1.2–9.0) and the mean follow-up was 3.1 years (2.1–5.6 years). The mean time of immobilization in a cast was 3.9 months (1.5–6.0 months). A painless plantigrade foot was obtained in 16 feet without the need for extensive soft-tissue release and/or bony procedures. Four patients (seven feet) had recurrence and failure was observed in five patients (eight feet) [15]. Lourenço and colleagues achieved correction (painless plantigrade foot) in 66% patients, and the recurrence rate was 33.3%. These less favorable rates might be because of older age of the patients in their study. Lourenço and colleagues also corrected varus deformity by 40° of external rotation compared with 70° in our method, which may result in undercorrection in severe cases. Furthermore, they used an abduction ankle foot orthosis [custom-made ankle-foot orthosis (LESF, Sao Paulo, Brazil)] instead of the Ponseti device.

There are a lot of studies reporting that recurrence after correction is related to patients' compliance with bracing [6,9,15–17]. When the parents of patients do not comply with the bracing protocol, many major and minor recurrences should be expected. Ponseti treatment describes patients' need for surgery, other than Achilles tendon lengthening, as a failure. Besides being a definitive therapy method for the older age group, the Ponseti method has another value of

diminishing the deformity and hence the extensibility of the planned operation.

Conclusion

The Ponseti method is an effective method in correcting the deformities of clubfoot, even after walking age.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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