RESEARCH ARTICLE

HYPEREXTENSION OF THE BIG TOE AT METATARSOPHALENGIAL JOINT(MTPJ): A SIGN OF THE UNDERCORRECTION OF CAVUS IN IDIOPATHIC CLUBFOOT IN PONSETI METHOD

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Abstract

Objective

Hyperextension of the big toe is described here as a simple and reliable sign to predict undercorrection of cavus deformity of clubfoot in the Ponseti Method.

Materials & Methods

This retrospective study was conducted on children with clubfoot who were treated successfully by Ponseti Method in the King Fahad Hospital, Saudi Arabia, and Emam Reza Hospital, Mashad, Iran, from 2003 through 2008. The total number of the patients in our study was 191, with 306 affected feet. Of them, 115 children had bilateral clubfeet (230 feet) and 76 had unilateral clubfoot. There were 119 males and 72 females. Hyperextension of the big toe at MTPJ was present in five cases of clubfoot. The average follow-up period was 20 months (range: 8-38 months).

Results

The authors observed that hyperextension of big toe at MTPJ had a linear relationship with the severity of cavus deformity of clubfoot. On the other hand, the big toe had a normal relationship with other toes after satisfactory treatment of the initial or relapsed cavus deformity by Ponseti Method.

Conclusions

Hyperextension of the big toe at MTPJ can be regarded as a reliable prognostic sign for detecting the severity, correction, and the number of castings needed for cavus deformity correction in clubfoot treatment in the Ponseti Method.

Keywords: clubfoot, cavus, hyperextension, big toe, Ponseti

Introduction

Idiopathic congenital talipes equinovarus (clubfoot) is a complex deformity. The deformity has four components: equinus, hindfoot varus, forefoot adductus, and cavus (1). The goal of treatment is to reduce or eliminate these four deformities so that the patient has a functional, pain-free, plantigrade foot, with good mobility and without calluses, and does not need to wear modified shoes.

There is nearly universal agreement that the initial treatment of idiopathic congenital clubfoot should be non-operative, regardless of the severity of the deformity. Today, the Ponseti Method, which typically involves serial gentle manipulations followed by the application of a short or long leg cast at weekly intervals (2-5), has become the mainstay of non-operative intervention in the treatment of club foot. The first element of management in Ponseti Method is correction of the cavus deformity by positioning the forefoot in proper alignment with the hindfoot. The cavus is

due to the pronation of the forefoot in relation to the hindfoot. The cavus is always supple in newborns and only requires elevation of the first ray of the forefoot to achieve a normal longitudinal arch of the foot. The forefoot is supinated to the extent that visual inspection of the plantar surface of the foot reveals a normal appearing arch—neither too high nor too flat. Alignment of the forefoot with the hindfoot to produce a normal arch is necessary for effective abduction of the foot to correct the adductus and varus and then the remaining deformity.

There is no agreed method for proper assessment of forefoot cavus correction. The purpose of this study was to use the hyperextension of the big toe at MTPJ as a factor to evaluate the correction of the forefoot cavus deformity during initial casting of idiopathic clubfoot with Ponseti Method. Although a complete and integrated research has been done by Ponseti et.al (2,3,4,7) on the details of clubfoot management, this paper is a new and complementary study in this field.

Materials & Methods

One hundred and ninety one children (306 feet) were treated using the Ponseti Method between March 2003 to September 2008 at king Fahad Hospital, Almadinah Almounawarrah, KSA, and Emam Reza Hospital, Mashad, Iran. All the patients were treated on an outpatient program. Every clubfoot treated through the Ponseti Method was "scored" each week using the Pirani clubfoot score, HS (hind-foot score), MS (mid-foot score) and T (total score). Manipulation and casting was carried out on an outpatient department without any anaesthesia or sedation. The general principles of the Ponseti Method for manipulative correction were followed; correcting of the components started from pronation and equinus was treated last. Below-knee casts, extended to above-knee casts, were applied for four weeks or further, as proper correction achieved. Scores were plotted on a graph showing where the foot was on the roadmap of treatment, Tenotomy was done when HS>1, MS<1 and the head of the talus was covered. Before performing Achilles tenotomy, it was assured that the foot was sufficiently abducted. End of cast treatment was determined when at least 15-20° of passive dorsi flexion was possible. Brace was applied immediately after the last cast was removed, three weeks after tenotomy. For unilateral cases, the Denis- Brown brace was set at 70° of external rotation on the clubfoot side, and 40° on the normal side. In bilateral cases, it was set at 70° of external rotation on each side. All patients were followed up.

Results

A total of 306 feet (119 males (62.3%) and 72 females (37.7%)) in 191 children were treated by the Ponseti Method from March 2003 to September 2008. One hundred and fifteen children had bilateral clubfeet (230 feet) and 76 had unilateral clubfoot. The total mean score at presentation was 5.22 (Fig 1). The corresponding HS and MS were 2.65 and 2.57, respectively. The majority of the cases (90%) required six casts for complete correction; the average duration of cast application was 5.84 weeks. Tenotomy was required in 291 feet (95%) and most of them had Pirani scores of more than 5. The score after nine months of follow-up was reduced to zero in most of the cases (99.3%). The average duration of follow-up was 20 months (range: 8 –38 months).

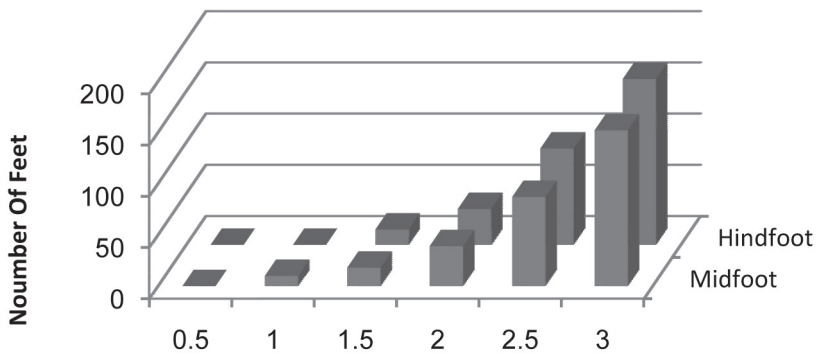

Fig 1. The distribution of midfoot / hindfoot among feet

Fifteen cases of relapse (4.9%, six cases of forefoot adduction, three cases of equinus, five cases of cavus accompanied by hyperextension of the big toe at metatarsophalangeal joint, and one toe inclawing) were encountered during follow-up (Table 1).

Equinus required re-tenotomy (4), while the rest were all treated with repeat casting except for one forefoot adduction who was treated by partial tibialis anterior transfer at the age of 4.

Table 1. Cases of Clubfeet with Cavus Deformities

N	Age (Week)	Pirani Score At presentation	NO of Casts	Associated Pathology	F/U (Months)	Pirani Score After Treatment
1	10	6	7	NO	27	Zero
2	10	6	9	YES*	22	Zero
3	8	6	8	NO	31	Zero
4	5	6	7	NO	18	Zero
5	12	6	8	NO	12	Zero
Mean	9	6	7.8		22.2	Zero

* Bilateral congenital knee dislocation

Discussion

Clubfoot or congenital talipes equinovarus is a complex deformity of foot that requires meticulous and dedicated efforts on the part of the treating physician and parents for the correction of the deformity. The Ponseti Method (2,3,4,7) of correction of clubfoot deformity requires serial corrective casts with long-term brace maintenance of the correction. The guidelines regarding patient selection and treatment protocol vary between investigators (5,8,9,10,11) but in general, the treatment needs to be started as soon as possible and should be followed under close supervision.

Cooper et al proposed that the Ponseti Method had better results and fewer complications than other traditional methods (9). Morcuende et al demonstrated that Ponseti Method could be successful in up to 98% of the feet (12).

According to the literature, we could not find an agreed method for grading the severity of deformity or monitoring the rate of improvement during the treatment. A simple scoring system was devised by Pirani (13) which was based on six criteria; three of them were related to the hindfoot (severity of the posterior crease, emptiness of the heel and rigidity of the equines), and three clinical signs were described according to mid foot involvement (curvature of the lateral border of the foot, severity of the medial crease and position of the lateral part of the head of talus).

The Ponseti Method has achieved a high kappa score for interobserver reliability (14,15). This method has been compared with Dimeglio scoring system (16) by Scher et al (6) and they showed a link between a high scoring foot and the need for tenotomy in both systems.

Although Ponseti Method is a reliable method of assessing the severity of the initial deformity, it cannot predict and monitor the amount of correction (20).

Evaluation of treatment success and cavus correction is essential for following up the patients, determining the time of brace wearing and predicting the relapse of the deformity.(18,19).

We had some confinements in this study; the study was done in two countries some difference in technical details.

This study was a case series while a cohort study and a regression analysis are much better for confirming the relationship between residual cavus and big toe

hyperextension.

For the first time in the literature, we showed that big toe hyperextension after serial casting in Ponseti Method is a reliable sign for undercorrection of the cavus deformity. Upon detecting this sign, the phiysicians are advised to continue casting until full correction of the cavus deformity (and disappearing of the big toe hyperextension) is achieved. This technique also reduces relapse rate.

We observed five cases of cavus deformity at initial presentation which was accompanied by hyperextention of the big toe at metatarsophalengial joint joint (Fig 2). There was a linear relationship between the severity of cavus and the degree of big toe hyperextention initially and during correction by serial casting. All five cases had a Pirani Score of 6.

Fig 2. Clubfoot with hyperextension of the big toe before treatment

Fig 3. Clubfoot with gradual improvement of the hyperextention during serial casting

We observed that excessive plantar flexion of the 1st metatarsal head caused extension at the metatarsophalangeal joint leading to hyperextension of the big toe. The number and duration of casts for these cases was higher with a mean of 7.8 weeks (7-9 week). It also required further manipulation and stretching of the medial planter aponneurosis and molding of the cast under the head of the first metatarsal head. The score after nine months of follow-up reduced to zero in all these cases and a normal relationship between the big toe and the others toes was achieved (Fig 3 , 4).

Fig 4. Clubfoot with hyperextension of the big toe improved after treatment

We believe that hyperextension of the big toe at the MTPJ is a sign of severity and indicates that correction of the plantar flexion is required. Persistence of the hyperextension shows undercorrection and requires more casts in the Ponseti Method.

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