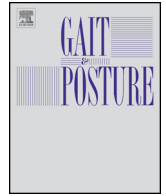




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Evaluation of gait, relapse and compliance in clubfoot treatment with custom-made orthoses



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ABSTRACT

Relapse after successful initial correction of idiopathic clubfoot with the Ponseti method is often related to poor compliance with the foot abduction orthosis (FAO). The aim of this study was to evaluate treatment with custom-made dynamic orthoses. Twenty children with idiopathic clubfoot (30 feet) who had been treated with dynamic orthoses after the correction phase according to the Ponseti casting technique were evaluated. Relapse rates during orthotic treatment were registered. A Vicon gait analysis system was used to measure gait parameters at the age of seven years. The overall gait quality was estimated with the Gait Deviation Index (GDI). Data were analyzed with a nested mixed model and compared with a control group of 16 healthy children. No relapse occurred during the orthotic treatment. High compliance with the orthoses was observed based on parents' self report and physiotherapist observations. Gait analysis showed decreased ankle power and moment, increased internal foot progression, decreased dorsiflexion during stance, and increased plantar flexion at initial contact compared with the control group. Hip and shank rotations were normal. No calcaneus or equinus gait was observed. The mean GDI was 89.7 (range 71.6–104). The gait analysis outcomes and frequency of relapse were comparable to those of previous studies. Internal foot progression originated primarily from the foot level and was not, as frequently found after FAO treatment, compensated by external rotation at knee or hip level. In children exhibiting poor compliance with an FAO, this dynamic model is considered an effective alternative.

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1. Introduction

In the past decade, the Ponseti technique has become the most widely used treatment for clubfoot [1,2]. The method comprises serial manipulation and a specific casting technique, with Achilles tenotomy when needed to correct any remaining equinus deformity, followed by the use of a foot abduction orthosis (FAO) [1,3]. It is crucial that the orthosis is used up to 4 years of age to prevent relapse [1,4–7].

Ponseti method outcome studies are mainly based on the combined outcome of two different treatments; the correction of the deformity with serial casting and the maintenance of the

corrected position with orthoses. When evaluating outcome it is important to evaluate separately both the phases, and the different factors that might have influenced them. Several studies have evaluated gait in children treated with the Ponseti technique. In the sagittal plane gait deviations in dorsal-/plantarflexion have been observed [8,9–11] corresponding to equinus gait, foot drop in swing phase, and calcaneus gait. In the transverse plane, internal foot progression, external hip and shank rotation have been reported [9–11] along with diminished ankle power and ankle moment [12,9].

Studies of the effects of different types of orthoses for clubfoot treatment are sparse [13–17]. In our department, prior to using the Ponseti treatment concept in 2001, we used custom-made dynamic knee–ankle–foot and ankle–foot orthoses (KAFO and AFO) (Figs. 1–2). The hinged orthoses are designed to allow mobility of the corrected clubfoot, enabling the child to move the legs and feet separately, and allow walking. The KAFO and AFO, which are made from individual casts, position the foot in maximal

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Fig. 1. Knee Ankle Foot Orthosis frontal and side view(KAFO).

external rotation relative to the tibia (usually around 25°) and provide correction of hindfoot varus and forefoot adduction. A pad over the lateral part of the talus forces the foot towards the medial part of the brace. An adjustable elastic strap attached to the shank and foot pieces stretches the Achilles tendon into dorsiflexion when the foot is at rest but does not prevent active plantar flexion. It also inhibits the foot from pushing out of the orthosis. In the KAFO the shank segment is adjustable to accommodate growth allowing the same orthosis to be used approximately 10–12 months.

In general our department found good compliance and low relapse frequency. It was therefore decided, before applying the whole Ponseti concept, to continue with the dynamic types of orthoses after Ponseti casting. The aim of this study was to evaluate compliance, relapse rate, and gait characteristics in 7-year-old children who had been treated for congenital clubfoot with serial casting (the Ponseti method) and who had been provided orthotic treatment with custom-made dynamic orthoses.

2. Methods

From our catchment area, a cohort of 22 consecutively born children with idiopathic clubfoot were treated and followed prospectively according to a standardized program. At the age of 7 years, they were referred for gait analysis. Informed consent was obtained from the parents for their child to participate. This age was chosen because it marks 3 years after the end of orthosis treatment and the stabilization of gait [18,19]. The exclusion criteria were teratologic clubfoot or clubfoot initially treated outside our department. The severity of deformity was classified according to Dimeglio [20] before the treatment started.

The children had been treated with serial manipulation and casting according to the Ponseti method, which was followed by percutaneous Achilles tenotomy when required (passive dorsiflexion (DF) $<10^\circ$), performed under general anesthesia. After initial correction, a custom-made dynamic KAFO was prescribed for 18 h a day for 2 months (Fig. 2). Subsequently, the use of the orthosis was gradually reduced to 12 h a day at the age of 8 months



Fig. 2. Ankle Foot Orthosis frontal and side view(AFO).

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