

Comparison of a dynamic and a hinged ankle–foot orthosis by gait analysis in patients with hemiplegic cerebral palsy

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Received 30 January 2001; received in revised form 30 June 2001; accepted 28 August 2001

Abstract

We studied the effect of a dynamic ankle–foot orthosis (d-AFO) on gait in 12 hemiplegic cerebral palsy patients. Sagittal plane kinematic and kinetic data of walking with the d-AFO were compared with walking barefoot, walking in a hinged ankle–foot orthosis (h-AFO) with a plantarflexion block and normal values. All patients had excessive plantarflexion and initial toe contact when walking barefoot. The d-AFO did not improve gait significantly whereas the h-AFO did. The benefits of controlling plantarflexion by a longer lever arm from the h-AFO to the proximal calf included a heel–toe gait pattern, reduced plantarflexion, increased step and stride length and reduced power absorption. © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Gait analysis; Cerebral palsy; Ankle–foot orthosis; AFO; Equinus

1. Introduction

The primary brain lesion in cerebral palsy (CP) and the secondary alterations in the locomotor apparatus can cause an energy inefficient gait [1] which can often be improved with an orthosis. These may improve function by helping to prevent deformity, support normal alignment and mechanics and allow a more normal range of motion [2]. An ankle–foot orthosis (AFO) is generally prescribed in patients with hemiplegic CP to prevent excessive plantarflexion that is one cause of toe walking. The AFO aims to correct the foot–shank angle in swing to improve pre-positioning of the foot at initial contact and allow a heel strike.

Several designs of AFO's are available for hemiplegics. The dynamic AFO (d-AFO) has been reported as influencing abnormal joint motions through changes in the spastic reflexes and underlying muscle tone by tone-reducing features [3,4]. Another reported benefit of a d-AFO is to enable maximum midline stability and

movement control while permitting freedom of movement [4]. We have used a hinged AFO (h-AFO) [8] that blocks ankle plantarflexion and allows free ankle dorsiflexion during stance for hemiplegic children.

The purpose of this study was to compare the effect of the d-AFO on gait in patients with spastic hemiplegic CP and to compare its performance with barefoot walking, walking in an h-AFO with normal values using sagittal plane kinematic and kinetic data.

2. Methods

Twelve patients (three females and nine males) diagnosed with hemiplegic CP (nine right and three left body side involvement) were enrolled in this study (Table 1). The mean age was 11.9 ± 4.9 years. All patients were community ambulators who did not use walking aids but did wear an h-AFO on the involved side. A control group of ten healthy subjects was included in the study. The group (seven females and three males) had a mean age of 26.9 ± 6.3 years, mean height of 174.3 ± 6.5 cm, and a mean weight of 69.8 ± 12.3 kg. The normal reference data were collected during barefoot walking.

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