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Hip locomotion mechanisms in cerebral palsy crouch gait

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Abstract

The purpose of this study was to evaluate three defined locomotion patterns in cerebral palsy gait using computerised gait analysis. Ambulant diplegic children who had no previous surgery were included in the study and were divided into two groups: one group consisted of children having a crouch gait, and the other group did not have the crouch pattern of gait. An age-matched group of normal children served as the control group. Locomotion patterns studied were the hip hike, propulsive function of the hip extensors, and pseudo-adduction. A statistical analysis was performed between the groups, using defined parameters. The mechanism of hip hike was not utilised by any of the groups. Both groups of diplegic children showed power generation at the hip beginning in the first double support phase of the gait cycle and continuing in the first half of single limb support, while in the normals this was only in the first half of single limb support. Both the groups of diplegic children showed significantly more internal rotation in the first half of stance as compared to the group of normal children; the degree of hip adduction was the same in all the groups. Thus diplegic children had pseudo-adduction.

Keywords: Crouch gait; Cerebral palsy; Hip locomotion mechanisms

1. Introduction

In cerebral palsy crouch gait, the hips and knees are generally flexed and have a reduced range of motion and the ankles might show deformities from equinus to calcaneus. The hips are frequently internally rotated and give the impression of being adducted.

Relatively little has been written on crouch gait. Its occurrence after heel cord lengthening has been reported only subjectively, and its effect on gait has rarely been addressed [1–4]. Sutherland used gait analysis and described four primary gait abnormalities of the knee: jump knee, crouch knee, stiff knee and recurvatum knee. He has documented prolonged activity of the hamstring and the hip flexors in the jump knee and the crouch knee [5]. In another study with four cases of crouch gait following heel cord lengthening, he has stressed that the hip and knee flexion contractures should be relieved prior to heel cord lengthening to prevent the development of crouch gait [6]. Recent studies suggest that subjects with crouch gait have hamstrings of normal length or longer, despite persistent knee flexion during stance. This occurs because the excessive knee flexion is typically accompanied by excessive hip flexion throughout the gait cycle and the moment arm of the hamstrings at the hip is about three times the lever arm of this muscle group at the knee [7–9].

In normal children the hip and the ankle joints contribute about 54 and 36% of the propulsive power of walking, respectively [10]. Until now it is unclear how patients with an impaired motor control, contracted joints and spastic muscles of the lower limbs generate power for progression during walking. When the propulsatory mechanisms are impaired and the stance limb has a flexed hip and knee one might expect problems with ground clearance of the swinging limb. Additionally the scissoring gait seen in these patients could primarily due to excessive adduction at the hip or to internal rotation caused by the spastic hamstrings. In

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