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Short Report

Electromyographic Examination of How Using a Cane Affects Kyphotic Gait

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Key words : kyphosis, cane, brace, gait, EMG

Abstract

The purpose of this study was to investigate how the use of a cane affects an artificially created kyphotic gait induced with a brace. Five normal adult males were examined. The electromyographic amplitudes of the rectus abdominis, oblique abdominis, erector spinae, biceps femoris, gluteus maximus, gluteus medius and quadriceps femoris muscles during gait were recorded with and without the brace, and with the brace and a T-cane used with the left hand. It was expected that the electromyographic amplitudes of all muscles would decrease during gait with a cane, but no significant changes were noted, except in the gluteus medius muscle. These results suggest that the manner in which a cane is commonly used does not provide proper support for the erector spinae, biceps femoris and the gluteus maximus muscles in patients with kyphosis. Patients need to be taught how to use a cane properly or maybe a different way of using a cane.

Introduction

Kyphosis of the spine is a typical deformation experienced by the elderly. This deformity has been observed in about 25% of Japanese [1]. According to Takemitsu et al. kyphosis of the spine is associated with a gait defect [2]. Previous studies reported the results of electromyographic(EMG) amplitude tests in the elderly with kyphosis [3], and the influence on gait of a brace which forced healthy males into an artificially created kyphotic condition [4]. The purpose of this pilot study was to investigate how the use of a cane affects the artificially created kyphotic gait.

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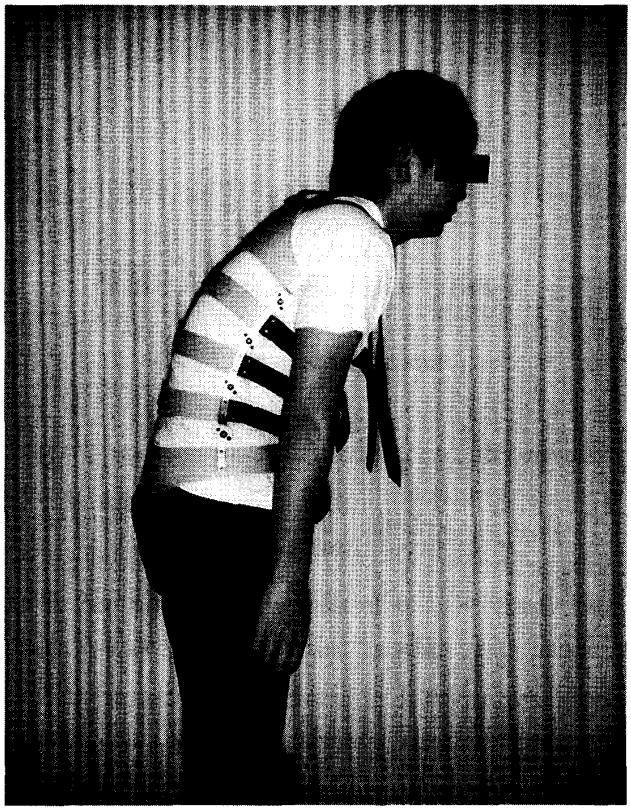

Fig. 1 This is a kyphosis brace that can change the angle of the spine and fix the trunk. It was constructed from five suborthoren parts connected by the ring locks, so that the angle of the spine could be easily changed.

Subjects and Method

Five adult males volunteered to participate in the study. The subjects ranged from 20 to 25 years in age, with the mean age of 21.2 years. A forced kyphosis brace that changed the angle of the spine and fixed the trunk was created (Fig.1). The amplitudes of the rectus abdominis, oblique abdominis, erector spinae, biceps femoris, gluteus maximus, gluteus medius and quadriceps femoris muscles during gait at a speed of 96 steps per minute on a 15m gait path were recorded without the brace (natural gait), with the brace (orthotic gait) and with the brace together with a T-cane (cane gait) used with the left hand. The kyphotic angle of the spine was set at 35 degrees by the brace. Each gait pattern was practiced before measurement was done. The amplitudes of the muscles were measured with a SYNA ACT 11 (NEC Medical Inc.). Bipolar surface electrodes (1cm in diameter) were placed on the right side of each muscle with a distance of 2cm between electrodes. Data were analyzed by BIMTUS (Kissei Comtec Inc.). A sampling rate of 1,000Hz was selected. Computer quantification involved a digital filter (20Hz to 100Hz), rectification, and integration during a walking cycle. The data for orthotic and cane gait were compared to the natural gait for each muscle. A three repetition analysis of variance (ANOVA) was used to determine significant differences in muscle amplitudes among the three different gait patterns. Fisher's PLSD post-hoc test was utilized to measure significant main effects. An alpha level of 0.05 was adopted in this study.

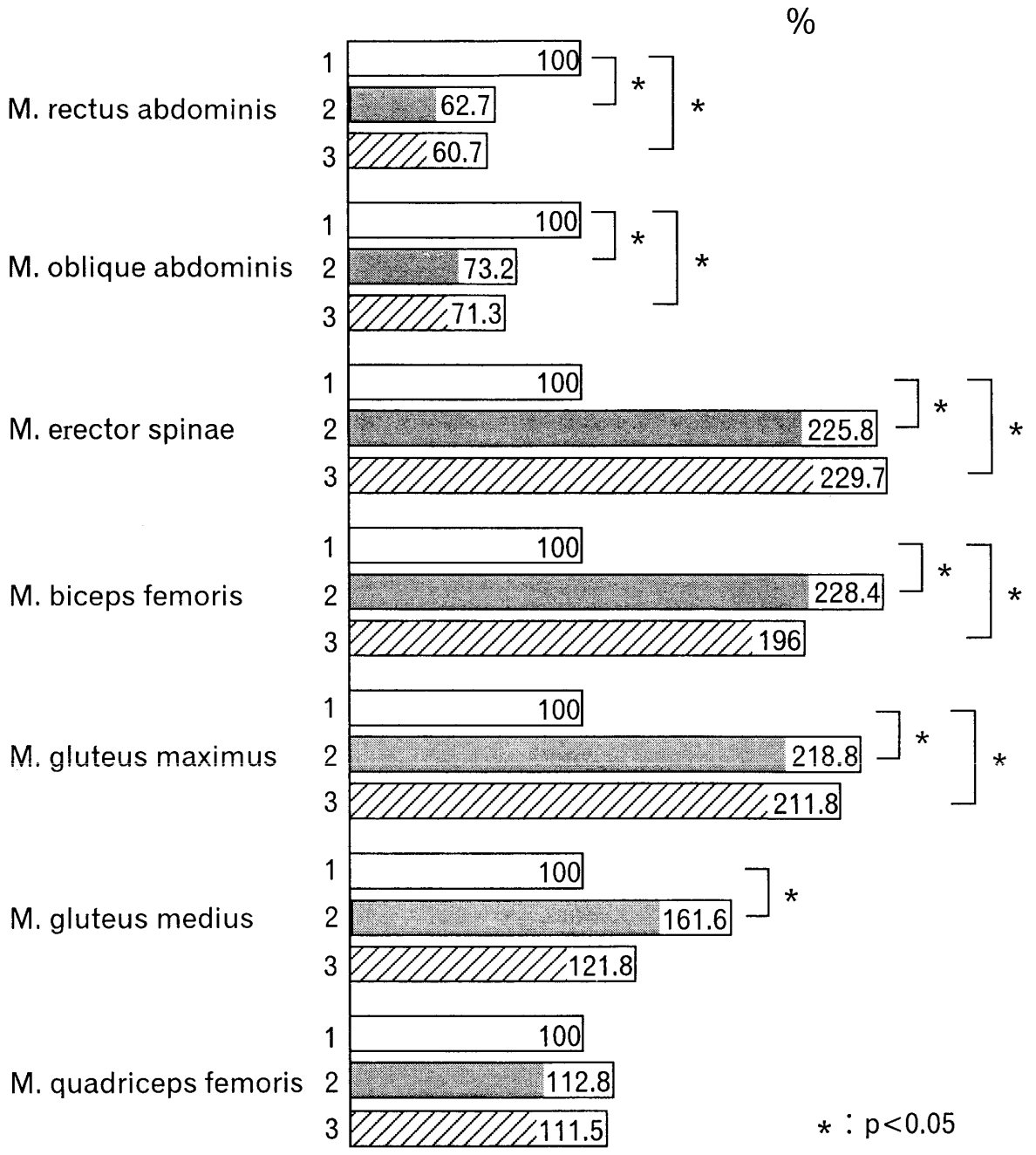

Fig. 2 Electromyographic activities of the muscles. 1:natural gait. 2:orthotic gait. 3:cane gait.

Results

The EMG amplitudes of the rectus and oblique abdominis muscles during orthotic and cane gait were lower than during natural gait. However, there was no significant difference between orthotic gait and cane gait. The EMG amplitudes of the erector spinae, biceps femoris and the gluteus maximus muscles during orthotic and cane gait were about twice as large as those during natural gait, but they did not differ significantly. In the gluteus medius muscle, EMG amplitudes during orthotic gait were about 160% of those during natural gait. At the same time, EMG amplitudes during cane gait were about 120% of those during natural gait. No significant

differences in amplitude were observed in the quadriceps femoris muscle (Fig.2).

Discussion

The results of a previous study showed that the EMG amplitudes of the erector spinae, hamstring and gluteus maximus muscles during orthotic gait were greater than those during natural gait. The EMG amplitudes of the opposite side of the rectus and oblique abdominis muscles during orthotic gait were smaller than those during natural gait [4]. This study confirmed those results. It was expected that the EMG amplitudes of all muscles during gait with a cane would decrease, but no significant changes were observed except in the gluteus medius muscle. We think that this result was due to how the cane was used; that is to say, the subjects were instructed to use the cane at their side during the right stance phase, so that the cane would affect only amplitudes of the gluteus medius during the frontal phase of movement. These results suggest that the manner in which a cane is commonly used does not provide proper support for the erector spinae, biceps femoris and the gluteus maximus muscles in patients with kyphosis. They need to be taught how to use a cane properly. This investigation was limited to a few cases and done under simple conditions. In the future, we will study a larger number of cases, examine changes in the EMG amplitudes of muscles due to the position of the cane, and determine the optimum length of the cane.

References

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