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Comparison of locomotor pattern between idiopathic scoliosis patients and control subjects

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Introduction

Idiopathic scoliosis has no known cause. One the potential hypothesis is the influence of an asymmetrical nervous command on the muscles acting the spine. The aim of this study is to compare idiopathic scoliosis patients (ISP) and control adolescents (CTRL) during locomotion at comfortable speed. The specific purposes of this study are to compare both groups during walking 1) for EMG activity of the erector spinea muscles and the kinematics (acceleration) of the spine in the antero-posterior (A/P) direction and 2) for the kinetics (moment, power and work) at the ankle, knee and hip.

Material and methods

A total of nine ISP and ten control subjects were asked to walk for 10 trials on a 10 m walkway. The ISP had a mean Cobb angle of 17° and their mean age, height and weight were 14,9y, 158cm and 51,5kg respectively while it was 14,4y, 161,2cm and 55kg for the CTRL group. A total of 30 reflective markers placed on anatomical landmarks were tracked with by 8-camera VICON system while muscle activation were collected from eight EMG electrodes placed on the erector spinea muscle at C7, T4, T10 and L2 levels. Two embedded force platforms were used to extract the ground reaction forces. Moment of force (N.m), power (W) and mechanical energy (J) were calculated from an inverse dynamic approach. Group differences were assessed with analysis of variance (ANOVA) and a level of significance of 0,05 was chosen.

Results

No difference was observed in the gait velocity between both groups. The ISP group had a greater delay of

muscle activation at C7, T4 and T10 with respect to L4 level compared to the CTRL group. The A/P accelerations were damped from S1 to the head while not much vertical acceleration damping was observed between these levels. For the kinetics, no difference was observed for the moment of force and power peaks. For the work parameters, the ankle plantar flexor (A2) and hip flexor (H3) work were significantly reduced in the in ISP compared to the CTRL group. Bilateral (right vs. left) significant difference was observed for the knee absorption burst (K1) by the knee extensors.

Discussion and conclusion

The results suggested the existence of a possible asymmetrical nervous command for the knee extensor during walking in ISP. A delay of spinal muscle activation was observed in the ISP group. The trend for a reduced in locomotion speed in ISP is linked with a reduction energy generation of the ankle and hip at push and pull-off.

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