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JOINT POSITION SENSE IS NOT AFFECTED BY FATIGUE OF HIP ABDUCTORS MUSCLES

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SUMMARY

The goal of the present study was to investigate the effect of hip abductors fatigue on hip position sense. Fatigue was induced by repeated concentric-eccentric hip abduction. Variable error was defined as the distance (in degrees) between the target and the actual hip position chosen by the volunteer as the targeted position. Our main results showed that fatigue of hip abductors muscle group did not disturb the proprioception at the hip.

INTRODUCTION

Proprioception involves both the sensations of joint movement and joint position sense (JPS) [1]. It has been described as an afferent information typically arising from peripheral mechanoreceptors as well as from spindle endings [2]. In order to determine the position of a joint, the brain has access to muscles spindles around the joint, as well as information from skin and joint receptors [3]. Joint position sense is a component of proprioception and represents the ability to actively or passively replicate a previously given limb position, in absence of visual feedback and it has been studied mainly at the knee . [4].

Abductors are the strongest hip joint muscles and play an important role in knee valgus. Weakness and fatigue of this muscle may result in greater adduction and femoral internal rotation [5]. Gluteus medius may be a source of altered neuromuscular control during exercise, as shown by [6]. Hip coordination has been related to ACL injury along the lower extremity kinetic chain [1]. However, the exact interaction between hip muscles fatigue and lower limb joints proprioception is still to be clarified. Therefore, the goal of the present study was to investigate the effect of hip abductors fatigue on the hip joint position sense.

METHODS

Eleven young females, 22.1±2,1years old, 168±2cm tall and weighing 58,9±10,1,3kg with no history of falling or acute impairment in the past year volunteered to participate in the study. Two volunteers were excluded from participation due to inability to perform the task or knee pain during the exercise. All volunteers were active sedentary. The experimental setup consisted in one session in which the volunteers were asked to perform, for 5 seconds, maximal voluntary isometric contraction (MVIC) towards hip abduction. Volunteers laid in lateral decubitus and were tied with belts along the trunk, with the hip joint aligned with an isokinetics dynamometer's (Byodex System 3-PRO) fulcrum. Then, their hip joint was placed at 22^{o} of abduction, for 10 seconds, to set and provide them with sensory information about the target angle. Three abduction/adduction hip movements were actively performed by the dynamometer.

After that, the volunteers (eyes closed) pushed a button to stop the machine where they thought to be the targeted angle. The same procedure was repeated three times before and three times after a fatigue protocol was applied. Fatigue was induced by repeated concentric-eccentric hip abduction with an ankle brace, weighting 3% of the volunteers' body mass, attached around the maleolus. Every 30 seconds a MVIC was performed to check for fatigue. The post-fatigue trials were performed when they reached 50% (or less) of the MVIC.

Variable error was defined as the distance (in degrees) between the target and the actual hip position chosen by the volunteer as the targeted position. Two-way repeated measures ANOVA was applied to compare trials (three) and condition (pre and post-fatigue). The level of significance was defined in 5%.

RESULTS AND DISCUSSION

We did not found significant difference between joint position sense in the pre compared with the post-fatigue trials (Figure 1). Muscle fatigue leads to error in the localized muscle, most likely because the subjects perceived the exercised muscle as longer than it actually was. It can be considered that exercise of any limb muscle can lead to a change in perceived position about a particular joint [7]. In the present study, all subjects start doing a specific training before pre-fatigue test in order to be totally adapted to the task and they were ready to begin only when they could

reach at least 5-10 consecutive right position angle. Perhaps, this way of learning had been too emphasized in the present study in comparing to those found at the literature. Other studies have to be done to investigating if this work can be confirmed.

The advantage of testing in a supine or sidelying position is that the subject will have more support and will be better able to focus on the hip joint [1]. In our study we analyzed only the dominant limb because there is no dominance-related to differences in fatigability [8].

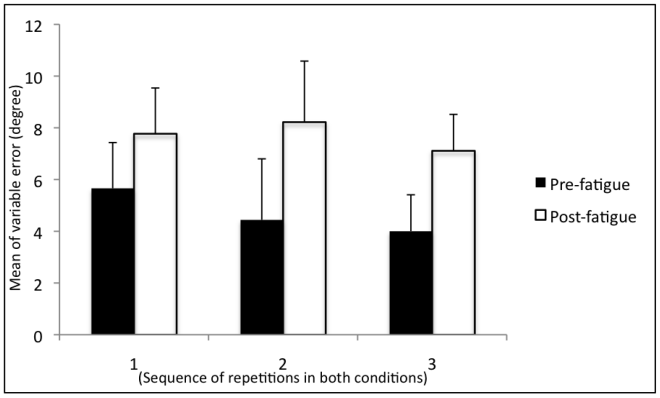

Figure 1. Mean of variable error (degree) in both pre-fatigue and post-fatigue conditions. No significant difference was found neither inter and intra group conditions.

Theoretically, fatigue of the hip abductors would be expected to alter neuromuscular control of the hip, thus compromising maintenance of body segments alignment in the erect posture, the coordination of voluntary movements, or the reaction to external stimuli. Subjects that performed resisted hip abduction to fatigue did not reflect a decline in balance control [9].

Possible cause/effect connexion between proprioception and muscle fatigue must be further investigated due to it's importance in falls mechanisms and sports injuries [7].

CONCLUSIONS

Fatigue of the hip muscles abductors group did not affect significantly the proprioception at the hip joint.

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