

IMMEDIATE EFFECTS OF HIGH-VELOCITY SPINAL MANIPULATION IN PEAK TORQUE AND POWER ON QUADRICEPS MUSCLE IN ASYMPTOMATIC INDIVIDUALS

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Abstract

The spinal manipulation has been frequently used in rehabilitation and injury prevention. The aim of the study was to evaluate the power and torque peak of the quadriceps after a manipulation with high-speed and low amplitude in the lumbar region in asymptomatic individuals. The results showed that the quadriceps strength and power increased after manipulation $p < 0,05$

Introduction

The manual therapeutic interventions such as joint mobilization or manipulation, have been used to restore the physiological movement of the skeletal muscle function that aims to increase the curative activities, homeostatic and self-regulatory of the body, [1] that can change the strength and the muscle activation. [2] The isokinetic is a gold standard evaluation instrument that allows to investigate the variables: peak torque, work and power. [3,4] The aim of this study is to evaluate the power and peak torque of the quadriceps after a high-speed and low amplitude manipulation in the lumbar region in asymptomatic individuals.

Methods

Sample

Seven female volunteers college students with a mean age and standard deviation of 20.5 ± 1.5 years composed the study sample. The Inclusion criteria were: lack of back pain, standard body mass index (BMI), sedentarism, no surgical history on the lumbar spine, and the absence of cardiac, neurological and/or musculoskeletal disease. After being informed about the research and agreed with the research procedures, all the participants signed a consent form. The ethics committee on human research at the University of Northern Paraná State, UENP, approved the study.

Instrumentation

Evaluation of strength and power of the quadriceps muscle (ESPQM)

For evaluation of strength and power of the quadriceps muscle before and after high speed low amplitude manipulation (HSLAM) was used isokinetic equipment called BIODEX ® 4.0. The tests were performed on two consecutive sets on the respective speed: 60 °/sec with 5 repetitions and 300 °/sec with 15 repetitions, performed with the dominant limb. All participants underwent the same evaluation procedures and verbal command during the evaluation.

Lumbar Manipulation

The HSLAM was performed with the volunteer in the lateral position, opposite to the side of the determined vertebral rotation. The volunteer was positioned with hip flexion (lower lever) and trunk rotation (upper lever) preserving the neutrality of the column regarding Flexion/Extension. The therapist fixed the vertebra in the shape of a clamp to be corrected, stabilized the superior, put tissues in tension and held HSLAM [5].

Study Protocol

Before ESPQM, volunteers warmed during 10min on a ergometer bicycle. Then, they were positioned on the isokinetic dynamometer and asked to perform 2 repetitions of knee flexion and extension in order to complete the period of muscle activation and also for familiarization with the equipment. The volunteers held a series with 5 repetitions at a speed of 60°/sec, rested 1min and held another set of 15 repetitions at 300°/sec. The verbal command was the same for all participants. After 48h of ESPQM, the volunteers returned for a second evaluation, initially passing by a physical evaluation with a blinded examiner with over 5

years experience in spinal manipulation. When the vertebra to be manipulated was determined, the volunteer warmed for 10min on an ergometer bicycle and soon after the HSLAM by a second therapist with experience in the area. After the process, the volunteers were submitted to a reevaluation of strength and power of the quadriceps muscle.

Statistic Analysis

The data were submitted to the normality test of Shapiro-Wilk. Checked the normality, the values from the initial and post ESPQM manipulation were analyzed by student's *t* test for paired data. The significance level considered was $p < 0,05$. The analysis was performed on the statistical software Minitab 13.20.

Discussion and results

It can be observed in Table 1 that at a speed 60°/sec there was an increase in mean peak torque and muscle power of the volunteers after HSLAM with significant value only for muscular power. Already, at a speed of 300°/sec there was a significant increase in both means the peak torque and the muscle power after HSLAM (table 2).

Table 1: Comparison between the difference of Peak Torque and quadriceps muscle Power. (60°/sec).

	ESPQM** pre manipulation	ESPQM after manipulation	<i>p</i> Value
Torque	131,39 ± 28,67	132,64 ± 29,35	0,619
Power	81,84 ± 20,41	89,07 ± 20,39	0,002*

* *p* significative value: $p < 0,05$ / ** Evaluation of the power and strength of the quadriceps muscle

Table 2: Comparison between the difference of Peak Torque and Power of the quadriceps muscle (300°/sec).

	ESPQM** pre manipulation	ESPQM after manipulation	<i>p</i> Value
Torque	69,5 ± 18,68	73,64 ± 18,35	0,045*
Power	153,67 ± 38,59	167,77 ± 33,25	0,019*

It is apparent, therefore, after HSLAM, a positive shift in power and strength of the quadriceps muscle. This result is similar to that obtained in the study of Hillermann et al. [6] However the sample of individuals with femur patellar syndrome, and the manipulation was applied on the sacroiliac conjunction.

Immediate changes in muscle strength were also observed in the study of Grindstaff et al. [2] However, after 20 minutes the changes were no longer present and the manipulation applied was nonspecific about the lumbopelvic region and the assessment instrument was the electromyograph connected to a load cell.

In this study the measurement of strength and muscle power was pre and post manipulation with isokinetic dynamometer. Such methodology precludes reassessments in short time due to muscle fatigue.

Some hypotheses are formulated to explain the mechanisms behind the effectiveness of these techniques of HSLAM. Most of these are based on neurophysiological reflexes triggered by sensory receptors mechanically stimulated by the act of manipulation. [2]

Conclusion

The results of this study showed an increase in average power and strength of the quadriceps muscle after high-speed manipulation and low amplitude in the lumbar region of asymptomatic individuals. It is recommended for future studies a larger sample size and the inclusion of two groups (control and athletes).

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