Journal of Chiropractic Medicine (2015) **14**, 240–248

ELSEVIER

JCM Journal of Chiropractic Medicine

www.journalchiromed.com

Effects of Lumbosacral Manipulation on Isokinetic Strength of the Knee Extensors and Flexors in Healthy Subjects: A Randomized, Controlled, Single-Blind Crossover Trial

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Received 8 April 2015; received in revised form 15 July 2015; accepted 3 August 2015

Key indexing terms:
Spinal manipulation;
Muscle strength;
Knee

Abstract

Objective: The purpose of this study was to investigate the effect of manual manipulations targeting the lumbar spine and/or sacroiliac joint on concentric knee extension and flexion forces. Torque production was measured during isometric and isokinetic contractions.

Methods: This was a randomized, controlled, single-blind crossover design with 21 asymptomatic, college-aged subjects who had never received spinal manipulation. During 2 separate sessions, subjects' peak torques were recorded while performing maximal voluntary contractions on an isokinetic dynamometer. Isometric knee extension and flexion were recorded at 60° of knee flexion, in addition to isokinetic measurements obtained at 60°/s and 180°/s. Baseline measurements were acquired before either treatment form of lumbosacral

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http://dx.doi.org/10.1016/j.jcm.2015.08.002

manipulation or sham manipulation, followed by identical peak torque measurements within 5 and 20 minutes posttreatment. Data were analyzed with a repeated measures analysis of variance.
Results: A statistically significant difference did not occur between the effects of lumbosacral manipulation or the sham manipulation in the percentage changes of knee extension and flexion peak torques at 5 and 20 minutes posttreatment. Similar, nonsignificant results were observed in the overall percentage changes of isometric contractions (spinal manipulation 4.0 ± 9.5 vs sham 1.2 ± 6.3, $P = .067$), isokinetic contractions at 60°/s (spinal manipulation −4.0 ± 14.2 vs sham −0.3 ± 8.2, $P = .34$), and isokinetic contractions at 180°/s (spinal manipulation −1.4 ± 13.9 vs sham −5.5 ± 20.0, $P = .18$).
Conclusion: The results of the current study suggest that spinal manipulation does not yield an immediate strength-enhancing effect about the knee in healthy, college-aged subjects when measured with isokinetic dynamometry.

Introduction

Spinal manipulation (SM) is a therapeutic procedure used by health care practitioners such as chiropractors, osteopaths, and physical therapists with the intent of ameliorating joint hypomobility and positively influencing neurologic functioning.[1,2] In addition to global utilization within the clinical setting to alleviate acute and chronic musculoskeletal complaints,[2] this form of treatment is also delivered for the purpose of enhancing the performance and augmenting the rehabilitation of collegiate and professional athletes.[3]

Research efforts from the past few decades have investigated the effects of SM on topics such as strength modulation, muscle inhibition, electromyographic (EMG) activity, motor training/reaction time, and balance.[3] Regarding strength, at least 22 different studies have recorded changes in force exerted during maximum voluntary contractions (MVCs) post-SM. Within these articles, a range of muscle groups was selected, such as the quadriceps femoris muscle group, cervical musculature, thoracolumbar erector spinae, biceps brachii, shoulder external rotators, lower trapezius, and gluteus maximus, in addition to measurements of knee flexion and grip strength.[4–25] Although these studies as a whole report changes in strength post-SM, each investigation must be considered individually because different muscle groups cannot be directly compared. Although many of the aforementioned studies reported increases in strength and/or increased EMG amplitudes, an important consideration is that only isometric contractions have been measured (with a hand dynamometer, isokinetic dynamometer, or load cell). Presently, no information exists in relation to strength changes after SM measured at various angular velocities during dynamic contractions. These data would prove useful in generating a more complete picture of the mechanisms occurring within the muscle after chiropractic treatment, as different motor recruitment patterns exist for concentric and isometric contractions. Specifically, this study investigated changes in torque, which is force applied to an object on an axis. This measurement differs from strength, which is the maximum amount of force that a muscle can exert against some form of resistance, and also from power, which is the rate of performing work.[26] This measurement was obtained after SM or the sham manipulation only, and did not include other therapeutic modalities typically included in chiropractic care. Because all athletic actions involve dynamic force generation, the data gathered would have a greater application than the single measurement of a maximal voluntary isometric contraction (MVIC). The addition of knee flexion would add to the results of previous experiments which measured the effects of SM on knee extension.[4–8]

It was hypothesized that significant differences would be found between the peak torques following high-velocity, low-amplitude (HVLA) SM and the sham manipulation at 5 minutes posttreatment but not at 20 minutes. This postulation was congruent with previous authors' findings that strength-modulating effects of SM do not exceed 10 to 20 minutes.[4,8,19] It was also estimated that the significant increase in peak torque generation would be most notable during the isometric contractions, considering the increases in isometric torque reported in prior research.[4–25]

Methods

A randomized, controlled, single-blind crossover design was used with 21 healthy subjects (12 men, 9 women) who were asymptomatic regarding low back, pelvic, or lower extremity pain and between the ages of 20 and 35 (23.6 ± 3.1 years) who had never received