Influence of Spinal Manipulation on Autonomic Modulation and Heart Rate in Patients With Rotator Cuff Tendinopathy

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Abstract

Objective: The purpose of this study was to analyze the influence of thoracic spinal manipulation (SM) on autonomic modulation and heart rate in patients with rotator cuff tendinopathy.

Methods: The design of the study was quasi-experimental. Participants were divided into 3 study groups: the asymptomatic group (n = 30), which received SM; the tendinitis group (TG, n = 30), which received SM; and the placebo group (PG, n = 30), which received placebo manipulation. Heart rate variability was analyzed with an electrocardiogram before and after intervention. For intragroup analysis, the paired Wilcoxon test was used to compare the means (pre vs post) of sex and age divided into 5 age groups. The Kruskal-Wallis test was employed for analysis between the groups, and a significance level of 5% was adopted.

Results: The TG demonstrated an increase in respiratory rate (mean of the selected intervals corresponding to parasympathetic activity) post intervention for both sexes ($P = .04$). Heart rate exhibited reduction post intervention in women in the TG ($P = .05$). The PG demonstrated an increase in respiratory rate post intervention for both sexes (female $P = .01$; male $P = .02$). In the age groups, only the PG presented any difference in the 40- to 50-year and 50- to 60-year age groups ($P = .03$) for the same variable. Heart rate exhibited a reduction post intervention in women in the PG ($P = .01$) and a reduction in the 50- to 60-year age group ($P = .04$). No difference in the studied variables was observed in the asymptomatic group, and there were no differences among the groups.

Conclusions: Upper thoracic SM does not directly influence autonomic modulation or heart rate. (J Chiropr Med 2018;17:82-89)

Key Indexing Terms: *Manipulation, Spinal; Tendinopathy; Rotator Cuff; Autonomic Nervous System; Heart Rate*

Introduction

Shoulder pain is the third most common musculoskeletal complaint, being more frequent in adults and gradually increasing with advancing age.[1] In relation to shoulder complaints, it is possible to highlight tendinopathies and rotator cuff injuries,[2] which have an overall incidence rate of 0.3% to 5.5% and an overall prevalence rate of 0.5% to 7.4%.[3,4]

To treat rotator cuff tendinopathy (RCT), conservative treatment is initially recommended, such as neuromuscular re-education exercises and manual therapy. Manual therapy uses techniques with therapeutic purposes that are manually applied on muscle, bone, and connective and nervous tissues, with the aim of promoting physiological reactions that normalize these areas.[5]

Among the manual therapy techniques, spinal manipulation is used to describe a maneuver performed on the spine that employs a dynamic impulse of small amplitude and high speed, known as *thrust*. This procedure can provide changes in reflex excitability and sensory processing.[6,7]

Studies have been carried out that proposed thoracic spinal manipulation as a conservative treatment for shoulder pain and presented clinically positive results for shoulder pain and functionality.[8-10] Based on these findings, individuals with RCT could benefit from such an approach. In addition, the relationship between the

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thoracic spine and shoulder movements leads to the term *regional interdependence*, which refers to the concept that apparently unrelated deficiencies in an anatomic region may be associated with primary symptoms and contribute to patient complaints.[11]

Thus, the rational basis for the clinical use of thoracic manipulation to treat the shoulder is based on this theory. In addition, studies have revealed that reduced mobility of the upper thoracic segments could be related to shoulder pain.[12,13] In this way, manipulation of the upper thoracic region can restore the mobility of the vertebra and consequently have a positive effect on the patient's shoulder.

Despite the therapeutic benefits that have been reported for spinal manipulation for shoulder dysfunction, its mechanisms of action are still not well defined in the scientific literature. Some authors have reported that there is a close relationship between pain and the autonomic nervous system (ANS),[14,15] such that manipulation may result in immediate sympathoexcitatory effects.[16] From this, some studies have revealed that spinal manipulation may be able to stimulate the ANS,[17] which can be analyzed through heart rate variability (HRV).[18,19]

Heart rate variability measured by an electrocardiogram (ECG) is a simple and noninvasive measure for verifying spontaneous cardiac impulses.[20] This measure describes oscillations between consecutive heart beats (ECG R wave intervals) and oscillations between consecutive instantaneous heart rates (HRs).[21] Heart rate variability can also measure the balance between the sympathetic and parasympathetic systems, which may be altered in people who exhibit some dysfunction or pain—for example, in participants with neck or lumbar pain.[18,19] However, it is not known whether this also occurs in individuals with shoulder pain, and although some studies have reported that there may be differences in HRV according to sex and age,[22] there is no consensus on this.

Although the literature contains studies with spinal manipulation related to shoulder articulation and spinal manipulation with HRV, to our knowledge there are no studies that link these 2 themes, especially in volunteers with RCT. Therefore, the present study aims to analyze the influence of spinal manipulation on the autonomic modulation and heart rate of volunteers with RCT.

Methods

The present study is a quasi-experimental study using a quantitative approach, performed in a Clinical Physiotherapy School and in a private clinic. The study was approved by the Ethics and Human Research Committee under Certificate of Presentation for Ethical Consideration number 37088014.0.0000.0118, and all volunteers signed an informed consent form to participate voluntarily in the study.

Participants were intentionally recruited through informal invitation and pamphlets. Inclusion criteria for the tendinitis group (TG) and placebo group (PG) were as follows: RCT; men and women; aged between 20 and 70 years; presenting pain for at least 6 months; accepting kinetic-functional evaluation and presenting a medical report or image examination of rotator cuff injury; not be taking medication that contains beta-blockers and anti-inflammatories for at least 1 month; not undergoing physical therapy; and presenting a pain intensity >3 on the visual analogue scale.[23] The same criteria were used for the asymptomatic group (AG), with the exception of presenting with shoulder injury and pain.

Exclusion criteria for all groups included full rotator cuff injury (>5 cm); any history of shoulder surgery; presenting an absolute contraindication to spinal manipulation; pain in the spine (thoracic region); heart transplant; pacemaker; a history of surgery or trauma to the spinal column; pregnant women; a history of cancer; presenting neurologic disease; and visual or hearing impairment.

A total of 90 participants were divided into 3 groups: AG (n = 30), this group that did not present with shoulder pain and received the true manipulation; TG (n = 30), the group that had a rotator cuff injury and received the true manipulation; and PG (n = 30), the group that presented with a rotator cuff injury and received placebo manipulation.

Regarding the intervention for the symptomatic volunteers (TG and PG), randomization of the manipulation was carried out by a single draw, consisting of an envelope containing 100 pieces of colored paper (50 orange and 50 blue) cut into rectangular shapes. Orange corresponded to the true manipulation, and blue corresponded to the placebo manipulation. In this way, each volunteer removed 1 piece of paper from the envelope and showed it to the physical therapist, who designated the individual to the randomly selected manipulation. Although the volunteers knew of the existence of a PG, they did not know which group they were assigned.

An anamnesis was applied, composed of identification data of the participant and issues pertaining to the research, such as age, sex, and the shoulder with the injury, among others. Subsequently, a kinetic-functional assessment was carried out by a physiotherapist to confirm the injury in question. This evaluation consisted of 5 clinical trials in which volunteers were required to perform at least 3 of the following tests with positive results, indicating signs of rotator cuff injury[24]: (1) positive Hawkins-Kennedy test, (2) positive Neer test, (3) pain during active elevation below 60 degrees in the scapular plane or sagittal plane, (4) positive Jobe test (empty mug), and (5) pain or weakness with external rotation of the shoulder resisted with the arm next to the body.

For HRV assessment, an ECG was performed for 8 minutes before and after the intervention. Participants were