



Effect of spinal manipulation on shoulder pain and range of motion in individuals with rotator cuff tendinopathy

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ABSTRACT

Introduction: There are few studies that propose to identify the relations of the spinal manipulation on the pain and the mobility of the shoulder, especially in injuries of the rotator cuff. **Objective:** To analyze the effect of spinal manipulation on shoulder pain and range of motion in individuals with rotator cuff tendinopathy. **Method:** Quasi-experimental study with quantitative approach. The sample consisted of volunteers aged between 20 and 70 years, presenting pain for at least 6 months, with Rotator Cuff Tendinopathy (RCT). An evaluation form composed of the identification data was applied. Subsequently, the following evaluations were performed: kinetic-functional, pain through the Visual Analogue Scale (VAS) and Range of Motion (ROM) of the shoulder (flexion and abduction) using the goniometer. After the evaluations, the spinal manipulation ("Crossed Pisiform") was performed on the thoracic spine, and then ROM and pain were evaluated. Statistical analysis showed the normality of the data by the Shapiro-Wilk test, comparing the effect of pre and post manipulation. A paired t-test was applied, adopting significance level of 5%. **Results:** Pain after spinal manipulation presented a significant reduction ($p=0,019$). The flexion movement after manipulation showed an increase in ROM in the shoulder with injury, but not significant ($p=0,058$), and for the abduction movement a significant increase was registered in both the shoulder with injury ($p=0,01$) and without injury ($p=0,03$). **Conclusion:** After spinal manipulation it was possible to verify decrease of shoulder pain as well as increase of shoulder ROM with and without injury in the abduction movement.

Keywords: Rotator cuff; Pain; Shoulder; Spinal manipulation; Range of Motion.

INTRODUCTION

Shoulder pain is the third most common musculoskeletal complaint, being more frequent in adults and its occurrence is increased with age.^(1,2) Regarding shoulder complaints, there are tendinopathies, especially tendinopathies due to the rotator cuff lesion⁽³⁾, which include partial tendinopathy and/or complete injury of the supraspinatus, infraspinatus and subscapularis tendon and may be associated to tendinopathy in the long head of the biceps tendon.⁽⁴⁾

For the treatment of rotator cuff tendinopathy (RCT) conservative treatment is initially recommended. However, most of the therapeutic approaches to dysfunction in the shoulder complex aim only the shoulder joint alone. But there are reports in the literature that the restrictions of thoracic movements may interfere in the kinematics of the glenohumeral ligament complex compromising its function.⁽⁵⁻⁸⁾

Regarding the techniques used in manual therapy, spinal manipulation is used to describe a technique performed on the spine, which exert a small-amplitude and high-velocity dynamic impulse known as "thrust". This procedure provides changes in reflex excitability and sensory processing.^(9,10)

Some studies have proposed as a conservative treatment for shoulder pain the thoracic vertebral manipulation. These studies have shown clinically positive results for shoulder pain and functionality.^(11,12,13) However, the repercussion of this on shoulder ROM diverges among the authors, where in some studies there was increase of shoulder ROM after spinal manipulation⁽¹⁴⁾ and in others there was no difference.⁽¹⁵⁾

The aim of this study was to investigate the effect of thoracic vertebral manipulation on shoulder pain and range of motion in individuals with rotator cuff tendinopathy (RCT). The initial hypothesis is that spinal manipulation will

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influence shoulder pain and ROM in individuals with rotator cuff tendinopathy (RCT).

METHOD

This is a quasi-experimental study with a quantitative approach.⁽¹⁶⁾ The research was approved by the Ethics and Research Committee on Human Beings (CAAE - 37088014.0.0000.0118). All subjects signed an Informed Consent Form (ICF) to voluntarily participate in the study.

The process of selection of the sample was intentional, being as inclusion criteria: individuals with rotator cuff tendinopathy of both gender, aged between 20 and 70 years, presenting pain for at least 6 months, who accepted to be submitted by kinetic-functional evaluation, and/or presented with medical diagnostic of the rotator cuff injury, not being in physiotherapeutic treatment and not using anti-inflammatory for at least 1 month.

For the exclusion criteria, were considered participants with complete rotator cuff lesion who underwent shoulder surgery, presented absolute contraindication for vertebral manipulation (fractures, severe osteoporosis, malignancy, circulatory disorders such as aneurysms, anti-coagulant therapy, atherosclerosis, rheumatic arthritis (acute phase), spondylolisthesis, vertebral dislocation), pain in the spine (thoracic region), history of surgery or trauma to the spine, pregnant women, history of cancer, neurological disease, visual and/or hearing impaired.

Initially, an evaluation form composed of the identification data of each participant and questions pertinent to the research was applied, such as age, gender, history of the previous disease, shoulder that presented the lesion, among others. Subsequently, the kinetic-functional evaluation was performed by a physiotherapist with 5 years of experience to prove the lesion of the volunteer. This assessment consisted of five clinical trials where individuals should present at least three of these with positive results indicating signs of rotator cuff injury.⁽¹⁷⁾ The tests were: (1) Positive in the Hawkins-Kennedy test; (2) Positive in the Neer's sign; (3) Pain during active elevation of less than 60 degrees in the plane of the scapula or sagittal plane; (4) Positive in the Jobe's test (empty can) to test for pain or weakness; (5) Pain or weakness with external rotation of the resisted shoulder with the arm at the side of the body.

After that, the participants were assessed for pain through the Visual Analogue Scale (VAS) and Range of Motion (ROM) in the shoulder flexion and abduction movements. These evaluations were performed by the same evaluator, before and shortly after spinal manipulation.

For the evaluation of shoulder ROM the participants were in sitting position. The evaluation for the shoulder flexion movement was performed with the universal goniometer (brand: Carci). The proximal rod of the goniometer was placed in parallel plane with the trunk of the participant, with the axis in the center of the humeral head. The distal rod followed the movement of the upper limb. While for abduction of the

shoulder, the proximal rod was placed in the parallel plane with the trunk, aligned with the scapula and the axis placed in the center of the humeral head. The distal rod was positioned along the humerus, accompanying the movement of the upper limb. These measurements were performed three times for each movement, obtaining an average value of them. During measurements, to not lose the position of the goniometer axis (located in the center of the humeral head), a piece of tape was fixed to the volunteer in this region in order to serve as a reference to the evaluator. The contralateral limb was also assessed following the same recommendations. After these evaluations, the spinal manipulation was performed on the thoracic spine (fourth and fifth thoracic vertebrae). The proposed technique for manipulation is called "Crossed Pisiform". The participants were placed in a prone position with the upper limbs along the body. The physiotherapist was orthostatic to the right of the participant, at the height of the thoracic spine, facing the head and open lower limbs.

The physiotherapist made contact with the hypothenar eminence of the right and left hand in the transverse processes, first of the fourth thoracic vertebra, keeping the upper limbs in extension. The therapist exerted pressure on the vertebra, keeping the upper limbs in extension. He/she asked the participant to take a deep breath and made an impulse at the end of the expiration. The technique was applied perpendicularly and parallel to the joint plane.⁽¹⁰⁾ After manipulation of the fourth thoracic vertebra, the same procedure occurred in the fifth thoracic vertebra.

Statistical analysis was performed using the *Statistical Package for Social Sciences* (SPSS) version 20.0. For the descriptive statistics the mean and standard deviation were used. To verify the normality of the data, a Shapiro-Wilk test was applied. The data presented normal distribution, and in order to verify the effect of pre and post manipulation, a paired t test was applied, adopting a significance level of 5%.

RESULTS

The study sample consisted of 35 volunteers aged between 21 and 70 years (mean age of 44.37 years), of both gender (27 females and 8 males), with average height of 1.65 m and average weight of 69.5 kg. It was verified that the average time in which the participants presented shoulder pain was of 3.37 years and in 77.1% of the cases the pain affects the right shoulder.

Of the sample (n= 35): 48.57% of the subjects do not practice any type of physical exercise, 22.85% are smokers and, in relation to the marital status, 48.57% are married, 28.57% are single, 17.14% are divorced and 5.71% are widowers.

With regard to pain before and after the manipulation, there was a significant reduction of shoulder pain ($p=0.019$) (Figure 1).

The pre- and post-manipulation comparison of the shoulder with the lesion expresses mean values of ROM in flexion and abduction movements. There was a significant increase in abduction of ROM after spinal manipulation (Table 1)



Regarding the shoulder without injury, it was also performed a comparison of pre and post manipulation of the ROM of shoulder flexion and abduction showing an increase of it after the manipulation, but not statistically significant (Figure 2).

Regarding the shoulder without injury, it was also performed a comparison of pre and post manipulation of the ROM of shoulder flexion and abduction (Table 2).

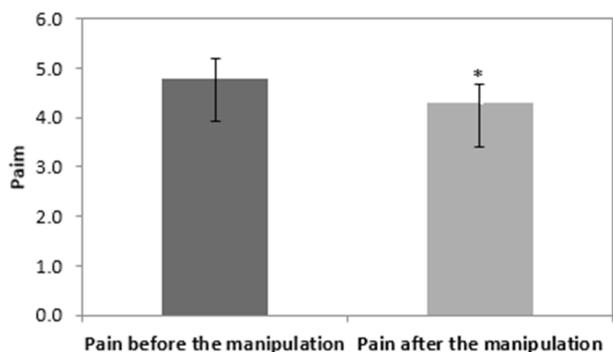


Figure 1 – Evaluation of pain before and after spinal manipulation with values expressed as mean and standard deviation. *(p<0.019).

Table 1 – Comparison of the range of motion (in degrees) of the shoulder with injury in pre and post spinal manipulation. Values expressed as mean.

	Pre	Post	p-value
Flexion	123.8	127.6	0.058
Abduction	113.3	121.1	0.01*

* Significant relationship by t test paired at probability of 5%

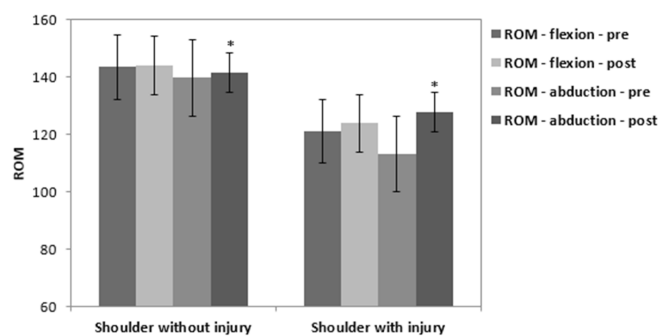


Figure 2 – Comparison of the ROM of flexion and abduction of the shoulder with and without injury in pre and post spinal manipulation. Values expressed as mean and 2x MSD (Mean Standard Deviation). * p<0.05.

Table 2 – Comparison of the range of motion (in degrees) of the shoulder without injury in pre and post spinal manipulation. Values expressed as mean.

	Pre	Post	p-value
Flexion	143.5	144.0	0.44
Abduction	139.7	141.5	0.03*

* Significant relationship by t test paired at probability of 5%

It was observed that there was an increase in ROM in both movements measured after spinal manipulation and, although some results were not statistically significant, both the shoulder with and without injury demonstrated an increase in ROM.

DISCUSSION

The aim of this study was to analyze the effect of spinal manipulation on shoulder pain and range of motion in individuals with rotator cuff tendinopathy.

It is known that tendinopathy involves extrinsic causes, intrinsic causes or the combination of these. When the patient has a partial rotator cuff injury, it is common to have reduced shoulder function (dyskinesia, weakness, pain and stiffness). In the evaluation, the therapist may find weakness of external rotators (supraspinatus weakness) and shoulder impact signs that may include subdeltoid bursa inflammation or positive special tests causing symptoms.^(18,19)

In order to improve the pain, the physiotherapy has some manual techniques, among them the spinal manipulation. This is a manual therapy technique that is characterized by exerting a small-amplitude and high-speed dynamic impulse known as “*thrust*”.^(9,10) Studies have shown that thoracic vertebral manipulation may be beneficial in reducing shoulder pain and dysfunction⁽²⁰⁻²²⁾ And aims to recover the physiological movement in areas that present some dysfunction or restriction. Thus, it can improve the function of the musculoskeletal system and also areas covered by the nerve or circulatory pathways, in order to benefit the overall function.⁽⁹⁾

In the present study, individuals with RCT had a significant reduction of pain after vertebral manipulation. Similar results were found in studies that proposed the thoracic vertebral manipulation as conservative treatment for shoulder pain. These studies have shown clinically positive results for shoulder pain and functionality.^(20,21,15,11-13)

According to research, any loss of joint movement in one segment will develop damage in another zone that should be compensated with a hyperfunction or a hypermobility.⁽²²⁾ By making this analogy, it is possible that a restriction of the movements of the thoracic vertebrae could trigger hypermobility in the shoulder complex where the clinical signs would be present. Still according to the researchers, it is very frequent to observe a rigid zone between the first and fifth thoracic vertebra.

The present study showed an increase in the ROM of shoulder abduction after high thoracic manipulation. These results corroborate with another study⁽²³⁾ which aimed to assess the ROM of arm abduction of subjects with impact syndrome of the shoulder in pre and post intervention using a set of vertebral manipulation, among them, the high thoracic vertebral manipulation of crossed pisiform type, and evidenced an increase in ROM of arm abduction.



In other study⁽¹⁵⁾ the effects of thoracic manipulation were evaluated in 30 individuals with signs of rotator cuff tendinopathy. In this study, were evaluated the scapular kinematics and the electromyographic amplitude signal of the shoulder musculature, besides the ROM, numerical scale pain and function by the Penn Shoulder Score and DASH questionnaires. The results were positive for pain reduction immediately after manipulation and improvement of function from 7 to 10 days after manipulation. However, according to the authors, these results could not be explained by changes in the scapular kinematics or by the activity of the shoulder muscles, since the changes were not statistically significant. The authors suggest that other neurophysiological processes have probably contributed to significant reductions in pain and improvement of function, and that further studies evaluating changes in pain perception may help to clarify how thoracic manipulation influences pain and function in people with signs of tendinopathy rotator cuff.

Similarly, Haik *et al*⁽¹¹⁾ Investigated the scapular kinematics by three-dimensional analysis, before and after thoracic vertebral manipulation in individuals with and without shoulder impact symptoms, in addition to pain, evaluated by the numerical scale of pain and the DASH and Western Ontario Rotator Cuff (WORC) questionnaires. There was a decrease in pain in individuals with shoulder impact symptoms immediately after thoracic manipulation. Changes in scapular kinematics were not considered clinically important.

There is the hypothesis that thoracic re-adaptation would provide improved overall functionality.⁽²⁴⁾ In this way, the manipulation performed can affect both the ROM of the shoulder and the decrease of the pain, as verified by the present research.

Despite the positive results of the present study, it is necessary to highlight some limitations that make it impossible to generalize the results found. First, the study does not include a placebo group and/or a control group to better understand the effect of thoracic vertebral manipulation, which, therefore, prevents it from establishing a cause and effect relationship. Secondly, the ROM and pain were verified by the same person who performed vertebral manipulation.

CONCLUSION

In this study, thoracic vertebral manipulation applied to individuals with rotator cuff tendinopathy was shown to be effective for decreasing shoulder pain, as well as for increase the ROM in the abduction movement of the shoulder with and without injury. For future studies it is suggested that a long-term follow-up of the individuals and a sample with a greater number be used, a placebo and control group be included, the evaluation be blinded.

AUTHOR'S CONTRIBUTION

ACS: Contributed in the conception and research design, data collection, analysis and interpretation of data and writing of the manuscript; JFP:

Participated in analysis and interpretation of data and writing of the manuscript; JLBM: Contributed in the statistical analysis; CMGM: Participated in the data analysis and writing of the manuscript.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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