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RESEARCH ARTICLE

Acute effects of joint manipulation on myofascial trigger point pain: A randomized clinical trial

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Abstract

Background: Myofascial trigger points are considered one of the main myofascial pain syndromes in the neck, characterized by regional pain and muscle tenderness with the presence of hypersensitive nodules in the muscle band. Several techniques are tested for controlling this pain, one of the options being joint manipulation. These techniques can be used either individually or even combined, in order to elicit neurophysiological responses related to pain processing and inhibition. **Objectives:** Evaluate the immediate effects of combined joint manipulation versus isolated application of this technique on the pressure pain threshold in individuals with trigger points in the upper trapezius fibers. **Methods:** Thirty participants aged between 18 and 30 years with myofascial trigger points in the upper trapezius muscle were distributed into three groups: cervical manipulation, thoracic manipulation, and combined manipulation. The visual analog scale and pain threshold were measured pre- and post-intervention in the upper trapezius muscle. **Results:** The results showed a significant difference between groups for pain (p=0.009), but there was no difference between groups for pressure pain threshold. Other studies have already shown significant effects of joint manipulation on pain and pressure pain threshold in individuals with myofascial pain. The combination of interventions that have neurophysiological responses related to pain inhibition has superior effects compared to local response techniques. **Conclusion:** It was concluded that cervical joint manipulation combined with thoracic manipulation was more effective in reducing myofascial trigger point pain in the trapezius muscle than cervical or thoracic manipulation applied in isolation. There was no difference in relation to the pressure pain threshold.

Keywords: Joint manipulation; myofascial trigger points; musculoskeletal pain.

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BACKGROUND

The myofascial trigger point (MTP) has been considered one of the main causes of myofascial pain syndrome (MPS) (30-85%) in individuals with musculoskeletal pain, such as neck pain. MTP are a condition associated with regional pain and muscle tenderness characterized by the presence of hypersensitive nodules within tense bands of muscle. They are defined as discrete areas of muscle sensitivity in tense muscle bands that are spontaneously painful[1]. In the head and neck region, trigger points in the cervical muscles often incite and perpetuate. Management requires the identification and control of as many perpetuating factors as possible (posture, body mechanics, psychological stress or depression, lack of sleep or nutrition)[2]. They can also develop as a result of athletic training and muscle tension, or they may be related to a physical condition, such as a herniated disc or arthritis. Trigger points generally occur in the trunk, most commonly in the shoulders and neck, and do not develop in the arms or legs. There are two different types of trigger points: active and latent[3]. Some studies have demonstrated the potential relevance of latent MTP. In fact, their presence can cause changes in the activation pattern. It has also been suggested that latent trigger points increase nociceptive sensitivity and alterations in sympathetic activity induced by latent MTP nociceptive stimulation have been investigated. However, individuals, even asymptomatic ones, can have trigger points, and a high prevalence of trigger points is found in the neck and scapular regions[4]. The formation of trigger points still does not have a unique definition; some studies have shown that the most common causes are trauma, fatigue from excessive use, joint dysfunctions, muscle fiber injuries, and psychological factors. These are factors that can trigger a decreased amount of nutrients and oxygen in muscle cells, these factors lead to an increase in tissue metabolic capacity[5].

Within the field of manual therapy, there are several effective interventions, one of which is low-amplitude, high-velocity joint manipulation, known as thrust manipulation. The main effects offered by this technique have neurophysiological characteristics mediated by spinal cord structures and supraspinal areas, with various neurochemical responses being released after the manipulation is applied, causing changes in muscle-reflexogenic responses, somatosensory processing, central motor excitability, cerebral neuroplastic alterations, motor neuron activity, sympathetic activity, central sensitization, and Hoffmann reflex responses (H reflex)[6]. Manual therapy interventions are popular among healthcare professionals, and the results obtained with this technique stem from the patient's beliefs, the professional's expertise, and the environment. A model suggesting the effects of manual therapy points to systemic neurophysiological responses leading to pain inhibition[7]. Manual therapy interventions have demonstrated an effective strategy for pain and pressure pain threshold in individuals with MTP. Among the manual therapy modalities, combined techniques and afferent reduction are the most effective for pressure pain threshold (PPT)[8]. Other studies have demonstrated efficacy for both muscles and joint deficits, with an immediate change in sensitivity and pressure pain threshold in trigger points of the upper trapezius muscle observed after a single cervical manipulation technique directed at the C3 – C4 levels. The results demonstrated an immediate decrease in basal electrical activation, sensitivity, and PPT of the upper trapezius muscle[9].

Therefore, the objective is to evaluate the immediate effects of combined joint manipulation compared to the isolated application of this technique on pain intensity and PPT in individuals with MTP in the upper fibers of the trapezius muscle.

METHODS

This study was approved by the Ethics Committee for Research with Human Beings of UniSALESIANO de Lins (CAAE: 67671723.2.0000.5379). Thirty participants aged between 18 and 30 years, of both sexes, were included, who presented MTP in the upper trapezius muscle, detected by palpation and assessment with an algometer[9]. The exclusion criteria included a history of spinal surgery, systemic diseases, recent use of analgesics, and other conditions that could influence the results[10,11]. The participants were randomized into three groups: cervical manipulation, thoracic manipulation, and combined manipulation. The intensity of pain was measured using the Numeric Pain Scale (NPS), and the pressure pain threshold was assessed with an algometer.

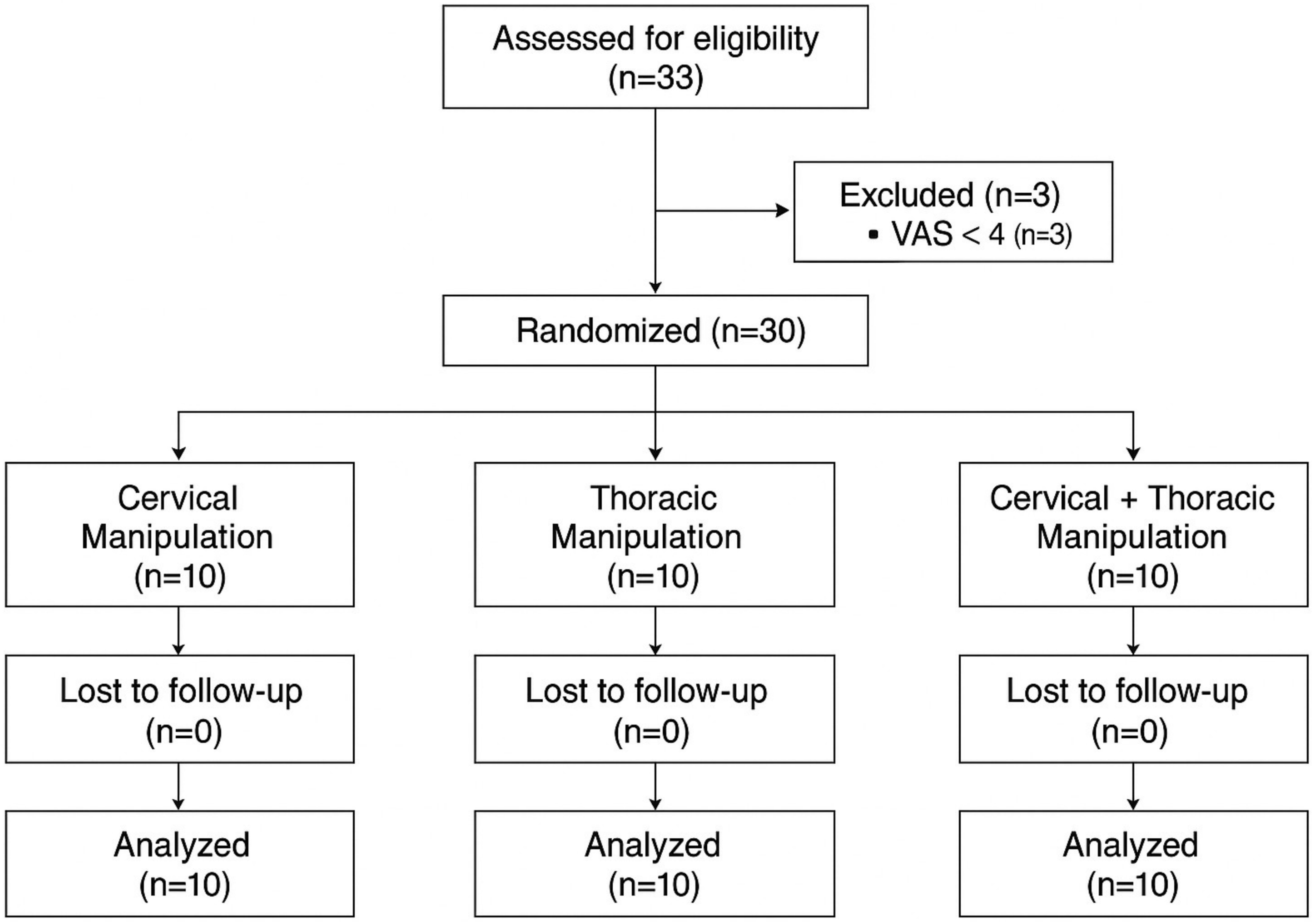

Figure 1. Study Flowchart

The included participants underwent an evaluation to provide their personal data such as name, age, weight, and height, and signed the Free and Informed Consent Form. after that, they underwent a physical examination using a pressure algometer to identify data such as pain and pressure pain threshold of the upper trapezius muscle fibers. The participants were stratified and randomized using the website *https://www.randomization.com*, where information such as sample size and number of groups was entered. The volunteers will be allocated into three groups: isolated cervical manipulation (ICM), isolated thoracic manipulation (ITM), or combined cervical + thoracic manipulation (CCT).

Procedures

The participants underwent an evaluation where the NPS was applied to identify the pain intensity (0 to 10) and algometry was used to identify the pressure pain threshold of the upper trapezius muscle. After the evaluation, another researcher entered the room and, according to the randomization, applied the technique according to the group they were allocated to. They received cervical manipulation, thoracic manipulation, or both manipulations. After the procedure, there was a 5-minute interval, and the participants underwent a post-intervention assessment. Once the re-evaluation was completed, the participants concluded their participation in the study.

Outcomes

Pain Intensity

NPS of sensory intensity and affective magnitude were validated as ratio scale measures for chronic and experimental pain[12]. To assess the NPS, the individual in a seated position with an algometer received a pressure of 2.5 kg of pressure. According to this pressure, the individual reported their pain intensity from 0 to 10, 0/no pain and 10/worst pain ever felt. The pressure was applied only once to obtain the NPS value. The assessment instrument will be a pressure algometer of the novotest brand – digital force gauge - model: SF-2.

Pressure pain threshold

Through palpation of the upper trapezius with the aid of an algometer, a device designed to assess and measure pain tolerance and perception in Kgf. For measurement, the individual will remain in a seated position[13], where the evaluator will find the most painful tension point of the muscle band, it will be marked with a pen, then three pressures will be applied, the value will be obtained when the digital pressure causes pain perception reported by the participant, at that moment they will say "pain" and the pressure will be paused, and the value obtained by the device will be recorded. The evaluation instrument will be a pressure algometer from the brand Novotest – digital force gauge - model: SF-2 (NOVOTEST Ltd. Spasskaya, Samar, Ukraine) (Fig 2).

Figure 2. Evaluation of pain threshold by pressure

Interventions

Cervical Manipulation

The researcher performed a high-velocity low-amplitude (HVLA) thrust on the most symptomatic segment of the cervical spine and the restricted side in the cervical lateralization test. The direction of the impulse and the number of two impulses were based on the individualized assessment of the patient[14].

The physiotherapist will position themselves at the head of the table and, with the middle phalanx of the second finger of one hand, will laterally support the articular processes of the selected vertebrae, and with the contralateral hand, will support the opposite side of the volunteer's face. Then, the researcher will perform a homolateral inclination to the selected segment and a contralateral rotation to the tissue barrier in order to carry out the manipulative impulse in rotation with high speed and short amplitude. (Fig. 3)[15].

Figure 3. Cervical joint manipulation technique

Thoracic Manipulation

The manipulation of the upper thoracic was performed with the patient supine. For this technique, the patient held their arms and forearms across their chest with the elbows aligned in a supero-inferior direction. The therapist made contact with the transverse processes of the lower vertebrae of the target movement segment using the thenar eminence and the middle phalanx of the third digit.

The superior lever was positioned over the target movement segment by adding rotation and lateral curve towards the therapist, while the inferior hand used pronation and radial deviation to achieve rotation and moments of lateral deviation, respectively. The space below the xiphoid process and the costochondral margin of the therapist was used as a contact point against the patient's elbows to provide a manipulation in the anterior-posterior direction targeting the upper thoracic region bilaterally[16] according Fig 4.

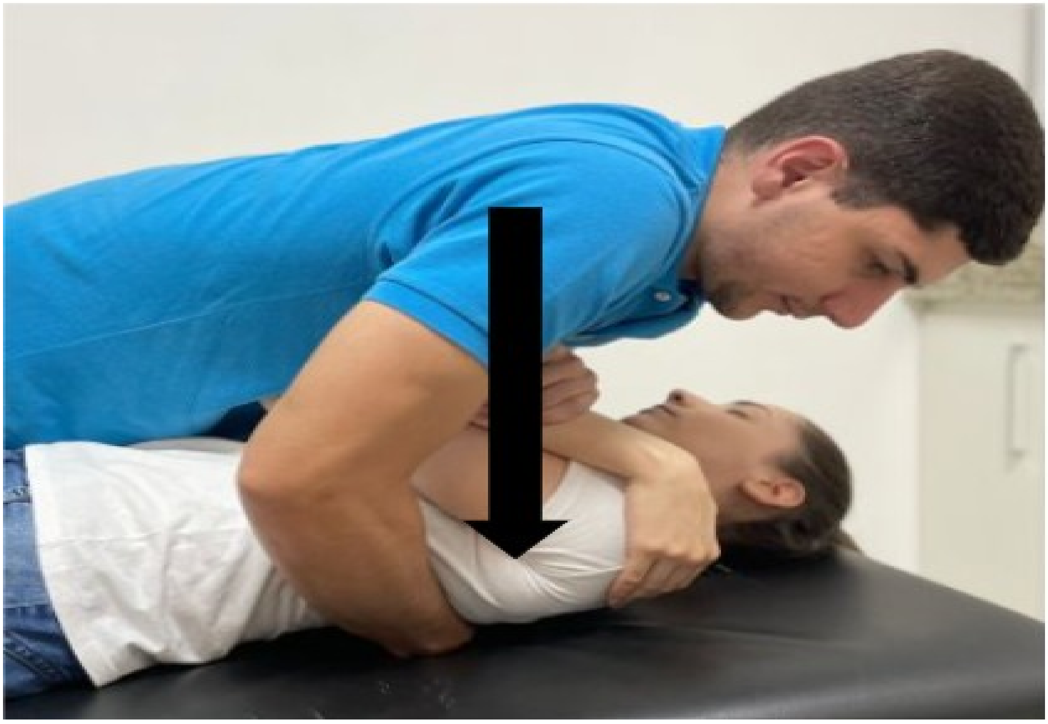

Figure 4. Thoracic joint manipulation technique

Data analysis

Data analysis will be performed using the Statistical Package for Social Science (SPSS) version 20.0 (SPSS, Inc., Chicago, USA). Data will be presented as mean and standard deviation and through descriptive techniques, such as graphs and tables. Data normality will be assessed using the Shapiro Wilk normality test, and if presented in normal distribution, they will be subjected to mixed analysis of variance (ANOVA) of repeated measures (between subjects and within subjects). In the presence of significant difference ($p<0.05$), Tukey's post hoc test will be applied.

RESULTS

Table 1. Características demográficas dos participantes de cada grupo

Characteristics	Cervical Manipulation (n=10)	Thoracic Manipulation (n=10)	Cervical + Thoracic Manipulation (n=10)
Gender n (%)			
Male	4 (40%)	3 (30%)	1 (10%)
Female	6 (60%)	7 (70%)	9 (90%)
Age, yars (mean±DP)	19,9±0,73	20,9±1,44	21±1,9
BMI Kg/m² (means±DP)	24,05±5,9	27,5±6,9	24,9±3,3
Manipulated Side n(%)			
Law	6 (60%)	7 (70%)	7 (70%)
Left	4 (40%)	3 (3%)	3 (30%)

The means of the END for all groups are shown in Table 2. There was a significant difference in the END measurement in the interaction between groups (p=0.009) where cervical and thoracic MA showed a reduction in END compared to cervical MA (p=0.05), and cervical and thoracic MA showed a reduction in END compared to thoracic MA (p=0.004) for the post-intervention measurement. No significant difference was observed between cervical MA and thoracic MA (p=0.23).

Table 2. The baseline, and post-intervention Numeric Pain Scale, and the percentage of change (Mean ± standard deviation)

Groups	**Baseline** mean ± standard deviation	**Times post intervention**	**% change**
Cervical Joint manipulation	**6.9 ± 0.9**	**5.5 ± 1.7**	**-21%**
Thoracic Joint manipulation	**5.7 ± 1.6**	**5.1 ± 2.0**	**-10%**
Cervical and thoracic joint manipulation	**6.7 ± 1.5**	**3.3 ± 2.9**	**-50%*#**

Percentage of change in NPS for the cervical JM, thoracic JM, and cervical and thoracic MA groups (mean±SD). Differences from baseline. * indicates that the thoracic and cervical MA is significantly different from the cervical MA (p=0.05). # indicates that cervical and thoracic MA are significantly different from thoracic MA (p=0.04).

The means of the LDP for all groups are shown in Table 3. There was no significant difference in the LDP measurement for any of the groups. Cervical and thoracic MA compared to cervical MA (p=0.06), cervical and thoracic MA compared to thoracic MA (p=0.58), and cervical MA compared to thoracic MA (p=0.45).

Table 3. Mean ± SD (standard deviation) of the pressure pain threshold (PPT) expressed in kilograms at baseline, post-interventions, and the percentage change found.

Groups	Baseline	Times post intervention	% change
Cervical Joint manipulation	**2.3 ± 0.6**	**2.4 ± 0.7**	**-3%**
Thoracic Joint manipulation	**2.3 ± 1.4**	**2.5 ± 1.6**	**-9%**
Cervical and thoracic joint manipulation	**1.9 ± 0.5**	**2.2 ± 0.4**	**-21%**

Note: JM = joint manipulation. Percentage change in PPT for the cervical MA, thoracic MA, and cervical and thoracic MA groups (mean ± SE). No significant differences were found between the groups.

DISCUSSION

In this controlled and randomized study, the current overall results suggest that the combination of cervical and thoracic thrusts is superior to an isolated thrust of these areas for pain, but not for the pressure pain threshold in individuals with MTP in the upper trapezius muscle. Spinal manipulative therapy has been proposed to induce hypoalgesia in the treatment area, but also in distal locations[17]. Changes in pain perception after manipulation were also explained based on peripheral, spinal, and supraspinal mediators and mechanisms[18]. The hypothesis that this coordinated hypoalgesic and autonomic response may be the result of the activation of descending inhibitory pathways in the central nervous system, specifically, they suggest that joint manipulation activates the periaqueductal gray matter[19].

The mechanical force applied in manual therapy can result in systemic neurophysiological responses and consequently cause pain inhibition. According to this reasoning, this study sought to evaluate whether the association of manipulation in two different areas of the spine could cause a greater effect, considering that these neurophysiological responses have a summative effect for pain inhibition[6].

A study demonstrated the effectiveness of cervicothoracic manipulation on the pressure pain threshold in the upper trapezius muscle compared to manual stretching[20]. Another study demonstrated that manipulation associated with TENS shows superior results compared to the isolated use of interventions at the pressure pain threshold in asymptomatic individuals[11]. In asymptomatic patients, the combination of various spinal manipulations did not yield significant results for pressure pain threshold, whereas in symptomatic individuals, this effect may be related to pain-related neuromodulators[22]. A systematic review with meta-analysis showed the efficacy of joint manipulation in individuals with acute cervical pain; manipulation can be used either alone or in combination with other interventions[23]. JM is already presented in several clinical practice guidelines for the treatment of acute or chronic cervical pain. Cervical manual therapy combined with thoracic therapy reduced cervical pain and associated cervical disability more effectively than cervical manual therapy alone[24].

CONCLUSION

With this study, it can be concluded that combined JM (cervical and thoracic) is more effective in the immediate reduction of pain in individuals with MTP in the upper trapezius muscle, compared to the isolated application of manipulations. However, no significant differences were observed in the pressure pain threshold between the groups. It is recommended to conduct future studies with larger samples to explore the long-term effects of these interventions.

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Conflict of interest: The authors declare that there are no conflicts of interest related to this study.

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