Original article

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The effects of the spray stretch and sustained pressure techniques for managing trigger points in the upper part of the trapezius muscle

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Abstract

Introduction: Among the interventions used to manage trigger points in the upper part of the trapezius muscle, spray stretch and sustained pressure interventions are relatively poorly studied. This aim of this study was to determine the effects of the spray stretch and sustained pressure for the management of trigger points in the upper part of the trapezius muscle.

Material and methods: A randomized clinical trial was perfofmed including 54 patients. The participants were randomly allocated into two treatment groups via the sealed envelope method. Group A received the spray stretch technique with conventional treatment while group B received the sustained pressure technique with conventional treatment. Both groups received six treatment sessions and were evaluated at baseline and after two weeks by pain pressure algometer, visual analogue scale, neck disability index, goniometer, and hospital anxiety depression scale.

Results: Group B showed significantly more improvement in pain threshold ($p < 0.05$) than group A, while neck disability points were significantly decreased in Group A ($p < 0.05$) than group B. Group A showed more improvement in neck ranges ($p < 0.05$) than group B. Both groups showed significant improvements in anxiety and depression ($p < 0.05$). Group A demonstrated a greater improvement in anxiety score than group B. Both groups demonstrated significant improvements in participant pain intensity ($p < 0.05$).

Conclusions: Both the spray stretch and sustained pressure techniques were effective at increasing pain threshold, increasing cervical range of motion, decreasing neck disability, decreasing pain intensity and improving anxiety among patients with an upper trapezius trigger point.

Keywords: acupressure, algometry, chloride, ethyl, myofascial pain syndrome

Introduction

Myofascial trigger points (MTrPs) are thought to be one of the most frequent sources of musculoskeletal discomfort [1], with a lifetime prevalence of 85% among the global population [2]. In addition, it is estimated that these are the cause of 30% of visits to orthopaedic or general clinics [3]. The upper fibres of the trapezius muscle are thought to contain a higher concentration of active MTrPs [4]. Despite varying between populations, the prevalence is believed to be 80% for the right upper trapezius and 35% for the left upper trapezius [5].

They also cause shoulder soreness and neck pain [1,6]. Active trigger points are more likely to be experienced by people aged 20-45 years, with a greater prevalence in women than men [7]. The cardinal features of MTrP include, tender point, pain reproduction, jump sign, local twitch response, referred pain, restriction in ranges and changes occurring in the autonomic nervous system [8, 9]. It is possible to distinguish between latent and active MTrP [6].

The primary goals of MTrP management are to eliminate pain, improve range of motion, and manage any predisposing factors [10]. Currently a large number of interventions exist for TrP management, which are classified as invasive and non-invasive [11]: dry needling, injections therapy, acupuncture, spray stretch technique, ischemic compression, strain-counter strain, proprioceptive neuro muscular facilitation and muscle energy technique [12].

Ischemic compression is a non-invasive manual technique in which the practitioner applies direct pressure on the tender point identified by palpation [13]. A recent systematic review found that ischemic compression plays an essential role in managing the upper portion of trapezius triggers. In addition, the spray and stretch technique can be used to inactivate trigger points and any involved muscles [14]. In this procedure, the effected muscle is placed in a stretch position and an ethyl chloride or fluromethane vapocoolant spray is applied parallel to the muscle fibre at a distance of about 18 inches. It is believed that the resulting reduction in skin temperature blocks the sensation of pain and spinal stretch reflex, thus allowing the muscle to reach its full length. This procedure inactivates the trigger point and helps in pain relief [10]. Several studies have reported that the spray and stretch technique is effective in the management of MTrPs [7, 15, 16]. However, relatively little data exists comparing the effectiveness of the spray stretch and sustained pressure techniques for the treatment of upper trapezius trigger points**.** Previous studies on this topic did not measure the cervical ROM, pain intensity or psychological distress associated with MTrP. Due to a lack of appropriate evidence, pain and discomfort are commonly associated with trigger points and are often mishandled. Therefore, this study was carried out to find the most effective treatment for the management of the trigger points of the upper part of the trapezius muscle. The findings will indicate the best approach for treating triggers to accommodate the needs of patients, and may serve as the background for future study.

Therefore, the research questions for this randomized trial were:

1. Do the spray stretch and sustained pressure techniques improve pain threshold and neck disability in people with upper trapezius trigger points?
2. Do the spray stretch and sustained pressure techniques improve the range of motion and pain intensity of the cervical spine?
3. Do the spray stretch and sustained pressure techniques reduce the anxiety symptoms of people with upper trapezius trigger points?

Materials and methods

Participants

This study was performed as a double-blinded randomized clinical trial, with concealed allocation, blinding of patient and assessors. The sample size was calculated by the open epi tool with a confidence interval of 95% and study power of 80%. The post-study mean pain threshold values of the upper trapezius triggers point were taken from the parent study: Group A: Mean 1.08 (SD 0.39), Group B: Mean 1.5 (SD 0.66) [7]. A total of 54 patients with upper trapezius active trigger points were recruited and randomly allocated to one of two groups (27 in each) via the opaque sealed envelope method.

The participants were selected through purposive sampling at Northwest General Hospital and Research Center and Khyber Teaching Hospital, Peshawar from September 2020 to March 2021. All patients were aged between 20 and 35 years; they also presented with at least one active MTrP in the upper fibres of the trapezius muscle and painful restriction of motion of the neck when bending to the contralateral side of the involved muscle. The exclusion criteria comprised a pain mechanism similar to trigger point pain but not related to MTrPs, such as cervicogenic headache, any traumatic injury to the cervical region (like whiplash injury) or any other cervical spine surgery, cervical tumors, reflex sympathetic dystrophy, thoracic outlet syndrome or cervical radiculopathy.

This study was performed in accordance with of the Declaration of Helsinki, and has been approved by the review board of Riphah College of Rehabilitation and Allied Health Sciences Islamabad, Riphah University, Islamabad (Ref: RIPHAH/RCRS/REC/Letter-00686). The clinical trial has been registered in (https://clinicaltrials.gov/) (identification No.: NCT04559906). All study participants have given their written informed consent to take part.

Before intervention, the length of the upper trapezius was assessed by quality of end feel and by bilateral comparison [17]. The upper trapezius typically as a gradual soft end feel [18]. TrP1 are typically found in the vertical fibres that attach anteriorly to the clavicle and are situated in the middle of the anterior border of the upper trapezius [19]. TrP2 are found within the almost horizontal, more central fibres of the upper

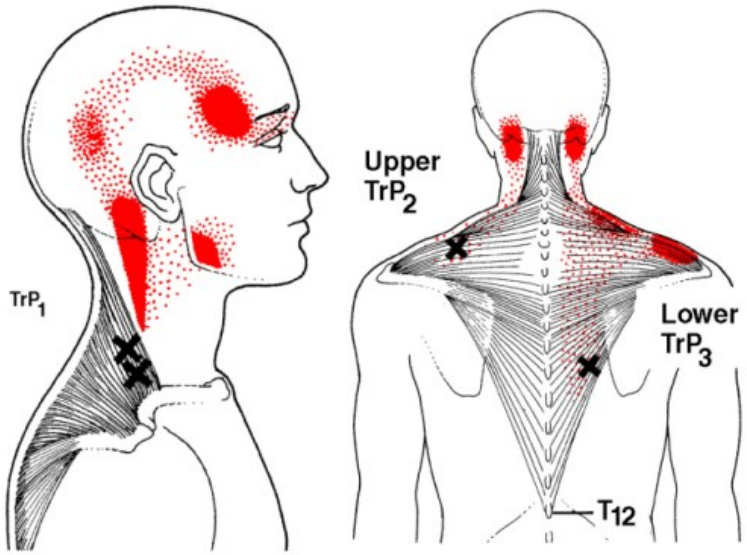

Fig. 1. 1 Trigger points 1 and 2 locations [19]

trapezius (Fig. 1) [19]. The presence of a trigger point was confirmed by the recognition of a taut band, a local twitch reaction brought on by pincer palpation, as well as the recreation of symptoms and referred pain brought on by compression of the TrP: consisting of a roughly 20 N force applied for 5 s [20].

Procedure

The patients allocated to Group A received the spray and stretch technique while Group B received the sustained pressure technique. In addition, both groups received identical conventional treatments comprising a heating pad for ten minutes, stretching (three sets of ten repetitions with ten seconds hold of the affected muscles, i.e. the upper trapezius) and AROM (active range of motion) of cervical area (flexion, extension, rotation and side bending) with three sets of ten repetition [21]. Both groups were treated by a physical therapist specialized in manual therapy with five years' experience. A different physical therapist recorded the pre and post measurements.

Group A received spray and stretch technique with conventional treatment. Each group received six sessions three times in a week for two consecutive weeks [21]. In accordance with Simons' original description of the technique, the upper trapezius muscle was stretched, and the patient was positioned in a relaxed sitting position on their ipsilateral hand to anchor the distal end of the affected muscle. Three to five parallel sweeps of ethyl chloride sprays were made over the upper trapezius muscle. The muscle was then stretched as far as it could go while still being comfortable, until the examiner felt the muscle tension barrier. The procedure was repeated two to three times [7, 20].

Group B received sustained pressure release with conventional treatment. A total of six sessions were performed three times a week for two consecutive weeks [21]. The sustained pressure release was implemented in two phases. In the primary phase, the triggers in the upper fibres of the trapezius were identified by palpation. MTrP were recognised as hard and hypersensitive bands within the muscle belly. In the secondary phase, the pressure-release technique was used, in which pressure was applied for 8 s to 18 s, and incremented slowly to a maximum of at least 20 s. The technique, i.e. the pressure, was continued until discharge was felt by the fingers, which could last five or even more minutes [7,20].

Outcome measures

All participants were evaluated at baseline and after a two-week follow-up.

The primary outcomes were pain threshold and functional disability. Pain threshold was measured by a Wagner Instruments FPX 10 digital algometer. The participant was placed in a position of comfort. Firstly, the trigger point in upper trapezius was identified through palpation. Then the algometer is placed on the affected site and constant vertical pressure was applied. The pressure was increased at a rate of 1kg/sec until the patient felt discomfort. The patient was instructed to raise their hand when feeling slight discomfort. The value was recorded and the procedure was repeated three times with 30 s breaks between each. The mean value was calculated as the pain threshold. The pressure algometer is a reliable tool for measuring pressure pain threshold [22]. Functional disability was measured by the neck disability index (NDI), which shows great responsiveness in evaluating cervical pain and disability

in patients with cervical pain due to recent or chronic conditions [23].

The secondary outcomes were pain intensity, cervical range of motion and anxiety symptoms. The Visual Analogue Scale (VAS) was used to evaluate subjective pain intensity. The participants were instructed to indicator the current status of pain on a scale. At the back of the scale, a 10 cm line marked 0-10 was introduced [24]. VAS is a reliable way to assess acute pain [25]. A universal goniometer was used to measure the cervical ranges: this is a reliable, inexpensive and easy-to-use device for measuring neck ROM [26]. Anxiety and depression were measured by the 14-item HADs (Hospital Anxiety and Depression scale); the items are divided into two categories, depression and anxiety, each with seven items. HADS is an accurate and reliable scale used to evaluate psychological distress in hospital and community setups [27].

Statistical analysis

The statistical analysis was performed by using IBM Statistical Package for Social Sciences, 25 (SPSS,v25) software. The data was tested for normality using the Shapiro-Wilk test. When the data was found to have a normal distribution, the independent t-test was applied for between-group analysis and the paired t-test for within-group analysis. When the was not normally distributed, the Mann-Whitney U-test was applied for between-group analysis and the Wilcoxon test for within-group analysis. Statistical significance was assumed as $p < 0.005$ for all tests.

Results

Flow of participants through the study

Between September 2020 and March 2021, 80 patients were screened for eligibility. Of these, 26 were excluded and 54 were randomly allocated to Group A or Group B (27 in each group; Fig. 2). Of the 54 enrolled participants, 32 (59.3%) were male and 22 (40.7%) were female. Group A had 17 men and 10 women, with a mean age of 27.1 (3.7) years, while Group B had 15 men and 12 women, with mean age of 26.4 (3.15) years. None of the participants dropped out during the study. The baseline characteristics of participants are listed in Table 1. There were no significant differences in clinical measures.

Effect of intervention

Table 2 presents a comparison of variables between groups. Before the intervention, a between-group

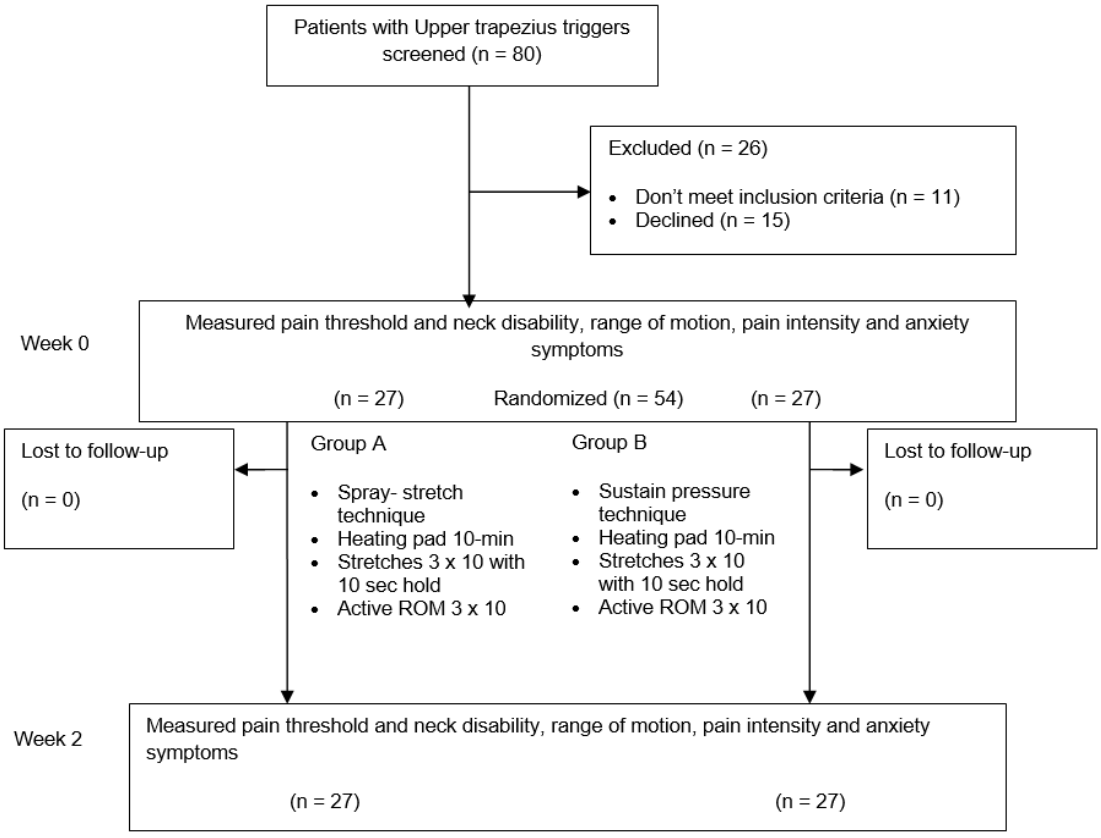

Fig. 2. Flowchart of the participants

Tab. 1. Baseline characteristics of participants

Characteristic	Group A (n = 27) Mean (SD)	Group B (n = 27) Mean (SD)	p
Age (years)	27 (3)	26 (3)	0.48
Sex			
Male n (%)	17 (62)	15 (55)	
Female n (%)	10 (37)	12 (44)	
Height (cm)	165 (3)	166 (3)	0.78
Weight (kg)	64 (7)	63 (7)	0.79
BMI (kg/m^2)	23 (2)	23 (2)	0.73
Neck pain duration (weeks)	2 (1)	2 (0)	0.08

BMI – Body Mass Index, SD – standard deviation.

Tab. 2. Comparison of variables between Group A and Group B

Outcome	Mean (SD) between group					
	Pre-test			Post-test		
	Group A (n = 27)	Group B (n = 27)	p-value[a]	Group A (n = 27)	Group B (n = 27)	p-value[a]
Pain Pressure Threshold (kg/cm^2)	0.98 (0)	1.00 (0.0)	0.16	1.64 (0.1)	2.29 (0.14)	0.000
Neck Disability Index (0-50)	13.0 (5.4)	15.3 (5.6)	0.12	3.29 (2.3)	8.03 (4.3)	0.000
Cervical ROM (degrees)						
Flexion	48.5 (5.0)	49.2 (5.1)	0.59	60.0 (4.8)	55.5 (5.6)	0.003
Extension	44.1 (4.9)	46.5 (8.7)	0.22	58.2 (5.2)	53.8 (7.2)	0.01
Rt Rotation	49.5 (5.6)	50.3 (4.2)	0.58	60.7 (4.9)	56.4 (4.5)	0.002
Lt Rotation	48.9 (5.1)	49.1 (4.7)	0.91	60.3 (5.5)	55.6 (4.8)	0.002
Rt Side Bending	45.1 (4.7)	44.2 (6.3)	0.65	54.3 (5.8)	50.9 (4.3)	0.01
Lt Side Bending	40.9 (7.0)	41.4 (6.3)	0.80	53.3 (5.4)	50.0 (5.2)	0.02

[a] – independent *t*-test, ROM – range of motion.

analysis revealed no significant difference between the groups for all variables ($p > 0.05$). However, significant between-group differences were observed in pain threshold ($p = 0.000$); the improvement was estimated to be greater in Group B (Tab. 2).

Similarly, the neck disability scores of the two groups differed significantly after the intervention ($p = 0.000$); this improvement was more favourable in Group A (Tab. 2). Cervical ROM also significantly differed between groups after intervention ($p < 0.05$), with a greater improvement observed in Group A (Tab. 2).

The anxiety and depression scores after intervention were significantly different between groups with $p = 0.000$ (for anxiety), $p = 0.001$ (for depression) ($p < 0.05$). The improvement was more favourable in Group A (Tab. 3).

Tab. 3. Median (IQR) value of interventions, median (IQR) difference within interventions, and difference between interventions

Outcome	Median (IQR) within groups						Median (IQR) between groups					
	Group A (n = 27)			Group B (n = 27)			Pre-test			Post-test		
	Pre-test	Post-test	p-value[a]	Pre-test	Post-test	p-value[a]	Group A	Group B	p-value[b]	Group A	Group B	p-value[b]
VAS (0-10)	5.0 (2)	1.0 (2)	0.000	5.0 (2)	0 (0)	0.000	5.0 (2)	5.0 (2)	0.74	1.0 (2)	0 (0)	0.000
HADS Anxiety (0-21)	9.0 (5)	3.0 (2)	0.000	9.0 (4)	6.0 (4)	0.000	9.0 (5)	9.0 (4)	0.93	3.0 (2)	6.0 (4)	0.000
Depression (0-21)	5.0 (2)	2.0 (2)	0.000	6.0 (3)	4.0 (1)	0.000	5.0 (2)	6.0 (3)	0.40	2.0 (2)	4.0 (1)	0.001

[a] – Wilcoxon test, [b] – Mann-Whitney U-test, HADS – Hospital Anxiety and Depression Scale, VAS – Visual Analogue Scale.

Tab. 4. Comparison of variables within groups

Outcome	Mean (SD) within groups					
	Group A (n = 27)			Group B (n = 27)		
	Pre-test	Post-test	p-value[a]	Pre-test	Post-test	p-value[a]
Pain Pressure Threshold (kg/cm^2)	0.98 (0)	1.64 (0.1)	0.000	1.00 (0.0)	2.29 (0.14)	0.000
Neck Disability Index (0-50)	13.0 (5.4)	3.29 (2.3)	0.000	15.3 (5.6)	8.03 (4.3)	0.000
Cervical ROM (deg)						
Flexion	48.5 (5.0)	60.0 (4.8)	0.000	49.2 (5.1)	55.5 (5.6)	0.000
Extension	44.1 (4.9)	58.2 (5.2)	0.000	46.5 (8.7)	53.8 (7.2)	0.000
Rt Rotation	49.5 (5.6)	60.7 (4.9)	0.000	50.3 (4.2)	56.4 (4.5)	0.000
Lt Rotation	48.9 (5.1)	60.3 (5.5)	0.000	49.1 (4.7)	55.6 (4.8)	0.000
Rt Side Bending	45.1 (4.7)	54.3 (5.8)	0.000	44.2 (6.3)	50.9 (4.3)	0.000
Lt Side Bending	40.9 (7.0)	53.3 (5.4)	0.000	41.4 (6.3)	50.0 (5.2)	0.000

[a] – paired *t*-test.

The VAS scores were significantly different between groups after intervention with $p = 0.000$ ($p < 0.05$). The improvement was estimated to be greater in Group B (Tab. 3).

Table 4 displays within-group comparison of variables; both groups demonstrate significant differences in pain threshold, neck disability and cervical ROM before and after intervention ($p < 0.05$).

In both groups, significant differences in HADs and VAS scores can be seen between post-intervention and baseline, i.e. within groups ($p < 0.05$) (Tab. 3).

Discussion

The aim of the study was to determine the effectiveness of the spray stretch and sustained pressure techniques for the management of trigger points of upper part of trapezius muscle.

Our findings indicate significant improvements in pain pressure threshold, neck disability, pain intensity, neck ranges and individual anxiety in both groups after a two-week follow up. In addition, a significant increase in pain pressure threshold was noted in both groups, although a significantly greater increase in mean pain threshold was observed in Group B (sustained pressure) than Group A (spray stretch).

Although both interventions significantly decreased neck disability, a greater reduction in neck disability points was found in Group A (spray-stretch) than Group B (sustained pressure). These findings are supported by a 2017 study indicating that the spray stretch technique was more effective for increasing functional activities than progressive pressure release, while progressive pressure release was more effective at increasing pain threshold than the spray stretch technique; however this study had certain limitations, including a small sample size, short-term follow up and few outcome measures [7].

Another study reported that severe localized postoperative pain which is not relieved by local anaesthetic infiltration and NSAIDs, including paracetamol and morphine, can be managed with the application of ethyl chloride spray. After the application of ethyl chloride spray, the subjects experienced a spontaneous and reasonable pain relieving effect. However, this study was only a case report and further research is needed to validate the findings [28].

In the current study, both groups showed significant improvement in neck ROM. Similar findings were noted in a 2017 experimental study that found the spray and stretch technique to be effective in increasing the pain pressure threshold and range of motion in cases of acute trapezitis; however, this was only a quasi-experimental study with a limited sample size [15]. Another clinical study found dry needling and manual therapy to achieve similar results with regard to pain threshold, functional disability and neck ROM. There are a few limitations to the current study. All approaches were implemented by only two practitioners, which limits the extent to which the findings can be applied. Furthermore, the data was gathered during a two-week short-term follow-up. The current study lacked a control group. In addition, for practical considerations, only two sessions were used for therapy interventions [29].

In the present study, the spray stretch group show more improvement in all neck ranges compared to the sustained pressure technique. This may be due to inclusion of heat application, which has been found to increase the clinical efficacy of spray stretch techniques [30]. A previous study describes how hot pack application was more effective than spray stretch alone in minimizing trigger point symptoms, and suggests that heating pad therapy should be included with spray stretch technique in managing myofascial pain syndrome (MPS) [30].

Our findings indicate that both groups showed significant improvement in anxiety and depression; however, the spray stretch technique yielded a slightly greater improvement in anxiety score than the sustained pressure technique. Indeed, participants in a randomized controlled trial also reported greater satisfaction with spray stretch techniques: the study reported that vapocoolant spray works well to lessen pain in hospital emergency room patients who have suffered mild injuries, and may shorten the first treatment period and increase patient treatment satisfaction [31]. People with myofascial pain syndrome (MPS) have also been reported to gain psychological benefits from both ischemia compression and dry needling [32].

Our findings indicate that both tested groups demonstrated significant improvements in participant pain intensity; however, sustained pressure yielded slightly more improvement in VAS than spray stretch. A previous study found that VAS scores were significantly reduced after ischemic compression sessions but not after dry needling sessions [32], although this could have been influenced by age differences between the groups, the inclusion of musculoskeletal pain syndrome with different causes in the same group, and the lack of any minimum VAS score.

A the present study does have certain limitations. It was only conducted on the upper fibers of trapezius muscles. In addition, no control group was included and sonography should be performed to determine the thickness of the trigger points in the upper trapezius muscle. Finally, although an inclinometer is a more reliable device for measuring cervical ROM, due to limited resources, the present study used a goniometer; nevertheless, this is a reliable instrument for measuring ROM.

Conclusions

In conclusion, both the spray stretch and sustained pressure techniques demonstrated significant effectiveness for increasing pain threshold and cervical range of motion, while decreasing neck disability, pain intensity and anxiety and depression among patients with trigger points in the upper part of the trapezius muscle.

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Conflicts of Interest
The authors have no conflict of interest to declare.

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