

Experimental Article

## Instrument-assisted soft tissue mobilisation versus stripping massage for upper trapezius myofascial trigger points



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### المخلص

**أهداف البحث:** التحقق من آثار تحريك الأنسجة الرخوة بمساعدة الأجهزة مقابل التدليك التجريدي على نقاط الألم العضلي الليفي في الجزء العلوي للعضلة شبه المنحرفة اليمنى.

**طرق البحث:** تم تقسيم ٤٠ مريضا (٣٤ امرأة و٦ رجال)، تتراوح أعمارهم بين ١٨ و٢٣ عاما، إلى مجموعتين متساويتين (أ وب). تلقت المجموعة أ (ن=٢٠) تحريك الأنسجة الرخوة بمساعدة جهاز شفرة مرتين في الأسبوع لمدة أربعة أسابيع بالإضافة إلى تمارين التمدد. بينما تلقت المجموعة ب (ن=٢٠) التدليك التجريدي مرتين في الأسبوع لمدة أربعة أسابيع مع تمارين التمدد. تم استخدام مقياس النظير البصري المرئي، ومقياس ضغط الأجوميتر ومؤشر إعاقه الرقبة العربي لتقييم حالة المريض قبل وبعد العلاج.

**النتائج:** أظهر التحليل داخل المجموعة وجود فرق كبير بين حالة ما قبل وبعد العلاج من المرضى لجميع المتغيرات في كلا المجموعتين. في المقابل، لم يظهر التحليل بين المجموعة أي فرق كبير بين حالات ما قبل وما بعد العلاج.

**الاستنتاجات:** تحريك الأنسجة الرخوة بمساعدة الأجهزة والتدليك التجريدي هما طريقتان فعالتان في تحسين الألم والوظيفة لدى المرضى الذين يعانون من نقاط الألم العضلي الليفي.

**الكلمات المفتاحية:** تحريك الأنسجة الرخوة بمساعدة الأجهزة؛ نقاط الألم العضلي الليفي؛ التدليك التجريدي؛ مؤشر إعاقه الرقبة العربي؛ تمارين التمدد

### Abstract

**Objective:** This study investigated the effects of instrument-assisted soft tissue mobilisation (IASTM) versus stripping massage (SM) on myofascial trigger points in the right upper trapezius.

**Method:** Forty patients (34 women and 6 men), aged 18–23 years, with active trigger points in the right upper trapezius were divided into two equal groups (A and B). Group A (n = 20) received IASTM using an M2T blade twice a week for four weeks in addition to stretching exercise. Group B (n = 20) received SM twice a week for four weeks in addition to stretching exercise. The visual analogue scale, a pressure algometer, and the Arabic version of the Neck Disability Index were used to evaluate patients' pre- and post-treatment statuses.

**Results:** Within-group analysis showed significant differences between pre- and post-treatment values of all outcome measures in both groups. In contrast, between-group analysis did not show any significant differences between the two groups in pre- or post-treatment values of any outcome measures.

**Conclusion:** IASTM and SM are effective methods for improving pain and function in patients with upper trapezius trigger points.

**Keywords:** Arabic version of the neck disability index; Instrument-assisted soft tissue mobilisation; Myofascial trigger points; Stretching exercise; Stripping massage

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## Introduction

Myofascial trigger points (MTrPs) are hyperirritable, palpable nodules found along taut bands of muscle fibres.<sup>1</sup> Commonly, they occur in the neck and shoulder muscles. The trapezius is the most frequently involved muscle.<sup>2</sup> It has been estimated that 85% of people who come to pain clinics have trigger points in the neck, and they occur more often in women than in men.<sup>3</sup> MTrPs are classified clinically into active and latent. Active trigger points cause constant pain at rest and are associated with referred pain patterns, while latent trigger points produce pain when palpated and cause restriction of movement.<sup>4,5</sup>

Myofascial pain syndrome is chronic pain caused by trigger points. It is associated with musculoskeletal problems (muscle spasm, restricted range of motion (ROM), and decreased fibre extensibility) and autonomic symptoms that affect the patient's physical abilities.<sup>6,7</sup> The physical therapy programme for myofascial pain and trigger points can include stretching exercise,<sup>8</sup> LASER,<sup>9</sup> ultrasound,<sup>10</sup> massage,<sup>5</sup> kinesiology taping,<sup>11</sup> or dry needling (an invasive technique).<sup>12</sup>

Stripping massage (SM) is a gliding tissue massage technique that focuses on the deeper layers of the fascia and skeletal muscle.<sup>13</sup> It is considered an effective and safe method that can manually deactivate myofascial trigger points using a direct approach.<sup>5</sup> Applying SM to tender spots in muscles can cause ischaemia followed by reflexive hyperaemia. This increases the local blood flow, which improves pliability of the muscles and fascia and helps break down adhesions and decrease pain sensations.<sup>14</sup>

Recently, practitioners have begun to depend on instrument-assisted soft tissue mobilisation (IASTM), which is a useful tool in treating trigger points and their pain. IASTM is the use of a specially designed instrument to mobilise soft tissue, with the aim of reducing pain and improving ROM and function. IASTM minimises stress on the practitioner's hand and enables greater penetration to better access fascia and release restrictions.<sup>15</sup>

To our knowledge, few researchers have studied the efficacy of both techniques on pain and function. Therefore, the aim of this study was to examine the effects of IASTM and SM on pain and function in subjects with active upper trapezius trigger points.

## Material and Methods

### Study design

This was a randomised clinical trial performed in the outpatient clinic of the Faculty of Physical Therapy, Cairo University, from 2018 to 2019. The required sample size was

estimated using G\*Power software (version 3.1.9.2; Franz Faul, University of Kiel, Germany), based on a pilot study conducted on 10 subjects. For a t-test with a type I error rate of 5% (alpha level 0.05), the effect size in the main outcome variable (Arabic version of the Neck Disability Index (ANDI) scores) was 1.37 and the type II error rate (beta) was set at 0.10 (power of 0.90). The required minimum sample size for this study was 30 subjects.

### Subjects

Fifty-three subjects were enrolled from the undergraduate students of the Faculty of Physical Therapy. Subjects were included in the study if they had neck pain in the right (RT) upper trapezius muscle with a tender nodule, constant pain, a jump sign during palpation, and referred pain over the lateral aspect of the upper trapezius that extends superiorly to the RT occiput.<sup>16</sup> Subjects were excluded if they had latent trigger points, signs of severe pathology such as malignancy, fractures of the cervical spine, cervical radiculopathy or myelopathy, or vascular syndromes such as vertebrobasilar insufficiency.<sup>17</sup> During screening, 13 subjects were excluded—10 did not provide consent and three had cervical radiculopathy, as shown in Figure 1. Forty subjects (34 females and 6 males), aged 18–23 years, were included in this study. They all signed a consent form that was approved by the Faculty of Physical Therapy. They were then randomly allocated, using sealed envelopes, into two groups, A and B. Group A received IASTM on the RT upper trapezius twice a week for four weeks in addition to stretching exercise. Group B received SM on the RT upper trapezius twice a week for four weeks in addition to stretching exercise.

### Instrumentation

All variables were assessed before and after the treatment programme.

The Visual Analogue Scale (VAS) was used to evaluate pain intensity. The VAS is a self-reported pain measurement scale, consisting of a horizontal or vertical line, usually 10 cm long. The extremes of the line are labelled as no pain and worst pain. Each subject was asked to mark the point on the line that exactly corresponded to his/her pain.<sup>18</sup>

Subjects' pressure pain thresholds (PPTs) were assessed using a Commander algometer (JTECH Medical, Midvale, Utah, USA) (Figure 2). An algometer is a handheld device that applies a manual pressure stimulus to assess pain intensity. It has been broadly used and validated.<sup>19</sup> The PPT was assessed by positioning the tip of the algometer on the trigger point (Figure 3) and increasing the pressure by 1 kg per second. When the patient indicated discomfort, the pressure value was recorded in kg/cm.<sup>2</sup> The procedure was repeated three times at 60-s intervals, and the mean pressure value was recorded as the PPT.<sup>20</sup>

The ANDI was used to assess neck function. It is a valid and reliable tool that consists of 10 items. Each item is scored from zero (no disability) to five (total disability), with the maximum possible total score being 50.<sup>21</sup> For each item, the subject was asked to choose one answer that best defined his/her neck function. Scores for each item were tallied and the

total score recorded. A total score of 0–4 indicated no disability, a score of 5–14 indicated mild disability, a score of 15–24 indicated moderate disability, a score of 25–34 indicated severe disability, and a score of 35 or greater indicated complete disability.<sup>22</sup>

### Interventions

#### Instrument-assisted soft tissue mobilisation

For IASTM, the subject was seated in a comfortable position. The subject's forehead rested on his/her forearm on a table in front of him/her. A lubricant (Vaseline) was applied to the skin around the neck area prior to treatment and the M2T blade (Figure 4) was cleaned with an alcohol pad. First, the M2T blade was used to find the exact areas of restriction in the RT upper trapezius. Then the M2T blade was used, at an angle of 45° and using treatment planes 1, 2, and 3, to apply slow strokes along the muscle, without causing any discomfort or pain, from the muscle origin to its insertion (sweeping technique) (Figure 5), for approximately 3 min. This procedure was repeated twice a week for four weeks.<sup>23</sup> Subjects were instructed to put an ice pack on the area if they felt any burning sensations after the session.

After IASTM session, each subject received passive stretching exercise (Figure 6) of the RT upper trapezius. This involved laterally flexing the head toward the left side, holding that position for 30 s, and repeating 3 times. Flexion of the neck was increased, when appropriate, to increase the tension of the stretch.<sup>24</sup> Subjects were advised to perform self-stretching exercise<sup>25</sup> (Figure 7) 5 times a week as a home programme. For performing self-stretching, each subject was instructed to sit on a chair, holding the bottom of the seat with his/her RT hand to stabilise the RT shoulder, and put his/her left hand on his/her head to pull the head toward the left side. Subjects were instructed that flexion of the neck could be increased, where appropriate, to increase the tension of the stretch, and that they were required to maintain the position for 30 s and repeat 3 times.

#### Stripping massage

For SM, the subject was seated in the same position as for IASTM. The nape of the neck was exposed and minimal lubricant was applied. Using the thumb, firm, slow pressure was applied along the length of the taut RT upper trapezius muscle and perpendicular to its fibres, moving from origin to insertion (Figure 8), for approximately 3 min, twice a week for 4 weeks.<sup>5</sup> Pressure was gradually increased with each successive stroke, according to the subject's pain tolerance.

As in group A, each subject also received passive stretching exercise<sup>24</sup> and was advised to perform self-stretching<sup>25</sup> exercise 5 times a week as a home programme.

The researcher who performed all techniques had over 14 years of experience in manual physical therapy practice.

### Statistics

Demographic data (age, weight, height, and BMI) and outcomes data (VAS scores, PPTs, and ANDI scores) were collected and statistically analysed using SPSS software (version 23; IBM Corp., New York, United States). Assessment of normality was performed using the Shapiro–Wilk

test. All variables were normally distributed except for VAS scores. Thus, VAS scores were analysed using non-parametric tests (z-tests: Wilcoxon signed rank and Mann–Whitney) and all other variables were analysed using parametric tests (t-tests: paired and unpaired). The level of significance was set at 0.05.

### Results

#### Demographic data

Using unpaired t-tests, no significant differences were found between the two groups in age, weight, height, or BMI, as shown in Table 1.

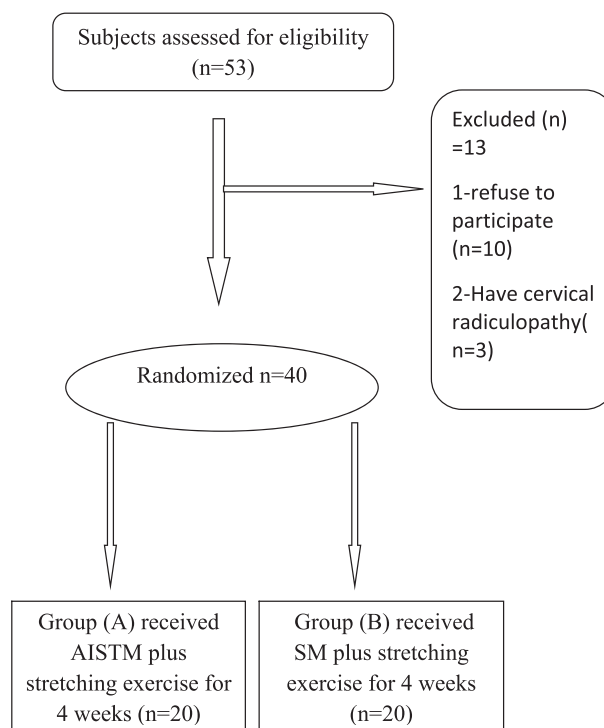


Figure 1: Flow chart of subject inclusion in the study.



Figure 2: A Commander algometer.



**Figure 3:** Pressure pain threshold assessment.



**Figure 6:** Passive stretching exercise



**Figure 4:** M2T blade



**Figure 7:** Self-stretching exercise.

*Within-group analysis*

In group A, there were significant differences between pre- and post-treatment values of all outcome measures, as shown in Table 2. VAS and ANDI scores decreased by 51% and 50%, respectively, while, PPT increased by 33%. In group (B) there were also significant difference between pre and post-treatment values of all outcome measures. VAS and ANDI scores decreased by 58% and 54%, respectively, while, PPT increased by 86%.



**Figure 5:** IASTM: sweeping technique. IASTM, instrument-assisted soft tissue mobilization.



**Figure 8:** Stripping massage.

**Table 1: Demographic data of both groups.**

	Group A	Group B	T-value	P-value
	Mean ± SD	Mean ± SD		
Age (years)	20.35 ± 2.49	20.50 ± 1.57	-0.23	0.82
Weight (kg)	63.10 ± 11.89	67.70 ± 12.23	-1.20	0.23
Height (cm)	164.10 ± 6.48	164.35 ± 6.08	-0.12	0.90
BMI (kg/m <sup>2</sup> )	23.33 ± 3.62	24.93 ± 3.64	-1.38	0.17

SD: Standard deviation, P: probability.

**Table 2: Pre- and post-treatment mean, SD, and percentage change values of VAS scores, PPTs, and ANDI scores for both groups.**

VAS scores	Group A	Group B	z-value (between-groups)	p-value (between-groups)
Pre-treatment (Mean ± SD)	7.05 ± 1.19	7.55 ± 0.76	-1.36	0.2 ns
Post-treatment (Mean ± SD)	3.45 ± 1.09	3.10 ± 0.72	-1.34	0.21 ns
Percentage change	51%	58%		
z-value (within-group)	-4.03	-3.95		
p-value (within-group)	0.001***	0.001***		
PPT	Group A	Group B	t-value (between-groups)	p-value (between-groups)
Pre-treatment (Mean ± SD)	0.64 ± 0.16	0.52 ± 0.12	1.68	0.1 ns
Post-treatment (Mean ± SD)	0.96 ± 0.27	0.97 ± 0.31	-0.11	0.92 ns
Percentage change	33%	86%		
t-value (within-group)	-3.363	-5.16		
p-value (within-group)	0.003****	0.0001****		
ANDI scores	Group A	Group B	t-value (between-groups)	p-value (between-groups)
Pre-treatment (Mean ± SD)	23.9 ± 2.59	24.85 ± 2.18	-1.25	0.22 ns
Post-treatment (Mean ± SD)	11.94 ± 3.08	11.50 ± 1.90	0.55	0.58 ns
Percentage change	50%	54%		
t-value (within-group)	23.65	19.26		
p-value (within-group)	0.0001****	0.0001****		

VAS: Visual Analogue Scale, PPT: Pressure pain threshold, ANDI: Arabic version of the Neck Disability Index, ns: no significance, \*\*\*, significance level for  $p < 0.001$ , \*\*\*\*: significant level  $p < 0.0001$ , SD: Standard deviation, P: probability value.

### Between-group analysis

Table 2 shows that there were no significant differences between the two groups in pre-treatment or post-treatment values of any outcome measures.

### Discussion

Trigger points may develop from repetitive microtrauma to muscle fibres. This causes the muscle to be under continuous stress. When repetitive microtrauma is combined with predisposing factors such as bad posture, the trigger points are activated.<sup>26</sup> Myofascial pain syndrome responds well to treatment that focuses on deactivation of MTrPs. Therefore, the aim of physical therapy treatment in a patient with myofascial pain syndrome is to reduce the pain and restore normal function.<sup>27</sup>

This research was performed to study the efficacy of IASTM versus SM in subjects with RT upper trapezius active myofascial trigger points. Both groups showed improvements in all outcome measures. The improvements in patients who received SM may be explained by the close contact with the subject's tissue while applying SM, which allows the practitioner to feel any restrictions easily. Therefore, the appropriate force can be applied according to the presence of involved trigger points and according to subject tolerance. In addition, SM helps to increase flexibility by breaking down adhesions in the fascia and relaxes spasmed muscle by increasing circulation.<sup>28</sup>

Massage provides a sensory stimulus over these tender spots, which produces an analgesic effect by activating non-nociceptive fibres and alleviating the pain sensation, according to gate control theory. SM acts as a mechanical stress that stimulates parasympathetic activity which leads to the release of substances such as endorphins. These

chemicals remove the noxious stimulus and decrease the pressure on nociceptors, reducing pain.<sup>29,30</sup>

The results of this study came in agreement with Domingo et al.,<sup>31</sup> investigated the effect of two 5-minute sessions of moderate-pressure massage on the upper trapezius and concluded that massage can lower upper trapezius muscle activity and promote relaxation.

Furthermore, Skillgate et al.,<sup>32</sup> examined the effect of massage in decreasing neck pain and they found greater improvement in pain sensation and patient activity after application. Also, Sherman et al.,<sup>33</sup> stated that massage can improve neck dysfunction greater than self-care after performing 10 massage sessions.

The refinement that occurred in IASTM group may come from its ability to induce tissue micro-trauma. Thus, resulting in the regional inflammatory process and increases the release of fibroblast. The fibroblast migration increases collagen synthesis and tissues regeneration that speeds up the healing process. In addition, increasing tissue temperature and blood flow due to friction between tool and tissue may contribute to improve tissue oxygenation and removal of local waste metabolites.<sup>34,35</sup>

These results were in line with Motimath et al.,<sup>36</sup> who concluded that IASTM technique by using M2T blade is a useful tool can decrease pain immediately in subjects with upper trapezius spasm. Bulbuli et al.,<sup>37</sup> tested the effect of M2T blade on subjects with heel pain and they found reduction in pain level and increased activity level and they explained that M2T blade can be used to soften tight fascia by applying rhythmic strokes over the fascia till the adhesions and cross-linkages are broken and the release of the fascia occurred.

A pilot study by Naik et al.,<sup>38</sup> examined applying M2T on subjects with shoulder pain and they found significant pain reduction post-treatment. In addition, Naik et al.,<sup>39</sup> comparing between the effect of M2T blade and

kinesiotape in treating shoulder pain subjects and at the end of the study, they concluded that both interventions reducing pain but M2T was more effective. They stated that applying M2T lead to stretch the restricted fascia so, removing compression on pain nerve fibers and increasing joint mobility.

In contrast to our results, Vardiman et al.,<sup>40</sup> performed the study on 11 healthy plantar flexors muscle by using IASTM and their results indicated that subjective measures as pain and ability to perform activities of daily living decreased immediately following IATSM.

Stretching exercise also can relax the spasmed muscle. The stretching exercise worked on viscoelastic properties of muscle fibers and inducing relaxation. As when applying constant external load slowly on shortened muscle, this leads to deformation and increasing flexibility of the target muscle.<sup>41</sup>

### Study limitations

There were some limitations to this study. The study did not include a control group. The duration of treatment was also only four weeks, which is relatively short. In addition, there was no follow-up assessment.

### Conclusion

IASTM and SM are beneficial methods for the treatment of active upper trapezius trigger points.

### Recommendations

We recommend replication of this study with the addition of postural correction exercise for both treatment groups.

### Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

### Conflict of interest

There is no conflict of interest.

### Ethical approval

The Research Ethics Committee of the Faculty of Physical Therapy, Cairo University, approved this study protocol (PTREC/012/002404). The study was registered in the Pan African Clinical Trial Registry (registration number PACTR201803003235246).

### Consent

The procedures involved in this study were explained to all participants and they all signed consent forms before the study began.

### Authors contributions

HAH formulated the idea, conducted the research, and collected and organised the data. ASA was responsible for clinical evaluations and carried out the statistical analysis. MT and SBT. reviewed the literature and assisted in writing the original draft. HME and AFG critically reviewed and approved the final draft. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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