The Effects of Instrument-Assisted Soft Tissue Mobilization on Active Myofascial Trigger Points of Upper Trapezius Muscle

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Abstract

Introduction: postural muscles, such as trapezius. The aim of this study was to evaluate the effect of instrument-assisted soft tissue mobilization technique (IASTM) on the active trigger points of the upper trapezius muscle and muscle fiber changes. **Methods and Materials:** A 29-year-old woman with the history of intermittent cervical pain and the active trigger point of upper trapezius muscle has been presented. Physiotherapist evaluated the local pain intensity through VAS (Visual Analog Scale) and pressure pain threshold (PPT) using algometer. Iranian version of Neck Disability Index (NDI) questionnaire was used to determine patient's ability to manage her everyday life. Also, thickness of the muscle was recorded by means of real-time images taken by ultra-sonographic apparatus. 50 days after completion of treatment, pressure pain threshold and local pain intensity were evaluated at 1st and 6th sessions. Muscle thickness and NDI were evaluated at 1st and 6th sessions. **Results:** The results of this study have shown that 6 sessions of IASTM technique were performed every other day, reduce the intensity of pain, increase the PPT, and decrease the patient's disability (NDI). Also, this technique has changed the muscle fiber thickness after 6 sessions of treatment. **Conclusions:** According to the present study, applying the complete protocol of IASTM technique had better and more durable effects on improving the active trigger point of the upper trapezius muscle.

Keywords: Instrument-Assisted Soft Tissue Mobilization (IASTM); Active Myofascial Trigger Points; Trapezius Muscle

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Introduction

Myofascial trigger points (MTrPs) have been defined as hypersensitive cord-like and nodular tender spots in a skeletal muscle which are painful on palpation, compression, or stretch (1). These nodules are generated by shortening the sarcomeres in muscle fibers (2). Myofascial trigger points are the primary cause of musculoskeletal pain by 30-85% of cases, and its prevalence of affection is more in postural muscles including trapezius (3-5). From a clinical viewpoint, there are many physical therapy approaches aimed at eliminating MTrPs symptoms which can be divided into 3 main groups: 1) Manual therapies (including pressure release, muscle energy technique, strain counter-strain, spray and stretch, massage, etc.); 2) Dry Needling; 3) other techniques (such as laser therapy and thermotherapy) (6,7). Graston technique is one of these therapeutic interventions for MTrps, which is an Instrument-Assisted Soft Tissue Mobilization method. This technique is an enhanced form of a Traditional Chinese medicine technique named Gua Sha (8). Graston technique is conducted by special steel instruments with the aim of scar tissue releasing and reforming the soft tissue restrictions. Graston technique helps the healing process by intentional micro-trauma, breaking down collagen cross-linkages, increasing blood flow, and cellular regeneration (9-14). However, the studies about the effectiveness of Graston technique are limited on improving the symptoms of AMTrps (Active Myofascial Trigger Points). The purpose of this study was the investigation of the effects of IASTM technique on symptoms and muscle fibers using the sonographic findings in a patient with active myofascial trigger points.

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Table 1. Inclusion criteria. (19)

Diagnostic exploration criteria by Simons et al. (1999)
Presenting one active trigger point at least, in a taut band on upper trapezius muscle.

Table 2. Exclusion criteria. (19)

Diagnosis of fibromyalgia
Diagnosis of cervical radiculopathy or myelopathy
Having undergone Trigger Point Therapy within the past month prior to the study
Drug intake (anti-inflammatory medication during treatment sessions)

Table 3. Correlation between muscle thickness measurements taken from MRI and RUSI scans (Pearson's Correlation Coefficient)

Muscle	Pearson's Correlation Coefficient (r)	*P*-Value	r2
Upper trapezius C6 (2cm)	0.52	0.001	0.27

Case Report

In this study, a 29-year-old woman with a history of neck pain and active myofascial trigger points in the upper trapezius muscles has been presented. The patient was complained about intermittent cervical pain for 3 months and referred to the physiotherapy clinic with a diagnosis of non-specific neck pain by the physician. The symptoms were gradually appeared without any acute trauma or overt injury. The patient had a normal posture and there was no significant medical or surgical history. Previous treatments for cervical pain had been limited to just prescription of analgesic drugs.

The primary physical examination was performed in the first treatment session. The trapezius muscle was thoroughly palpated to identify the active trigger points, and then the most sensitive points were marked. Assessment of local pain intensity (PI) was conducted on a visual analog scale. Pressure Pain Threshold (PPT) was measured using an algometer. The Neck Disability Index (NDI) questionnaire was used to determine the level of disability due to neck pain, (15).We also used the Rehabilitative Ultrasonic imaging (RUSI) for measuring the thickness of trapezius muscle in presence of trigger points and comparing the differences in thickness before and after the treatment (16-18).

Primary examination:

Inclusion and Exclusion criteria in the present study have been shown in Tables 1 and 2.

Pressure pain threshold:

Pressure pain threshold is the minimum pressure where a sense of pressure changes to pain or discomfort. In this study, the algometer (Lutron FG-5020 version) was used to quantify AMTrPs's tenderness. Previous papers have well reported to excellent inter-examiner and intra-examiner reliability for PPT. the tip of the algometer was placed over the marked AMTrP to assess the PPT, and held perpendicular to that point. The subject was immediately asked for reportinginstance where the sense of pressure changes to pain. This process was repeated three times, and the average has been sensitivity reported as a baseline measurement of AMTrP (20-22). Figure 1 shows the Position of the patient and algometer placement during the PPT measurement.

Pain intensity:

In order to measure the pain intensity, a 25 N/cm^2 pressure was applied on marked point by algometer, then the patient was asked to report the pain evoked through marking a line, on the visual analog scale (VAS). The VAS was a 10-cm horizontal line which divided into 10 equal intervals between 0 (=no pain) and 10 (=maximum pain ever felt). Previous studies have confirmed the reliability of VAS (23, 24).

Neck disability index:

The patient was asked to complete the Iranian version of the neck disability index (NDI) questionnaire to assess the level of disability. This questionnaire has been designed to give us the information about the effect of neck pain on patient's ability to manage his/her everyday life (15). The NDI was developed in 1989 by Howard Vernon and has become a standard means for measuring self-rated disability due to neck pain. Each of the 10 treatment sections was scored from 0 to 5. Therefore, the maximum score would be equal to 50 (25).

Muscle Thickness:

An ultrasonic apparatus (HS 2100, Honda electronics, Japan) at a 7.5 MHz linear array was utilized in order to measure the thickness of upper trapezius muscle in presence of MTrps. B mode real-time ultrasonography imaging (RUSI) was the capturing ultrasound image method. Reliability of the procedure for measuring all three regions of the trapezius muscle had been previously established. Table 3 indicates the results of correlation between muscle thickness measurements taken from MRI and RUSI scans.

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Figure 1 Position of the patient and algometer placement during the PPT measurement

The myofascial junction of the upper trapezius muscle was used as a landmark for measuring the muscle thickness. The patient was asked to lay prone for ultrasonic imaging, and the transducer was centrally placed over the spinous process at the level of C6 and then was slightly tilted in line with the skin curvature, so that the triangular shaped medial portion of the muscle could be identified. Figures 2, 3 and 4 show the position of the patient during the sonography and Position of transducer on trapezius muscle. The transducer was then laterally moved, keeping the triangular medial portion in the view. The cursor was placed on the inside edge of the muscle border and the measurements were done at 2 cm distance lateral to the triangular myofascial junction at the direction that was perpendicular to the plane of the muscle belly (16-18).

Treatment:

The patient was asked to avoid using any analgesic drugs 3 days before starting the treatment. The patient was prepared to increase her core body temperature before performing the IASTM technique as the main intervention. So, she was asked to use upper body ergometer for 10 minutes. Then the hot pack was used on the shoulder and cervical region for 5 minutes.

Then the IASTM technique was performed on the right side (the dominant side of the patient which will be called the main treatment side hereafter) in the following manner respectively (26):

1) one minute of sweeping the upper trapezius region (a longitudinal stroke performed parallel to the muscle fibers)

2) one minute of swiveling over the AMTrP, directly (a technique in which the knob of the tools was directly placed on the AMTrP and pivoted/rotated back and forth)

3) two minute of fanning the AMTrP and surrounding tissues in all directions (a stroke in which one end of the instrument is held in place and the other end is moved in a circular pattern in the shape of a fan).

4) And finally, one minute of sweeping the upper trapezius region again.



Figure 2. Position of the patient during the sonography*



Figure 3. Spinous process of C6 vertebrae



Figure 4. Position of transducer on trapezius muscle

** All of the photos were taken with permission of the patient and have been edited by the Prisma© software.*

The IASTM technique, exercise therapy was performed as follow. The Stretching exercises included upper trapezius stretching technique which was conducted by the therapist and was performed 3 times each for 30 seconds, followed by self-stretching of upper trapezius performed by the patient (2 sets, 12 times in each set). The Strengthening exercises included shoulder elevation exercise, which was performed 15 times in 2 different treatment sets. An icy gel (topical analgesic) was applied for 5 min in order to prevent muscle soreness after the treatment (27).

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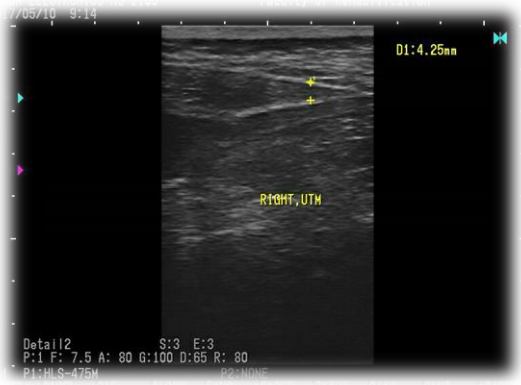


Figure 5: Right side Muscle Thickness before treatment



Figure 6: Right side Muscle Thickness after treatment

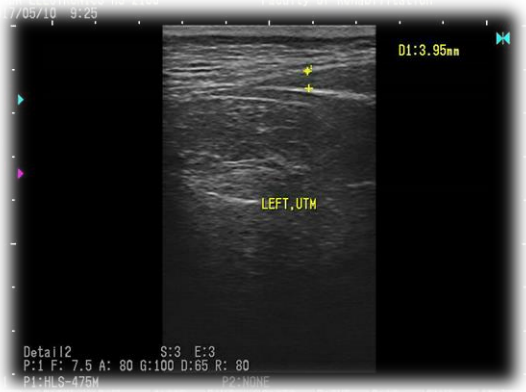


Figure 7: Left side Muscle Thickness before treatment

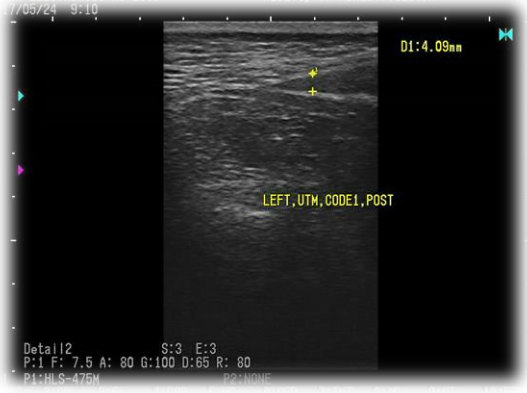


Figure 8: Left side Muscle Thickness after treatment

The left side of trapezius muscle was considered as a control. All the preparation process and exercises - except the IASTM technique- was conducted on the control side to compare the results with main treatment side (right side). Six treatment sessions were performed (three-times per week). The assessments of outcomes were done in 1st, 3rd and 6th sessions. A follow-up assessment was performed after 50 days.

Final examination:

The results of final assessment revealed that there was a significant improvement in AMTrPs symptoms following the treatment. Examinations showed that pressure pain threshold was significantly improved on both sides. However, in the last session, the value of PPT in the control side was better than the main treatment side, but the results of 50 days follow-up indicated that the main treatment side had higher PPT value. The pain intensity in the last session was significantly decreased on the main treatment side. However, 50 days follow-up revealed that the pain intensity on two sides was very close to each other. Neck disability index indicated that patient's everyday activities were improved on both sides. Unlike the left (control) side, the upper trapezius muscle thickness in right (main treatment) side was significantly decreased. Table 4 shows the results of assessments in 1st, 3rd, and 6th sessions.

Discussion:

The treatment of a 29-year-old woman with a history of intermittent cervical pain via active trigger points in upper trapezius muscle within three previous months has been reported in the present study. The existence of trigger points in the upper trapezius muscle was diagnosed as the main cause of the patient's pain; therefore the treatment was focused on it.

Two factors should be considered in the treatment of these types of patients due to the reduction in the length of sarcomeres and the occurrence of ischemia and hypoxia in the trigger point area (28):

Increasing the length of sarcomeres

Increasing the blood flow to the trigger points

The evaluations revealed that the mean value of the pressure pain threshold in the third and sixth (final) session measurements was increased on both sides. However, the increase in the PPT value was greater on the control side. The results can be attributed

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to the dominance of pain on the main treatment side and the soreness experienced the following application of IASTM technique. The follow-up has shown that the effect of the IASTM technique on PPT index was durable which was done 50 days after the last treatment session.

The improvement in PPT, following the application of IASTM technique was consistent with the Gulick's study. Gulick et al. evaluated the effect of soft tissue mobilization using Graston tool on the active trigger points of the upper body. Post-treatment evaluations showed significant improvements in pressure pain threshold. However, the type of application of the technique and the treatment protocol was different (26).

The results of the study indicated that the pain intensity was decreased in 3rd and 6th sessions on both sides. The decrease in the pain intensity on the main treatment side was more than the control side. It should also be noted that the pain intensity was measured 5 minutes after the end of the therapeutic intervention. After 50 days, results of the follow-up showed that the decrease in pain intensity on both sides was durable.

Improvements in pain intensity resulted from this study confirmed the results of the case study conducted by Lawson et al. That case study evaluated the effect of IASTM technique with Graston tools on the pseudo chest pain caused by active trigger points in the pectoralis minor muscle. The results of that study showed that after 4 sessions of treatment, the pain intensity was significantly decreased, and the patient was returned to his former daily activities (29).

The results of neck disability index, which were evaluated by the NDI and NPDS questionnaires, indicated that the disability score was significantly reduced. In other words, the patient's status has been improved from mild disability to no disability. This questionnaire was filled according to the general conditions of the patient (including both right and left) and there was no separate assessment for each side. According to the results of a questionnaire, the effects of treatment on both sides were durable following the 50 days of daily activities of the patient (15).

The thickness of the upper trapezius muscle was measured by the RUSI method (real-time image recording) using diagnostic ultrasound (17, 18). The diagnostic ultrasound is a more useful instrument than other diagnostic tools such as MRI. Being non-invasive, cheaper and portable and having non-ionizing radiations are among the significant features of this tool (30). Previous studies have shown the effectiveness of ultrasound in the diagnosis of trigger points, and in revealing the changes in muscle thickness, elastographic features of muscle, and circulation around the trigger points (31). The major part of studies has been conducted to demonstrate the reliability and validity of ultrasonography in this area, and clinical trials for evaluation of the ultrasonic imaging outcomes in the treatment group are very small. In other words, in this area, the findings of ultrasonic imaging are mostly used in research than on clinical trials.

Previous studies have evaluated the reliability of diagnostic ultrasound in measuring the muscle thickness (16-18, 32). O'Sullivan et al. in 2009 compared the results of ultrasonic imaging and MRI imaging in measuring the trapezius muscle thickness. The results of this study revealed that the reliability of determining the thickness of the upper fiber of trapezius muscle was poor. However, there was a good to moderate reliability for middle and lower fibers of this muscle (17).

Bentman et al. in 2010 evaluated the reliability of diagnostic ultrasound in measuring the middle trapezius muscle thickness in 13 cases. The results of this study indicated that inter- rater and intra-rater reliability of ultrasound was good and moderate, a (ICC=0.81, ICC=0.67) (32).

According to previous studies, the Graston technique can break the constraints of fascia and create a new extracellular matrix and can affect the re-formation of soft tissue (12). Because of the effect of IASTM (Graston technique) on inactivating the trigger points and breaking the tight bundles of the muscle, it seems that this technique can affect the thickness of the muscle.

Further intra- rater and inter-rater reliability studies, with a large number of samples, are required to evaluate the effect of IASTM technique on decreasing the thickness of a muscle suffering from active trigger points.

Conclusion

The results of this study showed that six sessions of IASTM technique treatment (using the Graston protocol) with a one-day interval could reduce the intensity of pain and neck disability index, and also increase the pressure pain threshold. Furthermore, soft tissue mobilization of upper trapezius muscle changes the thickness of the upper trapezius muscle fibers directly.

According to the findings of the present study, it is suggested that the applying the complete protocol of this technique (as the five steps mentioned above) has good and durable effects on reliving the active trigger points of the upper trapezius muscle. However, further studies with more samples are required to determine the more accurate effects of this technique.

Conflict of interest:
None

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None

Authors' contributions:
All authors made substantial contributions to conception, design, acquisition, analysis and interpretation of data.

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