Research Article

Efficacy of Extracorporeal Shock Wave Therapy on Active Trigger Point in the Upper Trapezius Muscle

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ABSTRACT

Introduction: To demonstrate the effectiveness of extracorporeal shock wave therapy (ESWT) in treating active trigger points to relieve pain and increase range of motion (ROM) and improve the function of the cervical region in fewer sessions.

Materials and Methods: In this single-group, pretest-posttest study, 15 participants with active myofascial trigger points (MTrPs) in the upper trapezius muscle took part. Before and after each treatment, visual analog scale (VAS), pressure pain threshold (PPT), neck disability index (NDI) questionnaire, and range of active contra lateral flexion (CLF) were assessed. Participants were given three treatments over a week, with at least a two-day break between them, and then all outcomes were evaluated.

Results: The general results of this study demonstrate a significant reduction in pain perception in terms of VAS (P=0.0001), increased pressure pain threshold (P=0.0001), increased CLF of ROM (P=0.0001), and improved neck function by reduction of NDI (P=0.0001), after the third session of ESWT intervention in participants with MTrP in the upper trapezius muscle.

Conclusion: It reveals that ESWT has positive effects on pain reduction, cervical range of motion, and cervical function in participants treated with MTrPs in the upper trapezius muscle.

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1. Introduction

One of the most common causes of persistent musculoskeletal diseases is myofascial pain syndrome (MPS), and it creates substantial health and economic difficulties in today's society [1, 2]. The upper trapezius muscle is a characteristic sign of MPS, and it is usually complicated in MPS, which piques researchers' curiosity. myofascial trigger points (MTrPs) are palpable taut bands defined by autonomic dysfunction and transferred pain in the irritable points [3]. MTrP is commonly recognized as one of the vital early anatomic and physiologic impacts of MPS. A pain response or spontaneous discomfort characterizes an active MTrP, whereas a latent MTrP is just a tender palpable nodule dependent on compression [4].

No universal diagnostic standards are currently available for MPS. To confirm the presence of MTrPs, a full medical history, and physical examination are required. In clinical practice, manually palpation of local or referred pain is a relatively reliable way to detect MTrPs. According to Travell and Simons, acute and micro damage to the muscle can cause the formation of a trigger point. The sarcoplasmic reticulum is disrupted, resulting in the release of free calcium ions. Calcium ions increase actin and myosin interactions, as well as metabolic activity. Increased metabolic activity causes the production of histamine, serotonin, kinin, and prostaglandins, which increases the sensitivity and firing of group III and IV muscle nociceptors, which then combine with other visceral and somatic information to generate a sense of local and referred pain [5]. Invasive and non-invasive techniques for MTrP treatment can be distinguished. Manual therapy, electrical treatment, and exercise therapy are examples of non-invasive methods. Passive stretch, muscular energy techniques (METs), strain-counterstrain (SCS), myofascial release, and ischemia compression are examples of manual treatments [6]. Electrical muscle stimulation, transcutaneous electrical nerve stimulation (TENS), light amplification by stimulated emission of radiation (LASER), ultrasound, extracorporeal shock wave therapy (ESWT), and diathermy are examples of electrotherapeutic methods [7].

Nonlinearity, high peak pressure shadowed by short rising time, low tensile amplitude, and short duration are all physical properties of ESWT. It has a single pulse, high-pressure rage, and wide frequency range [8]. ESWT is a recently developed active treatment for MPS. It is thought to reduce MPS pain by altering pain signals, stimulating angiogenesis, and enhancing perfusion in ischemic tissues generated by sensitization of nociceptors and muscle ischemia. The benefit of acoustic compression treatment for Trigger Point (TrP) therapy is that it appears to have a long-lasting treatment impact, reducing the period between successive treatments [9]. ESWT has been shown to reduce pain and enhance function in patients with musculoskeletal disorders in recent studies [10]. ESWT is one of the newest ways of TP management. Although evidence of its beneficial effects in this area indicates that more research is needed to clarify many elements of their use in this condition [9-13].

2. Materials and Methods

This is a pretest-posttest study with a comparative design. The Ethics Committee of the Tehran University of Medical Sciences approved this work. Along with the inclusion and exclusion criteria, a total of 15 individuals were selected. The study's inclusion criteria included the age of 18-40 years, the presence of a palpable taut band and a nodule in the upper trapezius muscle, the presence of 1 to 3 trigger points on one side, and iron or calcium deficiencies [14]. Diagnosed fibromyalgia, cervical radiculopathy, facial neuralgia, coagulation abnormalities, cancer, history of cervical or shoulder surgery, history of deep vein thrombosis, history of myopathy, history of infiltration at the upper trapezius trigger point, anticoagulant medication, aspirin intake in the previous three days, and patients with other muscle trigger points were all excluded [14].

Study design

To assess the efficacy of ESWT treatment for patients with active trigger points in the upper trapezius muscle. All participants were recruited for this study after a specialist orthopedic, neurologist, or rheumatologist diagnosed them with active trigger points in the upper trapezius muscle. All participants (7 women and 8 men, 31.067±7.17 y, 164.73±6.67 cm, 69.13±16.09 kg) were checked for the inclusion and exclusion criteria and gained 3 sessions of treatment along a week. Before starting the treatment protocol, written consent was explained and signed by the selected participants to assure their permission. In the written consent, all advantages and possible disadvantages are clearly explained to the patient before starting the treatment intervention. In addition, we advised the patients to avoid other treatments or medications at home.

Assessment

Before and after therapy, pain intensity, pressure pain threshold (PPT), neck disability index (NDI) questionnaire, and range of active contra lateral flexion (CLF) were all assessed.

Visual analog scale (VAS)

The VAS is a 10-centimeter horizontal line divided into ten equal sections, with polar forms of no pain and the worst possible pain. The rating was completed and pain intensity was reported to participants after showing VAS [12]. Participants specified their pain by drawing a line perpendicular to the spot where their current level of symptoms was represented.

Pain pressure threshold (PPT)

The gradation of compression strength at which participants experience unease or pain rather than pressure is known as the PPT. PPT is defined by the International Association for the Study of Pain as the weakest intensity stimulus that a person perceives as pain [13]. It has been proven that the PPT value of this meaning is reliable, repeatable, and valid [15-17]. In this work, an algometer (model SF-500, USA) was used. This device consisted of a 1 cm^2 spherical rubber disk pressed vertically to the MTP. Compression was increased at a rate of 1 $kg•cm^2•s$ to aggravate the participant's pain [18, 19]. This procedure was repeated three times at 10-second intervals, and the average value of PPT was determined [15, 19-21].

Active contralateral flexion (CLF) Range

The range of active CLF of the cervical spine was measured with a cervical range of motion (CROM) goniometer [22]. Participants were asked to sit on an upright position. The goniometer's pivot was on the spinous process of the first thoracic spine, with the goniometer arm's center placed at right angles to the occipital protuberance. The trick's horizontal arm was previously maintained stable by hand and its vertical arm was positioned on the occipital protuberance to measure lateral flexion angle [23]. Participants were instructed to turn their heads towards the opposite side. The motion was stopped when the available range of motion (ROM) was reached, and care was taken to avoid shoulder rise. The process was done three times with 30-second breaks, the average value of which was determined as the range of motion of the cervical spine [14].

Neck disability index (NDI) arabic version [24]

The NDI is a scale that ranges from 0 to 50 points (0%-100%), with higher notches corresponding to higher levels of disability. Mild disability was defined as a score of 5-14 points (10%-28%), moderate disability was defined as a score of 15-24 points (30%-48%), and severe disability was defined as a score of 25-38 points (50%-68%), and total disability was defined as a score of 34 points (68%) [25].

Intervention

The participant sat on a chair near a couch to rest his/her arms. The participant relaxed and used a skin marker to identify the trigger point and clear it. Shock wave gel was useful as a thin layer over the trigger point in the upper trapezius. Shock wave (M.L.R/S.M.R 8300 Iranian and PAGANI/Italian) is placed perpendicular to the recognized trigger point (Figure 1). He maintained this position throughout the session. Participants were asked to notify any burning feelings if he/she feels. The number of impulses/beats was 2000 beats and the frequency was adjusted to 5Hz.

Statistical analysis

All statistical analysis was performed using SPSS statistical software, v. 23. The Kolmogorov-Smirnov (K-S) test was performed to determine the data's normality. The values before and after the variables were compared using the paired t test. For all statistical tests, the alpha level was set at 0.05.

3. Results

Fifteen participants comprised of 8 men and 7 women participated in the present study. The Mean±SD age of participants was 31.06±7.16 years. All variables were normally distributed based on the results of the K-S test (P>0.05). According to the results of paired t-test (Table 1), shockwave therapy had a significant result in decreasing pain (P=0.0001), increasing ROM (P=0.0001), and improving neck function (P=0.0001). The changes in the visual analog scale were estimated to be 7.73±1.03 before the intervention, whereas the figures were estimated to be 4.73±1.16 after the intervention, and the changes before and after the intervention were significantly different (P=0.0001). The changes in pain pressure threshold (N/cm^2) were 23.80±4.02 before the intervention, while it was 33.93±4.68 after the intervention, and the changes before and after intervention were significantly different (P=0.0001). The changes in CLF

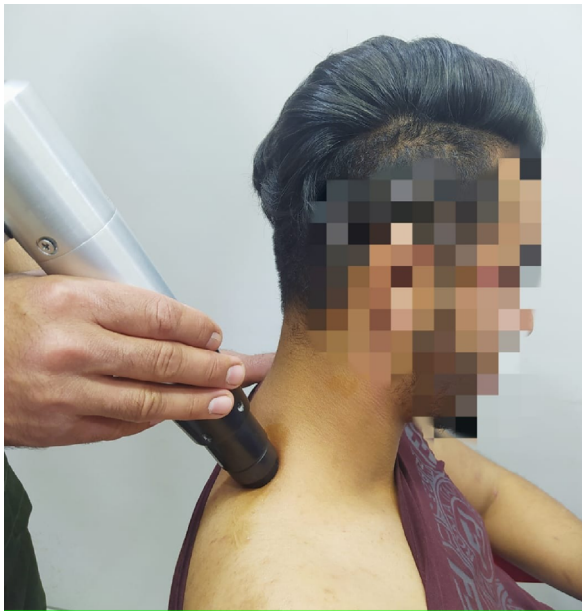

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Figure 1. A participant with an active trigger point in his upper trapezius muscle receiving ESWT in the sitting position

were 28.00±7.72 before the intervention, while it was 36.60±4.91 after intervention, and the changes before and after the intervention were significantly different (P=0.0001). The changes in the NDI were 43.00±13.10 before the intervention, while it was 27.33±14.90 after the intervention, and the changes before and after the intervention were significantly different (P=0.0001).

4. Discussion

We compared the VAS, PPT, CLF, and NDI before and after three sessions of therapy in this study. According to our findings, there is a substantial change between pre- and post-ESWT therapy (2000 beats, 5 Hz, 3 sessions/weeks). MPS is a multi-factorial neuromuscular disorder involving central and peripheral processes. Hyperirritable sites that caused persistent pain would send determined signals through afferent neurons to the spinal cord, which proceeded into spinal segmental sensitization [26] if MTrPs were left untreated or incompetently treated. As a result, desensitization of MTrPs would be the goal to proceed toward more stable and active management. Many recent studies have shown that ESWT can help individuals with musculoskeletal disorders reduce pain and increase function [10]. ESWT (2000 shocks) and dry needling in MTrPs were compared by Shuo Luan et al. Participants with myofascial trigger points were split into two groups ESWT and dry needling. The intervention lasted three weeks, with one-week intervals (in both groups). The NDI, PPT, VAS, and shear modulus were measured before the intervention, immediately after the first treatment, one month later, and three months later. After a series of three interventions, they discovered that ESWT is just as effective as dry needling in releasing pain, improving function, and lowering shear modulus in participants with MTrPs [27]. Manafnezhad et al. investigated the effects of shock wave (1,000 impulses, 16 Hz) and dry needling on the active upper trapezius muscle trigger sites in participants with non-specific Neck Discomfort Numeric Pain rating scale (NSNP). The ESWT group and the DN group were randomly assigned to participants with NSNP and active MTrPs in the upper trapezius muscle. Three weeks of treatment sessions with a corresponding intervention were held for all participants once a week. PPT, as evaluated by a digital algometer, pain severity, as measured by the NPRS, and functional impairment, as measured by the NDI, were the final measures. They found that both ESWT and DN are effective in treating MTrPs of the upper trapezius muscle in NSNP patients [28]. Hyun Jeon et al. assessed the effects of ESWT on MPS. MPS patients were randomly given ESWT and Trigger Point Injections (TPI) + TENS in the trapezius muscle. A total of 1,500 pulses of ESWT were done each time at one week of rest for a total of 4,500 pulses, TPI once a week and a total of three times, TENS five times a week and a total of three weeks, TPI once a week and

Table 1. The results of paired t-test for comparison before- after values of VAS, PPT, CLF, and NDT (n=15)

Variables	Mean±SD		Mean Difference	95% Confidence Interval	P
	Before Intervention	After Intervention			
VAS	7.73±1.03	4.73±1.16	-3.00	(-3.72)-(-2.27)	0.0001
PPT (N/cm^2)	23.80±4.02	33.93±4.68	10.13	(8.18)-(12.08)	0.0001
CLF (degree)	28.00±7.72	36.60±4.91	8.60	(6.20)-(10.99)	0.0001
NDI	43.00±13.10	27.33±14.90	-15.66	(-20.12)-(-11.20)	0.0001

VAS: Visual Analog Scale; PPT: Pain Pressure Threshold; CLF: Contra Lateral Flexion; NDI: Neck Disability Index

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a total of three times, and TENS once a week and a total of three weeks. They concluded that ESWT is just as beneficial as TPI and TENS for increasing cervical range of motion and reducing pain in patients with MPS of trapezius muscle [29]. The current study has similar results with previous studies regarding pain intensity (decreasing VAS), increasing PPT, increasing CLM, and improving cervical function. According to the authors' literature review, no studies were found to have conflicting results with the present study, and even no studies were found to show that ESWT did not affect pain, PPT, range of motion, and disability, and all the studies showed the positive effects of this therapeutic intervention.

5. Conclusion

The current study found that ESWT was beneficial for reducing pain, enhancing cervical range of motion, and improving cervical function in patients with active treating trigger points in the upper trapezius muscle after three sessions of therapy. While ESWT appears to be able to improve MTrPs, further research with a larger sample size and longer follow-up is needed to corroborate our findings. Long-term follow-ups are recommended to identify the potential adverse effects and effects of ESWT.

Some limitations exist in the current study that should be acknowledged. First, some of the referred patients were reluctant to participate in the study after we explained the possible discomfort associated with ESWT. Second, during the sessions, some of the eligible patients did not attend the treatment sessions due to the COVID crisis. Third, the study did not have a control group.

Clinical implication

According to the findings of this study, ESWT has beneficial effects on active trigger points in the upper trapezius muscle, resulting in pain reduction, increased cervical range of motion, and improved cervical function.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of Tehran University of Medical Sciences approved the study protocol (IR.TUMS.MEDICINE.REC.1399.917) and the Iranian Registry of Clinical Trials (IRCT) code was IRCT20130121012210N8.

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Authors' contributions

Conceptualization, study design: Karrar Albomahmood, Azadeh Shadmehr; Data analysis: Karrar Albomahmood, Shohreh Jalaie; Interpretation of data: Mohammad Reza Hadian, Karrar Albomahmood; Writing the original draft: All authors; Writing-review, editing: All authors.

Conflict of interest

The authors declared no conflict of interest.

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