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Research Paper: Comparing Between the Effects of Dry Needling and Shock Wave in the Treatment of Trapezius Myofascial Pain

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ABSTRACT

Introduction: Musculoskeletal disorders are important causes of pain. Trigger points are one of the common reasons for myofascial pain. This study aimed to compare a single session of dry needling versus a single session of shock wave therapy on the level of pain and Range of Motion (ROM) in the people with Myofascial Pain Syndrome (MPS) of the upper trapezius muscle.

Materials and Methods: Sixteen men with active trigger points of upper trapezius muscle were voluntarily attended in this study. They were randomly assigned into two groups. The patients were under a single session treatment of either dry needling or shock wave therapy. Level of pain (by Visual Analog Scale [VAS]) and active ROM of neck lateral flexion (by goniometer) were evaluated once before the treatment and immediately after the intervention.

Results: The VAS scores and the neck ROMs were substantially improved at both groups of study immediately after the treatment ($P<0.012$). However, there were no significant differences between the two groups of interventions in terms of the VAS and ROM scores ($P>0.05$).

Conclusion: Both dry needling and shock wave therapy can improve neck pain and ROM in patients with active trigger points in the upper trapezius muscle.

1. Introduction

Myofascial Pain Syndrome (MPS) is a musculoskeletal disorder and an important cause of pain [1]. Myofascial pain is the reason for about 30% of referral visits and also 85%-95% of direct visits at the public clinics [2]. MPS is a non-articular musculoskeletal disorder that is characterized by trigger points [3]. Trigger points are sensitive and palpable points in taut bands in skeletal muscles. Stretch or pressure on trigger points increases local pain and causes a contractile response. Pain sensation may spread to other areas following stretch or pressure. The release pattern may be specific and different for each muscle [3-5]. The pathophysiology of trigger points is still unknown, but two famous theories of energy crisis theory and motor endplate theory exist in this field [6]. The bad posture

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or habits, unsuitable working conditions for a long time, psychological factors such as anxiety, biochemical imbalance, nutritional and or hormonal problems are important reasons that result in trigger points [3, 7]. These points are often created at the postural maintenance muscles such as the upper trapezius, scalenes, levator scapula, and lumbosacral area muscles [8]. The upper trapezius is the most prone muscle to trigger points compared to the other neck muscles. The upper trapezius trigger points may lead to myofascial pain syndrome of the neck [9].

Therapeutic methods of trigger points are both invasive and non-invasive. Invasive methods include medical injections (such as Botox, corticosteroids, anesthetics) and dry needling [10]. The non-invasive methods include physiotherapy or electrotherapy methods (such as muscle stretching with cold spray, laser, ultrasound, and shock waves) [11, 12].

Dry Needling (DN) as a treatment method includes the specific dry needle(s) inserted into the area of trigger point without any other medication or intervention [13]. There are controversial reports on dry needling effectiveness for myofascial pain. Some researchers believed that DN is an effective method [14, 15], while the others reported that DN cannot provide significant improvement for the patients with myofascial trigger points [8, 16]. Yeganeh et al. indicated that one single session of DN on latent trigger points of the upper trapezius might relieve pain and increase the ROM in the women with MPS [17].

Shock Wave Therapy (SWT) is a non-invasive physiotherapy method for trigger points. Despite all significant evidence that clarifies the positive effects of the SWT application on musculoskeletal disorders (such as fractures nonunion, pseudoarthrosis, tenosynovitis, and plantar fasciitis) [18], its effectiveness on MPS is still under investigation. Since the SWT is characterized as a non-invasive, simple, and easy-to-use method of care for large areas, and also as low and moderate intensities of the SWT has had few identified side effects, this modality can be applied instead of other expensive or ineffective methods of treatment [2, 19-23]. Hye and colleagues reported that the VAS scores decreased and Pressure Pain Threshold (PPT) increased significantly after four sessions of shock wave therapy with the energy flux density of 0.056 mJ/mm^2 and 1000 impulses per session in the patients with MPS in the upper trapezius muscle [12]. The prevalence of trigger points in different muscles and their effects on individuals' performance and life [3] are still under research.

Finding much effective and faster improvement and also lower expenses for treatment methods have motivated the researchers to research on new and effective treatments for patients with trigger points. If SWT, as a non-invasive method of care with simple application and lower side effects, provide similar effects or better improvement than the DN, the clinician may use this modality to induce faster improvement for the patients with myofascial trigger points. Our literature search clarified that there was no study to compare the immediate effects of SWT and DN on active trigger points (evaluated by the VAS and ROMs). Besides, the previous researchers, who worked on the SWT effects on the trigger points, applied low doses of the SWT, while the higher or medium doses would be in a safe range and might be more effective in decreasing the number of treatment sessions. The purpose of this study was to compare the immediate effects of SWT and DN on the level of pain and the ROM of patients with active trigger points in the upper trapezius muscle.

2. Materials and Methods

This study was designed as a single-blind clinical trial. Sixteen men with the diagnosis of myofascial pain syndrome at upper trapezius muscle were recruited for the study. The patients in the shock wave group were referred to the Physiotherapy Clinic of Nikan Hospital in Tehran City, Iran, and the dry needling group was referred to the Physiotherapy Clinic at the School of Rehabilitation, Tehran University of Medical Sciences (TUMS). The researchers got the ethical approval code from the Ethics Committee at the TUMS (IR.TUMS.FNM.REC.1398.092) before they started the research. The inclusion criteria were as follows: pain sensation at the neck or upper trapezius area for at least a month, pain severity of at least 3 to 7 (based on the VAS scores) [24], aged between 18 and 35 years, with at least one active trigger point at the upper trapezius muscle based on Simon criteria (including taut band at upper trapezius muscle, touching sensitive points at upper trapezius muscle, and reproduction of usual referral pain pattern after pressure on trigger points) [4]. The exclusion criteria were as follows: any other neurological conditions such as fibromyalgia or whiplash injury after surgery or fractures of cervical vertebrae, cervical radiculopathy, central and peripheral neurological disorders, vascular diseases, systemic diseases such as cervical myelopathy, history of the treatment of trigger points in the past month, local infection, consumption of anticoagulants, fear of needle, alcohol and drug use, cognitive and communication

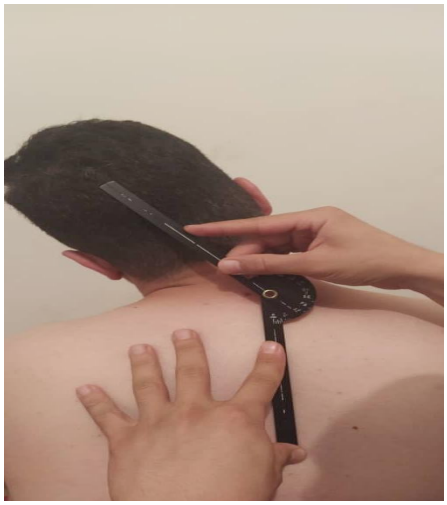

Figure 1. Measuring the active range of bending side to side with the goniometer

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problems, and lack of cooperation to continue treatment for any reason [25].

The patients were randomly divided into two experimental groups: the DN and the SWT. Each patient chose a card with the labels A or B, to be randomly assigned into one of the experimental groups. The purpose of the research and its procedure was explained in lay language, and the patients voluntarily signed a consent form before the interventions. The patients' characteristics and initial examinations were initially performed and the results were recorded in a specific form by an experienced therapist. Next, the level of pain (by Visual Analog Scale [VAS]) and active Range of Motion (ROM) of lateral neck flexion (by goniometer) were evaluated for each patient. The VAS is a pain-sensitive scale that has good validity and high reliability to determine pain caused by myofascial syndrome [24]. This scale was a 10-cm line and the patient had to determine the level of pain from zero as painless to 10 as the most severe imaginable pain [26]. A calibrated goniometer was applied to evaluate the ROMs of neck lateral flexion. The participant sat in a comfortable position in a chair with arms next to his body and with a straight face so that his nose was perpendicular to the mouth. The center of the goniometer was located at the cervical vertebra of C7, while the fixed arm was in the line of the fixed horizon, and the moving arm was on the line of the occipital protuberance. Then, the patient was asked to bend his neck to the opposite side without raising his shoulder, and accordingly, the movable arm was reached to the new place of a line of the occipital protuberance. The ROM was the active and painless range that was evaluated three times repeatedly with 30-s intervals and the average score was recorded as lateral neck flexion range [27] (Figure 1).

A sterile acupuncture needle with a diameter of 0.3 mm and a length of 5 cm was used for the DN application. The patient laid at a prone position in a way that the upper trapezius muscles were in a relaxed position. An

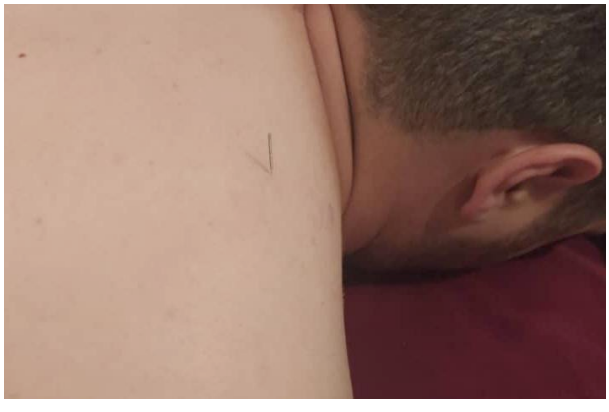

Figure 2. The procedure of dry needling the upper trapezius muscle

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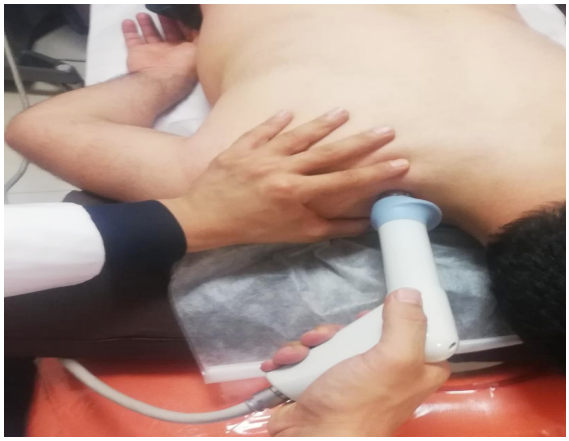

Figure 3. The procedure of upper trapezius muscle shock wave therapy

experienced physiotherapist identified the area of trigger point and the needling area was disinfected by an alcohol pad. The therapist held the trigger point between the index finger and thumb of the non-dominant hand. Next, the researcher perforated the needle into the skin in a transverse and controlled manner by his dominant hand and with protective gloves [25]. The sense of "deqi"[1] or local twitch response indicated the correct location for the needle. The needle was placed at the area of trigger point for 5 minutes and removed after this time [25] (Figure 2).

The radial shock wave (Model BTL-6000 SWT TOPLINE - England) with a 15-mm applicator was used to provide shock wave therapy intervention. The patient sat straight in a comfortable situation on a chair and put his hands on the edge of the chair. Next, the SWT was performed on the upper trapezius muscle with 1000 impulses, of which 700 impulses were on the taut band (A taut band of muscle fibers extends from the trigger point to the attachment at each end of the involved fibers) of the trapezius muscle and 300 impulses were around the taut band with the energy flux density of 0.38 mJ/mm^2, and frequency of 10 Hz [12, 28] (Figure 3).

Statistical analysis

SPSS version 20 was used for statistical analysis. The Shapiro-Wilk test was utilized to evaluate the normal distribution of numerical variables [29]. Because the data distribution was not normal, we used a nonparametric test to analyze data. The central tendency and dispersion indices were used to describe the numerical variables. The Wilcoxon signed-rank test was applied to evaluate significant changes for each variable after the intervention methods. Furthermore, the Mann-Whitney U test was applied to compare changes of the VAS and ROM scores between the two experimental groups.

1. Tingling, numbness, heaviness, and other feelings that occur after an acupuncture needle has been properly placed in the body

3. Results

The research was conducted on 16 patients at the age range of 19-35 years old, with a Mean±SD age of 28.13±3.98 years for both groups of dry needling (n=8) and shock wave therapy (n=8). The Mean±SD age was 27.00±4.50 years in the dry needling group and 29.25±3.28 in the shock wave therapy group. There was no significant difference between the two groups in terms of age.

The statistical evaluations indicated that the application of DN and SWT could significantly improve the VAS (P=0.010) (P=0.011) and also ROM (P=0.012) (P=0.012) scores, respectively, in the patients with upper trapezius trigger points (Table 1). The statistical results also showed no significant difference between the DN and the SWT application in patients with upper trapezius trigger points in terms of the identified outcome measures (Table 2).

4. Discussion

In the present study, one session of the DN application and shock wave therapy in patients with Myofascial Pain Syndrome (MPS) of upper trapezius muscle significantly decreased the VAS level and increased active ROMs of lateral neck flexion in both techniques.

The results of this study were consistent with the findings of former studies by Yeganeh and colleagues who found that one session of the DN application at the patients with trigger points in upper trapezius muscle could decrease the VAS level and increase the neck ROMs. However, it must be considered that Yeganeh and colleagues applied the DN on latent trigger points and

Table 1. Comparing of visual analog scale and active range of motion of lateral neck flexion in both study groups

Variables	Intervention	Mean±SD		Effect Size	P
		Before the Treatment	After the Treatment		
VAS	Dry needling	5.75±0.70	3.50±1.06	0.64	0.010
	Shock wave therapy	5.88±0.83	3.25±0.88	0.63	0.011
ROM	Dry needling	28.03±2.26	31.87±3.30	0.63	0.012
	Shock wave therapy	29.37±2.12	32.95±1.74	0.63	0.012

VAS: Visual Analog Scale; ROM: Range of Motion

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Table 2. Comparing of therapeutic effects of dry needling and shock wave therapy based on the VAS and active ROMs

Variables	Mean±SD		Effect Size	P
	Dry Needling	Shock Wave Therapy		
VAS Changes	2.5±0.7	2.62±0.91	0.24	0.337
ROM Changes	3.83±1.37	3.58±1.88	0.09	0.713

VAS: Visual Analog Scale; ROM: Range of Motion

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evaluated the parameters 48 h after the intervention [18]. Their method was different from our research framework. Rocio and colleagues (2014) also studied chronic mechanical neck pain and achieved similar results by two sessions of DN through fast-in and fast-out technique on trigger points of the upper trapezius muscle. In their method, the needle was inserted and took out several times for 25 to 30 seconds with a 1-Hz frequency. This method was also different from the current study in which DN was inserted and stayed at the trigger points for 5 minutes up to the time that the researchers observed the first local twitch response [30].

The effects of DN treatment can be studied in both mechanical and neurophysiological fields [31]. According to Travell and Simons, the therapeutic effects of the DN application refer to direct mechanical disturbances of needling at the trigger point and can facilitate the initiation of muscle regeneration in the target area, so that the defective process of excessive release of acetylcholine is broken [3, 32]. It is also indicated that the direct presence of the needle in the area causes local stretching of the contracted tissue and return sarcomeres to their normal lengths [33, 34]. The needle may also stimulate the A delta fibers, which causes encephalinergic activity in inhibitory interneurons in the posterior horn of the spinal cord and ultimately reduces pain. This is a mechanism that is involved in neurophysiological effects and may not be related to the immediate effects following dry needling [31, 35]. On the other hand, physiological studies have found that concentrations of chemicals such as bradykinin and substance P may be changed when the needle enters the trigger points [35].

The results of this study were consistent with the study by Jong and colleagues (2012) who reported the VAS scores significantly decreased and the neck ROMs substantially increased following three sessions of SWT with an energy flux density of 0.1 mj/mm^2 and 1500 impulse per session in the patients with a myofascial pain syndrome of the trapezius muscle.

Ki Deok Park also reported similar results to our study results [36]. There were some differences between the study plans of these two studies and the present study. The differences between the present study and Jong's research were the number of sessions of the SWT application as well as an applied dosage to the myofascial trigger point area. Jong et al. performed three sessions of treatment with an energy flux density of 0.1 mJ/mm^2 and 1500 impulses per session, but the researchers of the present study provided one treatment session with an energy flux density of 0.38 mJ/mm^2 and 1000 impulses [37].

The mechanism for shock wave therapy on myofascial trigger points is not completely clear; however, a variety of hypotheses have been suggested based on the cellular and molecular effects of the therapy. Lower blood flow causes

ischemia and nerve pain stimulation that in turn increases muscle stiffness and tension. SWT can increase perfusion, improve angiogenesis, and alter pain signals due to the influx of calcium ions into ischemic tissues [38]. Substance P is a neuropeptide that stimulates pain fibers (A delta and C) and causes pain. The former studies indicated that SWT might reduce pain by decreasing substance P production in the posterior horn of the spinal cord [39]. It may also reduce the muscular tension and improve local ischemia in the shortened area leading to block higher levels for metabolism and onset of the energy crisis and to reduce the release of painful substances in the area. It may also decrease the stimulation of muscle pain receptors and return the muscles to a normal state [12, 39].

The present study compared the effects of one session of DN with one session of SWT on patients with active trigger points of the upper trapezius muscle. The results indicated no significant differences between the two groups based on the outcome measures of the VAS and active ROMs of neck lateral flexion.

Shuo Luan and colleagues applied DN and SWT to treat trigger points in upper trapezius muscle for three sessions and indicated that both methods had similar effects on pain relief and disability improvement. They also reported that these interventions could increase the Pressure Pain Threshold (PPT) [40]. Shuo results were consistent with the results of the present study; however, there was no study to compare the effects of these interventions just for one session of the application. Jong and colleagues conducted a comparative study on the SWT application and a combined method of intramuscular injection with Transcutaneous Electrical Nerve Stimulation (TENS). They found that both methods had similar effects on pain relief and improvement of the ROMs. The results of Jong study were also in line with the results of the present study [37].

Given the above-mentioned mechanisms for the effectiveness of DN and SWT on trigger points, it is clear that both methods have two factors necessary for the treatment of trigger points. They both increase the length of the sarcomeres and improve blood flow circulation on the trigger point's area. The identified physiologic points might be the reason for the similarity of the effectiveness of both interventions. Since DN is an invasive method and may be followed by some complications during and after the intervention (such as pain and bruising, vascular rupture, bleeding, possible damage of nerve fibers, and pneumothorax), it seems that the SWT is a more reliable treatment and immediately decrease the level of pain and improve the ROMs in the patients with active trigger points in the upper trapezius muscle.

First, the study lacked a long-term follow-up, and second, the sample did not include female participants. It is suggested that future studies be conducted on the side effects and complications of each method and can be followed up for a longer time. Also, similar studies could be conducted with the patients in both genders under these interventions. Finally, further studies may apply to combine or compare muscle stretching exercises with dry needling and or shock wave therapy.

5. Conclusion

The results of this study clarified that DN and SWT applications may improve pain level (based on VAS) and ROMs in patients with active trigger points in the upper trapezius muscle.

Ethical Considerations

Compliance with ethical guidelines

The research project was Ethically Approved by the Tehran University of Medical Sciences (Code: IR.TUMS.FNM.REC.1398.092).

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Authors contributions

All authors equally contributed to preparing this paper.

Conflict of interest

The authors declared no conflict of interest.

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