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The Effectiveness of Dry Needling on Subjects With Multiple Myofascial Trigger Points in Shoulder Girdle Muscles

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Abstract

Objectives: Physiotherapists have accepted the dry needling (DN) technique as an adequate treatment for myofascial trigger points (MTrPs). Considering that most similar studies have only focused on one muscle, the current study aimed at evaluating the influence of DN on patients with musculoskeletal pains caused by active MTrPs in shoulder girdle muscles.

Materials and Methods: This quasi-experimental study was achieved based on experiences and observations in clinical settings. Totally, 20 subjects were selected with pain in shoulders and/or upper limbs, as well as head and neck with 3 to 5 MTrPs in the shoulder girdle muscles. They were candidates for treatment with DN in 5 sessions every other day during 2 weeks. The subjects were evaluated by the visual analogue scale (VAS), pressure-pain threshold (PPT), and the disabilities of the arm, shoulder, and hand (DASH). The statistical analysis was done using the paired *t* test.

Results: A significant difference was observed in VAS, DASH, and PPT results after the intervention compared with those values before the intervention. $P \leq 0.05$ was considered as the level of significance.

Conclusions: Considering the observed improvements in VAS, the PPT, and DASH scores, the DN can be used as an impressive therapeutic method for MTrPs in shoulder girdle muscles.

Keywords: Myofascial trigger points, Dry needling, Pressure pain threshold, Pain, Muscle pain, Shoulder muscles

Introduction

The pain caused by musculoskeletal pathologies is one of the conducting causes of referring to pain clinics and medical centers worldwide (1). The trigger point (TrP) or myofascial trigger point (MTrP) is a painful region, which can be diagnosed in clinics depending on medical history, physical exam, and painful muscle palpation. It is diagnosed by four characteristics (2-4) including a spotted, tender taut band of the muscle, a sensitive point, which its palpation sometimes causes a local twitch response in muscle fibers, feeling severe pain, which sometimes refers to other regions by upon compression, and the delimited range of motion (ROM) in the involved muscle.

The prevalence of the disease among the patients referring to pain clinics ranges from 30% to 80% in the United States. In a similar study, one-third of patients referring to pain clinics have myofascial pain syndrome accompanied by TrPs. The results of a study showed that MTrP is the leading cause of referring to neurologic clinics in 85% to 95% of cases. Another study indicated that 55% of 164 patients with chronic head and neck pain attending pain clinics had MTrPs in head and neck muscles (5,6).

Some studies on the pathogenesis of the disease demonstrated that it results from overuse syndrome, followed by reduced tissue oxygen and cell injury. The evaluation of the variation of blood pressure (BP) in a contracted muscle indicates that the arterial and venous BPs are 35 and 15 mm Hg, respectively. The difference between BP values causes muscle blood drainage. Normally, by the relaxation of the muscle in the resting state, the blood enters the muscle and makes it ready for normal metabolism. However, the muscle enters the anaerobic cycle during repeated contractions and after uptaking adenosine triphosphate and creatine phosphate, which produces pyruvic acid dropping pH in the muscle tissue (7).

The results of similar studies indicated that pH changes in MTrP are usually under a normal range (about 5). In the continuous muscle activity, long-term pH changes cause ischemia and cell injury, and finally, inflammation. On the other hand, low pH for a long time reduces the activity of cholinesterase thus the endplate potential may remain depolarized, which reduces the length of a sarcomere. This procedure causes the synthesis of calcitonin gene-related peptide (CGRP) in the same muscle cell. CGRP stimulates the secretion of acetylcholine by nerve endings, resulting

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in a vicious cycle, which sustains muscle contraction. Sustained muscle contraction increases the stimulation of pain receptors in the muscle (4,8,9).

By increasing the stimulation of muscle nociceptors, inflammatory mediators start to secret, which causes sustained inflammation in the muscle accordingly. In addition, the continuous stimulation of pain receptors in the muscle initiates the production of several chemicals in the neuronal cell body in the dorsal horn, including bradykinin, histamine, prostaglandin, serotonin, P content, CGRP, and the like. The chemicals made in the neurons of the spinal dorsal horn intensify pain severity, cause referral pain, and sustain inflammation. Such inflammation is referred to as neurogenic inflammation (10,11).

There are many methods for the treatment of MTrPs, including non-steroidal anti-inflammatory drugs (NSAIDs), electric stimulation, ischemic pressure, dry needling (DN), and the like. DN was more accepted by the physiotherapists due to the ease of application and fast efficacy (2,12).

Further, Dommerholt reported that DN has different mechanical, chemical, and neuro-physical effects (13). Furthermore, Rickards used DN in the treatment of MTrP and concluded that the improvement of sarcomere length is attributed to the needles that entered into MTrP (14). Similarly, Abbaszadeh-Amirdehi et al evaluated the neurophysiologic effects of DN on MTrP in the upper trapezius muscle and recommended the employment of DN in the care of MTrP in the upper trapezius muscle (15).

Different studies evaluated the effect of DN and improvement of visual analogue scale (VAS), pressure-pain threshold (PPT), along with the disabilities of the arm, shoulder, and hand (DASH) and reported its efficacy in MTrP treatment (16,17), but most of such studies only focused on one muscle. Accordingly, this study aimed to detect the influences of DN on disability, pain intensity, and pressure pain threshold in patients with multiple TrPs in shoulder girdle muscles.

Materials and Methods

Participants

Examinations and treatment were carried out by a physical therapist with 18 years of experience. The inclusion criteria were having pain in the shoulder, upper limbs, and head and neck. In addition, the other inclusion criteria were as follows (18,19):

- Having a palpable taut band and hypersensitive tender muscle;
- Feeling a referral pain pattern by compression;
- Detecting active TrPs by mechanical pressure imposing a 25 N/cm^2 pressure to TrPs;
- Having spontaneous pain without any pressure over the TrP;
- Having VAS score 3 in the primary assessment;
- Showing limited shoulder joint mobility (lower DASH score).

The MTrP region was determined and recorded for further sessions. On the other hand, the exclusion criteria were having the history of severe head injury, vertebrae column surgery, TrP treatment within the last month, and fibromyalgia syndrome, as well as the use of corticosteroids until the last month and sedative and NSAIDs 3 days prior and during the intervention, and finally, needling prevention conditions such as local infection, pregnancy with the risk of miscarriage, mensuration, HIV, and the like.

A total of 20 subjects (aged 20-60 years) was enrolled in the study. Their shoulder griddle muscles were examined, followed by determining the MTrPs. The subjects were examined for 3 to 5 MTrPs.

The project objectives and procedures were explained to the subjects and their written testimonial was taken before the intervention. First, the height, age, and weight of the subjects were measured and recorded (Table 1) and then the assessment of the DASH questionnaire was given to the subjects. Then, they received instructions on how to complete it and accordingly, all subjects did it with no further assistance. Next, their daily VAS scores and the PPT were assessed as well.

The acupuncture needles No. 30 x 35, 40 x 25, and 50 x 25 (Dong Bang, Korea) were used based on the subjects' body shape (obese or lean). All study subjects received 5 sessions of DN within 2 weeks and one day after the last session all patients were assessed again.

Assessment of Pain Severity

To assess the severity of pain, the VAS method was used before and after the treatment. According to this method, a line graded from 0 to 10 was used to score the pain. The subjects were asked to score their pain according to the rating scale ranging from 0 referring to no pain and 10 representing the highest degree of pain they have ever experienced. The reliability and validity of the test were confirmed in previous studies (20,21).

Assessment of Pressure-Pain Threshold

To assess PPT, a Lutron Electronic FG-5005 digital apparatus was used before and after the intervention. The small metal disc, attached by a vertical rod to the device, is held on 3 to 5 MTrPs and after imposing pressure to the points, the patient reports his/her pain score which is recorded accordingly. The validity and reliability of the method were confirmed in previous studies (22,23).

Assessment of the Disabilities of the Arm, Shoulder, and Hand

The DASH questionnaire was used to assess the disability of the upper limbs. Huisstede et al reported that the DASH questionnaire can also reveal the level of functional ability in patients with myofascial pain syndrome. The reliability and validity of the DASH questionnaire were also confirmed in previous studies (24). Mousavi et al translated DASH into Persian and then assessed and confirmed the validity and reliability of the questionnaire (25). The patients completed DASH before and after the intervention and the score of each item was separately used to compare before and after the intervention.

Statistical Analyses

SPSS19 was used to analyze the obtained data. Regarding the descriptive statistics, central tendency, and dispersion index were done for the studied variables. Additionally, the Kolmogorov-Smirnov test was used to assess data normality and the mean (SD) was used to express data values. Finally, the paired *t* test was performed to evaluate the significance of variables before and after the intervention.

Results

Twenty subjects (16 women and 4 men) aged 20-60 years were included in this study for 2 weeks. The demographic data of the subjects are provided in Table 1. Table 2 presents the results of the VAS, PPT, and DASH, as well as the paired *t* test. The median VAS score improved from 7.05 before the intervention to 2.90 after the intervention. In addition, the median PPT increased from 25.83 before the intervention to 34.22 after the intervention. The DASH also improved from 35.86 before the intervention to 15.14 after the intervention (Figure 1). All data were analyzed to confirm the normality distribution by the Kolmogorov-Smirnov test. Statistical analyses using the paired *t* test demonstrated a significant difference in the studied variables before and after the intervention (Table 2).

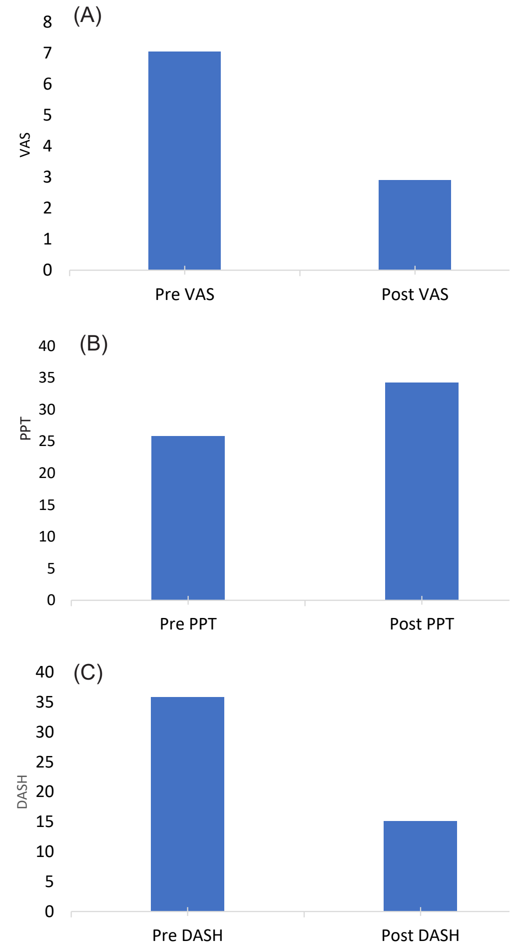

Figure 1. (A) Pain intensity (VAS score) after treatment compared with before treatment. (B) Pressure pain threshold (PPT) after treatment compared with before treatment. (C) DASH after treatment compared with before treatment

Discussion

To the best of our knowledge, this study was the first one to focus on multiple TrPs on shoulder muscles. The results of our study showed a significant difference in pain parameters before and after care. In a recent study, Lobo treated 20 patients (aged 65 years) who had nonspecific shoulder pain with active and latent MTrPs of the infraspinatus muscle. The subjects in the experimental group received one session of deep dry needling (DDN) on active and latent MTrP and the control group (CG) only received active MTrP. Pain intensity (PI), PPT on the anterior deltoid, extensor carpi radialis brevis muscles, and grip strength were assessed before and after treatment. The results revealed significant differences ($P < 0.05$) indicating the PPT improvement of the extensor carpi radialis brevis and PI in the experimental group in post-treatment evaluations, but no significant difference was found for grip strength (26). Tejera-Falcón et al evaluated the effectiveness of DN within a technique of manual physiotherapy and therapeutic exercise in the cure of chronic nonspecific shoulder pain. They measured VAS as the main outcome, as well as DASH, PPT, and the ROM. Based on the findings of this study, combination therapy (DN + manual physiotherapy or exercise program) was

Table 1. Demographic Data of Subjects

	Minimum	Maximum	Mean ± SD
Weight	45	98	72.55±13.46
Height (m)	1.54	1.89	1.7405±.087
Age	26	50	41.95±6.73
BMI, n=20	15.15	29.34	23.82±3.05

SD: Standard deviation; n: Case number.
Data include the means of height, age, and body mass index.

Table 2. Pre-post Measurement Scores for VAS, PPT, and DASH in the Subjects

Variables	Before Treatment Mean ± SD	After Treatment Mean ± SD	*P* Value
VAS	7.05	2.90	0.000
PPT	25.83	34.22	0.000
DASH	34.86	15.14	0.000

Note. SD: Standard deviation; VAS: Visual analogue scale; PPT: Pressure pain threshold; DASH: Disability of arm, shoulder, and hand.
Data are demonstrated as means ± standard deviation of VAS, PPT, and DASH. In addition, baseline and treatment scores indicated a significant difference.

an effective method in patients with chronic unspecific shoulder pain which reduced pain while not improving DASH, PPT, and ROM (27). However, our results showed statistically significant improvement release in the intensity of pain, the increase of PPT, and the decrease of the DASH score.

In another study, one session of the DN technique was used for 20 subjects with upper trapezius MTrPs and PI, the neuromuscular junction response (NMJR), sympathetic skin response (SSR), and PPT were assessed immediately after DN. The results represented significant amendments in pain, PPT, SSR latency and amplitude, post-treatment, as well as the NMJR reduction, and return to normal state after DN (28).

In a similar randomized clinical trial, Pérez-Palomares et al investigated the effectiveness of DN together with evidence-based individual physical therapy for treating shoulder pain. In general, 120 patients suffering from general shoulder pain were divided into two groups. Data analysis showed no significant differences between the groups even though both groups had less pain after the treatment (29).

Similarly, Téllez et al conducted a study on 44 people who suffered from pain in their necks and active MTrPs in the trapezius muscle. They were randomly assigned to the DDN or CG. All patients with MTrPs in the trapezius muscle in the DDN group were treated with DDN in addition to the passive stretch to their trapezius muscle. The subjects of CG only received a passive stretch. The PI (VAS), the cervical ROM, PPT, and muscle strength were measured before and after treatment and 15 days follow up. The obtained data revealed significant VAS and PPT differences in the DN group but no significant difference was observed for ROM and muscle strength (30).

Gerber reported a significant pain reduction following the DN technique in 56 patients and thus attributed the success to better regional blood circulation and changes in TrPs conditions (17). Further, Casey Unverzagt et al mentioned that the DN technique was an impressive method in the care of TrPs and reduced pain in such regions (31). They only concentrated on a single muscle. However, the current study evaluated 3 to 5 shoulder girdle muscles and compared the results. Furthermore, Hsieh et al used the DN technique to treat TrPs in infraspinatus and reported the increased PPT following the intervention (21). Moreover, Ziaeifar et al applied DN to treat TrPs in the upper trapezius muscle and reported the PPT increase after the intervention but found no significant difference between the control and trial groups. Therefore, they suggested that the results are probably contributed to the tissue damage caused by DN (16). However, the current study assessed pain-associated parameters on the day after entering DN when the injuries reduced to its minimum.

In addition, similar studies indicated that DN is an adequate therapeutic method for the treatment of myofascial pain syndrome accompanied by TrPs. Some studies demonstrated that the effectiveness of the DN method is the result of its mechanical, neurophysiologic, and biochemical effects (15,32).

Additionally, Simons et al showed that the other available treatments can increase BP in the region, which facilitates the improvement of sarcomeres length and the relief of pain (33). In another study, Shah et al reported the increase of regional BP and consequently, the reduction of pain while the needle entered the TrPs (34).

Some researchers evaluated the mechanical effects of the DN technique and reported that while DN enters TrPs, the cross-bridge between actin and myosin is opened and sarcomeres return to their normal size. Hence, the activity of A-delta fiber reduces and thus leading to pain relief (35,36). In addition, Sim used the DASH questionnaire to evaluate patients with MTrPs and confirmed its validity and reliability and reported that the DASH score indicates the functional disabilities of the patient, which has a strong relationship with his/her quality of life (37).

Boyling and Jull conducted several studies and reported that according to the biological cycle of trauma-injury-pain, the repair of anatomical, kinetic, social, and rationalized elements influencing the cycle, any pain in upper organs can influence functional ability on an individual. Further, the findings indicated that changes in any aforementioned factors affect the reduction of pain or improvement of the disability level (38).

Similarly, Ziaeifar et al applied the DN method to cure TrPs in the upper trapezius muscle and reported improvement in the functional status of patients based on the DASH (16).

Furthermore, Hsieh et al used the DN technique on TrPs in the rabbit and reported improvements in the function of the muscle and an increase in the level of β-endorphin in peripheral blood circulation, as well as a reduction in P content secretion in the muscle with TrPs and the associated spinal cord dorsal horn. Moreover, previous evidence showed changes in the content of biomarkers in the tissue surrounding MTrP and the increase of PPT. And improvement of DASH can be attributed to these changes due to the physiologic role of biomarkers in pain control (39).

Conclusions

According to previous research studies and the current study, the DN technique is effective in MTrPs and can relieve pain parameters. In addition, according to human and animal studies on this therapeutic method, DN can treat MTrPs by affecting tissue and blood biomarkers.

Conflict of Interests

The authors declared no conflict of interests in this study.

Ethical Issues

This study was confirmed by the Ethics Committee of the local university (Registered No. 13950400).

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