Effects of Superficial and Deep Dry Needling on Pain and Muscle Thickness in Subject with Upper Trapezius Muscle Myofascial Pain Syndrome

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Abstract

Background: Dry needling is one of the main therapeutic approaches in patients with Myofascial pain syndrome. Few studies have been compared the superficial and deep dry needling methods in these patients.

Objective: To evaluate the effects of superficial and deep dry needling on pain and muscle thickness in subjects with upper trapezius myofascial pain syndrome.

Design: A randomized quasi-experimental double-blinded trial.

Methods: 50 subjects with upper trapezius myofascial pain syndrome (age=26/08 ± 4/62, weight=63/88 ± 8/71 kg, height=167/7 ± 4/82 cm, pain duration=9/75 ± 7/05 m) randomly assigned to the superficial (n=25) and deep (n=25) dry needling groups. The pain and maximum thickness of upper trapezius muscle in rest, fair and normal contractions were measured by visual analogue scale (VAS) and an ultrasound device respectively before and after the intervention as well as 7 and 15 days follow-up.

Results: The mixed-model ANOVAs revealed a significant group-by-time interaction ($F=44.03$, $p<0.001$) for pain and muscle thickness in rest ($F=67.00$, $p<0.001$), fair ($F=108.73$, $p<0.001$) and normal contraction ($F=17.73$, $p<0.001$). The main effects of group and time were statistically significant for pain, rest, fair and normal muscle thickness ($p<0.001$). There were not any significant differences in rest, fair and normal muscle thickness after intervention as well as 7 and 15 days follow-up.

Conclusion: Both superficial and deep dry needling techniques induced significant short-term changes in the VAS. Muscle thickness in rest, fair and normal contractions did not show any significant changes between the groups.

upper trapezius were recruited from a general hospital and an outpatient clinic. T e variables included pain and muscle thickness in three situations: Rest position, fair and normal contractions of the muscle.

Inclusion criteria in this study were: Presence of at least one active trigger point in the central region of upper trapezius, age between 20 and 40 years, pain duration ≥ 3 months and diagnosis of myofascial pain syndrome based on clinical examinations. Also, the subject's exclusion criteria were: Fibromyalgia, thoracic outlet syndrome, upper extremity entrapment syndromes, severe joints immobility, and torticoli. Moreover, participants with history of rheumatoid arthritis, cancer, and surgical interventions in the neck and shoulder, and other regions of the trunk were also excluded. Additionally, participants who had received physical therapy or any local injection within the last 3 month were excluded.

At f rst, the subjects f lled the consent and the personal information questionnaire forms. T e subjects were evaluated at the f rst session and then were treated by 3 sessions of dry needling and re-evaluated a f er treatment and 7 and 15 days follow-up.

Clinical Examination

T e diagnosis of the myofascial pain syndrome was based on standard clinical criteria including: (1) palpable taut bands in upper trapezius muscle, (2) local tenderness in the taut bands (trigger points), and (3) pain recognition by the subjects [3,15]. T e presence

Fair	Prone, head out of the bed, hands near the body	Standing next to the patient's head	The patient lifts head and neck opposite to the gravity and looks up
Normal	Prone, head on the bed, hands near the body	Standing next to the patient's head, One hand on the parieto-occipitalis area for putting resistance to the head	The patient moves the head and neck in the range upward opposite to the maximum resistance.

Table 1: Measurement conditions of upper trapezius muscle thickness by ultrasound.

Statistical analysis

The sample size calculation was based on mean and SD of VAS scores of the recent study. In the mentioned study, the main dependent variable was pain (measured by the VAS). Before and after 1 month treatment, the mean VAS score ± SD were 5.3 ± 1.5 and 2.1 ± 1.6 respectively. The alpha level was assumed 0.05 and power of 80% with a ratio of the sample size of the two groups being 1. According to the formula ($n=(Z_{\alpha/2}+Z_{\beta})^2 \times 2 \times \sigma^2/d^2$) the sample size was 21 for each group. Finally by estimation of 10% missed data based on the formula (1/1-f) the sample size were calculated 25 subjects for each group.

Descriptive statistics, including mean and standard deviation (SD) values of all variables were computed for the SDN and DDN groups. The normality of distribution was evaluated by the Shapiro-Wilk test, and the results confirmed the use of parametric tests. A 2 × 4 (two groups: SDN and DDN; four times of measurements: Before and after 7 and 15 days of follow-up) mixed-model analyses of variance (ANOVAs) were conducted for pain and thickness parameters. Post-hoc analyses were performed using multiple comparison by Bonferroni's method to indicate the interaction between group and time. In addition, the effect size was calculated as the differences in outcome measures between the two groups divided by the SD of the either groups. Significant level was set at 0.05 for all tests.

Results

76 subjects were screened for eligibility. 26 were excluded: 24 were excluded because they did not meet the inclusion criteria

Rest thickness	Mean	12.02	11.98	11.93	11.92	12.21	11.84	11.74	11.66
	SD	1.98	1.97	1.96	1.95	1.64	1.65	1.65	1.66
Fair thickness	Mean	13.18	13.15	13.11	13.06	13.09	12.77	12.68	12.6
	SD	1.9	1.88	1.88	1.6	1.6	1.58	1.58	1.6
Normal thickness	Mean	13.59	13.54	13.52	13.5	13.44	13.04	12.94	12.85
	SD	1.91	1.91	1.91	1.92	1.42	1.43	1.44	1.43

[27]. Therefore, the long-term effects of DDN on pain reduction were more than the SDN. SDN is a quick and painless method for pain relief. It is indicated that the main mechanism of SDN in reducing pain is stimulation of A delta fibers and inhibition of C fibers through posterior horn of the spinal cord. Since stimulation of A delta fibers induces a sharp and transient pain and due to the fact that the SDN does not cause too much pain during the procedure, then other mechanisms, including increased skin circulation, effects on the limbic system, as well as stimulation of the A beta fibers should be considered.

From the clinical point of view, the ability of needling to increase circulation about twice in the main area of the trigger points is highly desirable [28]. In the SDN, increasing blood circulation does not occur in deep tissue and maybe it is one of the reasons that its effect is less than the DDN method in reducing pain in the long term. Apart from the depth of the needle issue, another effective factor in the therapeutic consequences of DDN is the local twitch response of the muscle. Local twitch response of the muscle causes changes in blood circulation, as well as improvement of ischemia, hypoxia, and increased pain mediators, such as substance P and calcitonin peptide due to stimulation of C and A delta fibers by axonal reflex. In this study, the patients treated with DDN showed local twitch response in the affected muscle. In contrast, in the SDN method, despite the therapeutic effects, no local twitch response was elicited. It seems that developing or not developing a local twitch response in muscle is an issue needing further investigations [29].

Effects of SDN and DDN on Rest, Fair and Normal Muscle Thickness

Although, in the present study, thickness of the muscle in the DDN group was reduced compared to the SDN group after treatment, and the follow-up period, the reduction was not significant between the two groups (0.5 mm). On the other hand, the maximum slope of muscle thickness reduction in the three modes was in the DDN group, before and after the treatment. The reason may be the localized twitch response following the application of DDN [30].

Examination of the muscle thickness with ultrasound has been shown contradictory results in different muscles [31-33]. imoe atesd eased tQ scle c ickness w en

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