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Original Article

The Effect of Dry Needling of the Trigger Points of Shoulder Muscles on Pain and Grip Strength in Patients with Lateral Epicondylitis: A Pilot Study

Alireza Kheradmandi[1], Maryam Ebrahimian[2], Farahnaz Ghaffarinejad[2], Venous Ehyaii[1], Mohammad Reza Farazdaghi[2]

[1]Student Research Committee, Department of Physiotherapy, School of Rehabilitation Sciences, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Rehabilitation Faculty, Department of Physiotherapy, School of Rehabilitation Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

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ABSTRACT

Background: Lateral epicondylitis, also known as tennis elbow, is the most common overuse syndrome of the elbow. The severity of pain may not be directly caused by tendinopathy of wrist extensors since trigger points of the shoulder muscles have a referral zone in the arm and elbow. Therefore the aim of this study was to evaluate the effect of dry needling of shoulder myofascial trigger points on wrist extensors muscles pain and function.

Methods: Fourteen female patients with tennis elbow (aged 20 - 45 years old) were recruited after primary evaluation by an orthopedist. They entered the study if they had pain in the lateral aspect of elbow of the dominant hand for more than 3 months along with the presence of myofascial trigger points in any muscles of supra spinatus, infra spinatus, sub scapularis or scalenes. Pain pressure threshold, maximal grip force and pain intensity of the hand extensors on lateral epicondyle of elbow were measured before and after treatment. Pain intensity was measured on a one to ten scale of visual analogue scale (VAS). A hand dynamometer used to measure the maximal grip force value of the affected hand in 0˚shoulder flexion/abduction, 90˚ elbow extension and mid-poison of forearm in sitting position. A pressure algometer was applied on hand extensor muscles to define their trigger point sensitivity. For the control group, treatment regimens consisted of routine physical therapy of tennis elbow. This regime was accompanied by dry needling of mentioned muscles for the intervention group. Wilcoxon and Mann-Whitney non-parametric tests were used for statistical analysis.

Results: Comparison of the results after intervention showed that the patients' pain significantly decreased in both groups ($P<0.001$); but the patient's PPT and grip force significantly increased solely in the intervention group ($P<0.05$). Mann Whitney test showed significant pain differences in both groups ($P=0.001$). The comparison of differences showed that the grip force and PPT statistically improved in the intervention group ($P<0.05$).

Conclusion: Dry needling of affected shoulder muscles along with routine physical therapy has a more significant effect on improvement of pain, sensitivity and grip power of patient's with tennis elbow syndrome.

Trial Registration Number: IRCT201508291552N5

*Corresponding author: Maryam Ebrahimian, PhD Candidate of Physiotherapy, Department of Physiotherapy, School of Rehabilitation Sciences, Shiraz University of Medical Sciences, Shiraz, Iran. **Tel:** +98 71 36271551, **Fax:** +98 71 36272495
E-mail: ebrahimian@sums.ac.ir

Introduction

Lateral epicondylitis, also known as tennis elbow, is the most common overuse syndrome of the elbow [1, 2]. It affects approximately 1% to 3% of the population each year with 7% occurrence rate in manual workers [3, 4]. Tennis elbow most commonly affects people between 30 to 50 years old [5] mainly on the dominant hand [6]. Although the rate of incidence is equal in both genders [7, 8], the severity and duration of symptoms are more prominent in women [9].

Although the cause of tennis elbow is unknown yet but a combination of mechanical overloading and abnormal micro-vascular responses has been found at the site of tendino pathy [10]. Typical signs and symptoms include pain and tenderness over the lateral epicondyle, exacerbated by resisted wrist extension and passive wrist flexion with impaired grip strength [1, 11].

A myofascial trigger point (MTrp) is a palpable sensitive spot in a muscle which is characterized by an exquisitely tender point in a taut band of muscle [12]. MTrps as a peripheral factor would increase sensitivity of peripheral and central nervous systems [13]. Latent MTrps are hyper sensitive spots in muscle which can be tender but not the source of pain [14]. Pathologic conditions such as tendinopathy of hand extensor muscles may activate these points and form an active MTrp. These MTrps are both tender and painful [14]. Beside the routine physical therapy techniques, dry needling methods have become popular in the management of MTrps [15, 16].

Dry needling would alleviate local and referral pain from these MTrps and improve the range and pattern of muscle activation [15]. Besides, other mechanisms such as limbic system affection [17] and descending inhibitory pathways [18] have been recently introduced for the effect of dry needling.

The severity of pain on lateral epicondyle of elbow may not be directly caused by tendinopathy of wrist extensors. Beside elbow joint, other parts such as cervical or shoulder myofascial pain may mimic lateral epicondylitis [14]. Studies have been shown that in the presence of multiple MTrps, needle stimulation on a primary MTrp can suppress satellite (secondary) MTrps [14]. Many muscles in the neck and shoulder regions can be the source of MTrp and their referral pain to the lateral of elbow. Referral pain of scalenes, subscapularis, supraspinatus and infraspinatus muscles and myofascial tissues can cause pain in the lateral area of elbow [19, 20].

Dry needling of wrist extensors has been used for the treatment of tennis elbow with combination of other treatments such as manipulation [21, 22] and taping [21]. Combination of dry needling of shoulder muscles along with physical therapy has shown to be an effective treatment for myofascial shoulder pain [23]. Different studies have evaluated the effect of dry needling of shoulder and elbow muscles on the localized pain of the muscles around affected joints. These studies showed that dry needling can be an effective treatment for regional pain [15]. Hsieh et al. evaluated the effect of unilateral infraspinatus muscles dry needling on pain pressure threshold (PPT) of bilateral shoulder and elbow muscles. They found PPT of extensor carpi radialis decreased after dry needling of infraspinatus muscle [14].

Local effects of dry needling have shown significant pain relief in regional shoulder or elbow pain so far, but no study has evaluated the effect of dry needling of shoulder muscles on tennis elbow syndrome.

As pain in the muscles of shoulder has a referral zone in the arm and elbow [20], the aim of this study was to evaluate the effect of dry needling of shoulder MTrps on elbow extensors muscles pain and function.

Methods

For this randomized clinical trial, seventeen female patients with tennis elbow (aged 20-45 years old) were recruited from rehabilitation clinics of Shiraz University of Medical Sciences. They were included in the study if they had pain in the lateral of elbow of the dominant hand for more than 3 months along with the presence of MTrps in any muscles of supra spinatus, infra spinatus, sub scapularis or scalenes. Then they were evaluated for the presence of tennis elbow on their dominant hand with different tests of COZEN, Resistive Tennis Elbow Test and Passive Tennis Elbow Tests [24]. The patients excluded if they had any history of surgery/fracture in upper extremity, depression and severe anxiety, neurological or cardiorespiratory deficits. Among participants three patients were excluded due to history of shoulder surgery.

The sample size was calculated based on 80 % of statistical power and a 0.05 alpha error. After signing a consent form, patients were randomly assigned to either of groups using blocked randomization. Prior to the study, all subjects signed the consent form approved by the Ethics Committee of Iranian Registry of Clinical Trials (Approval number: IRCT201508291552N5) (figure 1).

Pre-intervention tests included measurement of pain pressure threshold (PPT), maximal grip force and pain intensity of the hand extensor on lateral epicondyle of elbow. Pain intensity measured on a one to ten scale of visual analogue scale (VAS). A hand dynamometer (Collin dynamometer, COMED SAS, France) was used to measure the maximal grip force value of the affected hand in 0˚shoulder flexion/abduction, 90˚ elbow extension and mid-position of forearm in sitting position. A pressure algometer (FDIX Digital Force Gauge, Wagner Instruments, Greenwich CT, USA) was applied on hand extensor muscles to define their MTrp sensitivity using method described by Yueh et al [14].Three repetitive measurements at an interval of 30-60 seconds were performed at each muscle site [14].

After pre-intervention examination both group were treated for tennis elbow using physical therapy methods for 10 sessions. In the control group, routine physiotherapy managements including ultrasound, burst TENS (Transcutaneous Electrical Nerve Stimulation), hot pack and exercise therapy applied on the site of tennis elbow. Ulterasound therapy applied with 1 MHz frequency on 4 cm^2 applicator era and intensity of 1 W/cm^2 using "NovinUltraSound 215X" (Novin medical

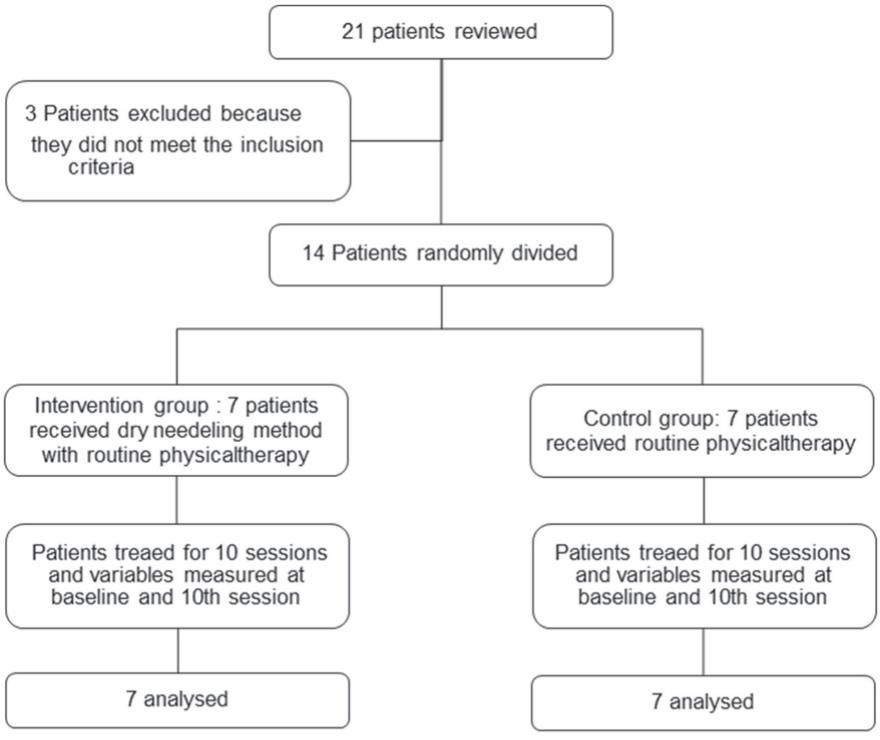

Figure 1: Consort Diagram of study

engineering Co., Isfahan, Iran). Burst TENS (Frequency of 100 Hz and pulse width of 100μsec) applied with hotpack for 20 minutes with the anodal pole on elbow lateral epicondyle and the cathodal pole on the proximal parts. Then patients performed 10 repetitions of eccentric contractions of wrist/finger extensors with a 0.5 kilogram dumbbell for 3 sets [25].

In the treatment group, MTrp dry needling of Supraspinatus, Infraspinatus, Subscapularis and Scalens muscles were applied along with the above physiotherapy treatment in the presence of MTrps in any above muscles. MTrp dry needling procedure followed the procedure by Hong et al. [26]. Dry needling sessions lasted for only 6 sessions [27]. After 10 sessions of physical therapy treatment in both groups, the outcomes were measured again.

Statistical analyses were done with SPSS version 18 software (SPSS Inc., Chicago, IL). Kolmogorov-Smirnov test was used to test the normal distribution of the variables. Wilcoxon and Mann-Whitney non-parametric tests were used to compare within and between group differences. The level of significance was set at $P<0.05$.

Results

Demographic data of patients at the initial stage are listed in table 1.

Non-parametric tests were used for analysis of the data after performance of normality test using Kolmogorov-Smirnov test.

Using Wilcoxon test, the results showed that patient's pain significantly decreased after treatment in both groups ($P<0.001$); Mann Whitney test showed significant pain differences in both groups ($P=0.001$).

The patient's PPT and grip force significantly increased solely in the intervention group ($P<0.0.05$) (table 2).

The differences of variables were compared between two groups using Mann Whitney test. The results showed that the grip force and PPT statistically improved in the intervention group ($P<0.05$) (table 3).

Discussion

The results of this study showed that the dry needling of the affected shoulder muscles along with routine physical therapy for tennis elbow syndrome has a more significant effect on improvement of patient's pain and sensitivity of hand extensor muscles in comparison to routine physical therapy.

Physical therapy is a conservative management for the treatment of pain, disability and satisfaction of patients with lateral epicondylitis [28]. Using modalities such as

Table 1: Demographic data and measurement scores of patients at the initial stage

	Mean±SD		P. value
	Intervention group	Control group	
Age	39.71±7.38	36.57±9.84	0.51
Height (cm)	1.64±0.06	1.64±0.05	0.96
Weight (kg)	64.34±9.32	66.34±5.85	0.64
BMI (kg/cm^2)	25.39±3.15	24.78±3.52	0.74

Table 2: Mean (Standard deviation) of measurements in both groups before and after intervention using Wilcoxon test

	Variables	Pre-intervention		Post-intervention		P. value
		Mean±SD	95%CI	Mean±SD	95%CI	
Intervention Group	VAS	7.14±1.57	5.69-8.60	3.14±2.26	1.05-5.24	0.017*
	PPT	0.79±0.37	0.44-1.13	1.83±0.46	1.39-2.26	0.018*
	Grip Power[1]	35.00±23.09	13.64-56.35	47.57±27.18	22.43-72.71	0.043*
Control Group	VAS	7.00±1.73	5.40-8.60	5.86±1.57	4.40-7.31	0.011*
	PPT	0.97±0.25	0.74-1.21	0.90±0.20	0.71-1.10	0.499
	Grip Power[1]	29.42±19.30	11.57-47.28	29.71±19.80	11.39-48.03	0.317

[1]Measurement unite: Kilograms per square centimeter, *P. value<0.05

Table 3: Comparison of mean differences of pre-post intervention measurements in both groups using Mann Whitney test

	Difference of pre-post intervention		
Variables	**Intervention group**	**Control group**	**P. value**
VAS	-4.00 (1.29)	-1.14 (.37)	0.001
PPT	1.04 (0.37)	-0.07 (0.14)	0.001
Grip Power[1]	12.57 (14.85)	0.28 (0.75)	0.038

[1]Measurement unite: Kilograms per square centimeter

heat, ultrasound and TENS has been recommended as an effective treatment in these patients. These treatments would increase soft tissue extensibility and blood flow along with pain and muscle spasm decrement [28]. So far, we know that physical therapy of the affected area would decrease patients' pain as we observed in the control group.

No studies have so far directly evaluated the effect of dry needling of shoulder muscles on pain and other variables of tennis elbow. So we couldn't compare the results of current study with previous studies except for Hsieh et al. Hsieh et al. in 2007 evaluated the effect of dry needling of primary MTrps of infraspinatus muscle on PPT of infraspinatus, anterior deltoid and extensor carpi radialis, longus muscles. They found significant increment of PPT in satellite MTrps on mentioned muscles which is consistent with the findings of this study. MTrps are hyper sensitive spots in muscle which can be tender but not the source of pain [14]. An increase in the number of sensitized nociceptors in a region would increase MTrp's pain and irritability and make a primary MTrp. These sensitized nociceptors may evoke central sensitization of some dorsal horn cells of spinal cord related to referral pain zones [29]. Sensitized MTrps in a referral pain zone are satellite MTrps which would expand the perceived zone of a primary MTrp [14]. This means that the pain would irradiate to other zones by activation of neurons in dorsal horn of the spinal cord. Therefore, due to decrease in central sensitization of spinal cord with dry needling of shoulder muscles, the irritability of satellite MTrps decreased and the results led to decrease in perceived pain zone of primary MTrps. This would result in lower pain perception (lower VAS rates) and higher pain pressure threshold. With the decrement of pain in the lateral epicondyle of elbow, the grip force would increase [30]. Most of the muscles of the shoulder complex fall into one of the two functional categories: proximal stabilizers or distal mobilizers. Optimal function of the shoulder complex requires an interaction between mobilizer and stabilizer muscles [31]. Studies have shown a positive relation between shoulder stabilizer muscles` strength and power of hand grip [32]. Based on Janda approach, unlike muscle synergies, muscle slings are global muscle chains that provide movement and stabilization across multiple joints [33]. The upper-extremity flexor and sling muscles include the pectoralis major, anterior deltoid, trapezius, biceps and hand flexors [33], so changes in activities of shoulder muscles may have effects on other muscles in the sling such as hand flexors for grip force strength. Many studies state that grip power is an important outcome measure among Tennis Elbow treatment interventions [34].

In this study physiotherapy methods suppressed active MTrps of hand extensor muscles in both groups. Although these inactive points are not painful as before, they were latent MTrps because they would not disappear [14]. On the other hand, dry needling of affected muscles around the shoulder joint improved pain, sensitivity and tenderness on the lateral of elbow epicondyle in the intervention group in comparison to control group.

The limitation of this study contained small sample size. As we observed for the grip force results, more sample size would be beneficial in the relevancy of the results.

Conclusion

Dry needling of some shoulder muscles along with routine physical therapy has a more significant effect on improvement of patient's pain and sensitivity of hand extensor muscles with tennis elbow syndrome.

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