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Original Article

Comparison of Therapeutic Efficacy of Acupuncture and Low-Level Laser in the Treatment of Cervical Myofascial Pain Syndrome: A Single-Blind Randomized Controlled Clinical Trial

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Keywords
Myofascial pain syndromes; Acupuncture; Laser therapy; Neck pain

Abstract

Background: Neck pain is a medical and public problem with a prevalence of 9-18 percent in the general population. Myofascial pain syndrome (MPS) is a regional pain syndrome that is characterized by tender trigger points in muscles. We aimed to compare the effects of acupuncture and low-level laser therapy (LLLT) in cervical MPS (CMPS) treatment.

Methods: In this randomized controlled clinical trial study, during 15 months, 60 patients with CMPS were divided into three groups; groups A, B and C, respectively, underwent acupuncture plus drugs, laser therapy plus drugs, and only medication. Pain severity using the visual analog scale (VAS), range of motion (ROM) using goniometry, palpation sensitivity through finger compression and daily function using the Northwick Park Neck Pain Questionnaire (NPQ) were assessed before, immediately after, and 2 months after treatment; and compared.

Results: In the acupuncture group, 5 men and 15 women (mean age: 38.80 ± 6.36 years), in the laser group, 6 men and 14 women (mean age: 37.70 ± 5.64 years) and in the control group, 8 men and 12 women (mean age: 37.60 ± 5.17 years) were evaluated. There was a significant difference in the majority of parameters between the two treatment groups compared to the control group. However, neck ROM in left lateral bending and VAS score showed better improvement in the acupuncture group compared to the other 2 groups ($P < 0.001$). Nevertheless, 2 months after treatment, no significant difference was detected between laser and acupuncture groups.

Conclusion: This study demonstrated that both acupuncture and laser therapy along with exercise and drugs are more effective than routine medication treatments alone in the management of CMPS. However, regarding myofascial pain pathology, acupuncture, at least in the short term, has more beneficial effects on pain improvement and neck ROM than laser or medical therapy alone.

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Introduction

Neck pain is a major medical and social problem and its incidence alone or along with upper extremity pain is observed in 9-18 percent of the general population. One third of the general population recalls at least one period of neck pain throughout their lives. Myofascial pain syndrome (MPS) is a regional pain syndrome that is characterized by tender points and myofascial trigger points (MTPs). The most important clinical characteristic of MTPs is the presence of point tenderness in the nodule, which is actually part of the taut and fibrous muscle band.[1]

Through pressing these points, pain or paresthesia occurs at the same point or spreading to the surrounding area, causing mild muscle contraction, limited range of motion (ROM) and muscle weakness. MPS is often observed when examining and treating patients with chronic pain. The pain is caused by stimulation of the trigger, localized or referential points, and exacerbated through stretching the affected areas, cold and pressure. Although the actual mechanism of trigger points is unknown, it seems that MPS is caused by trauma, inflammation and other unknown causes.[2]

Trigger points may be generated in any muscle or muscle group, but are often seen in muscles undergoing intense stress, or muscles that do not undergo full contraction and resting periods. In the upper extremity, often the trapezius, levator scapula and infraspinatus muscles are involved.[3]

Evidently, the above symptoms, as seen in fibromyalgia, are associated with disordered sleep, and in fact, MPS and fibromyalgia are two ends of a spectrum of illnesses.[1,2]

Acupuncture as part of traditional Eastern medicine and low-level laser treatment (LLLT) as a physical modality are used in treating the trigger and painful points in cervical myofascial syndrome.

In a review study, Furlan et al. examined the effects of complementary therapies, including acupuncture, on cervical and lumbar pain.[4] In this study, 152 clinical trials were investigated and the findings showed that complementary therapies, like acupuncture, were more effective in reducing pain and disability compared to the lack of treatment, physiotherapy or routine treatment immediately after treatment, or shortly after follow-up.[4]

The results on the effect of LLLT in the treatment of myofascial neck pain are contradictory. Some studies have shown it to be useful in myofascial pains.[5,6]

In a prospective clinical trial conducted by Dundar et al. to assess the effect of LLLT on patients with chronic neck pain, 64 patients were divided into two groups.[5] In the first group, laser was received at the target points, and in the second group, a placebo laser was used.

In both groups, significant improvement was observed in all the results compared to the period before the treatment, but no significant difference was found between the two groups.[5] However, in the study by Chow et al., which was a review article on the effect of LLLT on neck pain, the results showed that LLLT reduced acute cervical pain at an early stage immediately after treatment and these effects remained up to 22 weeks after treatment.[6]

Considering the above-mentioned issues, the importance of the subject, and the large number of patients with neck and shoulder pain problems, lack of a similar study in our society, and some controversies in the results, the authors decided to conduct the present research. In the current study we aimed to evaluate the efficacy of two modalities of acupuncture and LLLT in comparison with each other, and in comparison with the control group in terms of the criteria of pain intensity, limitation of neck ROM, palpation sensitivity, and disability in the daily functional activities of patients with cervical myofascial pain syndrome.

Methods

The 60 patients with myofascial neck pain syndrome who referred to the Physical Therapy and Rehabilitation Clinic, Imam Reza

Medical Center, Tabriz, Iran, or referred to the Rheumatology Clinic from January 2011 to March 2012, were randomly divided into 3 groups of 20 individuals. These 3 groups were matched for age and history of different diseases; in addition, tender and trigger points were identified among them through accurate examinations. Then, the patients' complaints including local or referral pain, weakness, paresthesia, etc. were recorded. The inclusion criteria included neck pain for more than 2 months, with the presence of tender points in the neck, willingness to participate in the study, and lack of any exclusion criteria. The exclusion criteria included radicular pain, detection of severe disk herniation in the patient's previous magnetic resonance imaging (MRI) or severe radiculopathy in electromyography (EMG), systemic, infectious, inflammatory and tumorous diseases, history of cervical spine fracture, neck spine surgery, physiotherapy or manipulation in the past 2 weeks, and degenerative or severe osteoporotic changes in the cervical vertebrae in radiography. Therefore, the patients with the above criteria were excluded from the study.

The randomization method was as follows: the patients selected one of the closed packets containing the letters A, B or C and they were placed, respectively, in the acupuncture group, laser group or control group through selecting each of these letters. The first (A) and second groups (B) were treated with acupuncture twice a week for 3 weeks (6 sessions) and with LLLT 3 times a week for 3 weeks, respectively. In all 3 groups, the usual treatment was applied, included training, and neck stretching and strengthening exercises accompanied by medication (including anti-inflammatory and antispasmodic drugs). The control group received only exercise and medication.

The assessment was carried out in 3 stages of before the treatment, immediately after the treatment (3 weeks after the onset of treatment), and 2 months after the treatment and was recorded in the checklist. Acupuncture was performed by a physician trained in acupuncture (acupuncture and physiotherapy physician) and laser therapy by an experienced physiotherapist.

It is worth noting that the examining physician and his/her assistant (physiotherapy and rehabilitation intern) were not aware of the patient's treatment group.

Determination of pain severity based on the visual analog scale (VAS): First, patients were asked to specify their pain severity through a score from 1 to 10 (3 to 4 as mild to moderate, 5 as moderate, 7 and 8 as severe, and 9 and 10 as very severe). Then, the responses were marked in a graph with a vertical section graded from 1 to 10.

Measurement of neck range of motion: Neck ROM was measured and recorded at two sagittal and frontal levels for measurement of flexion, extension, and bending to right and left using a goniometer.

Measurement of palpation sensitivity: Localized tenderness points were determined through precise examination of the neck and their severity was scored from 0 to +2 by the patient as the examiner was touching and pressing the patient's neck. The scores 0, +1 and +2 indicated no pain, mild to moderate pain and severe pain, respectively.

Determination of patient's daily performance based on Neck Pain Questionnaire: The daily performance of the patients was evaluated using the Northwick Park Neck Pain Questionnaire (NPQ), which had been translated into a plain and coherent language. The validity and reliability of this questionnaire has been confirmed in studies.[7,8] The questionnaire consists of 9 questions on the assessment of the daily symptoms and problems of patients, and each question was given a score of 0 to 4 according to the severity of the disability. Higher scores illustrate the greater severity of the disability of the patient. It is noteworthy that the validity of the questionnaire in this study was evaluated through content validity method, so that by reviewing the texts, the content of the questionnaire was verified to measure the 4th goal of the study, which evaluated the

individual's daily functional activities. Moreover, a test-retest method was used to test the reliability of the questionnaire. To this end, the questionnaire was completed by 5 patients before the treatment, then, a week later, the questionnaire was completed again by the patients with the initial assumption. The repeatability of the answers was evaluated to be excellent.

Determination of acupuncture locations: These points were selected based on the defined meridians. The channels involved with localization of pain and the preferred route of motion limitation were determined and the needle was inserted into the specified meridians.

In these meridians, including the gallbladder, colon, small intestine, bladder and heart meridians, acupuncture was performed with needles of 0.30 × 0.25 and 0.25 × 25 sizes. In all the patients, acupuncture was performed at points GB20 (middle point of upper trapezius), DU14 (on the posterior median line, in the depression below the spinous process of the 7th cervical vertebra), DU20 (on the top of head, at the midpoint of the line connecting the apexes of the two auricles), SI11 (in the region of subscapular fossa, level with the 4th thoracic vertebra) or SI12 (in the center of the suprascapular fossa, directly above SI 11), LI14 (inferior to the deltoid muscle insertion point), LI10 (with the elbow flexed, the point is on the dorsal radial side of the forearm, 2 cm below the transverse cubital crease), LI11 (lateral epicondyl, the point is on the lateral end of the transverse cubital crease, at midpoint between biceps tendon and lateral epicondyle of the humerus), LI 4 (On the dorsum of the hand, between the 1st and 2nd metacarpal bones, in the middle of the 2nd metacarpal bone on the radial side), accompanied by 2 or 3 trigger points, except for acupuncture points in the involved muscle (including paravertebral muscles, trapezius, levator scapulae, supraspinatus, infraspinatus and other muscles of the neck and shoulder in case of involvement) bilaterally with the preference of the involved side.[9] After insertion of the needle, electrical stimulation was performed with the transcutaneous electrical nerve stimulation (TENS) device with electrodes attached to the needles for 20 minutes.

Used laser: Ga-Al-As laser therapy was performed for each patient using an endolaser with a dosage of 4 J/cm^2, an average power of 100 mW and a continuous mode with a wavelength of 780-830 nm for 20 seconds with a total duration of 5 minutes on any painful point.

Data analysis: The data obtained from the study were statistically analyzed using descriptive statistics [rate, percentage, and mean ± standard deviation (SD)], mean difference test for independent groups, paired t-test and one-way analysis of variance (ANOVA) for comparison of the 3 groups and Mann-Whitney and Kruskal Wallis tests for non-parametric data in the SPSS statistical software (version 16, SPSS Inc., Chicago, IL, USA). In this study, a P value of less than 0.05 was considered statistically significant.

Ethical considerations: At the beginning of the study, the goals of the study and its generalities were described to the patients. In addition, they completed a written consent form in case of entering the study. Participating in the study did not impose additional costs on patients. Before the onset of the study, the study procedure and its goals were explained verbally to the patients. It is worth noting that the study has been approved by the regional ethics committee of Tabriz University of Medical Sciences, Iran, and has been registered in the Iranian Clinical Trials (IRCT) website with the code IRCT201105243217N3.

Results

A total of 60 patients entered the study. Thus, 5 men and 15 women, 6 men and 14 women and 8 men and 12 women were placed in the acupuncture group, laser therapy group, and the control group with a mean age of 36.60 ± 8.38, 37.70 ± 5.64, and 37.56 ± 17.50

years, respectively. There was no significant difference between the mean age of the 3 groups of patients and the 3 groups were similar in terms of age (P = 0.98). In terms of sexual distribution, the percentage of women was higher in all 3 treatment groups (P = 0.04).

In the next step of the study, 4 out of 20 patients in each group refused to participate in the study for a variety of reasons, including distance or relative improvement, and the study continued with a total of 48 patients.

Comparison of the study criteria including pain severity, neck ROM limitation, palpation sensitivity and disability in daily functional activities of patients before the onset of treatment between the 3 groups did not show a significant difference (P > 0.05).

In terms of intra-group comparisons, most of the criteria in all 3 groups showed significant changes after treatment compared to before treatment (P < 0.05); these effects sustained until 2 months after treatment for acupuncture and LLLT groups. In the control group, some of the variables had significant changes immediately after treatment compared to before treatment. Only for palpation sensitivity of point B and pain severity, these effects sustained for up to 2 months, and the durability of the effects was short for the remaining criteria. Table 1 shows these changes.

Table 2 shows the pairwise comparison of the mean changes of the criteria among the studied groups immediately and 2 months after treatment.

Discussion

Diagnosis of cervical myofascial pain syndrome (CMPS) is mainly clinical. Imaging usually shows non-specific changes that do not actually help diagnosis.

Table 1. Intra-group comparison of the study variables in the 3 stages of treatment

Variable	Group	Before treatment (Mean ± SD)	Immediately after treatment (Mean ± SD)	2 months after treatment (Mean ± SD)	P Stage 1.2	P Stage 1.3	P Stage 2.3
ROM-F	Acupuncture	52.50 ± 6.97	53.50 ± 4.89	53.43 ± 5.39	0.001	0.020	0.027
	LLLT	48.60 ± 11.48	51.00 ± 6.96	50.93 ± 8.41	0.010	0.470	0.630
	Control	56.11 ± 85.48	50.57 ± 10.67	50.35 ± 8.41	0.009	0.820	0.100
ROM-E	Acupuncture	46.50 ± 5.40	49.50 ± 7.23	51.25 ± 7.63	0.007	0.009	> 0.999
	LLLT	41.35 ± 10.69	43.75 ± 9.15	40.93 ± 9.16	0.008	0.150	0.270
	Control	42.25 ± 7.15	44.00 ± 7.41	43.21 ± 7.23	0.009	0.820	0.100
ROM-RB	Acupuncture	34.75 ± 6.97	42.00 ± 5.93	76.50 ± 18.42	0.001	0.001	0.130
	LLLT	34.75 ± 6.97	40.25 ± 6.38	39.68 ± 7.63	0.001	0.001	0.660
	Control	34.56 ± 4.14	37.50 ± 4.13	36.42 ± 4.56	0.003	0.390	0.020
ROM-LB	Acupuncture	38.25 ± 6.34	43.25 ± 4.66	44.37 ± 4.42	0.001	0.001	0.580
	LLLT	34.25 ± 5.91	37.00 ± 4.97	36.56 ± 5.07	0.008	0.380	0.300
	Control	37.00 ± 5.56	37.75 ± 4.12	37.50 ± 3.79	0.410	0.760	0.330
VAS	Acupuncture	7.75 ± 1.11	3.45 ± 1.34	3.18 ± 1.51	0.001	0.001	0.660
	LLLT	7.65 ± 1.81	4.70 ± 1.45	4.93 ± 1.43	0.001	0.001	0.600
	Control	6.90 ± 1.16	4.35 ± 1.34	5.21 ± 1.12	0.001	0.001	0.005
Tend-A	Acupuncture	1.80 ± 0.52	0.65 ± 0.58	0.37 ± 0.50	0.001	0.001	0.270
	LLLT	1.65 ± 0.48	0.70 ± 0.57	0.87 ± 0.61	0.001	0.001	0.330
	Control	1.50 ± 0.51	0.75 ± 0.55	0.85 ± 0.14	0.001	0.001	0.670
Tend-B	Acupuncture	1.60 ± 0.59	0.60 ± 0.62	0.43 ± 0.62	0.001	0.001	0.330
	LLLT	1.45 ± 0.51	0.55 ± 0.51	0.62 ± 0.61	0.001	0.001	0.580
	Control	1.15 ± 0.67	0.65 ± 0.48	0.64 ± 0.63	0.001	0.060	> 0.999
NPQ	Acupuncture	49.65 ± 18.86	22.30 ± 12.12	19.06 ± 13.52	0.001	0.001	0.510
	LLLT	50.15 ± 18.70	28.10 ± 12.68	26.93 ± 11.49	0.001	0.001	0.900
	Control	40.10 ± 12.25	26.90 ± 11.01	30.85 ± 8.77	0.001	0.700	0.060

SD: Standard deviation; ROM-F: Range of motion in flexion; ROM-E: Range of motion in extension; ROM-RB: Range of motion in right bending; ROM-LB: Range of motion in left bending; VAS: Visual analog scale; Tend-A: Tenderness in point A; Tend-B: Tenderness in point B; NPQ: Neck Pain Questionnaire; LLLT: Low-level laser treatment

Table 2. Pairwise comparison of the mean changes of the evaluation criteria (difference before and after the intervention) among the 3 groups under study

Variable	Group	Mean ± SD	P (A-B)*	P (A-C)*	P (B-C)*	P (3 groups)**
ROM-F diff 2-1	Acupuncture (A)	3.25 ± 3.75	0.720	0.440	0.890	0.470
	LLLT (B)	2.40 ± 3.76				
	Control (C)	1.90 ± 2.91				
ROM-F diff 3-2	Acupuncture (A)	-0.93 ± 3.27	0.970	0.930	0.840	0.850
	LLLT (B)	-0.62 ± 5.12				
	Control (C)	-1.42 ± 3.05				
ROM-E diff 2-1	Acupuncture (A)	3.00 ± 4.41	0.980	0.530	0.660	0.520
	LLLT (B)	2.78 ± 3.25				
	Control (C)	1.80 ± 2.74				
ROM-E diff 3-2	Acupuncture (A)	0.00 ± 5.16	0.770	0.140	0.420	0.160
	LLLT (B)	-0.93 ± 3.27				
	Control (C)	-2.71 ± 2.49				
ROM-RB diff 1-2	Acupuncture (A)	3.50 ± 5.10	> 0.999	0.140	0.140	0.090
	LLLT (B)	5.50 ± 4.26				
	Control (C)	2.85 ± 3.74				
ROM-RB diff 3-2	Acupuncture (A)	-0.93 ± 3.75	0.850	0.580	0.290	0.320
	LLLT (B)	-0.31 ± 2.86				
	Control (C)	-2.14 ± 3.23				
ROM-LB diff 1-2	Acupuncture (A)	6.70 ± 6.70	0.030	0.080	0.710	3.030
	LLLT (B)	1.50 ± 7.40				
	Control (C)	3.10 ± 4.70				
ROM-LB diff 3-2	Acupuncture (A)	0.62 ± 7.27	0.020	0.760	0.590	0.230
	LLLT (B)	-3.43 ± 7.00				
	Control (C)	-1.07 ± 5.25				
VAS diff 2-1	Acupuncture (A)	-4.30 ± 1.45	0.002	< 0.001	0.540	< 0.001
	LLLT (B)	-2.95 ± 1.14				
	Control (C)	-2.55 ± 0.94				
VAS diff 3-2	Acupuncture (A)	-0.12 ± 1.14	0.780	0.010	0.070	0.010
	LLLT (B)	0.12 ± 0.95				
	Control (C)	1.00 ± 1.10				
Tend-A diff 2-1	Acupuncture (A)	1.15 ± 0.67	0.027	0.080	0.230	0.100
	LLLT (B)	-0.95 ± 0.51				
	Control (C)	-0.75 ± 0.55				
Tend-A diff 3-2	Acupuncture (A)	-0.18 ± 0.65	0.280	0.330	0.810	0.280
	LLLT (B)	0.12 ± 0.50				
	Control (C)	0.07 ± 0.61				
Tend-B diff 2-1	Acupuncture (A)	-1.00 ± 0.72	0.630	0.040	0.010	0.020
	LLLT (B)	-0.90 ± 0.44				
	Control (C)	-0.50 ± 0.51				
Tend-B diff 3-2	Acupuncture (A)	-0.12 ± 0.50	0.260	0.600	0.670	0.480
	LLLT (B)	0.06 ± 0.44				
	Control (C)	0.00 ± 0.39				
NPQ diff 2-1	Acupuncture (A)	-27.35 ± 12.57	0.140	< 0.001	0.010	< 0.001
	LLLT (B)	-22.05 ± 10.11				
	Control (C)	-13.20 ± 9.78				
NPQ diff 3-2	Acupuncture (A)	1.68 ± 10.07	0.230	0.006	0.001	0.002
	LLLT (B)	-0.18 ± 5.87				
	Control (C)	6.57 ± 4.43				

SD: Standard deviation; ROM-F: Range of motion in flexion; ROM-E: Range of motion in extension; ROM-RB: Range of motion in right bending; ROM-LB: Range of motion in left bending; VAS: Visual analog scale; Tend-A: Tenderness in point A; Tend-B: Tenderness in point B; NPQ: Neck Pain Questionnaire; LLLT: Low-level laser treatment

* One-way ANOVA-Post Hoc Tukey tests; ** Nonparametric Kruskal-Wallis test

Further studies should be performed if CMPS does not respond to common treatments. MRI is useful in rejecting any anatomical disorder in the structure of the neck or spinal canal.[10,11]

Although several studies refer to specific electromyography/nerve conduction study (EMG/NCV) changes in CMPS, many studies consider electrodiagnosis (EDX) as non-specific. In a study by Simons et al., a record of changes in the low-range motor potential in the CMPS trigger points of the patients was reported.[2] The spontaneous electrical activity can be recorded in the area of trigger points through using a more sensitive recording tool. The study by Ballyns et al. has shown the usefulness of sonoelastography in determining active trigger points and natural areas.[12]

The results of the present study showed that acupuncture was preferred to laser therapy and control group in reducing pain and in 1 case of left-neck bending ROM. However, 2 months later, this significant difference between laser and acupuncture disappeared. Both laser therapy and acupuncture had a similar effect on improvement of point tenderness and daily functional activities of patients associated with problems due to normal neck function disability, and this effect was significantly different from that of the control group in the above cases. In other cases, there was no significant difference in terms of ROM and point tenderness among the 3 groups (despite improvement in intra-group comparisons).

Acupuncture in myofascial pain syndrome: Many studies have examined the physiological trends in the clinical effects of acupuncture, including the release of neurochemical materials, like endogenous opioids, nervous system segmental effects (Gate theory), autonomic nervous system regulation, local effects on brain function and other effects associated with the nervous system.[9]

Irnich et al. studied the effect of acupuncture on chronic cervical pain and compared it with placebo and dry needles.[13] In their study, 36 patients with chronic cervical pain suffering from cervical spine limitation were examined. The results of this study indicated that acupuncture had a definite effect on motion-related pain and ROM of patients with chronic cervical pain. It was also reported that the selection of needle entry points was of particular importance. Inserting needles at a certain distance was more efficient in treating ROM compared to inserting needles at a single point, and localized insertion of needles may not be effective in reducing pain in the patient.[13]

In another study conducted by Irnich et al. on 177 patients with chronic cervical pain to compare acupuncture and massage in the treatment of this disease, it was found that patients undergoing acupuncture felt less pain compared to the massage group at the time immediately after treatment and 1 week after treatment.[14] The researchers concluded that acupuncture was a suitable and safe treatment for the reduction of chronic cervical pain and improvement of neck ROM.[14] The results of this study are in agreement with those of the present study in terms of reducing the pain severity of patients in the acupuncture group, especially in the short term.

Kung et al. examined the effect of acupuncture treatment on chronic MPS in the neck and upper back areas.[15] In this study, 30 patients with chronic CMPS entered the study and received 2 sessions of acupuncture weekly for 3 weeks. At the end of the study, it was observed that pain intensity and neck ROM were significantly decreased and increased, respectively.[15] The researchers concluded that acupuncture was an effective way to reduce pain in patients with chronic neck MPS.[15] The method used in this study and duration of the treatment sessions were similar to those of the present study. However, the ROM improvement in the present study was not as much as that reported in the study by Kung et al. This can be due to the ROM measurement methods used in the two studies, as in the present study, the error in the goniometric measurement was high. This method is

accompanied with a high rate of error in the spine and the axial joints, unlike the peripheral joints.

Ga et al. compared acupuncture treatment and lidocaine injection to trigger points among elderly patients with MPS.[16] In this study, 39 patients with myofascial pain in the unilateral or bilateral trapezius muscle were studied. The results of the study demonstrated that there was an improvement in both groups; however, this improvement was not significantly different between the two groups. The researchers concluded that there was no significant difference between acupuncture and lidocaine 0.5% injection to the trigger points for treatment of CMPS among the elderly patients.[16] The results of this study actually indicated the identical effect of both acupuncture and dry needle methods, with their therapeutic mechanisms being similar in some ways.

Laser in myofascial pain syndrome: Low-level lasers, called cold lasers, are a group of non-thermal lasers with characteristics similar to those of infrared rays with a wavelength of 600-1000 nm and a power range of 5-500 mW. It is assumed that laser energy penetrates deeply and leaves deep biostimulatory effects in the tissue at an intensity of 8-10 J/cm^2, or somehow interfered in restoration and increased cell proliferation, in addition to stimulating the vascular and immune systems. These types of lasers are applied in relieving pain, improving tendon damage, reducing inflammation, improving soft tissue damage, healing wounds, treating burns, and performing acupuncture treatments with non-thermal mechanisms.

Baxter considered the physiologic mechanism of laser in pain relief similar to electrotherapy and acupuncture in increasing glucocorticoid levels and in association with serotonin metabolism.[17] Baxter also noted that laboratory research has shown the effect of laser on degranulation of mast cells and reduction of histamine as a potent inflammatory and pain agent. Increasing endogenous opioids was another neuropharmacological mechanism and pain-relieving feature of laser.[17]

In the study by Chow et al., which was performed on 90 patients with chronic neck pain, a low-level laser was used for treating cervical pain and patients were examined before treatment and at the end of weeks 7 and 12.[18] The results of the study indicated the effectiveness of LLLT in relieving pain among patients with chronic neck pain.[18] In addition, the results of this review study have confirmed the positive effects of LLLT in reducing acute cervical pain immediately after treatment and up to 22 weeks after treatment.[6]

In a study by Kiralp et al. on 43 patients suffering from MPS, laser therapy and injection to the trigger point were compared.[19] The results of the treatments were compared before, after, and 6 months after treatment in both groups. It was shown that although the results in the laser treatment group were better than the injection group, this difference was not statistically significant. In both groups, there was a statistically significant difference between the severity of pain before the study and pain severity immediately after treatment and also 6 months after treatment. There was no statistically significant difference between the two groups in terms of the treatment results 6 months after treatment.[19] The results of this study were somewhat similar to the results of the current study.

In a study, Gur et al. evaluated the effect of laser therapy on chronic neck MPS.[20] In this study, 60 patients with CMPS were examined. It was concluded that laser therapy was effective in reducing pain in patients with CMPS and on their quality of life (QOL).[20] In another study, Altan et al. investigated the effect of LLLT compared to placebo (using the device in off mode) among patients with cervical CMPS.[21] Statistical analysis illustrated that both groups had a significant improvement immediately and 12 weeks after treatment; however, the comparison between the two groups showed

that pain relief and neck lateral flexion immediately and 12 weeks after treatment showed no significant difference. In other words, laser therapy was not superior to placebo treatment in cervical MPS.[21]

In the present study, there was a significant difference between the groups of acupuncture and other groups in some of the criteria, like left-bending (ROM-LB), and this method was more effective in improving ROM in comparison with other methods. However, considering the average changes, this matter needs to be further explored. The results were effective only in the case of left lateral bending (LLB) and they were not meaningful in other cases of ROM. This can be attributed to the fact that most of the tender points are in the upper and middle trapezius muscle and this muscle is most commonly affected in myofascial syndrome; hence, its treatment will result in a ROM recovery in left bending, which was previously limited by muscle spasm. Another reason could be the method and instrument of measurement in the current study.

Regarding the severity of pain, the significant difference between acupuncture treatment and other methods indicated that acupuncture was a more effective and beneficial method for treatment of cervical MPS compared to laser therapy. Referring to the comparison of the mean changes also confirms that acupuncture treatment leads to higher rates of pain relief among patients. Nevertheless, there was no significant difference between the two modalities of acupuncture and laser 2 months after treatment. In other words, the short-term effects of acupuncture have been more pronounced than its long-term effects.

In comparison of the mean of the groups in terms of NPQ, a statistically significant difference was observed only in the third round of the study between acupuncture and control. However, the statistical difference between the mean changes of the groups in this variable indicates the higher effectiveness of acupuncture and laser compared to the control group. In this regard, although laser therapy is less effective than acupuncture, this difference is not significant.

The ineffectiveness of laser, unlike the previous studies which have proven its effect, can be related to the quality of the device and the laser dosage, in addition to the use of a continuous mode instead of a pulse mode.

Patients with CMPS require training to deal with pain intensifiers. The physiotherapist must provide the patient with a comprehensive program for home exercise. Moreover, depending on the patient's condition, the factors of the work environment and the patient's laying condition should be corrected. Modifying the pain intensifying factors in the work environment and observing ergonomics are of great importance in treating these patients. Furthermore, since there is a background of psychosomatic and sleep disorders in most patients with MPS, relieving their daily stress and observing mental health, along with other complementary therapies, are among the main pillars of treatment.[22] Hence, if the patient is actively involved in the treatment process, CMPS can be cured.

Conclusion

Acupuncture, which is part of traditional Chinese medicine, and laser therapy, which is a part of physiotherapy modalities, work more effectively and create a better treatment response in collaboration. In addition, in the treatment of MPS, intervention is mainly performed through a combination of methods, and not as a single therapy method. Namely, modalities of physiotherapy or acupuncture, along with neck exercises and drug therapy provide the basis of an effective and durable treatment.[23]

The results of the present clinical trial showed that both acupuncture and LLLT along with exercises and drug therapy were more effective in treating cervical MPS in comparison with purely medicinal and routine methods. However, acupuncture was

more effective than laser and medication therapy in improving pain and neck ROM at least in the short term due to the background mechanism of the MPS.

Limitations and proposals: -A similar future study on the assessment of therapeutic interventions in musculoskeletal disorders (MSDs) exploiting more accurate measurement methods including inclinometer instead of goniometer and algometric sensitivity instead of palpation sensitivity is suggested.

Investigation and elimination of the causes of sample drop in subsequent visits, so that patients will be followed up and re-evaluated for up to 1 year after treatment in order to provide a more accurate assessment of the treatment reliability, is recommended.

Reviewing of therapeutic criteria of laser therapy through pulse method and varying the intensity, dosage, and pulse frequency of laser radiation is also suggested, since the pulse method seems to be more effective compared to the continuous method.

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Conflict of Interest

Authors have no conflict of interest.

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