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Original Article

Comparison of the Efficacy of Laser and Extracorporeal Shockwave Therapy in Patients with Myofascial Pain Syndrome

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ABSTRACT

Objective: This study aims to compare the effectiveness of laser and extracorporeal shockwave therapy (ESWT) in patients with myofascial pain syndrome (MPS).

Methods: Forty patients included in this prospective randomized study were divided into 2 groups. Stretching and posture exercises and 15 sessions of laser therapy were applied to the first group. Stretching/posture exercises and 3 sessions of ESWT were applied to the second group. The patients were evaluated before (BT), after (AT), and in the first month (T1) of treatment. Demographic data, the Visual Analogue Scale (VAS), the pressure pain threshold (PPT), the Short Form-36 (SF-36), and the Beck Depression Inventory (BDI) were recorded.

Results: A total of 40 patients, 20 in the laser group and 20 in the ESWT group, were included in this study. The patients' mean age was 35.3 ± 11.2. There was no statistically significant difference found between the groups in demographic data ($P > .05$). Both groups showed a statistically significant decrease in VAS scores. There is improvement in T1 in both groups in the evaluations in the PPT. The BDI and SF-36 physical component values of the patients showed improvement in both groups in BT-T1, but no statistical difference was found in the SF-36 mental tab in BT-AT. No statistical difference was found between the groups in all values.

Conclusion: This study showed that laser and ESWT treatments provided significant improvement in MPS. However, the efficacy of these 2 treatments combined with exercise in MPS is similar, and no superiority has been found.

Keywords: Extracorporeal shockwave therapy, laser therapy, myofascial pain syndromes

INTRODUCTION

Myofascial pain syndrome (MPS) is a medical condition characterized by hypersensitive areas, also known as myofascial trigger points. These trigger points can cause pain, spasm, limitation of active joint motion, tenderness, and in rare cases, weakness and autonomic dysfunction.[1] Although the etiology has not been fully elucidated, acute injuries to myofascial structures, posture disorders, repetitive microtraumas, fatigue, and stress are the main causes. The prevalence of MPS decreases with age as stress and muscle loading decrease. The most common age range is 30-60. Local or referred pain is caused by impulses from trigger points affecting the central nervous system.[2] The MPS is quite common in the general population.[3] Myofascial pain syndrome is more prevalent in women than in men, and when the incidence is examined, it has been reported that it can be up to 54% in females and up to 45% in males.[1] The most common age of onset is between 27.5 and 50 years and is more common in sedentary individuals.[1]

The treatment of MPS includes a wide variety of medical treatments, various physical modalities, and exercises. Treatment options include exercise, massage, transcutaneous electrical nerve stimulation, superficial heat application, ultrasound, laser, ischemic compression, spray and stretching, extracorporeal shockwave therapy (ESWT), myofascial trigger point injections, acupuncture applications, and pharmacological agents.[4]

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In recent years, the use of ESWT in musculoskeletal diseases has been increasing. Extracorporeal shockwave therapy is a physical therapy modality that is on the agenda with its use in the treatment of MPS. The ESWT is a therapeutic method that uses high-amplitude sound waves on specific areas of the body. Although the mechanism of action of shock waves in MPS is not fully elucidated, it is suggested that they exert a modulating effect on pain in the dorsal horn via GABAergic interneurons.[5] In addition, it accelerates tissue healing by increasing lymphatic drainage and blood circulation through vibration and pressure.[6]

When the literature is examined, laser therapy is a safe treatment tool that has been used for many years. Since laser therapy causes a temperature increase below 0.5°C in the tissues, it is thought that its effect is not only due to its heating feature. Various theories have been proposed to explain the analgesic effect caused by the laser. Laser therapy is indicated for use in conditions such as osteoarthritis, bursitis, tendinitis, radiculopathy, trigeminal neuralgia, and neuropathy.[7]

The aim of the study is to compare the effectiveness of ESWT and laser therapy in patients with MPS.

MATERIAL AND METHODS

Study Population

Patients presenting symptoms of dorsal and neck pain were evaluated at the Physical Medicine and Rehabilitation outpatient clinic. Patients who were diagnosed with MPS according to the Travell and Simons criteria[8], whose complaints had been present for 3 months or more, who had undergone biochemical examinations and radiological methods were excluded, and who had not received any treatment for their symptoms in the last 1 month were included in this study. Voluntary consent forms were obtained from all patients before they participated in the study.

Exclusion criteria of the study were the presence of severe cervical disc disorder, the presence of psychiatric disease, the presence of oncological disease, the presence of allergic skin disease, pregnancy, patients with a diagnosis of fibromyalgia, and the presence of advanced lung, cardiovascular, or orthopedic disease.

This study was carried out with the approval of the Atatürk University Ethics Committee with the decision number 182 dated 13.10.2015. All patients completed an informed consent form prior to participating in the study. The study was conducted in accordance with the 1964 Declaration of Helsinki.

Intervention

Forty-six patients who were diagnosed with MPS according to the Travell and Simons criteria[8] and and meeting the inclusion criteria were randomly assigned to either the Laser or ESWT group. The Laser group was given laser therapy (3 weeks, a total of 15 sessions) and exercises. The ESWT group was given ESWT (3 sessions with an interval of 5-8 days) and exercises. An exercise program including posture, range of motion, and stretching exercises was recommended as 3 sets of 10 repetitions at home. The patients were asked to follow the exercise program every day for 2 months. The patients were evaluated pretreatment, after the treatment, and at the first month.

The laser group was treated with a Ga-As laser at a wavelength of 904 nm for 30 seconds (1.2 j/cm^2, 6 kHz) using the Uniphy-Phyaction CL minus device. Laser treatment was applied to the patients for a total of 15 sessions for 3 weeks. The application was applied to 2 trigger points in total, which are the most sensitive in the trapezius or paraspinal muscles, with a vertical angle and full contact technique.

The application site in the ESWT group was the same as in the laser group. Extracorporeal shockwave therapy was applied to the most sensitive 2 trigger points in the trapezius or paraspinal muscles. Extracorporeal shockwave therapy was applied once a week for a total of 3 sessions. A break of 5-8 days was given between 2 consecutive applications. Extracorporeal shockwave therapy application was performed with the BTL-5000 SWT compressor POWER ESWT device in the form of 10-15 Hz, 2.0 bar, 2000 shock pulses.

Measurements

The patients' pain levels were assessed using the Visual Analog Scale (VAS). The Algometer was used for pressure pain threshold (PPT) assessment. Quality of life was evaluated using the Short Form-36 (SF-36), and the degree of depression was evaluated using the Beck Depression Inventory (BDI).

The VAS is a scale that evaluates the severity of pain by placing numbers between 0 and 10 on a 10 cm line.

MAIN POINTS

- Extracorporeal shockwave therapy (ESWT) and laser therapy improve pain and quality of life in patients with myofascial pain syndrome (MPS).
- The efficacy of ESWT and laser therapy treatments are similar in patients with MPS.
- ESWT and laser therapy are among the effective treatment methods that can be chosen in the treatment for patients with MPS.

Absence of pain is given as 0 points, and the most severe pain felt is indicated as 10 points.[9]

The Algometer measurement was used to determine PPT value and objectively measure pain tolerance. A manual algometer (FDK60, Italy) that can measure pressure in kilograms or pounds was used in this study. The dial is calibrated to 30 kilogram (kg) in increments of 100 grams. The algometer was measured by applying vertical pressure to the skin, and the pressure increase was increased to approximately 1 kg per second. The first pressure value at which the patient felt pain was recorded in kg. This process was repeated after 30 seconds, and the average kg value was evaluated as PPT.[10,11]

The SF-36 is a scale that is used to evaluate the quality of life in the community and can be applied to various health diseases, making a comprehensive assessment. It consists of 36 questions in total and has 8 subscales. These subscales are: general health, mental health, social function, emotional role limitation, body pain, physical function, physical role limitation, and vitality. Additionally, the SF-36 also has 2 summary scales: the physical component and the mental component. The physical component summary scale consists of the body pain, physical function, physical role, and general health subscales. The mental component summary scale consists of the mental health, social functioning, vitality, and emotional role subscales.[12]

The BDI is a 21-question multiple-choice questionnaire and is a tool used to determine the severity of depression. Each question in this scale is scored between 0 and 3. Scores of 0-9 are evaluated as minimally depressed, 10-16 points mildly depressed, 17-29 points moderately depressed, and 30-63 points severely depressive.[13]

Statistical Analysis

The International Business Machiness (IBM®) Statistical Package for the Social Sciences (SPSS®) Statistics software for Windows, version 25.0 (IBM SPSS Corp.; Armonk, NY, USA). program was used in the analysis of the data. Data are presented as mean and SD and percentage. The suitability of the groups for distribution was analyzed with the Shapiro–Wilk test. In the analysis of nominal variables between groups, chi-square test was used. Parametric values suitable for normal distribution were evaluated with Independent-*t* test, while nonparametric values were evaluated with Mann–Whitney *U*-test. The Mann–Whitney *U*-test was used to analyze the differences in the variables obtained by taking the difference of the pre-treatment measurements after the treatment, and at the first month after the treatment. Friedman Test was used in the analysis of repetitive measurements within the group. The significance level of the analyzes was taken as $p < 0.05$.

RESULTS

Forty-six patients diagnosed with MPS and meeting the inclusion criteria were included in the study. Six patients with missing evaluations during treatment and follow-up were excluded from the study. In our study, data of 40 patients in the laser (n = 20) and ESWT (n = 20) groups were analyzed. Of the patients, 29 were female and 11 were male, and the mean age was 35.3 ± 11.2. When both groups were compared, no statistically significant difference was found in terms of gender, age, BMI, educational status, and marital status of the patients ($P > .05$) (Table 1).

In the evaluation of the VAS scores of the patients, when we compared the results of both groups to before the treatment, a statistically significant decrease was found both post-treatment and in the first month after the treatment. In the evaluations of PPT, improvement was observed in both groups in the first month after treatment compared to pre-treatment. The BDI results and SF-36 physical component values of the patients showed improvement in the first month after treatment compared to pre-treatment in both groups, but no statistical difference was found in the SF-36 mental component post-treatment compared to pre-treatment (Table 2).

In the intergroup comparisons, the differences in the post-treatment and after treatment first month values compared to the pre-treatment were evaluated. There was no statistical difference between the groups in VAS, PPT, BDI, and SF-36 subcomponents after treatment and at first month after treatment (Table 3).

Table 1. Comparison of Demographic Data of Patient

Demographic datas	Laser Group	ESWT Group	*P*
Age	33.0 ± 10.1	37.6 ± 12.1	.231
Gender (%)			.723
Female	15 (75)	16 (70)	
Male	5 (25)	4 (70)	
BKI (kg/m^2)	26.6 ± 4.1	27.4 ± 3.9	.531
Educational status (%)			.563
Primary	2 (10)	4 (20)	
High school	5 (25)	6 (30)	
University	13 (65)	10 (50)	
Marital status (%)			.525
Single or divorced	8 (40)	10 (50)	
Married	12 (60)	10 (50)	

BMI, body mass index; ESWT, extracorporeal shockwave therapy.

Table 2. Intragroup Comparisons of Follow-up Values

		Pre-treatment Mean ± SD	Post-treatment Mean ± SD	First Month After Treatment Mean ± SD	*P*	Post Hoc
VAS	Laser	6.8 ± 1.3	4.3 ± 1.5	3.1 ± 2.0	**<.001**	.003$^{(0-1)}$ <.001$^{(0-2)}$
	ESWT	7.1 ± 1.9	5.2 ± 1.9	3.9 ± 2.6	**<.001**	.010$^{(0-1)}$ <.001$^{(0-2)}$
PPT	Laser	2.5 ± 1.0	3.0 ± 1.2	3.7 ± 1.1	**<.001**	<.001$^{(0-2)}$
	ESWT	2.1 ± 0.9	3.0 ± 1.2	3.5 ± 1.3	**<.001**	<.001$^{(0-2)}$
BDI	Laser	18.4 ± 10.8	16.3 ± 8.9	15.5 ± 8.3	**.004**	.034$^{(0-2)}$
	ESWT	13.6 ± 7.7	11.3 ± 7.	11.6 ± 7.4	**.017**	.040$^{(0-2)}$
SF-36 PC	Laser	38.2 ± 7.9	40.7 ± 8.7	42.3 ± 8.0	**.009**	.022$^{(0-2)}$
	ESWT	36.7 ± 5.8	41.2 ± 6.7	43.6 ± 6.0	**<.001**	<.001$^{(0-2)}$
SF-36 MC	Laser	38.7 ± 9.1	41.9 ± 7.7	43.0 ± 8.2	.117	-
	ESWT	43.5 ± 12.4	46.7 ± 9.5	45.4 ± 7.9	.471	-

BDI, Beck Depression Inventory; ESWT, extracorporeal shock wave therapy; MC, mental component; PC, physical component; PPT, pressure pain threshold; VAS, Visual Pain Scale.

Table 3. Intergroup Comparisons of Follow-up Values

		PreT–PostT Difference Mean ± SD	*P*	PreT–First M After T Difference Mean ± SD	*P*
VAS	Laser	2.4 ± 1.7	.314	3.7 ± 2.2	.512
	ESWT	1.9 ± 1.4		3.2 ± 1.9	
PPT	Laser	0.4 ± 0.8	.127	1.1 ± 1.2	.114
	ESWT	0.8 ± 0.9		1.4 ± 1.0	
BDI	Laser	2.1 ± 3.5	.779	3.0 ± 4.8	.640
	ESWT	2.3 ± 3.2		2.0 ± 3.0	
SF-36 PC	Laser	2.5 ± 4.3	.221	4.2 ± 4.6	.336
	ESWT	4.5 ± 4.9		6.9 ± 7.2	
SF-36 MC	Laser	3.2 ± 5.5	.414	4.4 ± 6.5	.336
	ESWT	3.1 ± 6.7		1.9 ± 9.9	

BDI, Beck Depression Inventory; MC, mental component; PC, physical component; PostT, post-treatment; PreT, pre-treatment; PPT, pressure pain threshold; First M After T, first month after treatment; VAS, Visual Pain Scale.

DISCUSSION

In this study, significant changes were found in pain scores, depression level, and quality of life as a result of laser and ESWT treatments in MPS. In PPT evaluations, there was improvement in the first month after treatment in both groups. The superiority of the groups over each other was not determined.

Myofascial pain syndrome is a substantial condition in chronic musculoskeletal pain. Myofascial pain syndrome is a major health problem due to both the cost of treatment and the disability it causes.[14] Myofascial pain syndrome is a painful musculoskeletal disease that is frequently seen in the neck-shoulder junction and back region.[8] In the patient population of this study, it was determined that the trigger point frequency was highest in the trapezius muscle. In this study, 26 of 40 patients were found to have trigger points in the trapezius muscle. The results of this study are compatible with the literature. Trigger point prevalence was highest in individuals aged 30-49 years and was shown to decrease with age, stress, and activity.[15] The mean age of the patients in our study was 35.3 ± 11.2 years, and these data are consistent with the literature reporting that MPS is mostly a middle-age disease.

The treatment of MPS is very diverse and the goal of treatment is the control of pain, which is the main complaint of patients. The treatment methods applied for this

have a variety from analgesics to physical modalities.[16] Low-energy laser therapy used in physical therapy has bio-stimulant, analgesic, anti-inflammatory, and wound healing effects, and laser is used in various diseases. Considering that the major symptom of MPS is pain, it can be said that laser therapy is effective in the treatment of MPS.[17] As a result of our study, a significant improvement was found in pain, quality of life, and depression levels. Similarly, Simunovic et al.[18] applied laser therapy to trigger points in MPS. In the follow-up, the spasm decreased, the spontaneous and movement-induced pain decreased and even disappeared, and mobility was regained with functional recovery. They thought that the improvement of the local microcirculation may be related to the increase in the amount of oxygen in the hypoxic cells at the trigger point. Also, microcirculation, which improves with laser therapy, is thought to break the vicious cycle of pain. Consequently, Simunovic et al. found an improvement of more than 60% in chronic pain and more than 70% in acute pain assessed by VAS.A recent meta-analysis recommends adding laser therapy to exercise and manual therapy for the treatment of myofascial-related neck pain.[17]

Although the laser device, the wavelength used, and the duration of application in this study are different, the findings are similar. Similarly, Gür et al.,[19] similar to our study, found that low-dose laser therapy was effective in pain, functionality, and quality of life compared to placebo laser in their study on chronic MPS in the cervical region. Hakgüder et al.[20] determined that low-dose laser therapy on pain in patients with MPS was effective in algometry and thermography evaluations. Ilbuldu et al.[21] found that the efficacy of laser therapy was higher than that of placebo laser therapy and dry needling in patients with MPS. Differently; In another study where low-dose laser therapy was compared with placebo laser in MPS, no significant difference was found between placebo and placebo in the assessment of pain, range of motion, and disability.[22]

Extracorporeal shockwave therapy is a method based on focusing sound waves on a desired area of the body and showing its therapeutic effect in this applied area.[23] Recently, ESWT has been evaluated as an effective treatment method in patients with MPS. The mechanism of effect of ESWT on MPS has not been fully explained, but it is thought that it will have an effect on MPS with its effects such as a decrease in pain, an increase in angiogenesis, and tissue perfusion.[24] A recent meta-analysis investigated the effectiveness of ESWT in Myofascial Pain Syndrome. The analysis reported that ESWT was effective in reducing pain and improving functionality when compared to both the control group and ultrasound.[25]

According to the results of this study, there was a significant improvement in pain, quality of life, and depression levels with ESWT treatment. Müller Ehrenberg and Licht applied low-dose focus ESWT to trigger points in different regions of the MPS. Similar to the results of this study, they found significant changes in VAS scores during treatment follow-up.[26] In another study examining the effect of ESWT on trigger points in the upper trapezius muscle, they found a significant decrease in pain levels and a significant increase in PPT. Similar to the results of this study, they found that 2 weeks of ESWT treatment was effective in patients with MPS in the upper trapezius muscle.[27] In a recent meta-analysis that examined the effectiveness of ESWT on MPS resulting from trigger points in the trapezius muscle, it was found that it can be effective in reducing pain. However, it is recommended that it should be used in conjunction with other treatment methods.[28] A recent meta-analysis compared the effectiveness of laser and ESWT in treating MPS. Both treatments were found to be effective, but ESWT was reported to be more effective than laser.[29] The study's findings demonstrate that both ESWT and laser treatment are effective for MAS. Upon comparison, ESWT and laser showed similar effectiveness.

The most common symptom in MPS is pain.[1] As MPS becomes chronic, mood disorders such as depression and anxiety may accompany it. Describing depression is much more difficult for patients than defining pain. Fishbain et al.[30] found that the levels accompanying myofascial pain syndrome were equal in men and women. In the general population, women with chronic pain have higher rates of depression than men. It has been shown that this may lead to differences in the psychiatric evaluations of patients with chronic pain accompanied by MPS. In this study, improvement was found in BDI in both groups. The decrease in BDI despite the fact that the patients did not receive treatment for depression shows the effect of chronic pain on depressive complaints. Rayegani et al.[31] In their study evaluating the effectiveness of dry needling and physical therapy Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, stretching exercise) program in MPS, they found improvement in both groups with SF-36. Akturk et al.[32] In their study, an improvement was found in SF-36 values with ESWT in the treatment of MPS.Similarly, improvement was found in SF-36 values in both groups in our study. The lack of statistical significance between the groups in the SF-36 scale indicates that ESWT and laser are not superior to each other in increasing the quality of life in MPS.

The strength of this study is that there are few studies comparing the efficacy of ESWT and laser therapy in the treatment of patients with MPS. In addition, our sample consisted of only patients with MPS in the paraspinal and

trapezius muscles. The use of an objective tracking tool such as an algometer is another strength of our study.

The small number of patients included in the study and the lack of a control group are the limitations of our study. The inability to show the long-term effects of treatment results is another limitation of our study. While choosing the treatment modality for successful and long-term results, MPS triggering and preventing factors should be determined, keeping in mind that MPS is a complex phenomenon, and treatment should be selected according to these factors.

Extracorporeal shockwave therapy and laser therapy improve pain and quality of life in patients with MPS. However, the efficacy of these treatments is similar and no superiority has been found. More studies with larger sample sizes are needed to examine the efficacy of ESWT and laser treatments on MPS, as well as their long-term effectiveness. It has been concluded that ESWT and laser treatment are effective methods for treating patients with MPS.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Atatürk University (date: 02.06.2015 number: B.30.2.ATA.0.01.00).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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