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Comparison of the Efficacy of Extracorporeal Shock Wave Therapy and Trigger Point Injection with Local Anesthetics in Myofascial Pain Syndrome

Miyofasiyal Ağrı Sendromunda Ekstrakorporeal Şok Dalga Tedavisi ve Lokal Anesteziklerle Tetik Nokta Enjeksiyonunun Etkinliğinin Karşılaştırılması

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ABSTRACT Objective: To compare the effectiveness of trigger point injection (TPI) with local anesthetic and extracorporeal shock wave therapy (ESWT) in the treatment of myofascial pain syndrome (MPS). **Material and Methods:** Seventy-nine patients in the study were randomly assigned to the TPI group (n=39) and the ESWT group (n=40) using computer assistive randomization. Both groups were evaluated for pain, pain threshold scores, life quality, and psychological status with the visual analog scale (VAS), algometry, Nottingham Health Profile (NHP), and Beck Depression Index (BDI) before the treatment, at 1st week, and 1st month after treatment. In Group 1 (the TPI group), TPI was applied to trapezius, levator scapula, rhomboid, deltoid, or latissimus dorsi muscles three times at one-week intervals using 0.1 cc of 2% prilocaine for every trigger point (TP). In the second group, ESWT was applied to TPs in three weekly sessions with 400-800 10 Hz frequency between 1.8-3 bar pressure range. All patients were given a home exercise program, including cervical and back stretching and posture exercises. **Results:** Groups were similar in demographic features and VAS pre-treatment scores. VAS, pain pressure threshold, NHP, and BDI scores improved significantly in both groups at 1st week and 1st month of treatment. VAS, pain threshold, and BDI scores were similar at 1st week and 1st month ($p>0.05$). NHP scores were similar at 1st week, but were significantly lower in the ESWT group at 1st month after treatment ($p=0.04$). **Conclusion:** ESWT may be a good alternative treatment method for MPS, especially for patients with needle phobia.

Keywords: Myofascial pain syndrome; trigger point injection; extracorporeal shock wave therapy

ÖZET Amaç: Bu çalışmanın amacı, miyofasiyal ağrı sendromunun (MAS) tedavisinde tetik nokta enjeksiyonu (TNE) ile lokal anestezik ve ekstrakorporeal şok dalga tedavisinin [extracorporeal shock wave therapy (ESWT)] etkinliğini karşılaştırmaktır. **Gereç ve Yöntemler:** Çalışmaya alınan 79 hasta randomizasyonla TNE grubuna (n=39) ve ESWT grubuna (n=40) atandı. Her iki gruptaki katılımcılar görsel analog skala [visual analog scale (VAS)], algometri, Nottingham Sağlık Profili (NSP) ve Beck Depresyon İndeksi (BDI) ile ağrı, ağrı eşiği skorları, yaşam kalitesi ve psikolojik durum açısından tedavi öncesi, tedaviden sonra 1. haftada ve 1. ayda değerlendirildi. Birinci grupta (TNE grubu) her tetik noktası için 0,1 cc %2 prilokain kullanılarak birer hafta arayla 3 TNE yapıldı. İkinci grupta, tetik noktalara 1,8-3 bar basınç aralığında 400-800 10 Hz frekans ile 3 haftalık seanslarda ESWT uygulandı. Tüm hastalara servikal ve sırt germe ve postür egzersizlerini içeren ev egzersiz programı verildi. **Bulgular:** Gruplar demografik özellikler ve VAS tedavi öncesi skorları açısından benzerdi. VAS, ağrı basınç eşiği, NSP ve BDI skorları tedavinin 1. haftasında ve 1. ayında her iki grupta da anlamlı olarak düzeldi. Tedavi sonrası 1. hafta ve 1. ayda VAS, ağrı eşiği ve BDI skorları benzerdi ($p>0,05$). NSP skorları 1. haftada benzerdi; ancak tedaviden sonraki 1. ayda ESWT grubunda anlamlı olarak daha düşük bulundu ($p=0,04$). **Sonuç:** ESWT özellikle iğne fobisi olan hastalarda MAS için iyi bir alternatif tedavi yöntemi olabilir.

Anahtar Kelimeler: Miyofasyal ağrı sendromu; tetik nokta enjeksiyonu; ekstrakorporeal şok dalga tedavisi

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Myofascial pain syndrome (MPS) is characterized by pain, muscle spasm, hyperirritable nodule of spot tenderness, limited range of motion, weakness, referred pain, stiffness, fatigue, palpable muscular taut bands, muscular twitching response, and sometimes autonomic dysfunction. Micro and macro traumas because of excessive use of muscles, bad posture, aging, and emotional stress cause trigger points (TP) and taut bands.[1] MPS is sometimes underdiagnosed and not thought to cause of severe pain. However, MPS may severely diminish the quality of life by limiting the range of motion and considerable pain. Trigger point injection (TPI) with local anesthetics and exercise treatments are the most common therapies for MPS.

In recent years, extracorporeal shock wave therapy (ESWT) has been used to treat many musculoskeletal system diseases, such as epicondylitis, lymphedema, plantar fasciitis, and calcific tendinitis, etc.[2-4] Therefore, ESWT has been used more often in MPS.[5] ESWT is a new treatment method that focuses high amplitude sound waves upon the desired body area and provides treatment in that area.[6] The mechanism of radial extracorporeal shock waves on MPS is unclear; however, GABAergic interneurons in the dorsal horn are suggested to play through the pain-modulating effect. In addition, pressure and vibration may accelerate tissue healing by increasing blood circulation and lymphatic drainage.[7]

The purpose of this study is to compare the efficacy of TPI with a local anesthetic, which is a usual treatment method, and ESWT, a relatively new treatment method for patients with MPS.

MATERIAL AND METHODS

The study was conducted in accordance with the principles of the Declaration of Helsinki. Approval was obtained from the local ethical committee (date: May 15, 2009; no: 2009/97). Before the study, an informed consent form was taken from every patient. The study included 79 (56 females and 23 males) patients who met Simons's MPS diagnostic criteria and were between 18-60 years old with back, neck, and shoulder pain shorter than 12 weeks.[8] Patients with TPs located in more than one muscle, bleeding disorders, systemic infection, anesthetic allergy, malignancy, pregnancy, fibromyalgia, cognitive dysfunction, and those who used anticoagulants or analgesics were excluded from the study. After excluding 12 patients who did not want to participate and 17 patients who were lost of follow-up, the remaining 79 patients were randomized with closed-envelope technique to TPI (Group 1, n=39) and ESWT (Group 2, n=40) groups. Age, gender, body mass index, demographic information such as duration of illness and pain localization, other existing diseases, sleep patterns, history of trauma surgery, smoking, and alcohol habits were recorded. Complete blood counts (Sysmex XT2000i, Japan) and routine biochemistry (Integra 800, Roche-Manheim, Germany) tests were evaluated. Physical examination was performed, and patients have identified TPs and reflection areas. The pain of the patients was assessed with the visual analog scale (VAS). The fatigue of the patients was asked to mark on a 0-10 scale. The quality of life was evaluated with Nottingham Health Profile (NHP), and psychological status was assessed with Beck Depression Index (BDI).[9,10] NHP consist of 6 subscale and 38 questions, for every question 1 point was recorded, so the total score ranged from 0-38. BDI score between 0-16 shows minimal depression, 17-29 shows moderate depression, and 30-63 shows severe depression.

Pressure-pain thresholds of the patients were detected with an algometry in sitting position and semi-pronation of forearm, elbow flexed to 90°. Algometric measurement was performed two times at intervals of 30 seconds, and the results of both measurements were averaged.[11,12] Later, stretching and posture exercises were shown to patients. They were suggested to carry on the given the home-exercise program instructed by a physiotherapist, including cervical and back stretching and posture exercises to make 2×20 times/day for a month. Compliance to home exercise program was promoted with a phone interview. The patients in the TPI and ESWT group were evaluated in terms of VAS, NHP, and BDI at the first week and the first month.

TPI

The TP was identified with palpation, and the 10×10 cm circular area around the TP was cleaned with

betadine. After 25-G sterile needle insertion and twitching, a response was obtained and 0.2 mL of 2% prilocaine was injected. Then, the injector was back drawn, and our superior, inferior, medial, and lateral quadrants were searched for another twitching response. Again, 0.1 mL of 2% prilocaine was injected for all twitching responses. After the injection of all taut bands in the muscle was finished, the pressure was applied to prevent bleeding, injection sites were covered with a bandage, and patients were asked to move the muscle through its full range of motion 3 times. TPI was applied three times at one-week intervals.[13,14]

ESWT

The TPs were identified with palpation and the help of an algometry on the affected muscle. Ten Hz frequency, 1.8 to 3.0 bar pressure range from 400 to 800 beats with three sessions of shock wave therapy along the taut band performed with an interval of 5-8 days (Masterpuls MP200, Storz, Switzerland). The D20 header was used for the ESWT application. The pressure was increased at each session as the patient could tolerate it. ESWT was applied once a week and three times.

STATISTICAL ANALYSIS

Power analysis was carried out with G*power 3.1.9.3 (Heinrich-Heine-Universität Düsseldorf, Germany). To achieve 80% power at α:0.5 significance level with medium effect size, the minimum number of patients who must be included in the study was 64. All analyses were run out with SPSS 25.0 package program (IBM corporation, USA). The normality of variables was investigated with Kolmogorov-Smirnov and Shapiro-Wilk tests. Independent samples t-test was used for normally distributed parameters; the Mann-Whitney U test was used for abnormally distributed parameters. For repeated measures with normal distribution, repeated measures-analysis of variance, and for non-normal distributed repeated measures, Friedman tests were used. Pearson chi-square test and likelihood tests were used for categorical variables.

RESULTS

The demographic and clinical features of the patients in both groups are demonstrated in Table 1. The TPs were localized to 5 different muscles. There was no statistically significant difference between the groups regarding TP localization (p=0.072). There were no significant differences between the groups regarding VAS scores at pre-treatment, 1st week, and 1st month (Table 2). The median VAS scores of both groups showed a statistically significant decrease at 1st week and 1st month (p<0.05); also, VAS-1st month scores were significantly lower than VAS-1st week scores for both groups (p<0.05. When patients' pain thresholds were analyzed, the groups had no statistical significant differences. Pre-treatment average pressure pain threshold values showed a

TABLE 1: Distribution of patients according to age, BMI, duration of pain, and the trigger point location.

	TPI (Group 1) (n=39)	ESWT (Group 2) (n=40)	p value
Age ($\bar{X}$±SD)	33.8±8.3	34.5±9.4	0.74
Gender (n/%)			
Female	28 (71.8)	28 (70.0)	0.86
Male	11 (28.2)	12 (30.0)	
BMI ($\bar{X}$±SD)	24.44±3.80	25.09±4.90	0.51
Duration of pain (days) ($\bar{X}$±SD)	44.59±46.30	44.78±58.87	0.98
Muscles where trigger points were located (n/%)			
Rhomboids	11 (28.2)	15 (37.5)	0.67
Trapezius	19 (48.7)	23 (57.5)	0.57
Levator scapula	3 (7.7)	0 (0.0)	0.06
Deltoids	4 (10.3)	2 (5.0)	0.45
Latissimus dorsi	2 (5.1)	0 (0.0)	0.38

BMI: Body mass index; TPI: Trigger point injection; ESWT: Extracorporeal shock wave therapy; SD: Standard deviation.

TABLE 2: Comparison of VAS score between groups.

	TPI		ESWT		
VAS scores	**Minimum-maximum**	**Median (25%-75%)**	**Minimum-maximum**	**Median (25%-75%)**	**p value**
Pre-treatment	2-9	7 (6-8)	3-9	6.5 (5-8)	0.59
At 1st week	0-8	3 (1.25-5.00)	0-8	3 (2-5)	0.76
At 1st month	0-9	2 (2.00-4.75)	0-8	2 (1-5.5)	0.39
Pressure threshold score		**X̄±SD**		**X̄±SD**	**p value**
Pre-treatment		4.55±0.84		4.86±0.55	0.06
At 1st week		5.39±1.10		5.27±1.00	0.60
At 1st month		6.16±1.35		5.79±0.96	0.16

VAS: Visual analog scale; TPI: Trigger point injection; ESWT: Extracorporeal shock wave therapy; SD: Standard deviation.

statistical significant increase in 1st week and 1st month in both groups (p<0.05) (Table 2). VAS and pain threshold scores of the groups are demonstrated in Figure 1 and Figure 2, respectively. NHP scores of the groups were similar at pre-treatment and 1st week (p=0.663 and 0.351, respectively). However, at 1st-month NHP scores were statistically lower in the ESWT group. In the first month of control, there was more decrease in Group 2 compared to Group 1 (p=0.04) (Table 3). BDI scores of the groups were similar at pre-treatment, 1st week, and 1st month (p=0.092; p=0.262 and p=0.090) (Table 4).

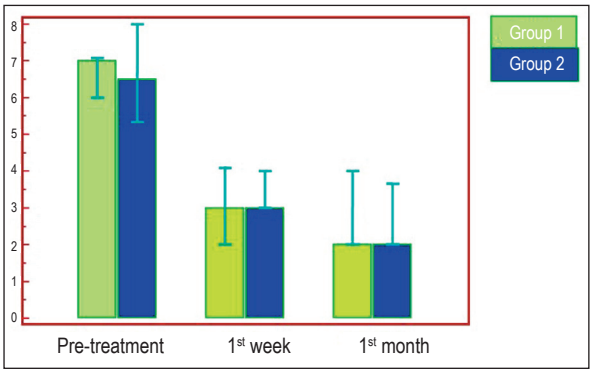

FIGURE 1: VAS scores of the groups.

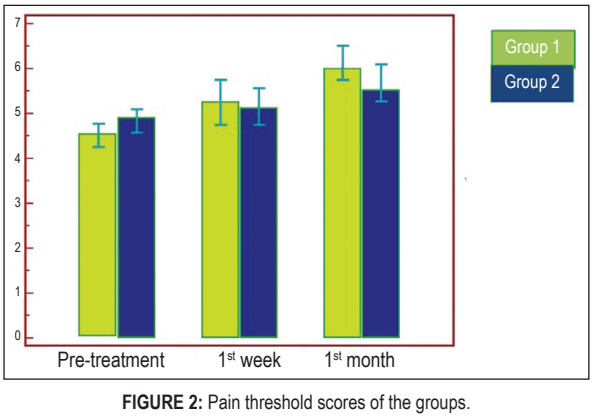

FIGURE 2: Pain threshold scores of the groups.

TABLE 3: Comparison of NHP values between groups.

NHP	TPI	ESWT	p value
Pre-treatment	13.33 ±7.00	12.58±8.34	0.663
At 1st week	10.82±8.29	9.03±7.63*	0.351
At 1st month	9.31±8.13	6.25±6.4	0.040

NHP: Nottingham Health Profile; TPI: Trigger point injection; ESWT: Extracorporeal shock wave therapy.

TABLE 4: Comparison of BDI scores between groups.

BDI scores	TPI	ESWT	p value
Pre-treatment	13.18±7.00	10.78±7.56	0.092
At 1st week	9.74±7.46	7.85±6.56	0.269
At 1st month	8.28±7.04	5.55±5.34	0.090

BDI: Beck Depression Inventory; TPI: Trigger point injection; ESWT: Extracorporeal shock wave therapy.

DISCUSSION

Many types of research showed that ESWT was effective for different musculoskeletal conditions, but there is a few data about ESWT application for MPS.

Manafnezhad et al. found that ESWT was as effective as dry needling for trapezius in terms of a neck disability and pain threshold score in their study with 70 patients, similar to our study.[15] Hong et al. found that ESWT had superior pain relief than TPI

for MPS in the quadratus lumborus muscle.[16] Aktürk et al. found that ESWT was effective as ultrasound for MPS in their sham-controlled study.[17] Ji et al. applied 20 (3 men, 17 women between 9-30 ages) patients with ESWT in a study.[18] They did ESWT 4 sessions on only upper trapezius trigger bands. They used VAS and pressure threshold for scaling. VAS decreased clearly, and the pressure threshold increased significantly. They showed that ESWT was effective for MPS patients. Their meta-analysis included ten articles and 477 patients. Zhang et al. concluded that ESWT was effective for MPS in the trapezius muscle, but not superior to conventional treatments (dry needling, TPI, laser therapy) for pain intensity and the neck disability index, so they suggested that ESWT may be an adjuvant therapy, not an alternative to conventional treatments.[2]

Jeon et al. compared ESWT and TPI plus transcutaneous electrical nerve stimulation in 15 patients and found that decrease in VAS pain scores and increase in pain threshold scores were higher in the ESWT group.[19] All these findings are consistent with the pain relief in our research.

There is a two-way relationship between pain and mental state. A painful medical illness can disrupt one's spiritual well-being. Mental disorders directly affect the perception of pain. A longer duration of pain increases the tension and depression of the patient. About half of all patients with chronic pain have psychological problems. Similar to other painful disorders, depression and anxiety can accompany MPS. So, improving psychiatric symptoms is one of the desired outcomes of painful musculoskeletal diseases. In a study by Ay et al. that evaluated the psychological problems of patients with MPS, at the end of treatment for both groups treated with local anesthetic injection or dry needling, the BDI scores of patients decreased significantly.[20] In our study, BDI scores were reduced with both treatment modalities.

In contrast to other studies, in the present study, functional status scores assessed with NHP were significantly higher in the ESWT group, but this effect was only seen at the first month.[4,5] This effect on NHP may source from that ESWT produces a regenerative and tissue-repairing effect in musculoskeletal tissues besides well-known mechanical effect.[21,22] ESWT may be relatively better in the long term to improve life quality.

Including relatively high number of, patients with MPS in different muscles, and assessment of pain, pressure threshold and functional impairment may be accepted as positive aspects of the study. Therefore, there are some limitations of our study. The first is including patients with only one muscle involvement to ensure comparison with ESWT treatment. The other one is a relatively small number of patients in the study. Also, short follow-up time is another limitation.

In our study, as in previous studies, ESWT had similar effectiveness for pain relief, pain threshold, and BDI. Therefore, we did not encounter a similar study evaluated fatigue and functional impairment. We think that ESWT may be a treatment choice, especially for patients with injection phobia.

CONCLUSION

Our study showed that ESWT was as effective as TPI in reducing pain and enhancing functional and psychological status. On the other hand, ESWT improves the quality of life more effectively in terms of the long-term results. ESWT is effective for patients with needle phobia or anxiety, and the implementation period may cause less labor loss, especially for the young and working patients.

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