Dicle Tıp Dergisi / Dicle Med J (2025) 52 (3) : 475-485

www.diclemedj.org

Original Article / Özgün Araştırma

Comparison of The Effect of High Power Ultrasound and High Intensity Laser Application on Pain and Quality of Life in Myofacial Pain Syndrome

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Received: 20.05.2025; Revised: 30.07.2025; Accepted: 04.08.2025

Abstract

Objective: his study aims to compare the effectiveness of high-power ultrasound (HPU), a novel treatment in myofacial pain syndrome(MPS) management, with high-intensity laser therapy (HILT) on pain, depression, and quality of life.

Methods: Sixty patients diagnosed with MPS, who had experienced pain for at least three months and had at least one active trigger point(TP) were included in the study. The patients were randomly assigned to two groups. Group 1 received hot pack therapy, transcutaneous electrical nerve stimulation (TENS), exercise and HPU, while Group 2 received hot pack therapy, TENS, exercise and HILT. Pain was assessed using the Visual Analog Scale (VAS), pressure pain threshold with an algometer and hand grip strength with a dynamometer. Quality of life was evaluated using the Short Form-36 (SF-36), psychological status with the Beck Depression Inventory (BDI) mand cervical health with the Neck Disability Index (NDI). All measurements were taken before and after the treatment.

Results: No significant differences were found between the groups in terms of baseline demographic data ($p>0.05$). Both groups showed significant post-treatment improvements in VAS, BDI, NDI, algometry scores and all SF-36 parameters ($p<0.05$). However, no significant changes were observed in hand grip strength ($p>0.05$). Furthermore, no statistically significant differences were found between the groups in any of the outcome measures after treatment ($p>0.05$).

Conclusion: Both HPU and HILT are effective in the treatment of MPS; however, HPU may be preferred more due to its lower cost, greater accessibility and shorter application time.

Keywords: Laser, Myofascial pain syndrome, Ultrasound

DOI: 10.5798/dicletip.1784963

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Miyofasiyal Ağrı Sendromunda Yüksek Güç Ultrason ile Yüksek Yoğunluklu Lazer Uygulamasının Ağrı ve Yaşam Kalitesi Üzerine Etkisinin Karşılaştırılması

Öz

Amaç: Miyofasiyal ağrı sendromu (MAS) tedavisinde yeni bir yöntem olan yüksek güçlü ultrason (YGU) ile yüksek yoğunluklu lazer (YYL) tedavisinin ağrı, depresyon ve yaşam kalitesi üzerindeki etkinliğini karşılaştırmayı amaçlamaktadır.

Yöntemler: MAS tanısı almış, en az üç aydır ağrı şikayeti bulunan ve en az bir aktif tetik nokta(TN) olan 60 hasta çalışmaya dahil edildi. Hastalar rastgele iki gruba ayrıldı Birinci gruba; hotpack, transkutanöz elektriksel sinir stimülasyonu (TENS), egzersiz ve YGU tedavisi uygulanırken; ikinci gruba hotpack, TENS, egzersiz ve YYL tedavisi uygulandı. Ağrı düzeyi Görsel Analog Skala (VAS) ile, basınç-ağrı eşiği algometre ile, el kavrama gücü ise el dinamometresi ile değerlendirilmiştir. Yaşam kalitesi Short Form-36 (SF-36) anketiyle, psikolojik durum Beck Depresyon Ölçeği (BDÖ) ile ve boyun sağlığı Boyun Özür Göstergesi (BÖG) ile değerlendirildi. Tüm ölçümler tedavi öncesi ve sonrası yapıldı.

Bulgular: Gruplar arasında başlangıç demografik veriler açısından anlamlı fark bulunmadı($p>0.05$). Her iki grupta da tedavi sonrasında VAS, BDÖ, BÖG, algometre ve tüm SF-36 parametrelerinde anlamlı iyileşme gözlendi($p<0.05$). Ancak el kavrama gücünde anlamlı bir değişiklik izlenmedi ($p>0.05$). Ayrıca, tedavi sonrası değerlendirmelerde gruplar arasında herhangi bir ölçümde istatistiksel olarak anlamlı fark bulunmadı ($p>0.05$).

Sonuç: Hem YGU hem de YYL, MAS tedavisinde etkilidir; ancak YGU, daha düşük maliyeti, daha kolay erişilebilirliği ve daha kısa uygulama süresi nedeniyle daha çok tercih edilebilir.

Anahtar kelimeler: Lazer, Miyofasiyal ağrı sendromu, Ultrason

INTRODUCTION

The MPS is a local muscle pain syndrome characterized by excessive sensitivity and tenderness in one or more muscles and connective tissues, referred to as TP[1]. The MPS is the most common cause of shoulder, neck, back, facial pain, sometimes radiating to the arm and tension-type headaches[2]. The MPS is most commonly observed in the trapezius, levator scapulae and suboccipital muscles, biological, psychological and social factors are influential factors in the development of MPS[3,4]. The prevalence of myofascial pain in the general population is reported as 12%, while in patient populations, it reaches 30%[5]. The aim of MPS treatment is to reduce pain, increase muscle strength and flexibility and eliminate factors contributing to TP formation, thereby reducing the likelihood of recurrence[6–8].

Treatment methods primarily include the elimination of factors that lead to TP formation, medical treatment, stretching and strengthening exercises, acupuncture, local or systemic injections, ultrasound (US), laser, electrical stimulation, TENS, extracorporeal shock wave therapy (ESWT), mesotherapy, massage therapy, biofeedback and other physical therapy modalities[9,10].

The US increases the flexibility of tendons, ligaments and joint capsules, reducing joint stiffness, pain and muscle spasms and can be used in the treatment of MPS due to its ability to increase blood flow[11]. The US has effects on pain and pressure pain threshold[12].

The HPU is a technique in which US waves are applied statically and intermittently to the TP. The application reduces spasms in muscle arterioles while inducing vasodilation. This process stimulates mitochondria, leading to adenozin trifosfat production and activation of energy processes. This technique was first introduced in 1983 through personal communication between Simons and Nielson. The procedure involves increasing the intensity of US until it reaches the pain threshold (1.5

W/cm^2), then reducing it to half and progressively increasing the intensity over the next 2-3 minutes according to the patient's pain tolerance[13].

Another commonly used treatment for MPS is HILT, which accelerates metabolism by increasing membrane permeability through its biostimulatory effect and provides analgesic benefits[6,7,14].

Although HILT is frequently used in the treatment of MPS, there are limited studies in the literature regarding its comparison with HPU. To the best of our knowledge, no studies have yet been conducted comparing the effectiveness of HILT and HPU. The aim of this study was to compare the efficacy of HILT and HPU treatments on parameters such as pain, depression, quality of life and to investigate whether HPU, which is a relatively new treatment in the treatment of MPS, is effective.

Research Hypothesis (Alternative Hypothesis - H_1):

According to the Research Hypothesis (Alternative Hypothesis - H1), pain levels and quality of life in myofascial pain syndrome (MPS) can be improved through the use of high-power ultrasound (HPU) therapy and high-intensity laser (HIL) therapy.

Null Hypothesis (H_0): The effect of pain levels and quality of life in patients with MPS does not differ significantly between HPU and HIL therapies, according to the Null Hypothesis (H0).

The study's aim of comparing the clinical outcomes of two different physical therapy modalities is matched by these hypotheses. The null hypothesis was supported by the study's results, as there were no statistically significant differences between the groups after treatment ($p > 0.05$).

METHOD

Sixty patients aged 18-60 years who applied to the Physical Medicine and Rehabilitation clinic of Gaziantep University Şahinbey Training and Research Hospital and underwent a treatment program in the physical therapy and rehabilitation unit were included in the study.

The study included patients aged between 18 and 60 years who were diagnosed with MAS and had no systemic, neurological, or psychiatric impairments.

Patients with a history of shoulder or spinal surgery, structural spinal deformities (such as kyphosis or scoliosis), pregnancy, severe systemic diseases, a history of malignancy, cardiac pacemakers, or cognitive impairments were excluded from the study. The study included 60 patients with at least one TP in the trapezius muscle, randomized into two groups. Group 1 consisted of 30 patients who received TENS, Hotpack, postural exercises and HPU, while Group 2 consisted of 30 patients who received TENS, Hotpack, postural exercises and HILT.

The HPU group received ultrasound therapy using a BTL 4000 premium brand electrotherapy device at a frequency of 1.5 MHz and a dosage of 0.5–2.0 W/cm^2 applied to a fixed trigger point. The ultrasound intensity was increased until the pain threshold level was reached, held for 2–4 seconds, then reduced to half of that intensity and maintained for 15 seconds. This procedure was repeated 3–5 times according to the patient's pain tolerance threshold

The HILT group received treatment using a BTL 6000 brand device: 2 minutes in analgesic mode at a power level of 8 W, and 5 minutes in biostimulation mode at a power level of 4 W.

Demographic characteristics, daily sleep duration, duration of pain, the amount of time

spent actively using their hands during the day and rest periods were recorded for the patients. Pain levels were measured using the Visual Analog Scale (VAS), pressure pain threshold was measured using an algometer and grip strength was assessed using a hand dynamometer. Quality of life was evaluated using the SF-36 questionnaire, mood was assessed using theBDI and neck disability was measured using the NDI .

This study was reviewed and approved for ethical compliance by the Non-Interventional Research Ethics Committee of Gaziantep University Faculty of Medicine at the meeting held on 01.11.2023.

Pain Intensity Assessment

Pain intensity was evaluated using the Visual Analog Scale (VAS), a subjective measurement tool based on individuals' personal experiences. It provides an important indicator of perceived pain severity. The scale ranges from 0 to 10, with 0 representing "no pain" and 10 indicating "unbearable pain." Participants were asked to rate their pain intensity on this scale, and the values reported were recorded as the VAS score [10].

Assessment of Pressure Pain Threshold

Patients' sensitivity to pressure-induced pain was assessed using a device called an algometer. The Baseline (Italy) push-pull force gauge brand algometer was used in the evaluation. Pain threshold and tolerance were objectively measured with this device. After identifying the trigger point (TP), separate measurements were made for the right and left sides. Pressure applied to the TP was increased by 1 kg per second. The moment the patient first perceived pain, the device was removed from the skin, and the needle reading was recorded in kg/cm^2. This procedure was repeated three times with one-minute intervals, and the average of the three values was recorded as the pressure pain threshold (1 kg = 2.2 pounds) [10].

NDI – Neck Disability Index

The Neck Disability Index (NDI) was used to assess the patient's physical limitations and pain (99). The index consists of 10 sections covering pain, personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreational activities. Each section is scored from 0 to 5, with a total score ranging from 0 to 50. Higher scores indicate greater disability. The total score was interpreted as the degree of neck disability [10].

SF-36 Health Survey

The SF-36 consists of 36 items and is used to assess the condition of patients with musculoskeletal disorders. It evaluates both positive and negative aspects of health through questions related to the individual's general health status. The survey includes assessments in eight different domains, each scored from 0 to 100, with 0 representing the poorest and 100 the best possible health status. Participants select the most appropriate option based on their experience.

10 items assess physical functioning, 2 items assess social functioning, 4 items evaluate role limitations due to physical health, 3 items evaluate role limitations due to emotional problems, 5 items assess mental health, 4 items assess vitality, 2 items assess pain, 5 items assess general health status.

Higher scores in each domain reflect better health-related quality of life.

Physical functioning measures the ability to perform physical activities.

Role-physical assesses difficulties in work or daily roles due to physical health problems.

Pain evaluates the severity and impact of pain on daily life.

General health reflects perceptions of overall health.

Vitality evaluates energy level and general life satisfaction.

Social functioning assesses limitations in social relationships due to health issues.

Role-emotional evaluates the impact of emotional problems on daily roles.

Mental health includes assessments of depression, anxiety, and general mood[10].

BDI – Beck Depression Inventory

The Beck Depression Inventory (BDI) was used to assess the emotional status of participants. The inventory consists of 21 items, each with four response options scored from 0 to 3. The total score ranges from 0 to 63 and indicates the level of depression[15].

Grip Strength

Grip strength was evaluated using a Jamar Hydraulic Hand Dynamometer (USA). The patient was seated in an upright position, with the arm unsupported, the elbow flexed at 90°, and the wrist in a neutral position. The grip measurement was performed three times on each hand with 10-second intervals. The average of the three readings was recorded in kilograms[16].

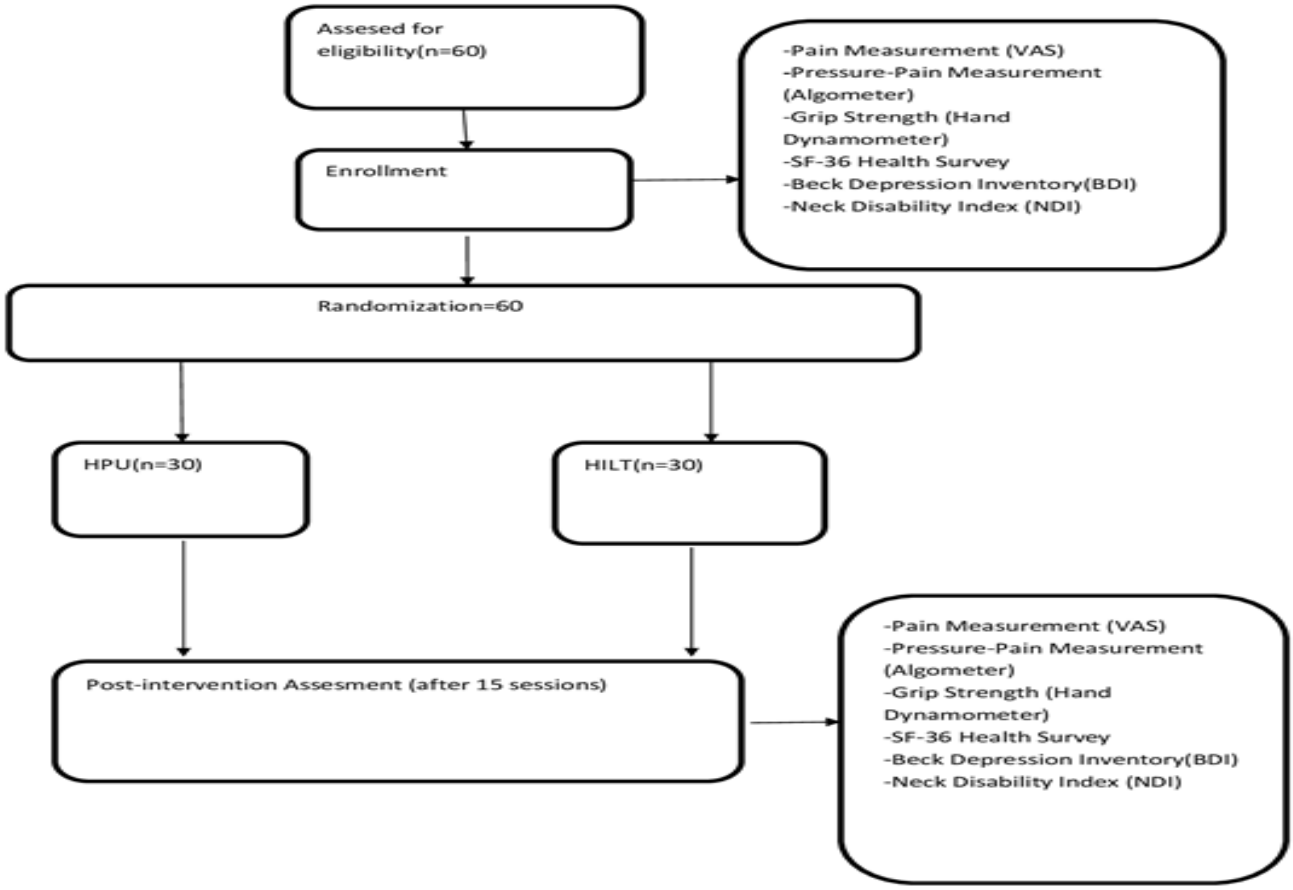

Figure 1. Flowchart of study

Statistical Analysis

Descriptive statistics for the data obtained from the study were presented using means and standard deviations for numerical variables and frequency and percentage analysis for categorical variables.

Normality of the data was assessed using the Shapiro-Wilk test. To compare demographic variables between study groups, independent

sample t-tests or Mann-Whitney U tests were used. Differences in categorical variables were tested using the Chi-square analysis.

For comparisons of the same variables at different time points between the study groups, repeated measures analysis of variance (ANOVA) was employed. All analyses were performed using SPSS version 22.0, with a significance level set at $p<0.05$.

RESULTS

A total of 60 patients were included in the study, with 30 patients assigned to the HPU group and 30 patients to the HILT group. Of the participants, 31.7% were male and 68.3% were female. In terms of occupation, 46.7% were housewives, 18.3% were desk workers, 11.7% were educators, 13.3% were healthcare workers, and 10% belonged to other occupational groups.

No significant differences were found between the groups in terms of gender and occupation. Similarly, there were no significant differences between the groups in age, daily sedentary duration, sleep duration, pain duration and the duration of active hand use (Table I).

Table I: Comparison of Demographic Characteristics of Participants by Groups

Variable	HPU Group (n=30)	HILT Group (n=30)	P-Value
Age (years)	43.03 ± 11.8	42.27 ± 11.1	0.739*
Daily Fixed Sitting Time (hours)	5.97 ± 2.95	5.33 ± 2.2	0.350**
Sleep Duration (hours)	6.87 ± 1.48	6.9 ± 0.96	0.988*
Duration of Pain (months)	7.9 ± 3.92	8 ± 3.7	0.814*
Active Hand Usage Time (hours)	4.63 ± 2.76	4.2 ± 1.9	0.627

*=(Mann-Whitney U), **= (Independent Samples t-test)*

Upon examination of Table 1, no statistically significant differences were found between the groups in terms of age, daily sedentary duration, sleep duration, duration of pain, and time spent actively using the hands ($p > 0.05$).

During the baseline assessments, the duration of rest was found to be longer in the HPU group compared to the HILT group. Likewise, the initial VAS scores were higher in the HPU group than in the HILT group.

In our study, a decrease in VAS values and an increase in algometer values were observed after treatment in both groups ($p<0.05$) and no significant difference was observed in grip strength (both right and left) before and after treatment in both groups ($p>0.05$). In the comparisons between the groups, no superiority of one treatment over the other was observed in any of the questionnaires or assessments (Table II).

Table II: Comparison of Pain, Pressure Pain Threshold and Grip Strength Between HPU and HILT Groups

Measurement	Group	Pretreatmant (Mean± SD)	Posttreatmant (Mean± SD)	Pre vs Post p	Between-Group p	Group × Time Interaction p
VAS(Pain Score)	HPU	7.77±1.45	3.70±1.84	<0.001	0.635	0.142
	HILT	7.27±1.39	3.90±1.35	<0.001		
Algometer Right Trapezius	HPU	3.26±0.83	3.75±1.00	<0.001	0.593	0.662
	HILT	3.08±1.18	3.64±1.29	<0.001		
Algometer Left Trapezius	HPU	3.32±1.00	4.49±3.15	0.003	0.157	0.141
	HILT	3.16±0.83	3.57±0.94	0.003		
Hand Grip Right	HPU	29.34±13.03	31.26±12.65	0.399	0.082	0.338
	HILT	25.56±9.74	25.44±9.26	0.399		
Hand Grip Left	HPU	27.30±10.91	29.72±13.56	0.241	0.066	0.174
	HILT	22.59±11.97	22.41±11.30	.241		

Mean ± SD: Mean ± Standard Deviation HPU: High Power Ultrasound HILT: High Intensity Laser Therapy Pre vs Post p: Comparison between pre-treatment and post-treatment; if less than 0.05, the difference is considered statistically significant. Between-Group p: Significance of the difference between groups. Group × Time Interaction p: Significance of the interaction effect between group and time.

In our study, a decrease in VAS scores and an increase in algometer values were observed in both groups following the treatment (p<0.05). No significant differences were found between pre- and post-treatment grip strength values (right and left) in either group (p>0.05). When the post-treatment results were compared between the groups, no statistically significant differences were found (p>0.05). The group × time interaction was not found to be statistically significant (p > 0.05).

An increase was observed in all eight subparameters of the SF-36 quality of life scale after treatment (p<0.05). After treatment, a reduction in BDI and NDI scores was observed in both groups (p<0.05). When comparing the results between the groups, no superiority of one treatment over the other was observed in any of the questionnaires or assessments (p>0.05) (Table III).

Table III: Comparison of SF-36, Beck Depression Index and Neck Disability Index Scores Between HPU and HILT Groups

Measurement	Group	Pretreatment (Mean ± SD)	Posttreatment (Mean ± SD)	Pre vs Post p	Between-Group p	Group×Time Interaction p
SF-36 Physical Function	HPU	67.5 ± 21.61	75 ± 19.3	<0.001	0.598	0.712
	HILT	70.67 ± 20.33	77 ± 17.98	<0.001		
SF-36 Physical Role Limitation	HPU	38.33 ± 31.98	47.5 ± 27.35	<0.001	0.766	0.429
	HILT	38.67 ± 32.56	51.67 ± 30.04	<0.001		
SF-36 Emotional Role Limitation	HPU	47.76 ± 39.81	63.31 ± 32.00	<0.001	0.213	0.989
	HILT	37.85 ± 29.83	53.3 ± 29.82	<0.001		
SF-36 Energy Vitality	HPU	38.67 ± 22.13	48.5 ± 21.98	<0.001	0.890	0.249
	HILT	36 ± 17.29	49.8 ± 18.61	<0.001		
SF-36 Mental Health	HPU	57.1 ± 22.18	64.1 ± 22.81	<0.001	0.988	0.560
	HILT	56.03 ± 16.65	65 ± 17.77	<0.001		
SF-36 Social Functioning	HPU	56 ± 25.75	65.42 ± 25.67	<0.001	0.994	0.460
	HILT	54.33 ± 18.71	67.17 ± 21.52	<0.001		
SF-36 Pain	HPU	38.58 ± 20.00	52.67 ± 17.94	<0.001	0.477	0.116
	HILT	37.75 ± 16.81	59.17 ± 15.87	<0.001		
SF-36 General Health	HPU	51.5 ± 19.13	56.67 ± 20.44	0.003	0.568	0.750
	HILT	48.3 ± 18.29	54.63 ± 18.11	0.003		
BDI	HPU	14.27 ± 9.44	11.03 ± 8.16	<0.001	0.996	0.179
	HILT	14.97 ± 6.46	10.17 ± 6.78	<0.001		
NDI	HPU	16.8 ± 8.07	10.47 ± 5.34	<0.001	0.638	0.205
	HILT	15.8 ± 6.07	10.03 ± 5.54	<0.001		

Mean ± SD: Mean ± Standard Deviation HPU: High Power Ultrasound HILT: High Intensity Laser Therapy BDI: Beck Depression Inventory NDI: Neck Disability Index Pre vs Post p: Comparison between pre-treatment and post-treatment; if less than 0.05, the difference is considered statistically significant. Between-Group p: Significance of the difference between groups. Group × Time Interaction p: Significance of the interaction effect between group and time. An increase was observed in all eight subparameters of the SF-36 quality of life scale after treatment (p<0.05). A decrease in BDI and NDI scores was observed in both groups following the treatment (p<0.05). When the post-treatment results were compared between the groups, no statistically significant differences were found (p>0.05). The group × time interaction was not found to be statistically significant (p > 0.05).

DISCUSSION

Different age groups have been reported regarding the prevalence of MPS and it has been indicated that it is observed twice as often in women compared to men. The highest prevalence of TP has been shown in patients aged 30-49, with a decrease in frequency associated with age, muscle activation and activity levels[17]. Delgado and colleagues found that the incidence of MPS was higher in individuals aged 27-52[2]. The average age of the patients included in our study was 42.65±11.39, which is consistent with the literatüre.

There are no studies in the literature regarding which professions are more commonly affected by MPS. In our study, housewives and office workers were the majority. Based on these findings, we speculate that long periods of inactivity, staying in fixed positions and stress may trigger the development of MPS. It is suggested that MPS occurs less frequently in individuals with physically intensive jobs compared to sedentary individuals, indicating a protective effect of daily physical activity on the formation of TP[18]. In our study, a correlation was found between the duration of activity and pain levels. The group with longer periods of rest experienced higher pain levels. These findings suggest that physical activity and exercise are effective in reducing pain. Therefore, it is recommended that patients with MPS engage in regular exercise[19]. Another study involving 504 individuals diagnosed with MPS reported that 37% were male and 65% were female[20]. The gender distribution of patients in our study was 68.3% female and 31.7% male, which is consistent with the literature.

Various treatment methods are applied for MPS pain and HPU is one of these methods. A study by Gariboğlu et al. compared the effectiveness of HPU treatment with traditional physical therapy methods and found that HPU is an effective, fast, reliable, easy-to-apply and non-invasive treatment method for TP in MPS patients. It is suggested that HPU will be more widely used in the future[21].

Several methods are used for pain evaluation in MPS, with the VAS being one of the most widely used due to its ease of applicability. Ünalan and colleagues compared conventional ultrasound with the HPU technique in MPS patients and found that VAS values in the HPU group significantly decreased compared to the conventional ultrasound group. They also found that the number of treatment sessions was fewer in the HPU group[13]. Koca et al. compared low (0.5 W/cm^2), medium (1.5 W/cm^2) and high-dose (2.5 W/cm^2) ultrasound in their study and found that HPU was more effective than other ultrasound applications[22]. High-power ultrasound (HPU) can be used more effectively than conventional ultrasound, as it creates both mechanical and thermal effects in tissues, accelerating cellular metabolism, reducing inflammation, increasing blood circulation, and thereby contributing to pain relief and faster healing. Furthermore, its ability to inactivate trigger points at lower intensities and its shorter application time make it a more efficient and practical treatment option[13].

In a study conducted on patients diagnosed with MPS, it was observed that conventional laser therapy was effective in alleviating pain complaints during rest and activity, while also reducing trigger point sensitivity and increasing the pressure pain threshold over the trigger points[10]. In our study, HILT demonstrated positive effects across all evaluated parameters and can be considered an effective treatment modality for MPS. Its ability to penetrate deep tissues, exert analgesic effects by reducing the production of prostaglandins and bradykinin, and promote tissue healing through its anti-inflammatory and regenerative properties contributes to its therapeutic efficacy. Additionally, HILT reduces sensitivity of nerve endings by stimulating endorphin release, enhances lymphatic flow, and, being a non-invasive and safe treatment method, represents a valuable option in the management of MPS[9].

In our study, we assessed the pressure-pain threshold using an algometer. Significant increases in algometer values were observed after treatment in both groups, but no significant differences were found between the two treatments when compared.

In a study where grip strength, isokinetic muscle strength and static muscle endurance values were measured in 100 women diagnosed with fibromyalgia and 50 healthy women, the MPS patients were found to have significantly

lower values compared to the healthy control group[23]. In a study by Kılıç P. et al., Jamar Hydraulic Hand Dynamometer was used to measure grip strength and reference values for both the right and left hands were established[24]. In our study, the measured grip strength values were found to be lower than the reference values, leading us to conclude that grip strength is reduced in MPS patients.

In our study, no significant differences were found in grip strength values before and after treatment. It is believed that improvements in muscle strength may take longer to develop, so long-term follow-up may be required to assess changes in grip strength.

In a study, individuals with cervical myofascial pain syndrome were found to have increased pain and depression levels and decreased functional status compared to healthy individuals[25]. In a study by Tüzün et al., the quality of life parameters of fibromyalgia and MPS patients were evaluated. The results showed that the physical function, physical role and pain parameters of the SF-36 scale were significantly lower in MPS patients compared to the control group[26]. In our study, an improvement was observed in all SF-36 parameters after treatment in both the HPU and HILT groups, but no superiority was found between the two treatments. Both treatments had a positive effect on pain, emotional and physical life parameters.

Altındağ et al. noted that individuals with MPS had higher levels of depression compared to healthy individuals and found a significant correlation between depression and pain intensity[27]. It has been reported that patients with MPS exhibit high levels of health anxiety and perceive their pain at a higher intensity[28]. In our study, both treatment methods resulted in decreased BDI scores, but no superiority was observed between the two treatments.

In a study, it was reported that individuals with chronic neck pain had reduced head and neck range of motion, increased pain levels, weakness in the trapezius muscle and developed fear of movement compared to healthy individuals[29]. In our study, neck pain, assessed using theNDI, decreased significantly in both groups, but no significant difference was found between the groups. Therefore, HPU and HILT can be used effectively in the treatment of neck pain in patients with MPS.

In the treatment of chronic diseases, it has been emphasized that, along with a multidisciplinary approach, attention should be paid to both improving physical functionality and enhancing psychosocial support components[30].

LIMITATIONS

The study could have evaluated the changes in parameters with a longer follow-up period. Due to the home-based nature of the exercise program, it was not possible to determine the level of participation and adherence to the exercises. Additionally, all the questionnaires used in our study (SF-36, VAS, BDI and NDI) are subjective measures, which could be considered a limitation in terms of obtaining objective data. The lack of a control group represents another limitation of our study.

CONCLUSION

Various treatment modalities can be used in the treatment of MPS. HPU and HILT are both viable treatment options. HPU therapy may be preferred more due to its greater accessibility, lower cost and shorter application time. The availability of ultrasound devices in clinics and the effectiveness of ultrasound in MPS treatment contribute to reducing waiting times for patients. Based on our study's findings, HPU can be used effectively and safely in the treatment of MPS.

Ethics Committee Approval: This study was reviewed and approved for ethical compliance by the Non-Interventional Research Ethics Committee

of Gaziantep University Faculty of Medicine at the meeting held on 01.11.2023.

Conflict of Interest: The authors declared no conflicts of interest.

Financial Disclosure: The authors declared that this study has receivet no financial support.

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