



# A Prospective Clinical Study to Evaluate the Comparative Effectiveness of Dry Needling and Laser Therapy in Neck and Upper Back Myofascial Pain Syndrome

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## Abstract

**Introduction:** Myofascial pain syndrome (MPS) is a disorder of the musculoskeletal system that is distinguished by the presence of pain, tenderness, muscle spasms, restricted joint range of motion, fatigue, and, in rare cases, autonomic dysfunction.

**Aim:** The purpose of this study was to compare the effectiveness of laser and dry needling (DN) treatments for enhancing cervical joint range of motion, neck pain, and quality of life in patients with active upper trapezius myofascial trigger points who experience persistent neck pain.

**Patients and methods:** A total of 50 patients who were clinically diagnosed with MPS were included. They were divided into two treatment groups, the DN (n=25) and laser (n=25) groups, by sequential randomization. The parameters used in the study were the visual analogue scale (VAS) score and cervical rotation, flexion, extension, lateral flexion, and extension to determine the cervical range of motion (ROM). Additionally, the Nottingham Health Profile (NHP) questionnaire was used to evaluate quality of life. VAS, NHP, and ROM measurements were performed on patients in both groups before treatment (BF), after treatment (AT), and at 1 month.

**Results and conclusion:** Both low-level laser therapy and DN were found to be effective in reducing pain intensity, increasing cervical range of motion, and improving quality of life in patients suffering from myofascial pain syndrome.

## Keywords

cervical joint range of motion, musculoskeletal system, muscle spasms, trigger points, upper trapezius

## INTRODUCTION

Myofascial pain syndrome (MPS) is a disorder of the musculoskeletal system that is characterized by the presence of pain, tenderness, muscle spasms, restricted joint range of motion, fatigue, and in rare cases, autonomic dysfunction.<sup>[1]</sup>

It is also defined as regional pain arising from extremely irritable points located within the tense bands of skeletal muscle, known as myofascial trigger points (MTrPs).<sup>[2]</sup> The

quality of life and health status of the patient may be impacted by the symptoms that arise from these trigger points. This is the most prevalent etiology of musculoskeletal discomfort.<sup>[1,2]</sup> The occurrence rate of this condition exhibits considerable variation ranging from 30% in general medicine clinics for patients reporting regional pain to as high as 85% and 93% in pain clinics.<sup>[3]</sup> The exact etiology of MPS is unknown. MTrPs are thought to develop as a result of poor posture, emotional stress, muscle overexertion, trau-

ma, or repeated contractions.<sup>[4]</sup> It is hypothesized that the muscle undergoes a decrease in blood perfusion, adenosine triphosphate supplies, and calcium levels as a result, which ultimately leads to an energy deficit in the muscle and obstructs the achievement of efficient muscle relaxation. It is hypothesized that contracture is sustained via sensitization mechanisms originating from both the central and peripheral regions.<sup>[5]</sup> Treatment is mainly based on reducing pain, increasing muscle strength, and increasing joint range of motion, thus providing good posture. MPS therapy encompasses a variety of therapeutic approaches, including dry needling, trigger point injections, stretching exercises, and physical modalities.<sup>[6]</sup> Recently, some studies have shown that low-level laser therapy may have a therapeutic effect on MPS.<sup>[7,8]</sup> It has been shown that the analgesic effect of lasers stimulates endogenous endorphin synthesis ( $\beta$ -endorphin), reduces the activity of C fibers and bradykinin, and changes the pain threshold.<sup>[9]</sup> In Western medicine, DN has been utilized for pain management for nearly two centuries, and it continues to be a prevalent treatment approach for MPS.<sup>[10,11]</sup> The mechanism of action of DN, which is an invasive treatment method, is based on mechanically destroying trigger points and relieving pain without using any medication.<sup>[12,13]</sup> In shortened muscles, dry needling at the trigger point mechanically releases contractile tissue. Returning to initial muscle length and elasticity is associated with decreased pain, increased pain thresholds, increased range of motion, and enhanced quality of life, according to controlled studies.<sup>[14,15]</sup>

## AIM

This study aimed to compare the efficacy of laser and DN treatments in improving quality of life, cervical joint range of motion (CROM), and neck pain in patients with active upper trapezius MTrPs who suffer from chronic neck pain.

## PATIENTS AND METHODS

This prospective, randomized clinical study was conducted at the Medical Park Bursa Hospital, Physical Medicine, and Rehabilitation Clinic. A total of 50 patients who were clinically diagnosed with MPS were included. The clinical diagnosis of MPS was based on the Travel and Simons criteria (five major criteria and at least one minor criterion are required for diagnosis).<sup>[16]</sup> Patients with at least one active trigger point in the upper trapezius muscle, aged between 18 and 60 years, and with a normal weight and symptom duration of at least three months were included in the study. If you have bleeding diathesis, cervical disc lesions, fibromyalgia syndrome, trigger point injection in the last month, neurological and inflammatory diseases, local or systemic infections, mental illnesses, cancer, any allergic skin disease, those with serious heart or lung problems, pregnant women, neck or those who had shoulder surgery

were not included in the study. Written informed consent was obtained from each patient. The study protocol was approved by the Istinye University Human Research Ethics Committee. Fifty patients were divided into two treatment groups, the DN group (n=25) and the laser group (n=25), by sequential randomization. Patients were not given analgesic or anti-inflammatory drugs during the study period. All patients included in the study were given a trapezius muscle stretching, stretching, and posture exercise program (three intervals with 10 repetitions daily) for 2 weeks.

The parameters used in the study were the visual analogue scale (VAS) score and cervical rotation, flexion, extension, lateral flexion, and extension to determine the cervical range of motion (CROM). Additionally, the Nottingham Health Profile (NHP) questionnaire was used to evaluate quality of life. VAS, NHP, and CROM measurements were performed on patients in both groups before treatment (BF), after treatment (AT), and at the 1st month. A 10-cm straight line with the end points defining extreme limits such as 'no pain' and 'the worst possible pain' was used for the pain assessment. Patients were asked to score their pain levels during the last week. The universal goniometer (UG) is a measuring tool commonly used in clinics, to measure the active CROM. UG was used to measure cervical ranges in all directions flexion, extension, lateral flexion, and rotation. The NHP, which is used to evaluate the quality of life of patients, evaluates the emotional, social, and physical health problems perceived by patients, consists of six parts. The patients were asked to complete this questionnaire. The survey has a total of 38 questions, with yes and no answers. In 1997<sup>[17]</sup>, Küçükdevec et al. studied the translation of the NHP into Turkish. For the people in the DN group, the three most painful trigger points in the upper trapezius muscle were found and marked. The skin was then cleaned with the appropriate antiseptic agent, and needling began. Manual stimulation was given to the needles by turning them counterclockwise at 5–10 minutes intervals. A 0.25×25 mm acupuncture needle was used, and DN was applied once a week for a total of 2 sessions. The local twitch response (LTR) in the trigger point area where the DN was applied was monitored for a maximum of 30 minutes until no response was observed. Afterward, the needles were removed and checked for any bleeding. The three most painful trigger points in the upper trapezius muscle were marked in the patients in the laser group. A Ga-Al-As 650 nm wavelength and 1.6 Watt power diode laser device (Elettronica Pagani, class 1, type BF, Italy) was used for a total of 10 sessions for a maximum of 12 minutes, 3 Joules/cm<sup>2</sup>, with a pulse of 3,500 Hz in 20-second periods. Laser treatment was applied to the muscle area via the full contact technique at a right angle.

## Statistical analysis

In our study, version 21.0 of the SPSS (Statistical Package for the Social Sciences) program was used for statistical analysis of the data. The mean value, standard deviation,

and minimum and maximum values were calculated for the evaluation parameters. In the initial evaluations, an independent samples *t*-test was used to evaluate the homogeneity between the two groups. The Wilcoxon signed-rank test was used to compare changes within groups, and the Mann-Whitney test was used to compare differences between groups. The results were evaluated within the 95% confidence interval and  $p < 0.05$  was considered to indicate statistical significance.

## RESULTS

There was no statistically significant difference between the average age and sex distribution of the patients according to group (Table 1).

In both groups, the changes in the VAS score on day 1 and at 1 month after treatment compared to before treatment were found to be statistically significant. There was no significant difference in the decrease in VAS score on the first day after treatment between the groups and before treatment. The decrease in the VAS score at 1 month was statistically significant in the DN group (Table 2).

When CROM was evaluated, a significant increase in flexion was detected in both groups. Extension increased more in the laser group than in the DN group. In terms of rotations, the increase was significant in both groups, and there was no difference between the groups. The right and left lateral flexion ranges were better for the laser group than for the DN group (Table 3).

**Table 1.** Distribution of patients by age and sex

	Laser Median±SD	DN Median±SD	<i>p</i>
Age	32.35±6.88	35.29±9.18	>0.05
Female/male	23/2	22/3	>0.05

SD: standard deviation

**Table 2.** VAS scores at baseline, on day 1, and at 1 month after treatment

	Laser (n=25) Median±SD	DN (n=25) Median±SD	<i>p</i>
VAS			
Baseline	6.08±0.974	6.20±1.55	>0.05
1 day	4.58±1.9	4.2±2.0	>0.05
1 month	2.96±1.7	1±1.75	>0.05
<i>p</i> <sup>1a</sup>	<i>p</i> 1<0.05*	<i>p</i> 1<0.05*	>0.05
<i>p</i> <sup>2b</sup>	<i>p</i> 2<0.05*	<i>p</i> 2<0.05*	<0.05*

*p*<sup>1a</sup>: difference in evaluation before and after treatment on the first day

*p*<sup>2b</sup>: difference in evaluation before treatment and at 1 month after treatment

**Table 3.** Comparison of the CROM before treatment and at the 1-month follow-up

	Laser (n=25) Median±SD	DN (n=25) Median±SD	<i>p</i>
<b>Flexion</b>			
Baseline	55.60±10.41	52.34±6.60	>0.05
1 month	63.82±8.80	62.29±8.75	>0.05
<i>p</i> 1	<0.05	<0.05	
<b>Extension</b>			
Baseline	64.05±9.25	63.80±6.33	>0.05
1 month	81.44±10.69	70.95±9.84	<0.05
<i>p</i> 1	<0.05*	<0.05	
<b>Right rotation</b>			
Baseline	62.90±8.84	63.71±16.27	>0.05
1 month	78.05±12.46	79.52±8.28	>0.05
<i>p</i> 1	<0.05	<0.05	
<b>Left rotation</b>			
Baseline	65.05±12.58	62.45±15.80	>0.05
1 month	75.53±11.07	75.12±11.21	>0.05
<i>p</i> 1	<0.05	<0.05	
<b>Right lateral flexion</b>			
Baseline	33.19±7.63	34.40±12.18	>0.05
1 month	52.71±10.05	42.65±10.23	<0.05
<i>p</i> 1	<0.05*	<0.05	
<b>Left lateral flexion</b>			
Baseline	38.55±9.25	32.80±10.88	>0.05
1 month	53.20±9.66	43.90±12.35	<0.05
<i>p</i> 1	<0.05*	<0.05	

*p*1: Difference in evaluation before treatment and 1 month after treatment

In the laser group, fatigue, pain, and sleep scores decreased significantly in the first month after treatment. There was no significant difference in emotional reactions, social isolation, or physical mobility scores. In the DN group, the decrease in all scales was statistically significant in the first month after treatment. In the comparison between groups, no significant differences were found in energy, pain, sleep, or social isolation scores. The differences in emotional reactions and physical mobility scores were statistically significant (Table 4).

## DISCUSSION

Our study assessed the efficacy of laser and DN therapy in ameliorating neck pain, CROM, and quality of life among patients diagnosed with chronic neck pain who also had active upper trapezius MTrPs. Both approaches were determined to be efficacious in enhancing VAS, CROM, and

**Table 4.** Evaluation of the NHP survey results

	Laser (n=25) Median±SD	DN (n=25) Median±SD	p
<b>Fatigue</b>			
Before treatment	63.514±41.89	59.64±51.26	
1 month	49.12±31.64	39.08±37.64	0.180
p	<0.05*	<0.05*	
<b>Pain</b>			
Before treatment	55.36±31.60	54.07±26.72	
1 month	17.11±25.12	18.07±11.84	0.756
p	<0.05*	<0.05*	
<b>Emotional reaction</b>			
Before treatment	51.68±27.57	44.12±29.60	
1 month	43.46±31.74	8.07±11.84	0.020*
p	>0.05	<0.05*	
<b>Sleep</b>			
Before treatment	46.99±32.54	35.75±28.34	
1 month	32.41±30.06	19.26±25.21	0.721
p	<0.05*	<0.05*	
<b>Social isolation</b>			
Before treatment	13.29±25.72	24.86±33.90	
1 month	10.67±20.55	9.79±24.20	0.165
p	>0.05	<0.05*	
<b>Physical activity</b>			
Before treatment	21.84±20.48	23.79±17.45	
1 month	14.63±13.82	8.06±12.98	0.047*
p	>0.05	<0.05*	

NHP values in patients diagnosed with MPS at the conclusion of the study.

Injections of MTrPs are a common and effective way to treat neurological disorders. This is likely because the needle mechanically disrupts and stops dysfunctional activity in the affected motor endplates.<sup>[18]</sup> For MTrP injections, dry needling, short-acting or long-acting anesthetics, or steroids may be utilized. DN has historically been regarded as one of the quickest and most efficient methods for neutralizing MTrPs and alleviating their associated discomfort.

Numerous studies have been conducted to examine the efficacy of DN.<sup>[18-21]</sup> A systematic review article on needling treatments for MTrPs showed that, based on available medical evidence, “the nature of the substance injected makes no difference to the outcome, and wet needling is not therapeutically superior to dry needling.”<sup>[22]</sup> Steroid injections into MTrPs are controversial and have no clear rationale because there is little evidence to support an underlying inflammatory pathophysiology.<sup>[19]</sup> Various studies have shown that low-dose laser therapy, when applied correctly, is effective in inactivating MTrPs and treating neck pain.<sup>[23-25]</sup> When applied to the MTrP area, laser therapy

increases the local microcirculation, provides oxygen support to hypoxic cells, helps remove cell metabolic waste products, and breaks the vicious cycle between muscle spasm and pain.<sup>[26-30]</sup>

Prior to treatment, both groups in our study had comparable VAS scores. The post-study VAS scores of both groups improved significantly, which is consistent with previous research.<sup>[31-33]</sup> Comparisons between groups revealed that the DN group achieved a significantly greater VAS score. Contrary to our research, certain studies have reported that laser treatment exhibits greater efficacy than DN.<sup>[25,34]</sup> The observed outcome could be attributed to the atypical weight distribution of the patients. Underweight and overweight patients were excluded from our study to prevent this from occurring and to ensure that standard needle use in terms of DN was captured. CROM decreases when a trigger point is present in the upper trapezius muscle, particularly during flexion and lateral flexion.<sup>[35]</sup> The CROM of both groups increased significantly after treatment compared to before treatment. However, our research showed that the improvements in extension and lateral flexion were much greater in the laser group. While the majority of the findings in the literature support the use of lasers, some studies suggest that DN is more effective for achieving higher CROM values.<sup>[25,35,36]</sup> Enhanced vascularization, spasm reduction in a larger number of muscle fibers, and differential improvement in CROM are all factors contributing to the relatively large region of stimulation that the laser induces. While the literature presents a range of findings concerning quality of life assessments, the majority of these studies have yielded results that are consistent with our own.<sup>[7,32,33]</sup> All sub-parameters of the NHP significantly improved in the DN group in our study, whereas changes in emotional reactions, social isolation, and physical activity did not significantly change in the laser group. The difference seen between these treatment methods is thought to be related to the fact that DN affects central processes by normalizing synaptic activity and eliminating nociceptive inputs. DN may also orchestrate actin-myosin complex interaction in muscle fiber bands with MTrPs, helping nearby tissues receive more blood and relax sarcomeres.<sup>[37]</sup> Although there are many studies on these two therapy modalities in the literature, there is little comparative research. It is necessary to conduct further studies with medium- and long-term follow-ups, enhance algorithmic and evidence-based treatment designs, and standardize DN application procedures. Although many musculoskeletal problems may be treated with lasers, there is debate about how beneficial this approach is. It should be mentioned that there is no set minimum effective dosage of laser therapy for the majority of patients. However, variations in the outcomes might be attributed to the use of distinct laser therapy regimens in different investigations, with respect to energy density, wavelength, treatment time, and laser type. Although laser therapy is more convenient and noninvasive than dry needling, its superiority may stem from the fact that DN may achieve comparable outcomes with only one or two weekly sessions.

Our study is subject to several limitations, including the presence of greater female representation, heterogeneity of the sample by sex, small sample size, absence of a placebo group, and collection of results during a brief follow-up period.

## CONCLUSIONS

Both low-level laser therapy and DN were found to be effective in reducing pain intensity, increasing CROM, and enhancing quality of life in patients with MPS in our study. While the reduction in pain lasted longer in the DN group compared to the laser group, the improvement in CROM was observed to be better in the laser group than in the DN group. Differences in quality of life scores after treatment were also found to be statistically significant in favor of DN.

## Declaration of conflicting interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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# Перспективное клиническое исследование по оценке сравнительной эффективности сухой иглотерапии и лазерной терапии при миофасциальном болевом синдроме в области шеи и верхней части спины

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## Резюме

**Введение:** Миофасциальный болевой синдром (MPS) – это расстройство опорно-двигательного аппарата, которое характеризуется наличием боли, болезненности, мышечных спазмов, ограниченным диапазоном движения суставов, усталостью и, в редких случаях, автономной дисфункцией.

**Цель:** Целью данного исследования было сравнение эффективности лечения лазером и сухой иглой (СИ) для улучшения диапазона движения шейных суставов, боли в шее и качества жизни у пациентов с активными верхними трапециевидными миофасциальными триггерными точками, которые испытывают постоянную боль в шее.

**Пациенты и методы:** Всего было включено 50 пациентов с клинически диагностированным MPS. Они были разделены на две группы лечения, группы СИ (n=25) и лазера (n=25), путём последовательной рандомизации. Параметры, используемые в исследовании, включали оценку по визуальной аналоговой шкале (VAS) и вращение, сгибание, разгибание, боковое сгибание и разгибание шейного отдела позвоночника для определения диапазона движения шейного отдела позвоночника (ROM). Кроме того, для оценки качества жизни использовался опросник Ноттингемского профиля здоровья (NHP). Измерения VAS, NHP и ROM проводились у пациентов обеих групп до лечения (BF), после лечения (AT) и через 1 месяц.

**Результаты и заключение:** Было обнаружено, что как низкоуровневая лазерная терапия, так и СИ эффективны для снижения интенсивности боли, увеличения диапазона движений в шейном отделе позвоночника и улучшения качества жизни у пациентов, страдающих миофасциальным болевым синдромом.

## Ключевые слова

диапазон движения шейного сустава, опорно-двигательный аппарат, мышечные спазмы, триггерные точки, верхняя трапециевидная мышца