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OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 1/2022 (22) DWUMIESIĘCZNIK ISSN 1642-0136

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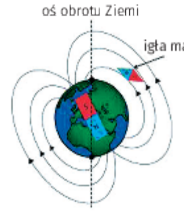

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nr 1/2022 (22)

Comparative study of the effectiveness of phonophoresis and low-level laser therapy on myofascial trigger points of upper fibers of the trapezius muscle

Badanie porównawcze skuteczności fonoforezy i laseroterapii niskopoziomowej na mięśniowo-powięziowych punktach spustowych górnych włókien mięśnia czworobocznego

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Abstract

Background. Myofascial trigger points and hypersensitive taut bands within the muscles can be a very distressing condition. It's linked to regional muscular spasms, tightened related joints, and a restricted range of motion. Purpose. This study aimed to investigate the effectiveness of phonophoresis and low-level laser therapy on trigger points of the upper fibers of the trapezius. Methods. It was a randomized controlled trial that conducted on forty-five patients from both genders, with their age ranging from 20-40 years that had myofascial trigger points in the upper trapezius, selected from El-Ahram physical therapy center, Giza and randomly assigned into three groups. All groups received traditional treatment in addition to low-level laser therapy in group (A), phonophoresis in group (B), and a combined treatment of low-level laser therapy and phonophoresis in group (C). Cervical range of motion was measured by cervical range of motion device and pain intensity by pressure algometer before and after 12 sessions of the treatment. Results. All groups saw a significant increase in cervical range of motion (P = 0.0001) and a significant decrease in pain after treatment.The improvement in pain level and left side bending motion range was in favor of group (C) than group (A) and (B). Conclusion. According to the findings, both low-level laser and phonophoresis are helpful in enhancing cervical range of motion and decreasing pain intensity in upper trapezius myofascial pain, with the combination therapy being superior in reducing pain and improving left side bending.

Key words:

low level laser therapy, phonophoresis, myofascial pain syndromes

Streszczenie

Wprowadzenie. Mięśniowo-powięziowe punkty spustowe i nadwrażliwe, napięte pasma w obrębie mięśni mogą być bardzo niepokojącym stanem. Wiąże się to z miejscowymi skurczami mięśni, zaciśniętymi stawami i ograniczonym zakresem ruchu. Cel. Celem badania było zbadanie skuteczności fonoforezy i laseroterapii niskopoziomowej na punkty spustowe górnych włókien mięśnia czworobocznego. Metody. Było to randomizowane badanie kontrolowane, które przeprowadzono na czterdziestu pięciu pacjentach obu płci, w wieku od 20 do 40 lat, z mięśniowo-powięziowymi punktami spustowymi w górnym odcinku mięśnia czworobocznego, wybranych z ośrodka fizjoterapii El-Ahram w Gizie i losowo przydzielonych do trzech grup. Wszystkie grupy oprócz laseroterapii niskopoziomowej (grupa A), fonoforezy (grupa B) oraz skojarzonego leczenia laserem niskopoziomowym i fonoforezy (grupa C) były poddawane tradycyjnemu leczeniu. Zakres ruchu w odcinku szyjnym mierzono za pomocą aparatu ruchu szyjnego, a natężenie bólu algometrem ciśnieniowym przed i po 12 sesjach. Wyniki. We wszystkich grupach zaobserwowano znaczny wzrost zakresu ruchu w odcinku szyjnym (P = 0,0001) oraz znaczne zmniejszenie bólu po leczeniu. Zaobserwowano poprawę poziomu bólu i zakresu ruchu zginania w lewo na korzyść grupy (C) w porównaniu do grupy (A) i (B). Wniosek. Zgodnie z obserwacjami, zarówno laseroterapia niskopoziomowa, jak i fonoforeza są pomocne w zwiększaniu zakresu ruchu w odcinku szyjnym i zmniejszaniu intensywności bólu mięśniowo-powięziowego, przy czym terapia skojarzona jest skuteczniejsza w zmniejszaniu bólu i poprawie zginania po lewej stronie.

Słowa kluczowe

laseroterapia niskopoziomowa, fonoforeza, zespoły bólowe mięśniowo-powięziowe

Introduction

Myofascial pain is defined as regional muscular pain that involves a specific tender points' pattern. It is usually worsened with performing an activity or when being under stress. This pain can be severe enough to cause discomfort and affect working ability [1,2]. When patients, with myofascial pain, are left untreated or when they turn into a chronic condition, other problems apart from musculoskeletal complaints may arise as overall fatigue, depression, or even behavioral disruptions [1].

A myofascial trigger point is a frequently reported origin for myofascial pain, constituting a prevalence point of 10-18% and a lifetime prevalence of 30-50%. Though, it is still underdiagnosed and inadequately treated [2]. These points are the sites within the skeletal muscle with a high level of sensitivity and irritability. They are always found linked to a lump palpated within a tense muscular band [3]. Upon pressure on these trigger spots, a typically referred pain pattern usually results [2].

Several factors may contribute to forming myofascial pain. Structural insufficiencies, from bad body postures and mechanics, are a common cause. Also, an acute traumatic event or repetitive microtrauma, inflammatory diseases, alcoholic toxicity, wearing too restrictive clothing, and to some extent, a deficiency in growth hormone are other possible causes [1].

To treat a patient complaining of myofascial pain, many therapeutic options are available, including pharmacological treatment by analgesics, anti-inflammatory drugs, and muscle relaxants. Other non-pharmacological alternatives for treating that condition involve manual therapy, using electrotherapy modalities, applying acupuncture, stress reduction, correcting faulty posture and body mechanics, ergonomic guidance, and nutritional support [4].

Of the commonly used and recognized non-invasive electrotherapeutic modalities in the physiotherapy field in general and in treating myofascial pain in particular, are ultrasound and low-level laser therapy (LLLT) [5]. Ultrasound application involves a process of deep heating through creating an alternating high-frequency current, which converts the electrical energy into mechanical oscillatory energy [6]. When ultrasound is used at a low frequency to increase transdermal drug absorption, it is called phonophoresis, a technique that has been extensively utilized in the field of sports medicine a long time ago [7].

Laser, on the other hand, is another modality that was proved effective in managing soft tissue and myofascial pain, according to the parameters applied for treatment [8]. LLLT is thought to decrease pain when applied on trigger points by regulating microcirculation leading to improved oxygen delivery to the hypoxic trigger points [9].

One form of the commonly used manual therapy approaches for myofascial pain and myofascial trigger points may include locally applying pressure over the trigger points to release it in a process called ischemic compression, where trigger points are pressed on by thumb till reaching the patient's pain tolerance level then pressure is gradually increased as the patient feels more pain relief [10].

There is a debate in the literature about whether it is more effective to use LLLT alone, phonophoresis alone, or combined therapy of both treatments in treating myofascial trigger points, especially in the cervical region. So, this study evaluated the efficacy of combination therapy to either phonophoresis or LLLT in treating myofascial trigger points of upper fibers of the trapezius.

Materials and methods

Study design

This was a prospective randomised controlled trial with single-blinding and pre–post-test features.The National Institute of Laser Enhanced Science provided ethical approval prior to the investigation.The study began in January 2021 and was completed in June 2021. The study procedures were explained to all participants and their voluntary agreement to participate was obtained with informed consent. They were informed of the option to refuse or withdraw at any time. Additionally, they were assured about the confidentiality of any obtained information as all data would be digitized to protect anonymity.

Randomization and blinding

Computer-generated random numbers were used to assign the participants into three equal groups (A, B, and C).To hide the distribution, numbered opaque envelopes were used and opened by an independent blinded researcher. No dropouts occurred after randomization, figure 1.

Participants

Forty-five patients from both genders with myofascial trigger points in the upper fibers of the trapezius muscle were selected from El-Ahram physical therapy center, Giza. Their ages were ranging from 20 to 40 years old and BMI of 25-29 kg/m2. They were randomly assigned into three groups (A, B & C). Patients were included in the study if they had a hypersensitive tender point, a palpable taut band, and a regional twitch reaction in response to pressing that taut band. Spontaneous production of a typical pattern for referred pain, when compression those points was considered an inclusion criterion. Conversely, patients were excluded if they had a fracture, chronic sinusitis, cancer, a history of musculoskeletal disorders, also, patients having psychiatric disorders, and those taking pain killers or muscle relaxants.

Intervention

Patients were assigned into three groups, for the group (A), involved 15 patients and received LLLT in addition to traditional myofascial management of stretching, hot application, and ischemic compression, while group (B) included 15 patients and received phonophoresis in addition to the same traditional management and group (C) included 15 patients and received a combined treatment of LLLT and phonophoresis in addition to the same traditional management. The interventions were given to all of the patients.

Group (A)

In addition to the traditional treatment, group (A) received LLLT (J&S Medical-Cyberlight, Ga/As, Rome, Italy) with a wavelength of 904 nm, a pulse duration of 200 ns, a pulse frequency of 1953 Hz, a peak power of 90 mW, an average

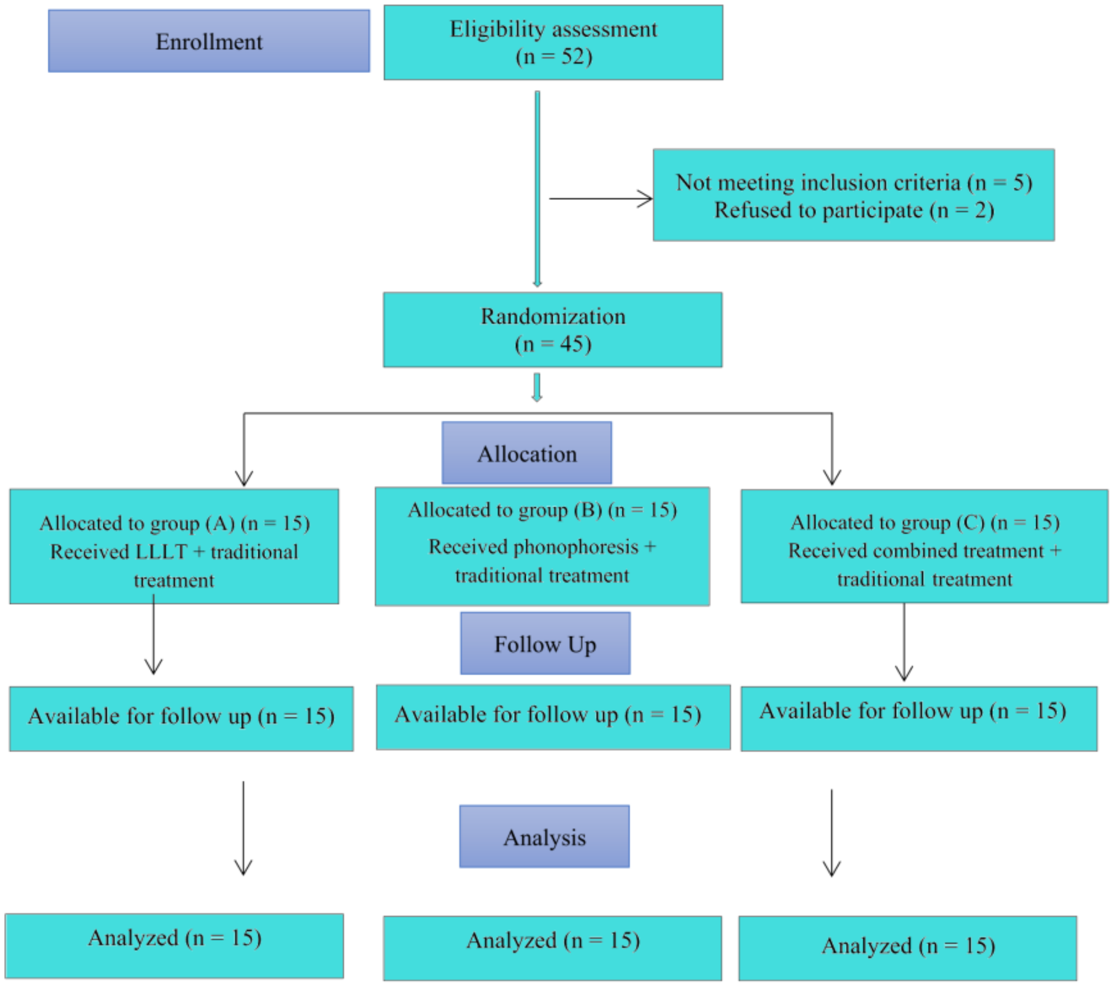

Figure 1. Flow chart of the study

output of 30 mW and power density of 22.5 mW cm2. The total treatment time/ session was 10 minutes, with an energy dose of 18 J applied to a spot size of 4 cm2, applied by a laser probe of a 4 cm2 head size with a steady skin contact without pressure on trigger points [11].

Group (B)

In addition to the traditional treatment, group (B) received phonophoresis using Ultrasound device (Eme-Medical Ultrasonic1300) with a 5 cm2 head size probe applied to trigger points of the trapezius muscle in a sustained skin contact without pressure. The probe was utilized to deliver a frequency of 1 MHz, and a power density of 1.5 W/ cm2 for 10 minutes in a continuous mode. A coupling gel was used together with both Diclofenac gel (Voltaren) and corticosteroid ointment (Hydrocortisone ointment 1%), applied with a thickness of 2-3 mm, to maximize the effect of phonophoresis [12].

Group (C)

Patients of the group (C) received a combined treatment composed of LLLT and phonophoresis, with the same parameters as the groups (A & B), in addition to the traditional myofascial pain treatment.

Assessment of outcomes

The cervical range of motion was examined with a cervical range of motion device (CROM) while pain intensity was quantified with a pressure algometer before the trial and after a month of intervention for the three groups (A, B & C).

Cervical range of motion (CROM) device

This device is valid and reliable with intra-rater intraclass correlation coefficients (ICCs) ranging from 0.84 and 0.96 and inter-rater ICCs from 0.73 to 0.94 in all cervical range of motion. It can be easily utilized with both asymptomatic and symptomatic individuals, as it needs slight palpation to detect the landmarks and can test all directions of cervical range without the need to change the inclinometer's position [13].

The device has a plastic structure, put on the ears and nose and secured in place by Velcro straps. Attached to that structure is an inclinometer in the frontal plane, another inclinometer in the sagittal plane, both locating the head position in relation with the line of gravity and a third one in the horizontal plane to locate the head rotational position in relation with a reference point [13].

To use the CROM device in measuring cervical range, patients were instructed to sit straight, with the trunk fully supported, feet placed flat on the ground, and hands put on thighs. To limit trunk and shoulder movement and allow for only neck movement, two straps were needed. For assessing flexion range, each patient was instructed to look straight forward, tuck the chin in then move the head down as far as allowed to the point of discomfort or tightness. For extension range, the patients were asked to raise their chin, look up, and then move the head back to the point of limitation [13].

Similarly, the patient was asked to look ahead and side-bend the neck to both directions as far as possible to the tightness point. The patient was asked to swivel his head to both sides while gazing at a horizontal imaginary line on the wall, moving as far as possible until discomfort was felt.The therapist assured stabilization of the shoulders during side bending by placing a hand over the clavicle's end of the shoulder, which is contralateral to the bending direction. Before actual testing and recording, a trial was done in each movement direction to help patients understand the procedure and the movements required to be done during the test [13, 14].

Pressure algometer

It is a tool used to determine the highest amount of pressure that can be endured before turning that pressure sensation into pain, normally in cases complaining from myofascial pain to detect myofascial trigger points. Pressure-pain thresholds recognized by testing can provide a quantitative measure of the patient's tenderness, as tender spots will require an abnormally low force level to elicit pain. The pressure algometer has high validity and excellent reliability, with Pearson (r) correlations of its maximal force reading reaching 0.99 between it and the force plate and ICCs of 0.70–0.94 [15, 16].

Six painful spots throughout the upper fibres of the trapezius muscle on both sides of the neck were found and marked before using the pressure algometer. The patient was seated and the therapist stood behind the patient. Through the one cm2 application surface area of the handheld algometer (Force One, FDIX 50™, Greenwich, Conn), the pressure force was perpendicularly and slowly applied over each point with constant pressure, at a rate of approximately 1 kg/m2, till the patient felt discomfort [15, 16]

Statistical analysis

The statistical analysis was carried out with the SPSS statistical package (version 25 for Windows) (SPSS, Inc., Chicago, IL). Age data is expressed as a mean and standard deviation, whereas gender data is expressed as numbers and percentages. While a mixed design 3 x 2 multivariate analysis of variance (MANOVA) was used to compare the variables of interest across study groups and assessment periods, a mixed design 3 x 2 multivariate analysis of variance (MANOVA) was used to compare the variables of interest across study groups and assessment periods. The three tested groups were the first independent variable (between-subject factors). The second independent variable (within-subject factor) was the assessment periods with two levels (before and after treatment). The Bonferroni adjustment test was employed for pairwise comparisons within and between groups. All statistical results were considered significant at a level probability ($P \leq 0.05$).

Results

45 patients took part in the trial, which was divided into three groups of 15 individuals each. In demographic data for age ($P = 0.517$; $P > 0.05$) and BMI ($p = 0.851$;$p < 0.05$) among groups A, B, and C, no significant differences were found as shown in (Table 1).

Table 1. Demographic data among the three groups

Variables	Group A (n = 15) Mean ± SD	Group B (n = 15) Mean ± SD	Group C (n = 15) Mean ± SD	P-value
Age [years]	34.00 ± 5.83	31.60 ± 7.39	31.60 ± 6.34	0.517
BMI [kg/m²]	26.68 ± 5.79	27.35 ± 5.98	26.18 ± 5.10	0.851

SD: standard deviation, P-value: probability value, P-value > 0.05: non-significant

The statistical analysis utilising 3x2 mixed design MANOVA (Table2) revealed that the tested groups (the first independent variable) had significant differences (F-value = 5.039; P = 0.0001) on all tested dependent variables (range of motion and pressure algometer). Furthermore, the measuring periods (the second independent variable) had substantial effects on the dependent variables (F-value = 120.218; P = 0.0001). There was also a statistically significant interaction (groupsx period interaction) between the two independent variables (F-value = 5.631; P = 0.0001).

For CROM, post hoc tests showed that there was a significant improvement in cervical ranges, including flexion, extension, as well as both sides' side bending, and rotation after treatment compared to pre-treatment within groups. The significant difference found in the left side bending measurements after treatment was in favor of group (C), receiving combined therapy when compared to the groups (A) and (B) taking either LLLT or phonophoresis, respectively, while other cervical movements showed no significant difference ($P > 0.05$) among the three groups after treatment (Table 3).

For pressure algometer, post hoc analyses revealed that all trigger points (1, 2, 3, 4, 6) experienced a substantial reduction in pain after treatment compared to pre-treatment within groups. In addition, when compared to groups (A) and (B), the combination therapy group (C) showed a significant improvement in pain levels following treatment (Table 4).

Table 2. Main effects of independent variables by 3 x 2 MANOVA test for dependent measuring variables

Source of variation	Wilk's Lambada value	F- value	P-value
Groups effect	0.288	5.039	0.0001*
Period effect	0.046	120.218	0.0001*
Groups x period interaction effect	0.259	5.631	0.0001*

*P-value: probability value * Significant (P-value < 0.05*

Table 3. Inter- and intra-group comparison for CROM

CROM	Items	Group A (n = 15) Mean ± SD	Group B (n = 15) Mean ± SD	Group C (n = 15) Mean ± SD	P-value
	Before-treatment	48.20 ± 4.17	44.64 ± 6.17	43.47 ± 5.47	0.121
	After-treatment	59.13 ± 2.03	58.69 ± 2.13	60.87 ± 1.84	0.316
Extension	Mean difference	10.93	14.05	17.40	
	Improvement%	22.68%	31.47%	40.03%	
	P-value	0.0001*	0.0001*	0.0001*	
	Before-treatment	42.07 ± 4.44	44.43 ± 3.67	40.27 ± 3.53	0.150
	After-treatment	50.33 ± 1.49	49.69 ± 0.85	52.07 ± 1.79	0.092
Flexion	Mean difference	8.26	5.26	11.80	
	Improvement%	19.63%	11.84%	29.30%	
	P-value	0.0001*	0.0001*	0.0001*	
	Before-treatment	34.20 ± 4.91	36.64 ± 3.50	35.53 ± 3.48	
	After-treatment	43.53 ± 2.06	44.23 ± 1.30	45.47 ± 1.12	0.107
Right side bending	Mean difference	9.33	7.59	9.94	0.225
	Improvement%	27.28%	20.72%	27.98%	
	P-value	0.0001*	0.0001*	0.0001*	
	Before-treatment	36.07 ± 2.63	37.36 ± 2.76	37.93 ± 2.34	0.054
	After-treatment	43.60 ± 1.90	44.31 ± 1.31	45.60 ± 1.18	0.038*
	Mean difference	7.53	6.95	7.67	
Left side bending	Improvement%	20.88%	18.60%	20.22%	
	P-value	0.0001*	0.0001*	0.0001*	
	Before-treatment	67.60 ± 4.15	68.71 ± 4.49	69.20 ± 4.16	0.431
	After-treatment	79.47 ± 3.06	79.46 ± 1.26	81.73 ± 2.08	0.126
Right rotation	Mean difference	11.87	10.75	12.53	
	Improvement%	17.56%	15.65%	18.11%	
	P-value	0.0001*	0.0001*	0.0001*	
	Before-treatment	68.47 ± 4.29	69.43 ± 5.25	68.20 ± 3.02	0.607
	After-treatment	79.67 ± 2.84	78.62 ± 1.93	81.73 ± 2.08	0.055
Left rotation	Mean difference	11.20	9.19	13.53	
	Improvement%	16.36%	13.24%	19.84%	
	P-value	0.0001*	0.0001*	0.0001*	

*P-value: probability value; * Significant (P < 0.05)*

Table 4. Inter- and intra-group comparison for pressure algometer

Pressure algometer	Items	Group A (n = 15) Mean ± SD	Group B (n = 15) Mean ± SD	Group C (n = 15) Mean ± SD	P-value
TrP1	Before-treatment	2.77 ± 0.65	2.31 ± 0.64	2.46 ± 0.69	0.239
	After-treatment	4.02 ± 0.79	3.81 ± 0.69	5.72 ± 0.92	0.0001*
	Mean difference	1.25	1.50	3.26	
	P-value	0.0001*	0.0001*	0.0001*	
TrP2	Before-treatment	2.78 ± 0.51	2.81 ± 0.77	2.88 ± 0.52	0.924
	After-treatment	4.07 ± 0.52	4.30 ± 0.92	6.29 ± 0.85	0.0001*
	Mean difference	1.29	1.49	3.41	
	P-value	0.0001*	0.0001*	0.0001*	
TrP3	Before-treatment	2.98 ± 0.74	2.70 ± 0.75	2.71 ± 0.44	0.556
	After-treatment	4.30 ± 0.96	3.97 ± 0.75	5.92 ± 1.00	0.0001*
	Mean difference	1.32	1.27	3.21	
	P-value	0.0001*	0.0001*	0.0001*	
TrP4	Before-treatment	3.14 ± 1.01	2.82 ± 0.92	2.91 ± 0.56	0.980
	After-treatment	7.18 ± 1.51	3.84 ± 0.72	6.16 ± 1.18	0.137
	Mean difference	4.05	1.02	3.25	
	P-value	0.015*	0.555	0.049*	
TrP5	Before-treatment	3.07 ± 0.79	2.86 ± 1.04	2.61 ± 0.60	0.301
	After-treatment	4.49 ± 0.79	4.00 ± 0.57	6.50 ± 0.92	0.0001*
	Mean difference	1.42	1.14	3.89	
	P-value	0.0001*	0.0001*	0.0001*	
TrP6	Before-treatment	2.77 ± 0.71	2.90 ± 0.76	2.71 ± 0.66	0.812
	After-treatment	4.10 ± 0.75	4.08 ± 0.74	6.23 ± 1.07	0.0001*
	Mean difference	1.33	1.19	3.52	
	P-value	0.0001*	0.0001*	0.0001*	

*TrP: trigger point ; P-value: probability value; * Significant (P < 0.05)*

Table 5. Post-hoc pairwise comparison (Bonferroni test) between groups (after treatment)

Variables	Items	Group A (n = 15) Mean ± SD	Group B (n = 15) Mean ± SD	Group C (n = 15) Mean ± SD
Left side bending	Mean difference	0.71	2.00	1.29
	95% CI	−1.29 – 2.67	−0.10 – 3.89	−0.67 – 3.25
	P-value	1.000	0.035*	0.042*
TrP1	Mean difference	0.22	1.69	1.91
	95% CI	−0.47 – 0.90	1.03 – 2.35	1.22 – 2.60
	P-value	1.000	0.0001*	0.0001*
TrP2	Mean difference	0.23	2.20	1.98
	95% CI	−0.41 – 0.88	1.59 – 2.84	1.33 – 2.63
	P-value	1.000	0.0001*	0.0001*
TrP3	Mean difference	0.33	1.62	1.95
	95% CI	−0.41 – 1.07	0.90 – 2.33	1.21 – 1.07
	P-value	0.835	0.0001*	0.0001*

Variables	Items	Group A (n = 15) Mean ± SD	Group B (n = 15) Mean ± SD	Group C (n = 15) Mean ± SD
TrP5	Mean difference	0.71	0.23	2.00
	95% CI	−1.29 – 2.67	−0.41 – 0.88	−0.10 – 3.89
	P-value	1.000	1.000	0.035*
TrP6	Mean difference	0.22	0.33	1.69
	95% CI	−0.47 – 0.90	−0.41 – 1.07	1.03 – 2.35
	P-value	1.000	0.835	0.0001*

*TrP: trigger point; CI: confidence interval; P-value: probability value; * Significant (P < 0.05)*

Discussion

The presence of myofascial trigger points is a frequently occurring condition that is commonly associated with chronic musculoskeletal problems. It can cause local pain or extend to produce a referred pattern [17].

The results from the study indicated that there was a significant improvement in cervical range of motion and a significant reduce in pain after the treatment in all groups, with the improvement in pain level and left side bending motion range being in favor of group (C), which received combined treatment of LLLT and phonophoresis in addition to the traditional myofascial pain treatment, compared to group (A) that received only LLLT with the traditional treatment, and group (B) that received phonophoresis with the traditional treatment.

The results of pain improvement in the groups receiving LLLT with or without phonophoresis could be explained based on various mechanisms by which laser can reduce pain. It reduces skin resistance, thus allowing for more blood to reach the hypoxic trigger points. Consequently, more oxygen is available to be delivered into the trigger points, and more waste products are removed from the area of these trigger points. The result is a normalized circulation of small vessels. That will eliminate the hypoxic state causing the pain and inhibit its spread [18].

The findings from Hakgüder et al. [19] agreed with the results of the current study as they stated that LLLT had significantly reduced the pain of neck active trigger points, compared with other treatment modalities, when added to stretching exercises.

For the improvement in pain occurring in the groups receiving phonophoresis with or without LLLT, studies suggested that ultrasound could greatly decrease pain through increasing tissue blood flow by its thermal effects. Also, it affects membranes' permeability and facilitates fluids transport, especially when used in the pulsed mode. Another mechanism for pain relief is the micro massaging-like effect, by stimulating mechanoreceptors, that causes analgesia by blocking pain from reaching higher centers [20].

Phonophoresis, on the other hand, was found more effective than applying only ultrasound for treating many musculoskeletal conditions, especially when combined with other treatments. This may be due to the added effect of the medication used that could further decrease pain and inflammation as well as relieving muscle spasms [21]. Moreover, according to Altan et al. [22], that employing ultrasound to deliver nonsteroidal anti-inflammatory medications and muscle relaxants was more effective in controlling myofascial pain than standard ultrasound treatment.

On patients with a latent myofascial trigger point in the upper trapezius muscle, Sarrafzadeh et al. [23] compared the effects of ischemic pressure, phonophoresis with 1% hydrocortisone, and ultrasonic routine treatment, and found that phonophoresis and pressure therapy were more effective in reducing pain and increasing cervical lateral flexion motion range.

Dry needling and betamethasone phonophoresis, on the other hand, were found to be more successful than pressure release in treating a latent myofascial trigger point in the upper trapezius muscle by Tabatabaiee et al. [24].

Also, according to Ay et al. [25], there was no significant difference in myofascial pain reduction between diclofenac phonophoresis and normal ultrasound treatment, despite the fact that both were helpful in lowering pain.

The results of this study indicated the significant improvement in trigger points' pain to be in favor to the group (C), whose patients have received the combined treatment of both LLLT and phonophoresis. This finding was supported by Gurudut and Bhadauria [26], who looked at the effect of LLLT and ultrasound treatment on the pressure pain threshold and the amount of soreness of myofascial trigger points when used alone and in combination. They discovered that combining the two modalities resulted in a greater improvement than either modality alone.

Though research has investigated the effect of LLLT and ultrasound treatment in managing myofascial pain, there still a controversy. According to a study performed by Rayegani et al. [27], laser treatment was superior to ultrasound treatment in managing myofascial pain syndrome, which disagreed with the results from the current study as there were significant improvements in trigger pointe' pain and cervical motion range in both group (A) and group (B), without significant differences between them.

Regarding the effect of phonophoresis on motion range, the group (B) that received phonophoresis saw a considerable increase in cervical motion in all directions. This could be due to ultrasound's ability to reduce muscular spasms and improve tissue healing capability by promoting the development of new collagen fibres [20]. These findings disagreed with those from Xia et al. [28], who assessed the therapeutic effect of ultrasound in cases having myofascial pain syndrome and claimed that it could have a huge effect on pain, but not on motion range.

The current study has many strong points as the patients were randomized and the tools used for assessment are objective. Though, there are some limitations. The study did not explore gender as a variable as patients involved in the study were of both genders. So future studies should investigate the effect of gender using a larger sample size so that findings could be generalized.

Conclusion

This study found that combining LLLT and phonophoresis with traditional physiotherapy treatment improved cervical range of motion, especially side bending, and decreased pain intensity of myofascial trigger points of upper trapezius muscle fibres, compared to using LLLT or phonophoresis alone with traditional physiotherapy treatment.

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Acknowledgement

The authors would like to express their gratitude to all of the patients who took part in this study.

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