EFFECT OF LOW LEVEL LASER THERAPY ON CERVICAL MYOFASCIAL PAIN SYNDROME

Rana Saber El Sayed[1], Hala Ahmed Abdelgawad[2], A.N. Kassab[3].

Article History: Received: 13.04.2023 **Revised:** 10.05.2023 **Accepted:** 16.05.2023

Abstract

Cervical myofascial pain (CMP) is a muscular-skeletal disorder that causes pain in the muscles and its surrounding connective tissue "known as fascia" in the neck region. The pain may be localized or widespread and can also be characterized by multiple trigger points. Trigger points are highly sensitive muscle focal that are painful to touch and refer pain to the surrounding area. The prevalence rate of CMP is 22-70%, and the age range is between 20–54 years more in women than men.

Study proposed to confirm the efficiency of low laser therapy with a wavelength 830nm in improving cervical myofascial pain syndrome.

This study was conducted on 40 patients with CMP both sex with their age from (20-60) years old. They were chosen from the outpatient physical therapy clinic of Benha Teaching Hospital. They were divided randomly into two groups equal in number: **Group A (control group):** received physical therapy sessions only (Isometric exercise and stretching exercises for cervical region) for 5 sessions per week for a period of 3 weeks. **Group B (study group):** received low level laser therapy (GA–As–Al diode laser device) with wavelength 830nm on three trigger points bilaterally of cervical region for 5 sessions per week for 3 weeks as well as the previous program of physical therapy in group A. In this study, visual analogue scale was used for measurement of pain intensity and goniometer instrument was used for measurement of active range of motion of cervical region for all patients of both groups before and after 3 weeks of the study.

The results were statistically analyzed, as it was concluded that there is significance difference in both group after treatment in favor of group (B).

This study concluded that low level laser therapy with wavelength 830nm improve pain and cervical range of motion in patient with cervical myofascial pain syndrome.

Keywords: Myofascial pain syndrome, Low level laser therapy 830nm, Cervical muscles, Trigger points

[1]. Physical Therapy Department, Benha Fever Hospital, Benha, Egypt.
[2]. Prof. of physical therapy Sphinx University, Egypt.
[3]. Assistant professor of otorhinolaryngology, Laser Institute, Cairo university, Egypt.

DOI: 10.48047/ecb/2023.12.si4.873

1. INTRODUCTION

A chronic pain disorder called myofascial pain syndrome (MPS) causes pain in the muscles and the connective tissue "fascia" that surrounds muscles as well as causing limitation in range of motion (ROM). This painful syndrome is typically brought on by overuse of the muscles, which can result from repetitive motions with poor posture and ergonomics (Gerwin RD, 2014). The pain can be local or regional, and can also be characterized by multiple trigger points (MTrPs). Highly sensitive muscle concentrations known as trigger points (TrPs) radiate pain to the surrounding area and are painful to touch. Particularly in the cervical region, the rhomboids, trapezius, levator scapulae, supraspinatus, and infraspinatus are frequently implicated muscles (Giamberardino MA et al., 2011). In patients with chronic neck discomfort, the upper trapezius and infraspinatus are two of the muscles most likely to have TrPs. These points not only induce pain locally but also have the ability to transmit pain to different areas (Salavati M et al., 2017). Pain, stiffness, reflex contraction of the cervical muscles, restriction of the cervical range of motion (ROM), radiation to the upper limbs, increased tiredness, vertigo, and headache are the major symptoms. Also visual and auditory disruptions, insomnia, difficulty concentrating, and

emotional issues frequently accompany the symptoms (anxiety and depression) (Masiero S et al., 2020). There is an aberrant rise in acetylcholine, which causes muscles to contract more tightly and taut bands to develop, which then constrict blood vessels. This results in hypoxia, which causes tissue distress and nociceptors to become activated. This regulates the autonomic nervous system, increasing acetylcholine release, and restarting the cycle (Kashyap R et al., 2018). The overall goals are to deactivate painful trigger points, relieve tight muscles, and interrupt the vicious cycle of pain-muscle, and spasms-ischaemia-pain. Local injection therapy, other forms of physiotherapy, including shockwave therapy, acupuncture, stretching exercises, local heat applications, kinesio taping, and laser therapy, are all effective, according to published data research (Khalighi HR et al., 2016). Laser treatment is one method currently employed in physical therapy for the restoration of connective tissue, the healing of wounds, and the management of pain (Dima R et al., 2018). Laser treatment can have biological effects on tissues where chromophores (light photo-acceptors) such water molecules, hemoglobin, and melanin are present because laser energy is absorbed by them (Grotthus Draper's law) (de la Barra Ortiz HA et al., 2021). This laser therapy creates kinetic energy in cells by transmitting photons, which will stimulate the activation process leading to pain reduction. It has also been reported to be very useful in the management of trigger point pain that causes cases of myofascial pain syndrome (Ahmed, 2020). According to certain research, LLLT may decrease stiffness by promoting blood circulation (Jafri MS, 2014). Following microcirculation restoration, LLLT improves oxygenation and decreases inflammation during the healing process of the MTrPs. LLLT greatly increased the quality of life, cervical ROMs, and pain levels in MPS patients (Shahimoridi D et al., 2020).

2. MATERIAL AND METHODS

1-Subjects:

-Prospective clinical study was conducted from 2021 to 2022 in outpatient physical therapy clinic of Benha Teaching Hospital on a sample of "forty patient with cervical myofascial pain syndrome of both sexes.

Inclusive criteria: -

All patients were selected as the following:

1-Diagnosis with cervical MPS.

2-Age range between (20-60) years old from both sexes.

3-Taut band palpable in an accessible muscle.

4-Restricted range of motion (ROM) when measured.

- Exclusions criteria:

All patients were excluded from the study as the following:

1-Patients with mental retardation.

2-Patients with neurological deficits involving the upper limbs.

3-Patients received irradiation therapy for cancer treatment.

4-Pregnant woman.

5-Patients with osteoarthritis of cervical spine or cervical disk hernia causing radiculopathy symptoms.

Ethics: -

All patients of selected patients before starting the study gave a written information consent, according to the scientific, ethical committee rules of Benha Teaching Hospital.

-Subjects were divided randomly into two groups equal in number and treatment duration for 3 weeks:

Group A (control group): Included 20 patients with cervical MPS received physical therapy sessions only (Isometric exercise and stretching exercises for cervical region) for 5 sessions per week.

Group B (study group): Included 20 patients with cervical MPS received low level laser therapy (GA–As–Al diode laser device) with wavelength: 830nm on three trigger points bilaterally of cervical region for 5 sessions per week as well as the previous program of physical therapy.

2- Procedures:

A-Evaluation procedures:

1-Visual Analogue Scale (VAS) was used for measurement of pain intensity for all patients in both groups before and after treatment.

2- Goniometer was used for measurement of active range of motion of cervical region for flexion, lateral flexion and rotation for all patients of both groups before and after treatment, and then took the average of tree measurements.

B-Treatment procedures:

1-Physical therapy program: fig(1)

It was conducted to each patient of both groups. The program included: Stretching exercise and Isometric exercise are a form of physical exercise in which a specific muscle or tendon or muscle group is deliberately to improve the muscle's felt elasticity, achieve comfortable muscle tone, increase muscle control and muscle strength. By performing stretching the muscles to the opposite side, holding for 10-20 seconds and repeating on the other side and performing resistance exercises without movement of the affected joint, hold for 10-20 seconds and repeat on the other side.

Figure. (1): Physical therapy program.

2-Low level laser therapy (LLLT):

GA–As–Al diode laser used for treatment of cervical myofascial pain syndrome for each patient of group (B) only. Laser parameters applied are shown in table (1).

Table (1): Laser parameters applied.

Irradiation parameter	Unite of measurement
Wavelength	830nm
Power output	58mW/cm2
Beam spot diameter	1cm
Frequency	1,000 Hz
Treatment time/point	2 min
Number of points	3 point bilaterally
Treatment interval	5 sessions per week for 3 weeks

Laser was applied on 3 trigger points as shown in fig. (2): -

1-On the muscle belly of trapezius: the mid-portion of superior margin, extending into the vertical fiber that reaches the clavicle bilaterally.

2-On occipital point: the most prominent point on the occipital bone bilaterally.

3-The central part of the muscle belly between the C7-T3 levels bilaterally.

Figure (2): Trigger points

Patient position: prone position, the head in neutral position and wearing safety Goggle.

Physiotherapist position: standing beside the patient and wearing Goggle.

Determine the 3 trigger points accurately by using the marker.

After setting the parameter of laser device, applied the laser on 3 trigger points bilaterally for 2 min per point as shown in fig (3)

Figure (3): Treatment procedure.

Data analysis

Statistical analysis was conducted using SPSS for windows, version 28 (SPSS, Inc., Chicago, IL). Prior to final analysis, data were screened for normality assumption, homogeneity of variance, and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculations of the analysis of difference. Preliminary assumption checking revealed that data was normally distributed for all measured variables, as assessed by Shapiro-Wilk test ($p > 0.05$). There was homogeneity of variances ($p > 0.05$) and covariances ($p > 0.05$), as assessed by Levene's test of homogeneity of variances. Accordingly, parametric statistics were used. The independent sample t-test was used to compare whether there is a difference in the dependent variable for the two independent groups. While, paired sample t-test was used to compare whether there is a difference within the same group. Unpaired t-test was used to compare whether there is a difference pretreatment in the demographic characteristics for the two study groups including age. The Chi-squared test was used to compare whether there is a difference in gender between both groups. The alpha level was set at 0.05.

3. RESULTS

-Demographic and clinical characteristics of participants:

1- Age comparison between both groups:

The baseline characteristics of the participants showed that no statistically significant differences existed between both the groups in age ($P>0.05$), as shown in Table 2. There was also, no significant difference between both groups in gender, the $\chi 2$ value was 1.62 ($P>0.05$).

2-Pretreatment comparison between both the groups:

No statistically significant differences were noticed regarding the pre- treatment between the two groups in all measured variables ($P>0.05$), as shown in Table (3).

3-Pretreatment and post-treatment comparison in each group:

A significant improvement in all measured variables (P<0.05) in both groups was shown in Table (3).

4-Post-treatment comparison between both the groups:

There was a statistically significant improvement in all measured variables between both groups (P>0.05) in favor of group B, as shown in Table (3).

Table (2): General characteristics of participants in both groups

	Control group	**Study group**	***P*- value**
	$\bar{x}$ ± SD	**$\bar{x}$ ± SD**	
Age (Years)	41.30 ± 9.25	38.95 ± 8.11	0.771
Gender			
Male	12 (60 %)	10 (50 %)	0.399
Female	8 (40 %)	10 (50 %)	

P-value: probability value; *Significant at P<0.05

Table (3): Comparison between both groups in all measured variables

Variable	**Time**	**Group A $\bar{x}$ ± SD**	**Group B $\bar{x}$ ± SD**	***P*- Value**
VAS (score)	Before	7.05 ± 0.83	7.25 ± 0.72	0.418
	After	4.2 ± 0.77	3.6 ± 0.59	0.002*
	P Value	0.0001*	0.0001*	
	% of change	40.43 %	50.34 %	
Flexion (degrees)	Before	56.85 ± 6.44	54.01 ± 4.84	0.123
	After	69.75 ± 4.01	73.01 ± 2.96	0.006*
	P Value	0.0001*	0.0001*	
	% of change	22.69 %	35.18 %	
Rt- Side-bending (degrees)	Before	23.05 ± 4.55	22.75 ± 4.61	0.837
	After	26.6 ± 4.64	30.15 ± 4.63	0.02*
	P Value	0.0001*	0.0001*	
	% of change	15.4 %	32.53 %	
Lt- Side-bending (degrees)	Before	22.95 ± 3.27	22.6 ± 3.71	0.753
	After	26.5 ± 3.72	30.35 ± 3.68	0.002*
	P Value	0.0001*	0.0001*	
	% of change	15.47 %	34.29 %	
Rt- Rotation (degrees)	Before	53.9 ± 6.37	51.25 ± 4.77	0.145
	After	66.5 ± 4.15	70.3 ± 3.08	0.002*
	P Value	0.0001*	0.0001*	
	% of change	23.38 %	37.17 %	
Lt- Rotation (degrees)	Before	53.65 ± 5.04	51.25 ± 4.27	0.113
	After	65.45 ± 3.2	68.15 ± 2.72	0.007*
	P Value	0.0001*	0.0001*	
	% of change	21.99 %		

$\bar{x}$: Mean; SD: Standard deviation P-value: probability value; *Significant at P<0.05

There was improvement of VAS by (14.29%) and range of motion of cervical region: flexion by (4.67%), RT side bending by (13.35%), LT side bending by (14.53%), RT rotation by (5.71%), LT rotation by (4.13%) when comparing group (B) with group (A).

4. DISCUSSION

With both peripheral and central pathophysiology, MPS is classified as a complicated pain disease lead to painful trigger points. By delivering pain signals to the spinal cord via afferent neurons, these painful spots can produce sensitization of spinal segments and result in chronic pain if they are not treated correctly (Rahbar M et al., 2021). Increasing cervical motion, reducing pain, and improving disability are some of the important therapeutic aims of MPS. Myofascial pain has been successfully treated using laser therapy, which has shown to be more effective than both conventional

methods like dry needling and ischemia pressure, as well as more recent additions like extracorporeal shock waves or percutaneous electrical sensory stimulation (Chang WH et al., 2021). Laser therapy is a non-invasive method of pain management. It might be a replacement or an addition to pharmaceutical medications. This has effects on bio stimulation and works as a relaxing analgesic muscle in the treatment of musculoskeletal diseases. It also helps with tissue recovery (Chung H et al., 2012).

Agung I et al., (2018) approved that mechanisms of pain relief in response to low-level laser therapy may include increased local and systemic microcirculation inhibiting the development of ischemia-mediated inflammation. Once laser therapy has been applied, a decrease in pain tolerance will also be accompanied by an increase in oxygen supply to hypoxic tissue. Increased blood flow, which increases the diameter of the blood vessels, is also connected to an increase in nitric oxide. Local and systemic nitric oxide releases were improved, and certain inflammatory mediators were inhibited. In patients with upper trapezius myofascial pain syndrome, low-level laser therapy is more successful at reducing pain intensity than dry needling therapy.

Ahmed (2020) stated that pain pressure thresholds and pain intensity at the upper trapezius muscle trigger point were successfully decreased by post-isometric relaxation and laser therapy procedures.

Graham N et al., (2013) reported that for individuals with acute, subacute, or chronic neck myofascial pain, LLLT (wavelengths of 632.8 nm, 830 nm, 904 nm, or 905 nm) was actually more successful than a placebo in lowering pain and better in improving function, overall perceived effect, or quality of life.

Yamany AA and Salim SE (2011) demonstrated that lasers prevent the transmission of both A-delta and C-fiber. Therefore, repetitive laser application may reduce tonic peripheral nociceptive afferent effort to the dorsal horn and enable rearrangement of synaptic connections in the central nervous system causing pain regulation.

Prianti AC Jr et al., (2014) founded that it's probable that LLLT's ability to lower COX-2 mRNA expression in the central nervous system (CNS) explains why it has a reducing effect on hyperalgesia.

This study is also in line with research conducted by Chang WD et al., (2014) related to how myofascial pain syndrome patients' pain is affected when receiving laser therapy. Low level laser therapy applied to the upper trapezius trigger point area is very significant in alleviating pain in myofascial pain syndrome cases and is effective in increasing the range of motion of the joints.

Ozdemir F et al., (2001) demonstrated that by reducing the spasm in muscle arterioles, which is necessary for tissue oxygenation, and by enhancing ATP synthesis, laser irradiation is thought to produce analgesia and to lead to a return to normal in the metabolic rate of the tissues with low energy levels. The other mechanisms might be connected to how it affects endorphin levels and the pain-gate mechanism. Through all of these techniques, it is able to break the trigger point's vicious cycle.

Maracci LM et al., (2020) are in opposition with this study, as low-level laser therapy is not useful in lowering pain in patients with upper trapezius myofascial pain, although its effectiveness in enhancing quality of life.

Dundar et al., (2007) examined the effects of LLLT on 64 patients with chronic neck pain are treated with laser. The results showed improved signs for two groups that were statistically significant before and after treatments, however there was no evidence of a significant difference between these two groups.

5. CONCLUSION

It is concluded that, low level laser therapy with wavelength 830nm improve pain and cervical range of motion by analgesic effect and anti-inflammatory effect in patient with cervical myofascial pain syndrome.

6. REFERENCES

Gerwin RD (2014). Diagnosis of myofascial pain syndrome. Phys Med Rehabil Clin N Am. 25(2): 341–355.

Giamberardin MA, Affaitati G, Fabrizio A and Costantini R (2011). Myofascial pain syndromes and their evaluation. Best Pract Res Clin Rheumatol. 25(2):185-98.

Salavati M, Akhbari B, Takamjani IE, Ezzati K and Haghighatkhah H (2017). Reliability of the Upper Trapezius Muscle and Fascia Thickness and Strain Ratio Measures by Ultrasonography and Sonoelastography in Participants With Myofascial Pain Syndrome. Journal of chiropractic medicine. 16(4):316–23.

Masiero S, Litwocenko S and Agostini F (2020). On behalf section of Rehabilitation in Environ-mental Thermal for Italian Society of

Physical Medicine and Rehabilitation. Rehabilitation in an Italian thermal setting: A new therapeutic strategy for patients with musculoskeletal disability-the results of an Italian survey. Int. J. Biometeorol64, 951–954.

Kashyap R, Iqbal A and Alghadir AH (2018). Controlled intervention to compare the efficacies of manual pressure release and the muscle energy technique for treating

mechanical neck pain due to upper trapezius trigger points. J Pain Res. 11:3151-3160.

Khalighi HR, Mortazavi H and Mojahedi SM et al (2016). Low level laser therapy versus pharmacotherapy in improving myofascial pain disorder syndrome. Lasers Med Sci 7(1):45–50.

Dima R, Tieppo Francio V, Towery C and Davani S (2018). Review of literature on low-level laser therapy benefits for nonpharmacological pain control in chronic pain and osteoarthritis. Altern Ther Health Med. 24(5):8–10.

de la Barra Ortiz HA, Acevedo Cangas S, Cumio Herrera A, Oñate García F and Velásquez S (2021). Efficacy of class IV laser in the management of musculoskeletal pain: a systematic review. Physiother Q. 29(2):1–11.

Ahmed (2020). Effect of post-isometric relaxation and laser on upper trapezius trigger point pain in patients with mechanical neck pain. Niger J Clin Pract. 23(12): 1660-1666 .

-Jafri MS (2014). Mechanisms of myofascial pain. International Scholarly Research Notices.

Shahimoridi D, Shafiei A and Yousefian B (2020). The effectiveness of the polarized low-level laser in the treatment of patients with myofascial trigger points in the trapezius muscles. Journal of Lasers in Medical Sciences. 11(1): 14–19.

Rahbar M, Samandarian M, Salekzamani Y, Khamnian Z and Dolatkhah N (2021). Effectiveness of extracorporeal shock wave therapy versus standard care in the treatment of neck and upper back myofascial pain: a single blinded randomised clinical trial. Clin Rehabil; 35: 102-113.

Chang WH, Tu LW, Pei YC, Chen CK, Wang SH and Wong AM (2021). Comparison of the effects between lasers applied to myofascial trigger points and to classical acupoints for patients with cervical myofascial pain syndrome. Biomed J. 44(6):739–47.

Chung H, Dai T, Sharma SK, Huang YY, Carroll JD and Hamblin MR (2012). The nuts and bolts of low-level laser (light) therapy. Annals of biomedical engineering. Feb 1;40(2):516-33.

Agung I, Murdana N, Purba H and Fuady A (2018). Low-level laser therapy and dry needling for myofascial pain syndrome of the upper trapezius muscle: An interventional study. J Phys Conf Ser. 1073(6).

Graham N, Gross AR, Carlesso LC et al (2013). An ICON overview on physical modalities for neck pain and associated disorders. Open Orthop J. 7:440–460.

Yamany AA and Salim SE (2011). Efficacy of low level laser therapy for treatment myofascialtrigger points of shoulder pain. World Applied Sciences Journal. 12(6):758-64.

Prianti AC Jr, Silva JA Jr, Dos Santos RF et al (2014). Low-level laser therapy (LLLT) reduces the COX-2 mRNA expression in both subplantar and total brain tissues in the model of peripheral inflammation induced by administration of carrageenan. Lasers Med Sci 29(4):1397–1403.

Chang WD, Wu JH, Wang HJ and Jiang JA (2014). Therapeutic outcomes of lowlevel laser therapy for closed bone fracture in the human wrist and hand. Photomed Laser Surg. 32(4), 212–218.

Ozdemir F, Birtane M and Kokino S (2001). The clinical efficacy of low power laser therapy on pain and function in cervical osteoarthritis. Clin Rheumatol. 20(3):181–184.

Maracci LM, Stasiak G, de Oliveira Chami V, Franciscatto GJ, Milanesi J, Figueiró C and Marquezan M (2020). Treatment of myofascial pain with a rapid laser therapy protocol compared to occlusal splint: A double-blind, randomized clinical trial. Cranio. 1-7.

Dundar U, Evcik D, Samli F, Pusak H and Kavuncu V (2007). The effect of gallium arsenide aluminum laser therapy in the management of cervical myofascial pain syndrome: a double blind, placebo-controlled study. Clin Rheumatol. 26(6):930–934.