International Journal of Physiotherapy and Research,
Int J Physiother Res 2018, Vol 6(4):2797-05. ISSN 2321-1822
DOI: https://dx.doi.org/10.16965/ijpr.2018.154

Original Research Article

EFFECT OF CONVENTIONAL THERAPY AND LOW-LEVEL LASER THERAPY ON PAIN AND LIMITATIONS OF DAILY FUNCTIONS IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION

Rehab El-Saeed El-Sherbeeny Ahmad [1], Emad Eldin Mohamed Abd Elatief *[2], Wadida H. Abdel Kader El Sayed [3], Rania Reffat Ali [4], Essam M. Ashour [5], Mohamed Yehia Abdelhamid Abdelsamee [6].

[1] Department of Basic Science, Faculty of Physical Therapy, October 6 University, Egypt

[*2] Department of Basic Science, Faculty of Physical Therapy, October 6 University, Egypt.

[3] Department of Basic Science, Faculty of Physical Therapy, Cairo University, Egypt.

[4] Department of Basic Science, Faculty of Physical Therapy, Cairo University, Egypt.

[5] Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, October 6 University, Egypt.

[6] Department of Basic Science, Faculty of Physical Therapy, Delta University for Science and Technology, Egypt.

ABSTRACT

Background: Temporomandibular joint dysfunctions (TMJDs) are considered the most common chronic orofacial pain condition characterized by pain in the temporomandibular joint (TMJ) area, masticatory muscles and associated musculoskeletal structures with the affection of mouth opening. Conventional therapy and low-level laser therapy (LLLT) are safe and noninvasive modalities that each therapist focuses on to relieve pain and increase function.

Objective: The purpose of this study was to investigate the effect of conventional therapy and low-level laser therapy on pain and limitations of daily functions in patients with temporomandibular joint dysfunction (TMJD).

Methods: Sixty patients (45 females and 15 males) with myofascial pain syndrome of TMJ were divided randomly into study and control groups. The study group received conventional therapy consisting of active and stretching exercises for mandibular muscles with ultrasound and LLLT application on TMJ area. Control group received conventional therapy only. Pressure pain threshold was evaluated using hand-held pressure algometer and pain-related limitations in daily functions were evaluated by the limitations in daily functions-temporomandibular disorders questionnaire (LDF-TMDQ) at baseline and 4 weeks after the treatment.

Results: There was a significant decrease ($p < 0.05$) in limitations in daily functions, with a significant increase ($p < 0.05$) in pressure pain threshold for TMJ, masseter and anterior temporalis muscles at both sides in the study group compared with control group.

Conclusion: The combination of conventional therapy with LLLT was more effective in pain relief and improvement of limitations in daily functions than does conventional therapy alone for patients with temporomandibular joint dysfunctions.

KEY WORDS: Temporomandibular joint, Conventional therapy, Low-level laser therapy.

Address for correspondence: Emad Eldin Mohamed Abd Elatief, Department of Basic Science, Faculty of Physical Therapy, October 6 University, Egypt. **E-Mail:** omdamohamed9111@gmail.com

Access this Article online	Journal Information
Quick Response code	**International Journal of Physiotherapy and Research** ICV for 2016 86.93 ISSN (E) 2321-1822 | ISSN (P) 2321-8975 **https://www.ijmhr.org/ijpr.html** **DOI-Prefix:** https://dx.doi.org/10.16965/ijpr
DOI: 10.16965/ijpr.2018.154	**Article Information** Received: 25 May 2018 Accepted: 26 Jun 2018 Peer Review: 26 May 2018 Published (O): 11 Aug 2018 Revised: None Published (P): 11 Aug 2018

INTRODUCTION

Temporomandibular joint dysfunctions (TMJDs) are an umbrella term that includes pain, dysfunction of the masticatory muscles and disorders of the temporomandibular joint (TMJ). The most common symptoms are pain, restricted mandibular movement, and clicking, popping, or grating sounds in the jaw joint. Pain can be temporary or last many years with one or both sides of face affection [1]. TMJDs can be detrimental to the quality of life Although they are not a real threat to life, this is because the symptoms increase gradually and become chronic [2]. About 20% to 30% of the adult populations have the manifestation of TMJDs. Usually, people affected by temporomandibular joint dysfunctions are between 20 and 40 years of age and it is more common in females than males [3].

The causes of orofacial pain are several but TMJDs considered the most second frequent cause after dental pain like a toothache. The etiolo-gy is currently known to be multifactorial, including [4]. The etiology of TMJDs is undoubtedly multifactorial, with the presence of trauma stress, parafunctional habits, as well as occlusal factors that have important roles in the aggravation of the symptoms.

The etiology is related to an association of predis-posing factors that include other pain conditions (e.g., chronic headaches), fibromyalgia, autoimmune disorders, sleep apnea, and psychiatric illness. These factors increase the risk of TMJDs [5]. Previous studies revealed that about 75% of the adult population have one sign of TMJDs and about 35 % have at least one symptom, however, only a minor percentage of the population, 3-7%, have severe problems that need appropriate treatment for TMJDs [6].

The most common treatment for TMJDs is the nonsurgical treatment which consists of medication, such as nonsteroidal anti-inflammatory drugs (NSAIDs) with or without the physiotherapy. NSAIDs have a direct effect on inflammation and swelling reduction but may also increase the risk of complications, such as gastric ulcer [7].

Physical therapy is an essential and important part of recovery from TMJDs symptoms especially those of mild to moderate severity, as it helps minimize pain, adhesion, stiffness and muscle tightness through its sedative, anti-inflammatory, myorelaxing, and stimulations effects. Low-level laser therapy (LLLT) is an op-tion for the treatment of musculoskeletal disorders; it is a noninvasive application, limited treatment time with minimum contraindications. It has an analgesic effect due to increase in serotonin (5-HT) levels (inhibit pain transmission to the brain and from nociceptors) and an anti-inflammatory effect due to stimulation of mitochondria and stabilization of cellular membrane and regenerative effects [8]. Exercises play an important role in increasing muscle strength and coordination and improving mouth function [7].

To our knowledge, no studies investigating the effect of conventional therapy in combination to LLLT on pain and limitations of functions in myofascial pain syndrome of TMJ. So, the purpose of this study was to investigate the effect of conventional therapy and low-level laser therapy on pain and limitations of daily functions in patients with temporomandibular joint dysfunction.

MATERIALS AND METHODS

Subjects: This prospective study was conducted on sixty patients of both genders (45 females and 15 males) with myofascial pain syndrome of TMJ in the Department of Physical Therapy at October 6 University Hospital from December 2016 to October 2017. All participants signed a written consent. The study was approved by the ethical committee of the Faculty of Physical Therapy. Randomization was performed simply by asking the patient to choose a a piece of paper which (A) or (B) letter was written. (A) considered the study group, while (B) considered the control group. The patients were selected to be enrolled in this study according to the following criteria:

Inclusive criteria

1- Patient age ranged from 20 – 60 years.

2- Pain in masticatory muscles or TMJ for at least 3 months in accordance with the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).

Exclusive criteria

1- Presence of systematic musculo-articular pathologies.

2- Pregnant women.

3- History of facial trauma.

4- Facial Palsy.

5- Fractures of the facial bones.

Design of the study: The study was a randomized-controlled trial. Patients who fulfilled the inclusion criteria of the study were randomly assigned into two groups. The study group received conventional therapy and LLLT. Control group received conventional therapy only. The evaluation procedure had been done for all patients in the two groups before starting the program and after 4 weeks of treatment.

Instruments for evaluation

Pressure pain threshold: Pressure pain threshold (PPT) was determined using a handheld pressure algometer with a 1 cm^2 rounded tip made of rubber to decrease skin irritation. It responds to force application between 0 and 10 kg. The values of the maximum force recorded when the pain threshold has been reached. The hand-held pressure algometer is reliable and responsive to assess the PPT [9].

The limitations in daily functions-temporomandibular disorders questionnaire

The LDF-TMDQ comprised of 10 items:

How much does your present jaw problem prevent or limit you from the following daily activities?

1) Opening your mouth when you eat big pieces of food

2) Grinding thin food

3) Clenching your teeth

4) Brushing your back teeth

5) Yawning

6) Talking for a long period

7) Using your jaw for a long period during meals

8) Performing activities at home, school, and/or work

9) Falling asleep soon after going to bed

10) Sleeping continuously at night

The patients were asked to choose any one of the five levels on a numerical rating scale for each item. the scale arranged from 0 to 4 points: (0) “no problem at all” – (1) “mild difficult” – (2) “moderate difficult” – (3) “severe difficult” - (4) “extremely difficult”. The total score of the 10 items ranged from 0 to 40 points. The internal consistency (Cronbach’s alpha) of the total scores appeared to be good at 0.78 for the 10 items [10].

Instruments for treatment

Low-level laser device: LLLT was performed by MLS® Laser Therapy (ASA Srl, Vicenza, Italy). It is a high power (average power up to 1.1 W, class IV) IR laser with two synchronized sources (laser diodes). The two modules have different wavelengths, peak power, and emission mode. The first one is a pulsed laser diode, emitting at 905 nm, with peak optical power = 25 W; each pulse is composed of a pulse train (single pulse width = 100 ns, maximum frequency 90 kHz), thus varying the average power delivered to the tissue. The frequency of the pulse trains may be varied in the range 1-2000 Hz. The second laser diode (808 nm) operates in continuous mode (power 1.1 W) or in pulsed mode (pulses repetition rate 1-2000 Hz), mean optical power output = 550mW, duty ratio 50% independently of the pulse repetition rate.

The probe was placed behind, in front of, and above the mandibular condyle, and into the meatus acusticus externus with the following parameters: Pulse rate: 1500 Hz, Pulse duration: 100ns, Energy density: 16 J/cm^2, Laser beam diameter: 3.14cm^2 and Duration: 14 seconds for each point.

Ultrasound device: Phyaction Ub was used in the treatment of myofascial pain syndrome (Gymna Uniphy, GY336600, Italy). The transducer (4 cm2) was moved inferiorly from directly over the TMJ toward the angle of the mandible. The unit was then moved back over the TMJ, proceeding next in an anterior/inferior direction along the approximate slope of the articular eminence. The patients were treated with pulsed ultrasound at a frequency of 3 MHz and an intensity of 0.5 W/cm2 with 1:1 duty cycle for 6 minutes over the TMJ area.

Hot pack: The hot pack (13x 30 cm) was applied to the area around the TMJ joint and masticatory muscles for 10 minutes.

Procedures

Assessment Procedures: Each patient was assessed before and after 4 weeks at the end of the treatment for both groups. The assessment includes oral history and physical examination.

a) Oral History. The oral history was always taken by the examiner and included questions on pain in the orofacial region. When the pain was present, its location, nature, duration, and radiation were determined. Moreover, aggravation of pain on the function of the masticatory system was noted. After the history taking, the subjects were asked to choose any one of five levels on a numerical rating scale from "no problem at all" (0) to "extremely difficult" (4 points)

b) Physical Examination. Include pressure algometry. During this test, the subject was seated in an upright position and was asked to relax the muscles with the teeth apart. The subject's head was supported by a headrest. PPT was measured once at TMJ, masseter muscles and anterior temporalis muscles on both sides in a relaxed posture.

Treatment Procedures: Patients in both groups received ultrasound application, hot pack application and exercise program, in three sessions per week for 4 weeks in addition to LLLT for the study group.

Exercise program.

a) Active exercises for mandibular muscles: Active exercises were used to correct the mouth opening.

1- Lateral motion towards the right and the left side, protrusion and wide mouth opening.

The patients performed these exercises 3 sets with 10 repetitions in each set.

2- Relaxed jaw exercise: The tongue slightly rested on the top of the mouth behind the upper front teeth. The teeth come apart while relaxing the jaw muscles.

3- Chin tucks: The patient pulled the chin straight back with the shoulders back, creating a double chin. This position repeated for 10 times.

4- Resisted opening of the mouth: The patient placed the thumb under the chin and asked to open the mouth slowly and pushing gently against the chin for resistance. The patient was asked to close the mouth slowly after holding for 3 seconds.

5- Resisted closing of the mouth: The patient asked to squeeze the chin with the index and thumb with one hand and to close the mouth as placing gentle pressure on the chin. This exercise applied for 3 sets with 10 repetitions in each set.

b) Stretching exercise for mandibular muscles: the patient was asked to open the mouth by pushing simultaneously the thumb against the upper anterior teeth and forefinger against the lower anterior teeth for 4 sets per session. The single set included 3 cycles of stretching, each cycle lasted 30 seconds.

Statistical Analysis:

All statistical measures were performed through the Statistical Package for Social Studies (SPSS) version 22 for windows. The current test involved two independent variables. The first one was the (tested group); between-subject factor which had two levels (study group receiving conventional therapy consisting of active movements and stretching exercise with ultrasound and LLLT application and control group receiving conventional therapy only). The second one was the (training periods); within-subject factor which had two levels (pretreatment and post-treatment).

In addition, this test involved seven tested dependent variables (Pressure pain threshold for TMJ, Masseter and Anterior temporalis muscles at both sides, and function scale). Prior to final analysis, data were screened for normality assumption and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculation of the analysis of difference and analysis of relationship measures. Descriptive analysis using histograms with the normal distribution curve showed that the data were normally distributed and not violates the parametric assumption for the all dependent variables. Additionally, testing for the homogeneity of covariance using Box's test revealed that there was no significant difference with p values of > 0.05.

The box and whiskers plots of the tested variables were done to detect the outliers.

Normality test of data using Shapiro-Wilk test was used, that reflected the data was normally distributed for the all dependent variables. Accordingly, 2×2 Mixed design MANOVA was used to compare the tested variables of interest at different tested groups and training periods. The MANOVAs were conducted with the initial alpha level set at 0.05. To determine the similarity of both groups at baseline, subject age, height and body weight were compared using independent t tests.

RESULTS

As indicated by the independent t test, there were no statistically significant differences (P>0.05) between subjects in both groups concerning age, weight, and height (Table 1).

Table 1: Demographic characteristics of both groups.

	Study group	Control group	Comparison	
	Mean ± SD	Mean ± SD	t-value	P-value
Age (years)	37.56±8.26	37.03±6.26	0.282	0.779
Height (cm)	165.96±2.49	166.73±2.89	-1.097	0.277
Weight (kg)	84.66±2.89	83.93±3	0.963	0.34

Statistical analysis using mixed design MANOVA analyzed thirty patients assigned into two equal groups. It revealed that there were significant within-subject (F = 742.633, p = 0.000), treatment *time (F= 100.87, p = 0.000), and between subject (F = 25.892, p = 0.000). Tables (2 and 3) present descriptive statistic and multiple pairwise comparison tests (Post hoc tests) for the pressure pain threshold for TMJ, masseter and anterior temporalis muscles at both sides, and function scale respectively. In the same context, the multiple pairwise comparison tests revealed that there were significant decreases (p <0.05) in function scale in the post-treatment condition compared with the pretreatment one in both groups. However, there were significant increases (p <0.05) in pressure pain threshold for (TMJ, masseter and anterior temporalis muscles at both sides) in the post-treatment compared with the pre-treatment in both groups.

Regarding between-subject effects, multiple pairwise comparisons revealed that there were significant decreases (p < 0.05) in function, witha significant increase (p < 0.05) in pressure pain threshold for TMJ, masseter and anterior temporalis muscles at both sides in the study group compared with control group.

Table 2: Descriptive statistics for pressure pain threshold for TMJ, masseter and anterior temporalis muscles at both sides, and LDF-TMDQ score for both groups at different measuring periods.

Variables	Control group		Study group	
	Pre	Post	Pre	Post
Right TMJ	3.29±0.57	1.90±0.22	1.87±0.43	3.29±0.57
Right Masseter muscle	3.75±0.18	2.64±0.19	2.61±0.25	3.75±0.18
Right anterior temporalis	4.7±0.18	4.23±0.20	4.11±0.24	4.7±0.18
Left TMJ	2.96±0.33	1.91±0.19	1.89±0.23	2.96±0.33
Left Masseter muscle	3.71±0.23	2.79±0.16	2.71±0.22	3.71±0.23
Left anterior temporalis	4.78±0.16	4.33±0.21	4.30±0.19	4.78±0.16
LDF-TMDQ score	7.53±0.97	14.56±1.63	15.3±2.11	7.53±0.97

Table 3: Multiple pairwise comparison tests (Post hoc tests) for pressure pain threshold for TMJ, masseter and anterior temporalis muscles at both sides, and LDF-TMDQ score for both groups at different measuring periods.

Within groups (Pre Vs. post)							
p-value	Rt TMJ	Rt Masseter	Rt Anterior temporalis	Rt TMJ	Rt Masseter	Rt Anterior temporalis	LDF-TMDQ score
Study group	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Control group	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Between groups (study group Vs. control group)							
p-value	Rt TMJ	Rt Masseter	Rt Anterior temporalis	Lt TMJ	Lt Masseter	Lt Anterior temporalis	LDF-TMDQ score
Pretreatment	0.74	0.604	0.05	0.719	0.102	0.659	0.379
Post-treatment	0.0001	0.0001	0.002	0.0001	0.0001	0.0001	0.0001

The mean difference is significant at the alpha level (p< 0.05), Rt: right, Lt: Left.

DISCUSSION

The current study investigated the effect of conventional therapy and low-level laser therapy on pain and limitations of daily functions in patients with temporomandibular joint dysfunction and the results showed significant differences among two groups in pain threshold and functional disability.

Pressure Pain threshold: There are several factors play an important role in the etiology of TMJDs such as structural, behavioral, psychological, behavioral and environmental factors. These factors are closely associated with increasing pain in TMJ area. Therefore, the aim of the treatment in patients with TMJD should be considered from different aspects to control pain [10]. A combination of US, manual therapy, LLLT, patient education and occlusal splints appeared to be useful in the treatment of TMJDs [11-12].

Gray et al. evaluated the effectiveness of several modalities such as short-wave diathermy, US, and laser treatments for patients with TMJDs and he found that no method was superior to the others in changing PPT values, but that these modalities were significantly better than placebo treatment [13]. Also, Mohl et al. 1990 stated that US alone has no significant effect on increasing PPT values in TMJ disorders in trials [14].

Increasing PPT values due to the application of exercise in agreeing with the study of Mehmet et al. 2014 who stated that the combination between US and a home exercise program may improve the symptoms of patients with TMJDs. This improvement may attribute to the reduction of inflammation, promotion of muscular relaxation, and the increase in blood flow [15].

Previous studies [11, 12, 13] demonstrated that stretching exercises, isometric tension, and relaxation exercises with educational instruction are effective in increasing PPT values in TMJDs and mouth opening and improving mandibular movements.

Nicolakis et al. revealed that exercise therapy reduces pain in 80% of cases and improves the range of motion in 75% of closed lock patients. This indicates that exercise therapy is significantly more effective than placebo [16].

Yoshida et al. found that performing Mandibular Condylar Movement Exercise (MCME) eight times per day increases PPT values and the range of mouth opening in closed lock cases [17].

Regarding thermotherapy in TMJDs, a study was conducted with 27 patients with TMJDs symptoms and muscle impairment found that symptoms of pain were reduced in 34.7% of patients of the study group (occlusal splint and thermotherapy) and only in 3.75% of patients in control group (occlusal splint only) [18].

In a recent study on sixty patients with chronic low back dysfunction. The author found that the combination of exercises, thermotherapy, and ultrasound in the session have an effective role in decrease pain severity and functional disability in these cases. This agrees with the result of the conventional therapy group [19].

The effect of LLLT on pain intensity was demonstrated in previous studies by Ahrari and Madani [20] (pulsed 810 nm, average power 50 mW, peak power 80 W, 1500 Hz, 120 seconds, 6 J, and 3.4 J/cm2 per point) and Salmos-Brito and Menezes [21] (gallium–aluminum–arsenide; » = 830 nm, P = 40 mW, CW, ED08 J/cm2), who all found a statistically significant improvement in PPT values of TMJDs.

The findings of this study in agree with Hamid et al study who concluded that LLLT caused a significant improvement in mouth opening and PPT values in patients with myofascial pain syndrome [22]. Also in agreeing with Fikácková study who suggest that LLLT (application of 10 J/cm (2) and 15 J/cm (2)) can be considered as a useful method in decreasing pain related to TMJDs [23]. This improvement may be attributed to increasing of lymphatic flow that reduces edema and causes a decrease of prostaglandin E2 and cyclooxygenase-2 levels after application of LLLT [24]. In contrast, the findings of this study disagree with Emshoff et al. [6] (632.8 nm, 30 mW, 1.5 J/ cm2), Carrasco et al. [25] (780 nm, 50/60/70 J/cm2) and da Cunha et al. [26] (830 nm, 500 Mw, 100 J/cm2), who reported that there was no difference between both laser and placebo groups in pain reduction.

Limitations in daily functions:

A study by Grieder et al. [27] suggested that the

ultrasonic therapy was less effective in relieving symptoms of TMJDs; however, it is more effective when used in combination with other modalities of therapy. Esposito et al. [28] concluded that ultrasound is less effective in reducing symptoms associated with the disk and most successful in relieving muscle symptoms. Esenyel et al. [29] concluded that ultrasound treatment and trigger point injections were found to be equally effective in relieving symptoms of TMJDs. Majlesi and Unalan [30] observed high-power ultrasound applied before stretching the muscle with the trigger points were more effective ($P < 0.05$) than conventional ultrasound in reducing limitations associated with daily functions. This may be attributed to thermal effects of the US. [31].

Regarding the effect of heat on TMJ dysfunction, a study found that superficial moist heat in combination with occlusal splint was more effective to reduce pain-related limitations in daily functions than the splint group [18]. Another study compared the effectiveness of an electric heating pad and moistened towel on acute muscular TMJDs with guidelines regarding removal of harmful oral habits and restricted diet. The results revealed that the mouth opening increase with relief of symptoms of limitations in daily functions [32].

Nozaki et al. reported that the use of thermotherapy followed by massages on the masseter muscle, upward and downward, with both hands, 24 times per minute increase the bite force in patients with TMJDs [33].

Muhtaroullari et al. performed a treatment program consisting of active ROM and stretching exercise for 5 times per day for 5 min and after a 6-month period of treatment, he found that all patients reported a beneficial improvement in mouth opening and limitations in daily functions [34].

The laser therapy was efficient in promoting an increase of mandibular movements in the patients who received the low-level laser dose (15 J/cm2). This may be due to the analgesic effect of low-level laser therapy especially with 905 nm pulsed wavelength on the selected points that considering the presence of nociceptors in the periarticular tissues (ligaments, capsule and retrodiscal tissues) because these structures are involved in TMJ pain [35]. Marini et al postulated that mandibular function improved in all patients who received LLLT and it has been more efficient in the treatment of pain and decrease of movement caused by TMJ disorder compared to ibuprofen [36]. Also, Simel et al. suggested that LLLT an appropriate treatment for TMJDs related pain and limited mouth opening [37]. This may attribute to the great value of lasers in increasing of beta-endorphin level, increasing of pain discharge threshold, decreasing of bradykinin and histamine release, increasing of lymphatic flow, decreasing of edema and algesic substances, increasing of blood supply, reduction of inflammation, and promotion of muscle relaxation [38].

Improvement of mouth opening in TMJDs after application of LLLT may be due to the stimulation of the cellular respiratory chain in the mitochondria that induces increased vascularization and fibroblast formation. LLLT not only affects the blood microcirculation but also increases adenosine triphosphate (ATP) production [24].

The results of this study disagree with Emshoff et al. [6] and Venancio et al. studies [5] who all reported that there was no improvement of pain and mouth opening in TMJ disorders after the application of LLLT. Also, Petrucci et al. [39] reported that LLLT is inadequate in reducing chronic TMJ pain and improve functional disability related to TMJDs.

CONCLUSION

The results of the study confirmed that the combination of conventional therapy with LLLT was effective in the improvement of PPT values of TMJDs and promoted a significant reduction of pain symptoms related to limitations in daily functions.

Conflicts of interest: **None**

REFERENCES

[1]. Cascos-Romero J, Vazquez-Delgado E, Vazquez-Rodriguez E and Gay-Escoda C.: The use of tricyclic antidepressants in the treat-ment of temporomandibular joint disorders: systematic review of the literature of the last 20 years. Med Oral Patol Oral Cir Bucal. 2009;14: E3-7.

[2]. Guo C, Shi Z and Revington P.: "Arthrocentesis and lavage for treating temporomandibular joint disorders". Cochrane Database Syst Rev. 2009 Oct 7;(4).

[3]. Edwab RR.: Essential dental handbook: clinical and practice management advice from the experts. Tulsa, OK: PennWell. 2003.pp. 251–309.

[4]. Kato MT, Kogawa EM, Santos CN and Conti PC.: TENS and low-level laser therapy in the management of temporomandibular disorders. J Appl Oral Sci. 2006 Apr;14(2):130-5.

[5]. Venancio Rde A, Camparis CM and Lizarelli Rde F.: Low intensity laser therapy in the treatment of temporomandibular disorders: a double-blind study. J Oral Rehabil. 2005; 32:800-807.

[6]. Emshoff R, Bosch R, Pumpel E, Schoning H and Strobl H.: Low-level laser therapy for treatment of temporomandibular joint pain: a double-blind and placebo-controlled trial. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008 Apr;105(4):452-6.

[7]. Carvalho CM, de Lacerda JA, dos Santos Neto FP, Cangussu MC, Marques AM and Pinheiro AL.: Wavelength effect in temporomandibu-lar joint pain: a clinical experience. Lasers Med Sci. 2010; 25:229-32.

[8]. Kulekcioglu S, Sivrioglu K, Ozcan O and Parlak M.: Effectiveness of low-level laser therapy in temporomandibular disorder. Scand J Rheumatol. 2003; 32:114-118.

[9]. Mutlu EK and Ozdincler AR.: Reliability and responsiveness of algometry for measuring pressure pain threshold in patients with knee osteoarthritis. Journal of Physical Therapy Science. 2015;27(6):1961-1965.

[10]. Liu F and Steinkeler A.: Epidemiology, diagnosis, and treatment of temporomandibular disorders. Dent Clin North Am, 2013, 57: 465–479.

[11]. Okeson JP.: Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management. Chicago: Quintessence, 1996.

[12]. Tuncer AB, Ergun N, Tuncer AH, Karahan S.: Effectiveness of manual therapy and home physical therapy in patients with temporomandibular disorders: A randomized controlled trial. J Bodyw Mov Ther. 2013 Jul; 17(3):302-8.

[13]. Gray RJ, Quayle AA, Hall CA and Schofield MA.: Physiotherapy in the treatment of temporomandibular joint disorders: a comparative study of four treatment methods. Br Dent J, 1994, 176: 257–261.

[14]. Mohl ND, Ohrbach RK, Crow HC and Gross AJ.: Devices for the diagnosis and treatment of temporomandibular disorders. Part III: Thermography, ultrasound, electrical stimulation, and electromyographic biofeedback. J Prosthet Dent, 1990, 63: 472–477.

[15]. Mehmet Ucar, Ümit Sarp, 0rfan Koca, Selma Erolu, Alparslan Yetisgin, Ahmet Tutoglu, and Ahmet Boyac1. Eûectiveness of a Home Exercise Program in Combination with Ultrasound Therapy for Temporomandibular Joint Disorders. J. Phys. Ther. Sci. 2014. 26: 1847–1849.

[16]. Nicolakis P, Erdogmus B, Kopf A, Ebenbichler G, Kollmitzer J, Piehslinger E, Fialka-Moser V.: Effectiveness of exercise therapy in patients with internal derangement of the temporomandibular joint. J Oral Rehabil 2001, 28, 1158–1164.

[17]. Yoshida H, Kashiwagi K, Sakata T, Tanaka M, Kawazoe T, Morita S.: Prognostic factor of mandibular condylar movement exercise for patients with internal derangement of the temporomandibular joint on initial presentation: Preliminary report. J Craniomanillofac Surg 2013, 41, 356–358.

[18]. Nelson SJ and Ash MM. An evaluation of a moist heating pad for the treatment of TMJ/muscle pain dysfunction. Cranio. 1988;6(4):355-9.

[19]. Emad Eldin Mohamed Abd Elatief Ibraheem. Conventional therapy versus positional release technique in the treatment of chronic low back dysfunction. Int J Physiother Res 2017;5(5):2325-31.

[20]. Ahrari F, Madani AS.: The efficacy of low-level laser therapy for the treatment of myogenous temporomandibular joint disorder. Lasers Med Sci. 2014;29(2):551-557.

[21]. Salmos-Brito JA, Menezes RF.: Evaluation of lowlevel laser therapy in patients with acute and chronic temporomandibular disorders. Lasers Med Sci.2013;28(1):57-64.

[22]. Hamid Reza Khalighi, Fahimeh Anbari, Jamileh Beygom Taheri, Sedigheh Bakhtiari, Zahra Namazi, and Firoz Pouralibaba. Effect of Low-power Laser on Treatment of Orofacial Pain. J Dent Res Dent Clin Dent Prospect. 2010; 4(3): 75–78.

[23]. Fikácková H1, Dostálová T, Navrátil L, Klaschka J.: Effectiveness of low-level laser therapy in temporomandibular joint disorders: a placebo-controlled study. Photomed Laser Surg. 2007 Aug;25(4):297-303.

[24]. Melis M, Di Giosia M, Zawawi KH.: Low-level laser therapy for the treatment of temporomandibular disorders: a systematic review of the literature. Cranio. 2012 Oct;30(4):304-12.

[25].Carrasco TG, Mazzetto MO, Mazzetto RG and Mestriner W Jr. Low intensity laser therapy in temporomandibular disorder: a phase II double-blind study. Cranio. 2008 Oct;26(4):274-81.

[26]. da Cunha LA, Firoozmand LM and da Silva AP. Efficacy of low level laser therapy in the treatment of temporomandibular disorder. Int Dent J. 2008; 58:213-7.

[27]. Grieder A, Vinton PW, Cinotti WR and Kangur TT. An evaluation of ultrasonic therapy for temporomandibular joint dysfunction. Oral Surg Oral Med Oral Pathol. 1971; 31:25–31.

[28]. Esposito CJ, Veal SJ and Farman AG. Alleviation of myofascial pain with ultrasonic therapy. J Prosthet Dent. 1984; 51:106–8.

[29]. Esenyel M, Caglar N and Aldemir T. Treatment of myofascial pain. Am J Phys Med Rehabil. 2000; 79:48–52.

[30]. Majlesi J and Unalan H. High-power pain threshold ultrasound technique in the treatment of active myofascial trigger points: A randomized, double-blind, case-control study. Arch Phys Med Rehabil. 2004; 85:833–6.

[31]. Ter Haar G. Therapeutic ultrasound. Eur J Ultrasound. 1999; 9:3–9.

[32]. Nelson SJ, Santos JJ, Barghi N and Narendran S.: Using moist heat to treat acute temporomandibular muscle pain dysfunction. Compendium. 1991;12(11):808-16.

[33]. Nozaki S, Kawai M, Shimoyama R, Futamura M, Matsumura T, Adachi K and Kikuchi Y. Range of motion exercise of temporo-mandibular joint with hot pack increases occlusal force in patients with Duchenne muscular dystrophy. Acta Myol. 2010;29(3):392-7.

[34]. Muhtaroðullari M, Ertan AA, Demiralp B and Canay S. Correlation between clinical and magnetic resonance imaging findings in the treatment of anterior disc displacement. Int J Prosthodont 2013, 26, 138–142.

[35]. Núñez SC, Garcez AS, Suzuki SS, Ribeiro MS. Management of mouth opening in patients with temporomandibular disorders through low-level laser therapy and transcutaneous electrical neural stimulation. Photomed Laser Surg. 2006 Feb;24(1):45-9.

[36].Marini I, Gatto MR and Bonetti GA. Effects of superpulsed low-level laser therapy on temporomandibular joint pain. Clin J Pain. 2010; 26(7):611-6.

[37]. Simel Ayyildiz, Faruk Emir and Cem Sahin. Evaluation of Low-Level Laser Therapy in TMD Patients. Case Reports in Dentistry.2015.

[38]. Pinheiro AL, Cavalcanti ET, Pinheiro TI, Alves MJ and Manzi CT. Low power laser therapy in the management of disorders of the maxillofacial region. J Clin Laser Med Surg. 1997;15(4):181-3.

[39]. Petrucci A, Sgolastra F, Gatto R, Mattei A and Monaco A. Effectiveness of low-level laser therapy in temporomandibular disorders: a systematic review and meta-analysis. J Orofac Pain. 2011 Fall;25(4):298-307.

How to cite this article:

Rehab El-Saeed El-Sherbeeny Ahmad, Emad Eldin Mohamed Abd Elatief, Wadida H. Abdel Kader El Sayed, Rania Reffat Ali, Essam M. Ashour, Mohamed Yehia Abdelhamid Abdelsamee. EFFECT OF CONVENTIONAL THERAPY AND LOW-LEVEL LASER THERAPY ON PAIN AND LIMITATIONS OF DAILY FUNCTIONS IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION. Int J Physiother Res 2018;6(4):2797-2805. **DOI:** 10.16965/ijpr.2018.154