

ORIGINAL ARTICLE

A comparative study of low-level laser therapy combined with drugs versus drug therapy alone in the management of myogenic TMJ pain

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ABSTRACT

Aim: To compare the effect of low-level laser therapy combined with pharmacotherapy (naproxen + orphenadrine with paracetamol (myogestic)) and pharmacotherapy alone in treating myofascial pain related to temporomandibular joint.

Materials and Methods: Twenty-four participants with myofascial pain related to TMJ diagnosed according to diagnostic criteria DC/TMJ are randomly divided into two groups (n=12); Group1 received naproxen 500mg twice a day and myogestic three times a day for 21 days, Group 2 received Low-Level Laser Therapy for nine sessions three sessions a week with a diode laser with dual-wavelength with the same drugs as group1. Measures of myofascial pain during the function were evaluated at baseline, after 10 days, at the end of treatment, and 3 months after the end of treatments using the visual analog scale VAS, which has scores from zero (no pain) to ten (sever pain) also maximum mouth opening was measured in each session.

Results: VAS scores decreased in both groups but significantly more in Low-Level Laser Therapy with pharmacotherapy group at 10 days, 21 days, and 3 months ($p < 0.05$). Maximum mouth opening highly improved in Group 2 with significantly more significant gains in Low-Level Laser Therapy group at all follow-up points except baseline ($p < 0.05$).

Conclusions: These results indicate that Low-Level Laser Therapy with pharmacotherapy was more effective than pharmacological therapy in decreasing pain and improving jaw function in patients with TMJ-related myogenic pain.

KEY WORDS: temporomandibular joint, naproxen, Low-Level laser therapy, myogestic, myogenic pain

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ABBREVIATIONS

TMD: Temporomandibular Disorders

TMJD: Temporomandibular Joint Disorder

LLLT: Low-Level Laser Therapy

TMJ: Temporomandibular Joint

DC: Diagnostic Criteria

DC/TMD: Diagnostic Criteria for Temporomandibular Disorders

MMO: Maximum Mouth Opening

VAS: Visual Analog Scale

MMD: Masticatory Musculature Disorder

INTRODUCTION

Temporomandibular disorders (TMDs) are an umbrella term encompassing disorders of both the temporomandibular joint disorder (TMJD) and masticatory musculature disorder (MMD) [1], TMDs include both painful and painless disorders that involve masticatory muscle and TMJ and its surrounding structures with prevalence to

masticatory disorders, given that the temporomandibular joint TMJ is used approximately 1500-2000 times a day, the discomfort caused by symptomatic TMDs can significantly impair daily activities [2]. Temporomandibular pain commonly manifests in the preauricular region, masticatory muscles, or temporomandibular joint (TMJ). Patients frequently describe symptoms besides localized discomfort, such as facial pain, headaches, and cervical discomfort. Jaw dysfunction often accompanies these complaints, including restricted mouth opening capacity, mechanical locking in either the open/closed position, or joint noises like clicking, popping, or crepitus during movement [3]. The difficulty of treating TMD arises from a poor understanding of the aetiology and pathogenesis of this condition. Understanding the aetiology of TMDs is very important in identifying and avoiding potential pathologic factors [4]. Diagnosing TMD has become more accurate with modern tools like the Diagnostic Criteria for TMD (DC/TMD). These guidelines are trusted for identifying the

most common TMD types and help doctors, dentists, and therapists work together effectively. The system groups TMD into two main categories:

Pain-related issues: Muscle pain (myalgia), joint pain (arthralgia), and headaches linked to TMD

Non-painful problems: Jaw disc misalignment, joint wear (degenerative disease), and unstable jaw movement (subluxation) [5], (DC/TMD) was created to standardize diagnoses based on epidemiological studies from multiple centers [6]. Because the causes and mechanisms of TMD are complex, many different treatment approaches have been used to manage it. These include acupuncture, bite splints, physical exercises for the jaw, physical therapy, posture correction, psychological support, medication, TENS (transcutaneous electrical nerve stimulation), and behavioral therapies [7]. Given the complex causes of TMD, current research supports starting with non-invasive, team-based care combining self-care, behavioral techniques, physical therapy, and medication [5]. Among these approaches, LLLT is sometimes used to ease symptoms and improve jaw function. LLLT uses a gentle laser with minimal energy output that does not raise skin temperature. Its effects come from light absorption, typically wavelengths between 630–1300 nanometers. Though the exact mechanism is not fully understood, LLLT is thought to reduce pain and inflammation by stimulating tissues [8]. Specialized lasers (like diode lasers at 630–670 nm, 800–830 nm, or 900–940 nm) deliver red or near-infrared light at safe energy levels (up to 500 mW). These tools promote healing and reduce swelling through biostimulation (using 2–4 Joules/cm²) or pain relief (using 10–12 Joules/cm²) [9]. LLLT used for many purposes. For example, it helps faster healing after tooth extraction by reducing the chance of infection, lowering pain, and decreasing problems that may happen after the procedure [10]. LLLT also speeds up tooth movement during orthodontic treatment [11], supports better healing of episiotomy wounds [12], and helps treat long-lasting wounds, especially in patients who cannot have surgery due to health issues like epilepsy or chronic hepatitis [13]. Another treatment option is using medications. Several types of drugs can help manage temporomandibular disorders (TMD). These medicines are usually not used alone but are often combined with other treatments, such as mouth splints or physical therapy [14]. Medication is often the first step in treatment and is commonly used alongside non-surgical methods. Different drugs can be used for TMD, including anti-inflammatory medicines (NSAIDs), muscle relaxants, and steroids. These drugs often work better when used together, helping reduce symptoms and stop the condition from worsening. Naproxen is

one of the most used NSAIDs for TMD. It has been shown to lessen pain and improve jaw movement [15]. Muscle relaxants are also used often in TMD treatment, as they help reduce the extra activity in the chewing and neck muscles. According to Shaffer et al., “physical therapy is the preferred conservative approach for treating TMD” [16], while pharmacological therapy remains a first-line treatment for myogenic TMJ disorders, its efficacy may be limited when used in isolation. Low-level laser therapy has shown promise in enhancing tissue healing and reducing pain. However, there is still a lack of high-quality comparative studies evaluating the combined use of LLLT and drugs versus drug therapy alone. This study seeks to address this gap by investigating the potential synergistic effects of these two approaches in the management of myogenic TMJ pain.

AIM

To compare the effect of low-level laser therapy combined with pharmacotherapy (naproxen + orphenadrine with paracetamol (myogestic)) and pharmacotherapy alone in treating myofascial pain related to temporomandibular joint.

MATERIALS AND METHODS

STUDY DESIGN

The present research was undertaken as a clinical trial to compare the effectiveness of different modalities in managing myofascial pain associated with TMJ.

PARTICIPANTS

The study recruited twenty-four myogenic patients referred for management of TMJ pain according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) in the age group 20-40.

INCLUSION CRITERIA

Patients with a history of pain in the TMJ of more than four weeks duration, a TMD diagnosis of myofascial pain as defined in the DC/TMD.

EXCLUSION CRITERIA INCLUDED

Patients younger than 18 or older than 40, patients with OPG showed joint degeneration, TMJ arthroscopy in the last four months, autoimmune disease, contraindications to drugs included in the study, or with trauma to TMJ area, and pregnant women are excluded.



Fig. 1. Quick Lase Soft Tissue Diode Laser device used in the LLLT sessions
Picture taken by the authors



Fig. 2. A patient undergoing low-level laser therapy targeting TMJ-related tender points
Picture taken by the authors

BASELINE ASSESSMENT

Pain was measured using a Visual Analog Scale (VAS), where zero was defined as the absence of pain and 10 was described as the severity of pain that can be

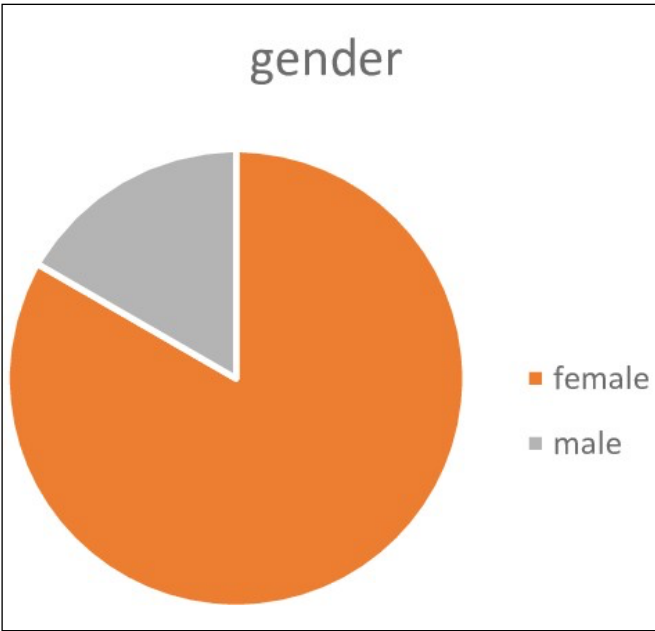


Fig. 3. Gender Distribution
Picture taken by the authors

imagined. Pain levels were documented at the baseline prior to treatment while MMO was measured by the interincisal distance were 40 mm and more count for normal mouth opening without restriction.

TREATMENT PROTOCOL

The clinical diagnosis was made using the DC/TMD criteria, based on the patient’s history and examination findings. Panoramic X-rays were taken to rule out major bone changes in the jaw joints and to exclude any dental conditions that could be causing the symptoms. However, the radiographs were not used for diagnosing TMD, as the DC/TMD system was followed for that purpose. Patients were advised not to take any painkillers, anti-inflammatory drugs, muscle relaxants, or medications affecting the nervous system during the treatment and evaluation period. They were asked to follow this instruction carefully. In addition, patients in both groups were encouraged to follow simple self-care practices like consuming soft foods and refraining from chewing gum and supporting the jaw when yawning.

LOW LEVEL LASER THERAPY

In this regard, LLLT was accomplished utilizing a Diode laser from Quick Lase Soft Tissue Diode Laser model QWLASER6D-12D (810+980nm) using the dual-wave-length which consider a 4th generation laser using the biostimulation handpiece, Fig. 1. The Quick Lase Soft Tissue Diode Laser device used in the LLLT sessions, the power is 0.4 w for each wavelength, during each session

the laser was directed towards previously demarcated tender spots around the TMJ. Within the muscles, Fig. 2. A patient undergoing low-level laser therapy targeting TMJ-related tender points, sessions were conducted three times per week for nine sessions.

PHARMACOLOGICAL TREATMENT

Naproxen 500 mg was prescribed twice daily to manage inflammation and pain.

Myogestic (a muscle relaxant) was administered three times daily to reduce muscle spasms and continued for 21 days

OUTCOME MEASURES

The outcome measure was a reduction in pain intensity and an increase in mouth opening.

ASSESSMENTS

The pain intensity is measured according to VAS four times the baseline record, after 10 days, at the end of treatment and after three months. MMO was measured in each time points

STATISTICAL ANALYSIS

All statistical analyses were performed using IBM SPSS Statistics software (30). Descriptive statistics were calculated for all relevant variables, including means, standard deviations, and medians. For inferential analysis, the normality of data distribution was assessed using the Shapiro-Wilk test. Between-group comparisons were conducted using the independent samples t-test for normally distributed variables and the Mann-Whitney U test for non-normally distributed variables. Statistical significance was determined at a p-value threshold of < 0.05 , and 95% confidence intervals were reported where appropriate.

ETHICS

The project was carried out after obtaining consent from the Laser Institute for Postgraduate Studies, University of Baghdad, on January 22, 2025 (approval number103). The research was performed in accordance with Helsinki Declaration of the World Association of Physicians and the principles of Correct Clinical Trial Guidance (Guidelines for Good Clinical Practice). Participation in the project was voluntary. Patients had obtained comprehensive information about the nature, scope of clinical activities and the course of the proceedings.

At each stage, the respondents had the right to refuse to participate in the study, without any corresponding consequences. Participation in the study was preceded by the patient's written informed consent.

AI STATEMENT

The author states that no AI tools were used in writing this article.

RESULTS

A total of 24 patients were included in this comparative analysis, divided equally into two groups: Drug group ($n=12$) and Combination group (Low-Level Laser Therapy combined with drugs; $n=12$).

AGE DISTRIBUTION

The mean age of participants in the drug group was 28.92 years ($SD = 5.53$), while the combination group had a slightly higher mean age of 29.33 years ($SD = 5.07$). An independent samples t-test was conducted to compare the age between the two groups. Levene's test indicated homogeneity of variances ($F = 0.442$, $p = 0.513$), Table 1, allowing for the assumption of equal variances. The t-test revealed no statistically significant difference in age between the drug and combination groups, $t(22) = -0.192$, $p = 0.849$ (two-tailed), with a mean difference of -0.417 years (95% CI: -4.91 to 4.08). Effect size estimates were also calculated, Cohen's d was -0.079, Hedges' g was -0.076, and Glass's delta was -0.082, all indicating a negligible effect size. These results suggest that the two groups were comparable in terms of age, and age is unlikely to have confounded the primary outcome comparisons in this study.

GENDER DISTRIBUTION

Out of 24 participants, 20 were female 83.3% and 4 were male 16.7%. In the Drug group, 9 participants were female and 3 were male, while in the Combination group, 11 participants were female and only 1 was male, Table 2. A chi-square test of independence showed no statistically significant difference in gender distribution between the two groups ($\chi^2 = 1.200$, $df = 1$, $p = 0.273$). Fisher's Exact Test further confirmed the lack of significant association $p=0.590$. These findings suggest that gender distribution was statistically comparable between the Drug and Combination groups, allowing unbiased assessment of treatment effects across groups, Fig.3.

Table 1. Age Distribution by Group

	N	Mean Age (years)	Standard Deviation	p-value
Drug	12	28.92	5.53	0.849
Combination	12	29.33	5.07	

Source: compiled by the authors of this study

Table 2. Gender distribution in the drug and combination therapy

Group	Female (n)	Male (n)
Drug	9	3
Combination therapy	11	1

Source: compiled by the authors of this study

Table 3. Mann-Whitney U Test Results for VAS Scores (Drug vs. Combination)

Time Point	Mann-Whitney U	Z Score	p-value	Interpretation
Baseline	58.000	-0.914	0.361	No significant difference
10 Days	0.000	-4.231	< 0.001	Highly significant difference
21 Days	0.000	-4.320	< 0.001	Highly significant difference
3 Months	0.000	-4.246	< 0.001	Highly significant difference

Source: compiled by the authors of this study

Table 4. Median MMO and IQR values for Drug and LLLT groups with corresponding test results

Time Point	Drug Group (Median, IQR)	Combination therapy Group (Median, IQR)	Test Used	p-value
Baseline	38.5 (1)	39.0 (2)	Mann-Whitney U	0.759
10 Days	39.5 (3)	41.50 (3)	Mann-Whitney U	0.007
21 Days	40.5 (2)	44.50 (3)	Mann-Whitney U	<.001
3 Months	39.5 (2)	45.00 (3)	Mann-Whitney U	<.001

Source: compiled by the authors of this study

VAS SCORES

The normality of the data was assessed using the Shapiro-Wilk test. The results showed that the pain scores (VAS) were not normally distributed in either the drug or LLLT groups at most time points ($p < 0.05$).

Due to this violation of normality and the relatively small sample size, non-parametric tests were used. Specifically, The Mann-Whitney U test was used to compare VAS scores between the two groups at each time point.

VAS SCORES OVER TIME

The Visual Analogue Scale (VAS) was used to assess pain levels at four time points: baseline, 10 days, 21 days, and 3 months after treatment. The Mann-Whitney U test was applied to evaluate differences between the Drug and Combination groups, Table 3.

The results indicate that although baseline pain scores were comparable, patients receiving the combination therapy (LLLT + pharmacotherapy) showed significantly greater reductions in VAS scores at all follow-up periods. These findings suggest superior and sustained pain

relief in the combination group compared to drug therapy alone.

MMO SCORES

The normality of MMO data was assessed using the Shapiro-Wilk test. The results indicated that MMO values in the drug and LLLT groups were not normally distributed at several time points ($p < 0.05$). Therefore, the non-parametric Mann-Whitney U test was used for group comparisons. Descriptive statistics are reported using the median and interquartile range (IQR), which are more appropriate for skewed data.

MMO SCORES OVER TIME (MEDIAN AND IQR)

At baseline, there was no significant difference between the drug group (Median = 38.5 mm, IQR = 1) and combination therapy group (Median = 39.0 mm, IQR = 2) with a p-value of 0.759. By day 10, the combination therapy group showed more significant improvement (Median = 41.50 mm, IQR = 3) than the drug group (Median = 39.5 mm, IQR = 3), $p = 0.007$. At 21 days,

the combination therapy group continued to improve (Median = 44.50 mm, IQR = 3) versus the drug group (Median = 40.5 mm, IQR = 2), $p = <.001$. At 3 months, the combination therapy group maintained better outcomes (Median = 45.0 mm, IQR = 3) than the drug group (Median = 39.5 mm, IQR = 2), $p = <.001$, Table 4.

These findings demonstrate that the Combination therapy group experienced significantly greater improvements in MMO across all post-treatment time points compared to Drug therapy alone, supporting the effectiveness of combining Low-Level Laser Therapy with pharmacological treatment in managing myogenic TMJ pain.

DISCUSSION

The participants in this study were between 20 and 40 years old. According to epidemiological data, TMDs are most commonly seen in individuals aged 18 to 44 [5], with a noticeably higher occurrence in this age group compared to older adults. [17]; the gender prevalence was female over male with 71% female participant as found by Reny de Leeuw [18], the analysis revealed no significant differences in baseline demographic variables, including age and gender, confirming homogeneity between the LLLT and drug groups. The present study compared the effectiveness of combining Low-Level Laser Therapy (LLLT) with pharmacologic therapy against pharmacotherapy alone in treating myogenic pain related to temporomandibular joint disorders (TMD). Pain intensity was assessed using the Visual Analog Scale (VAS), while mandibular mobility was evaluated through maximum mouth opening (MMO) measurements. The combination therapy group demonstrated a significantly greater and sustained reduction in pain scores across all post-treatment intervals (10 days, 21 days, and 3 months), while both groups had similar baseline VAS scores, which aligns with a systematic review by Melis et al. reported higher efficacy of LLLT in alleviating temporomandibular joint [19]. Similarly, a study by Emshoff et al. found that LLLT significantly reduced pain intensity in TMD patients combination therapy resulted in a more significant and faster reduction in VAS pain scores than pharmacologic treatment at all follow-up intervals, a finding that corroborates several recent randomised controlled trials. like Shobha et al. found significant within-group pain reductions following diode laser treatment in TMD patients, the body of evidence favours LLLT for its analgesic and anti-inflammatory effects, which are thought to occur via photobiomodulation, mitochondrial activation, and modulation of proinflammatory cytokines [20]. These mechanisms may underlie the sustained reduction in myofascial pain observed in the present study. A meta-analysis found that wavelengths of 780

nm and 830 nm—which were also used in our present study—were most effective, producing moderate to large effect sizes (up to -1.72) in reducing pain. These wavelengths are thought to penetrate deeply into soft tissue (1–5 cm), making them particularly suited for treating deep joint or masticatory muscle pain [21]; in addition to pain relief, the current results showed that combination therapy significantly improved maximum mouth opening. The study results agree with the findings of Ahmad et al. (2021), whose systematic review noted functional improvements, including increased MMO, in several randomised trials utilising LLLT for TMJ-related pain [22]. Patients treated with drugs showed an improvement in pain and mandibular function during the treatment, but this result collapsed after treatment terminated. The early but moderate pain reduction observed in the drug group is consistent with previous literature demonstrating the effectiveness of NSAIDs in managing acute TMD-related pain [23]. However, the limited long-term improvement aligns with the known limitations of NSAIDs in chronic or myogenic TMD cases, as their anti-inflammatory action may not address more profound muscular dysfunction. Therefore, combining both modalities offers significantly superior outcomes compared to drug therapy alone in the management of myogenic (TMJ) pain. Patients in the combination group experienced greater and more sustained reductions in pain, along with notable improvements in mandibular mobility, as reflected by Visual Analogue Scale (VAS) and Maximum Mouth Opening (MMO) scores. These findings support the integration of LLLT as an effective, non-invasive adjunct to conventional pharmacological management, particularly for patients with limited response to medication alone. By addressing both inflammatory and neuromuscular mechanisms, combination therapy provides a more comprehensive treatment strategy for TMJ disorders. Future studies with larger sample sizes and long-term follow-up are warranted to validate these results and establish standardized treatment protocols involving LLLT in routine clinical practice

CONCLUSIONS

These results indicate that Low-Level Laser Therapy with pharmacotherapy was more effective than pharmacological therapy in decreasing pain and improving jaw function in patients with TMJ-related myogenic pain. These findings suggest that LLLT may be considered a useful, non-invasive adjunct to conventional pharmacological management of myogenic TMJ pain. Further studies with larger sample sizes and longer follow-up are recommended to confirm these findings and support routine clinical use.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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