

## REVIEW ARTICLE

**Effectiveness of Low Level Laser Therapy in the Management of Temporomandibular Joint Disorders: A Review**P Sneha Balakrishnan<sup>1</sup>, Lino George Kurian<sup>2</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT**

TMJ (temporomandibular joint) disorders are condition that can manifest with symptoms jaw pain or tenderness, clicking or popping sounds in the jaw, difficulty chewing or opening the mouth, and headaches. While the classic presentation of TMJ Disorders involves deficits, it is essential to recognize the effectiveness of low level laser therapy in the management of temporomanadibular joint disorders. This manuscript comprehensively reviews the literature examining the effectiveness of low level laser therapy in the management of TMJ disorders. A thorough search of Pubmed and Google Scholar was conducted to identify relevant articles published between 2014 and 2024. Six studies were selected for analysis, illustrating various interventions in TMJ disorders. It may lead to the timely diagnosis and physiotherapy management in TMJ disorders. Further research is warranted to elucidate the underlying mechanisms and optimal physiotherapy treatment strategies like low level laser therapy in the management of temporomandibular joint disorders.

**KEYWORDS**

- Physiotherapy • Low level laser therapy • TMJ joint disorders

**INTRODUCTION**

The temporomandibular joint is a bicondylar joint with an articular depression as the socket and movable, spherical condyles as the upper end. A fibrocartilaginous disc facilitates easy movement and serves as a cushion during

opening and closing of the mouth. Controlling the movements is aided by strong muscles that are linked to the joint. The masseter muscle seals the lips, and the temporalis aids in raising the temporal bone. There are three degrees of freedom in the joint, and each degree of freedom is connected to a different axis of rotation.

**AUTHOR'S AFFILIATION:**

<sup>1</sup> Associate Professor, Department of Physiotherapy, St John's Medical College, Bangalore, India.

<sup>2</sup> BPT Intern, Department of Physiotherapy, St John's Medical College, Bangalore, India.

**CORRESPONDING AUTHOR:**

**Lino George Kurian**, BPT Intern, Department of Physiotherapy, St John's Medical College, Bangalore, India.

**E-mail:** snehapt@gmail.com

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The TMJ has two main movements: rotation and anterior translation. Other probable TMJ movements include mediolateral translation and posterior translation.<sup>1</sup>

There are several issues pertaining to this joint, collectively referred to as temporomandibular disorders (TMD). The most prevalent conditions affecting the TMJ are traumas, internal derangements, arthritis, and pain dysfunction syndrome. The causes of TMD include rheumatoid arthritis, osteoarthritis, and direct injuries to the jaw joint or disc displacement. Flattening of the bones, popping or clicking sounds, disc displacement, pain, restricted motion, and occasionally the joint appearing locked when trying to open the mouth are the indications and symptoms of TMD. Physical therapy, surgery, and nonsurgical treatment are available for TMJ disorders. Splints are employed in non-invasive medical procedures. In cases of complex conditions, surgery is performed. Patients with TMJ disorders might also benefit from physical therapy to reduce stiffness, relieve discomfort, and regain mobility after arthroscopy, discectomy, arthrocentesis, and joint replacement procedures. When performing range-of-motion exercises, such as jaw opening and closing, a little bit more pressure is applied to fully open the mouth. Additional activities for treating TMD pain include extending the jaw muscles with a variety of facial expressions and using a moist heat or cold pack.<sup>3,4,5</sup>

Master and associates introduced low level laser treatment as a therapeutic approach, and it has been utilized to treat temporomandibular disorders by reducing symptoms by applications of low energy ruby laser. Due to data that suggests low intensity lasers may be a biomodulating form of electromagnetic radiation that promotes healing, its use in rehabilitation has been advised. When applied to the skin that covers the affected nerve or nerves that innervate the area, it also exerts analgesic effects. Low level laser therapy has the following physiological effects: increased levels of beta-endorphin in spinal fluid, increased excretion of glucocorticoids in the urine, increased pain threshold via an electrolytic nerve fiber blocking mechanism, decreased release of histamine and acetylcholine, decreased synthesis of bradykinin, increased production

of ATP, improved local microcirculation and lymphatic flow, which reduces edema.<sup>6</sup>

One noninvasive, non-pharmacological therapeutic option that has demonstrated promise for treating TMD pain is low level laser therapy. It has been demonstrated to increase joint mobility by altering secondary nerve inhibitor, which is brought on by overactive sensory receptors within the joint, and to have an anti-inflammatory action on the C nerve fibers around the TMJ. In general, LLLT has biostimulative, regenerative, and analgesic effects. This literature study thus aims to determine the efficacy of low level laser therapy in temporomandibular joint problems with respect to pain relief and function improvement.<sup>7</sup>

## OBJECTIVE

To review the effectiveness of low level laser therapy in the treatment of temporomandibular joint disorders like pain, arthritis and joint stiffness.

## METHODOLOGY

### SEARCH STRATEGY

A web search for studies from 2014-2024 was conducted in databases PubMed and Cochrane Library. Articles were identified using keywords such as temporomandibular joint disorders, low level laser therapy or LLLT, pain relief or pain management. Type of study is Literature Review.

### STUDY SELECTION

#### *Inclusion criteria*

Types of studies: randomized controlled trials, systematic review, meta-analysis. Timeline: articles published from 2014 to 2024.

Eligible research articles were selected based on specific criteria defined by the PICOS tool. The inclusion criteria were as follows: (1) Article in English language. (2) Low level laser as sole intervention or combination with other forms of Physical therapy.

#### *Exclusion criteria*

1. Articles published in languages other than English.
2. Articles where full text was not available.

## PROCEDURE

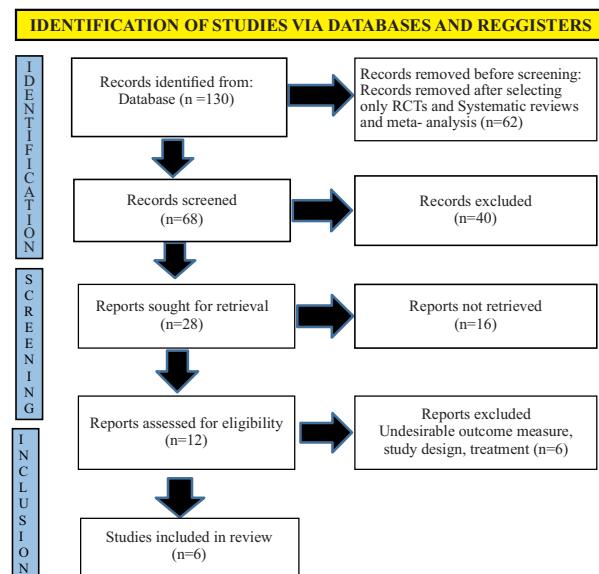
A web based literature source was done and the database included was PubMed and Cochrane Library. The search aimed to yield studies which establish The Effectiveness of Low Level Laser Therapy in the Management of Temporomandibular Joint Disorders. A search strategy was developed to establish the same using the keywords. Randomized controlled trials, systematic review and meta-analysis were included. Timeline chosen was from 2014 -2024.

130 articles were found during the search. Following a screening of the titles and inclusion criteria, 6 articles were kept and included in this evaluation.

Our primary aim was to find out the Effectiveness of Low Level Laser Therapy in the Management of Temporomandibular Joint Disorders. The articles were further assessed based on objectives and data was analyzed and explored. The included articles will be studied in detail and a critical appraisal will be done.

## RESULTS

### Prisma Flowchart



## LITERATURE REVIEW

*Aharari (2014)* conducted a study on the efficacy of low-level laser therapy for the treatment of myogenous temporomandibular joint disorder. In this double-blind, randomized

clinical trial, 20 female patients with myogenic TMD, such as myofacial pain and limited mouth opening, were assigned to receive a laser or a placebo. For four weeks, a pulsed 810-nm low intensity laser was applied three times a week to sore muscles in the laser group. The laser group's therapy was administered to the placebo groups as well, however there was no energy output. The degree of pain and the amount of mouth opening were measured in each of the patients' evaluations prior to laser therapy, six laser application sessions, treatment completion, and one month following the final application. In the laser group, there was a substantial decrease in pain feelings and a significant increase in mouth opening ( $p<0.05$ ). The placebo group did not show a comparable improvement ( $p>0.05$ ). At all evaluation time points, there was no discernible difference in the measurement of mouth opening or pain severity between groups ( $p>0.05$ ). For those with myogenic TMD, LLLT can result in a notable improvement in pain threshold and mouth opening.<sup>1</sup>

*S. yanik (2020)* conducted a randomized controlled study of low-level laser therapy (LLLT) improved the clinical outcomes of patients with temporomandibular joint osteoarthritis (TMJ-OA) compared with arthrocentesis alone. The visual analogue scale scores (VAS 1, VAS 2) for different treatment outcomes and millimetric measures of mandibular movements during the short and long term were the outcome variables. Both groups saw significant short and long-term improvements, according to intragroup comparisons, but both groups' long-term results outperformed their short-term ones. Furthermore, Group 2 had higher gains in mandibular motions and muscle palpation ratings compared to Group 1. those with non-reducible disc dislocation have been demonstrated to benefit more with arthrocentesis than those with other internal derangements. Two other beneficial clinical outcomes have included a decrease in discomfort and an increase in maximal mouth opening. In TMJ-OA, the benefits of arthrocentesis include a reduction in pain and an increase in the mandibular range of motion. However, despite its widespread use to treat TMDs, its effectiveness is likely to be temporary.<sup>2</sup>

**Camila Haddad Leal de Godoy (2017)** conducted a randomized controlled study of topic Effect of Low-Level Laser Therapy on Adolescents With Temporomandibular Disorder. The purpose of this pilot study was to assess how low-level laser therapy affected the mandibular motions, occlusal contacts, and discomfort in young adults and adolescents with temporomandibular dysfunction. People in the 14–23 age range were assessed. To diagnose temporomandibular disorders, the Research Diagnostic Criteria for Temporomandibular Disorders were employed. A visual analog scale was used to measure pain. After low-level laser therapy, there were no statistically significant changes in pain, mandibular range of motion, or occlusal contact distribution. To confirm that low-level laser therapy is not effective, these early results must be confirmed in a larger sample of patients.<sup>9</sup>

**Gang Zhu XU (2018)** conducted a meta analysis study on the use of low level laser therapy for temporomandibular joint. Practical guidelines for clinical physicians treating patients with TMD were given by the study's results. The visual analogue scale score, which represents pain severity, served as the primary outcome measure. The secondary outcomes in the LLLT and placebo groups were quality of life, psychological satisfaction, adverse effects, pressure pain threshold, joint sounds, tinnitus, electromyographic activity, and changes in TMJ function between the baseline and follow-up oral function. For every study, data extraction was done from the longest follow-up period. The modified Jadad scale was used to evaluate the methodological quality of all included research. 31 distinct RCTs were included after statistical analysis.<sup>3</sup>

**Basili M (2017)** conducted a study on low-level laser therapy in the treatment of muscle-skeletal pain in patients affected by temporomandibular disorder. The goal of the research was to determine whether low-level laser therapy could effectively relieve patients' acute and chronic temporomandibular dysfunction-related joint and muscle discomfort. 180 patients were selected as a sample for the investigation. The VAS scale was applied to each patient in three periods, according to the study protocol: immediately after the initiation of laser therapy, after 15 days, and 30 days later. It was recommended to all patients that they refrain from using anti-inflammatory and pain medications for the length of their treatment.<sup>4</sup>

**De Godoy CH (2015)** conducted a blind randomized controlled pilot study on effect of low level laser therapy on adolescents with temporomandibular disorder. For this project, participants were selected from Novo de University's undergraduate and graduate departments, consisting of both male and female teenagers and young adults. Ages 14 to 23 years old, a diagnosis of TMD defined as myofascial pain according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDS-TMD), and a signed informed permission statement were the inclusion criteria. Dentofascial malformations, permanent dentition lacking the second molars, orthodontic or orthopedic treatment of the jaws, psychiatric treatment, physical therapy, and the use of muscle relaxants, anti-inflammatory drugs, or bite plates were the exclusion criteria. The process began with a TMD diagnosis, followed by assessments of the mandibular range of motion, discomfort, and the distribution of occlusal contacts. Following every assessment, they made use of low level laser therapy. For six weeks, two weekly laser application sessions were conducted (for a total of 12 sessions). With a wavelength of 780 nm, an energy density of 1.67W/cm<sup>2</sup>, and a 20-second exposure period each point, the laser's parameters yielded a total energy of 1J per point. Using a conventional tip and a beam spot of 0.04 cm<sup>2</sup>, point application in direct contact with the skin was performed in accordance with the Veneizian and Carvallho procedure. On each side of the face, one point on the anterior temporal muscle and three spots on the masseter muscle (superior, medial, and inferior bundles) were targeted by the laser. A recording of the noises the device made was used for the placebo treatment, and all other equipment was switched off. Throughout the course of the 12 sessions, the participants in both the treatment and placebo groups reported feeling their muscles relax and become more sensitive. Nonetheless, there were no significant variations in muscle sensitivity between the pre and post-treatment assessments, with the exception of the right masseter muscle's superior bundle in the LLLT group. The placebo group showed a non-significant increase in maximal mouth opening. Following several of the sessions, the placebo group in this study also reported feeling less sensitive to pain.<sup>5</sup>

## SUMMARY OF LITERATURE REVIEW

Aharari (2014) conducted a study on the efficacy of low-level laser therapy for the treatment of myogenous temporomandibular joint disorder with CASP score 7.<sup>1</sup> S.yanik (2020) conducted a randomized controlled study of low-level laser therapy (LLLT) improved the clinical outcomes of patients with temporomandibular joint osteoarthritis (TMJ-OA) compared with arthrocentesis alone with CASP score 7.<sup>2</sup> Camila Haddad Leal de Godoy(2020) conducted a randomized controlled study of topic Effect of Low-Level Laser Therapy on Adolescents With Temporomandibular Disorder, CASP score 7.<sup>9</sup> Gang Zhu XU (2018) conducted a meta analysis study on the use of low level laser therapy for temporomandibular joint, CASP score 7.<sup>3</sup> Basili M (2017) conducted a study on low-level laser therapy in the treatment of muscle-skeletal pain in patients affected by temporomandibular disorder,CASP score 7.<sup>4</sup> De Godoy CH (2015) conducted a blind randomized controlled pilot study on effect of low level laser therapy on adolescents with temporomandibular disorder with a CASP score 6.<sup>5</sup>

## DISCUSSION

This Clinical trials have examined and employed low level laser therapy (LLLT) for the management of various acute and long-term musculoskeletal ailments, degenerative diseases, and wound healing. Biostimulative,

regenerative, analgesic, and anti-inflammatory are the main effects of LLLT. There is debate over the relative clinical effectiveness of LLLT in treating TMD. For this investigation, six articles were gathered.

Low intensity laser therapy was used as an intervention in all trials, either with or without medication. The trials' findings showed that LLLT was useful in lowering TMD pain. De Goadoy CH et al. attribute the analgesic and anti-inflammatory properties to the synthesis of bradykinin, reduction in histamine and acetylcholine secretion, increase in beta endorphin production, and increase in adenosine triphosphate production.<sup>5</sup>

These actions can lead to muscle relaxation and an increase in blood microcirculation, which in turn relieves pain. Pain symptoms described by patients with both acute and chronic DTM5 have significantly improved, according to research done by Basili M et al.<sup>4</sup> Every study discovered a sharp decline in tender sites, and pain severity. Following a decrease in pain intensity, all patients with temporomandibular disorders also had an increase in their active range of motion.

The fact that LLLT is non-invasive, affordable, and has no known adverse effects makes it a good choice for treating TMD. S. Yanik carried out, and the findings indicate that while the approach reduced joint discomfort and function, it also appeared to assist myofascial components when combined with LLLT.<sup>2</sup>

Author	Intervention	Benefits	Level of Evidence
Aharari F (2014)	The patients were randomly assigned to either a laser group or a placebo group. In the laser group, patients → received treatment using a pulsed 810-nm low-level laser with specific parameters: average power of 50 mW, peak power of 80 W, frequency of 1,500 Hz, duration of 120 seconds per session, delivering 6 J per point, and a dosage of 3.4 J/cm <sup>2</sup> per point. Treatment → sessions occurred three times a week over a period of 4 weeks. Conversely, the placebo group underwent identical procedures but without any actual energy output from the laser device.	The results of the study demonstrated significant improvements in both pain levels and mouth opening among patients in the laser treatment group. → Evaluation points → included measurements taken before laser therapy initiation, after 6 sessions of laser application, at the end of the 4-week treatment period, and 1 month following the conclusion of treatment.	LEVEL II
S. yanik (2020)	The study compared two treatment groups: Group 1 receiving arthrocentesis alone and Group 2 receiving → both arthrocentesis and LLLT.	Both treatment groups (Group 1 and Group 2) demonstrated significant → short-term and → long-term improvements in pain reduction and functional outcomes (VAS scores). This indicates that both arthrocentesis alone and arthrocentesis combined with LLLT are effective in alleviating pain and improving → → functional abilities → in → TMJ-OA patients.	LEVEL II

Table cont...

Author	Intervention	Benefits	Level of Evidence
Camila Haddad Leal de Godoy (2020)	The study aimed to assess changes in mandibular motions, → occlusal contacts, and discomfort following → LLLT treatment. Participants included individuals aged 14 to 23 years who were diagnosed → with temporomandibular disorders → using the Research → → Diagnostic Criteria → for Temporomandibular Disorders. → → → The intervention involved the application → → of LLLT according → to → → specified parameters.	The study did not observe statistically significant changes in pain levels measured using a visual analog scale (VAS) following LLLT treatment. This suggests that LLLT did not → significantly alleviate pain symptoms in adolescents with TMD within the study's parameters.	LEVEL I
Gang Zhu Xu(2018)	The → study → aimed → to provide → practical guidelines for clinical physicians → treating patients with TMD based on the accumulated evidence → → from randomized controlled trials (RCTs).	The → study → aimed → to provide → practical guidelines for clinical physicians treating patients with TMD based on the accumulated evidence from → randomized controlled trials (RCTs).	LEVEL I
Basili M(2017)	The study aimed to evaluate whether LLLT could effectively alleviate acute and chronic discomfort in the temporomandibular joint (TMJ) and associated muscles.	The primary outcome measure, assessed using the VAS scale, showed significant reductions in pain → perception immediately → → after initiation of LLLT, as well as at follow-up assessments after 15 days and 30 days. This indicates that LLLT effectively reduces both acute and chronic pain associated with TMD.	LEVEL II
De Godoy (2015)	LLLT treatment involved sessions conducted twice weekly over six weeks, totaling 12 sessions. The laser parameters included a wavelength of 780 nm, energy density of 1.67 W/cm <sup>2</sup> , and 20-second exposure per point, delivering 1 J of energy per point. Laser application → targeted specific points on the anterior temporal and masseter muscles using a conventional tip and direct contact method.	Participants in both the LLLT treatment and placebo groups reported subjective feelings of muscle relaxation and increased sensitivity throughout the 12- session → treatment period. → However, statistically significant variations in muscle sensitivity were not observed between pre-and post-treatment assessments, except for a significant decrease noted in the right masseter → → muscle's superior bundle in the LLLT group.	LEVEL II

## CONCLUSION

The purpose of this review of the literature was to investigate the effectiveness of low-level laser therapy in the treatment of temporomandibular disorders discomfort. For this investigation, seven articles were gathered. Low intensity laser therapy was used as an intervention in all trials, either with or without medication. The VAS scale was one of the outcome measures used in every study. They conducted the study after splitting the patients into two groups in the majority of the cases.

Three studies of level 1b, one study of level 1a, one study of level 2b, one study of level 2a, and one research of level 3b evidence are included in this literature review. All of the trials demonstrated that patients with temporomandibular disorders who received low level laser therapy experienced a significant improvement in both mouth opening and pain severity. For this reason,

LLLT is a good non-invasive treatment option for temporomandibular joint discomfort.

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