

# Efficacy of low-level laser therapy in temporomandibular disorders: A systematic review

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## ABSTRACT

**Purpose:** The aim of this systematic review was to assess the efficacy of low-level laser therapy (LLLT) in patients with temporomandibular disorders (TMDs). **Methods:** Medline search was done from 1997 to 2011 using search terms appropriate to establishing a relation between LLLT and TMD. Only randomized controlled trials were included in this study. Outcome variables related to pain, muscle tenderness, mandibular movements, and Electromyographic (EMG) activity were considered. Of the 242 articles examined, 13 were finally included in the critical analysis conducted as a part of the present systematic review. **Results:** Of the 242 titles reviewed, only 13 articles were considered eligible. 7 articles showed significant improvement in the study group, whereas 5 showed no significant improvement between the study and control groups. The primary outcome of most of the studies was pain. Other variables considered were muscle tenderness, mandibular movements; EMG activity was considered. **Conclusion:** Our results have shown that LLLT seems to be effective in reducing pain in TMD's. It may be a treatment option for patients with an interest in a noninvasive, complementary therapy.

**Key words:** Low-level laser therapy, mandibular movements, temporomandibular disorders

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## INTRODUCTION

Temporomandibular disorder (TMD) or craniomandibular disorders is a collective term embracing a number of clinical problems that involve the masticatory muscles, the temporomandibular joint and associated structures, or both.<sup>[1]</sup> There are different types of treatments for TMDs. Low-level laser therapy (LLLT) (a form of physical therapy) has been used to reduce signs and symptoms of patients with TMDs, but the effectiveness has still not been totally explained. The basic effects of (LLLT) are biostimulative, regenerative, analgesic, and anti-inflammatory. Thus, the purpose of this systematic review was to evaluate the efficacy of LLLT, and

summarize the evidence from, randomized controlled trials (RCTs) that examined the effectiveness of LLLT intervention in the management of TMD.

## METHODS

### Search strategy for identification of the studies

This search strategy was in accordance with the Cochrane guidelines for systemic review. For identification of studies included or considered for this review, MEDLINE search was done using the combination of controlled vocabulary and free text terms. RCTs of LLLT for treating TMDs were included from January 1997 to December 2010.

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Studies carried out in animal models and studies other than RCT's were excluded. Primary outcome was pain relief with laser therapy in all the articles was assessed using visual analog scale.

### Study selection

Titles and abstracts of identified studies were assessed independently to judge if the studies match the inclusion criteria. If it was clear that the study did not refer to an RCT on the treatment of TMD, we excluded it. If it was unclear, then we obtained the full text of the study for assessment.

### Data extraction and management

Data were abstracted on first author, year of publication, number of cases, study design, outcomes, and results. The data were extracted and double-checked.

## RESULTS

The search identified 242 publications, of which 204 were excluded after reviewing the title or abstract. 33 studies were retrieved for further detailed evaluation resulting in the exclusion of another 20 studies as they did not fulfill the requirement for the inclusion criteria. In the end, 13 studies were considered potentially appropriate to be considered for this review [Figure 1]. Out of the selected 13 studies, 7 indicated the superiority of LLLT over placebo, whereas remaining 6 had no significant differences between real and placebo groups in relation to pain. This review found that there was some evidence supporting that LLLT is effective in reducing pain due to TMDs.

## DISCUSSION

This systematic review examines the evidence from RCTs regarding the efficacy of LLLT for TMDs. Only 13 RCT of LLLT for TMDs met the inclusion criteria for this

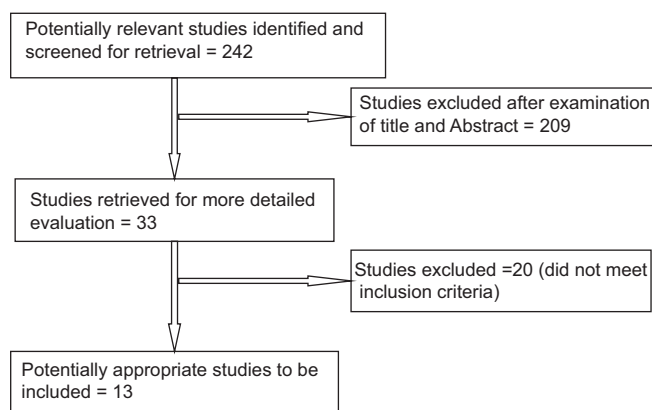


Figure 1: Flow diagram of the selection data process

review [Table 1]. However, the risk of bias in these studies was unclear across several of the domains assessed. In four studies, the number of patients was considered too low to allow generalized result out of which three showed that LLLT is efficacious in significant reduction of pain which was the primary outcome. In the study by Katsoulis *et al.*,<sup>[2]</sup> sample size was 11. The authors have justified the low number of participants included in the study explaining that many patients seen at the clinic were referred patients who have already been treated had to be excluded from his study. He has concluded that low-level laser has no detrimental effect on the patients and could be an option for patients interested in noninvasive therapy. Carrasco *et al.*<sup>[3]</sup> divided 14 patients into two groups (active and placebo) and concluded that low-intensity laser application is effective in reducing TMD symptoms, and also has influence over masticatory efficiency. Shirani *et al.*<sup>[4]</sup> conducted the study on 16 patients and concluded that LLLT is an effective treatment for pain reduction. Conti<sup>[5]</sup> too had only 20 patients as sample and his conclusion was no significant differences between real and placebo groups.

Out of the remaining nine studies, four showed significant improvements in the study groups regarding pain. In the study by Mazzetto *et al.* (2010),<sup>[6]</sup> LLLT was effective in the improvement of the range of mandibular lateral movements and caused a significant reduction of pain symptoms. In the study by Venezian *et al.*<sup>[7]</sup>, LLLT was effective in reducing the pain, but no differences were found when electromyography activity was. Mazzetto *et al.*<sup>[8]</sup> found that LLLT effectively promoted significant reduction in the pain. A study by Marini *et al.*<sup>[9]</sup> proved the effectiveness of LLLT in the treatment of pain, which was demonstrated by a significant improvement in clinical signs and symptoms of temporomandibular joint disc displacement without reduction and osteoarthritis at the end of treatment. In the studies by da Cunha *et al.*, Emshoff *et al.* and Venancio *et al.*,<sup>[10-12]</sup> laser therapy was not better than placebo at reducing TMJ pain. Öz *et al.*<sup>[13]</sup> demonstrated that low-level laser therapy is as effective as occlusal splint in pain release and mandibular movement improvement. A study by Kulekcioglu *et al.*<sup>[14]</sup> reported significant improvement in mandibular functions in comparison to placebo group. The weakest point of this review is the heterogeneity in the procedures of the treatment and within the patient sample. Heterogeneity may also increase with the differences in numbers and frequencies of the treatment sessions. However, the majority of trials involved treatment for 3–4 weeks, and only two trial treated for 2 weeks and measured the effect of LLLT,<sup>[7,9]</sup> whereas there were two studies which involved treatment till 8 weeks.<sup>[8,11]</sup> The literature on LLLT is full of reports that are conflicting, and much of this is caused by the lack of dosage consensus.<sup>[15]</sup>

**Table 1: Characteristics and details of included studies**

First author	Journal and year	Sample	Age/sex	Study design	Outcome measures and result
Measurements of jaw movements and TMJ pain intensity in patients treated with GaAIA's laser Mazzetto	Braz Dent J, 2010	n = 40 Group 1 = 20 (study group) Group 2 = 20 (control group - placebo)	Not specified	RCT	Significant improvement in study group ( $P < 0.01$ ) VAS, mouth opening, mandibular excursions Decrease in pain in study group Increase in mouth opening in study group Improved mandibular excursions
Low-level laser effects on pain to palpation and EMG activity in TMD patients: A double-blind, randomized, placebo-controlled study Venezian	Cranio, 2010	n = 48 Group 1 = 24 (study group) Group 2 = 24 (control group - placebo)	Not specified	RCT	Pain to palpation and EMG activity Statistically significant reductions in pain study group No significant statistical differences in the EMG activity between the groups
Laser acupuncture for myofascial pain of the masticatory muscles. A controlled pilot study Katsoulis	Research and Sci, 2010	n = 11 Group 1 = 4 (verum open) Group 2 = 3 (verum blind) Group 3 = 4 (control group - placebo)	Age = 18–70 Female = 10, male = 1	RCT	The pain reduction on the VAS in Group 1 (verum open) was >50% for all four patients, in Group 3 (placebo blind) for three of four patients, and in Group 2 (verum blind) all remained under 50%
Low-intensity laser therapy in TMD: A phase II double-blind study Carrasco	Cranio, 2008	n = 14 Group 1 = 7 (study group) Group 2 = 7 (control group - placebo)	Not specified	RCT	Pain: Statistical tests revealed significant differences at 1% likelihood in study group Masticatory behavior: Both groups presented similar masticatory behavior, and no statistical differences were found
LLLT and myofascial pain dysfunction syndrome: A randomized controlled clinical trial Shirani	Laser Med Sci, 2009	n = 16 Group 1 = 8 (study group) Group 2 = 8 (control group - placebo)	Not specified	RCT	Pain: LLLT was more effective ( $P = 0.031$ )
Efficacy of LLLT in the treatment of TMD da Cunha	Int Dent J, 2008	n = 40 Group 1 = 20 (study group) Group 2 = 20 (control group - placebo)	Female = 39, male = 1	RCT	No significant differences were observed regarding VAS and CMI ( $P > 0.05$ )
LLLT for treatment of temporomandibular joint pain: A double-blind and placebo-controlled trial Emshoff	Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 2008	n = 52 Group 1 = 26 (study group) Group 2 = 26 (control group - placebo)	Group 1 Female = 22, male = 4 Age = $44.1 \pm 16.6$ Group 2 Female = 20, male = 6 Age = $41.8 \pm 11.2$	RCT	Pain = Between group differences were not highly evident ( $P > 0.05$ )
Low-intensity laser application in TMDs: A Phase I double-blind study Mazzetto	Cranio, 2007	n = 48 Group 1 = 24 (study group) Group 2 = 24 (control group - placebo)	Not specified	RCT	Decrease in the pain level mainly for the active probe
Low-intensity laser therapy in the treatment of TMDs: A double-blind study Venancio Rde	J Oral Rehabil, 2005	n = 30 Group 1 = 15 (study group) Group 2 = 15 (control group - placebo)	Group 1 Female = 13, male = 2 Mean age = 34.9 Group 2 Female = 12, male = 3 Mean age = 37.6	RCT	Pain = groups did not present statistically significant differences ( $P = 0.2060$ ) Range of mandibular movements, TMJ pressure pain threshold = no statistically significant difference
TMD Kulekcioglu	Scand J Rheumatol, 2003	n = 35 Group 1 = 20 (study group) Group 2 = 15 (control group - placebo)	Group 1: 20 Female = 18, male = 2 Age = $38.3 \pm 8.3$ years Group 2: 15 Female = 10, male = 5 Age = $37.9 \pm 12.3$ years	RCT	Pain: $P = 0.438$ , no significant difference between groups. Number of tender points ( $P = 0.001$ ), maximal active ( $P = 0.001$ ) and passive mouth opening ( $P = 0.003$ ), right lateral jaw motion ( $P = 0.005$ ) and left lateral jaw motion (0.2) significantly improved in active treatment group

Contd...

**Table 1: Contd...**

First author	Journal and year	Sample	Age/sex	Study design	Outcome measures and result
LLLT in the treatment of TMD: A double-blind pilot study Conti	Cranio 1997	n = 20 Group 1 = 10 (study group) Group 2 = 10 (control group - placebo)	Female = 90%, mean age = 39.9 years	RCT	No significant differences between real and placebo groups in relation to pain, mandibular movements
Effects of SLLLT on temporomandibular joint pain Marini	Clin J Pain. 2010	n = 99 Group 1 = 39 (SLLLT) Group 2 = 30 (NSAID) Group 3 = 30 (control group - placebo)	Not mentioned	RCT	Pain: VAS pain scores in SLLLT group was significantly lower than in nonsteroidal anti-inflammatory drug group and control group (P=0.0001) Mouth opening and excursions: Superiority of SLLLT (P=0.0001)
Management of myofascial pain: LLLT versus occlusal splints Öz	J Craniofac Surg. 2010	n = 40, Group 1 = 20 (study group) Group 2 = 20 (control group - occlusal splints)	Female = 34, male = 6 mean age of 32.84 years	RCT	Pain = no significant difference between the groups Mandibular movements = no significant difference between the groups Pressure pain threshold = no significant difference between the groups

TMD: Temporomandibular disorders, LLLT: Low-level laser therapy, EMG: Electromyography, VAS: Visual analog scale, SLLT: Superpulsed low-level laser therapy, RCT: Randomized controlled trial

## CONCLUSION

### Implications for practice

LLLT seemed to be effective in reduction of pain in TMDs. The hypothesis that LLLT acts through a dose-specific anti-inflammatory effect in the irradiated joint capsule is a possible explanation of the positive results. However, due to the limitations of this review, findings must be interpreted with caution.

### Implications for research

There is a need for more well-conducted RCTs examining LLLT as interventions for TMDs. These studies need to be clear in the reporting of allocation, blinding, sequence generation, withdrawals, intention-to-treat analysis, and any other potential source of bias in the study. In addition, there should be use of well-validated standardized outcomes so that the RCTs could be compared with other similar trials. The sample size of the RCTs should also be calculated beforehand so that the study has adequate statistical power.

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### Conflicts of interest

There are no conflicts of interest.

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