

# Review article: The effect of low-level laser therapy and occlusal splint on the treatment of Temporomandibular joint disorder with myofascial origin: a literature review



Amirreza hendi<sup>1</sup> , Mahsa Koochaki<sup>2</sup> , Mohamad Sadegh mohamadi-tabar<sup>3</sup> 

<sup>1</sup> Assistant Professor, Dental Sciences Research Center, Department of Prosthodontics, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran

<sup>2</sup> Assistant Professor, Department of Oral and Maxillofacial Medicine, Guilan University of Medical Sciences, Rasht, Iran

<sup>3</sup> Student Research Committee, School of dentistry, Guilan University of Medical Sciences, Rasht, Iran

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## ABSTRACT

**Introduction:** Temporomandibular joint disorder with myofascial origin has a high prevalence among other types of this disorder. Two treatments prescribed for Temporomandibular joint disorder would be low-level laser therapy and occlusal splints. The purpose of this review is to compare the effects of LLLT and occlusal splints for the treatment of TMD patients with myofascial pain.

**Materials and Methods:** The literature search was done by specific terms in Scopus, PubMed, and Web of Science databases and the studies were reviewed by two authors based on inclusion criteria.

**Results:** From 86 articles gained by the search 6 have remained after the evaluation of authors.

**Conclusion:** Based on the reviewed studies and within the diversity of the methods used by the researchers, it could be concluded that both LLLT and occlusal splint would be equally a proper treatment for patients suffering from TMD with myofascial pain.

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### \* Corresponding Author:

**Mahsa Koochaki**

**Address:** Assistant Professor, Department of Oral and Maxillofacial Medicine, Guilan University of Medical Sciences, Rasht, Iran

**Tel:** +98 - 13-33486418

**E-mail:** mahsa\_koochaki18@yahoo.com

## Introduction

Functions such as speaking, chewing, and swallowing that are considered to be vital for human beings work properly because of the Temporomandibular joint (TMJ). In case of dysfunction in TMJ, signs that could be seen are muscle tenderness, sounds of TMJ, limitation in mouth opening, bruxism, and headache(1, 2). The most prevalent cause of non-odontogenic pain in the maxillofacial region is TMD with a 40% to 60% prevalence(3, 4). The prevalence of TMD in a subpopulation of Iran was reported at 34.7% with the predominance of girls in the community(5). According to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) TMD can be divided into three categories(6):

1. Pain of masticatory muscles
2. Displacement of TMJ disc
3. Arthralgia, Arthritis, Arthrosis

Masticatory muscle pain is the most prevalent cause of TMD(1). Patients who suffer from TMD myofascial pain indicate a painful response to the palpation of the areas called trigger points. The reasons for this condition vary from psychological dysfunctions and anxieties to occlusal interferences(3). Because of the multifactorial nature of TMD clinicians prescribe various treatments for the disease for instance pharmacotherapy, laser therapy, and occlusal splint(3).

Low-level laser therapy (LLLT) as a modality for the treatment of myofascial TMD has escalated in popularity due to the acceptance of the patients and the characteristics like being safe, not invasive, anti-inflammatory, analgesic, biostimulative, and regenerative(1). The light of the laser stimulates the mitochondria to turn Adenosine diphosphate into Adenosine triphosphate to produce energy for the cell that would end in the replication and metabolism of the fibroblasts(7). LLLT also produces endogenous endorphins that change the pain threshold for analgesic actions(8).

Another popular treatment for TMD with myofascial pain is using occlusal splints. The

stabilization splints are able to increase the vertical dimension without the need to alteration of the relation between jaws. This makes the muscles relax and accelerates the healing process(9). The occlusal splints are highly acceptable by patients in addition to being easy to use and noninvasive(3).

Therefore, the purpose of this review is to compare the effects of LLLT and the occlusal splints for the treatment of TMD patients with myofascial pain and whether any of the modalities have superiority over the other in case of pain after palpation, spontaneous pain, mouth opening and other indices evaluated by the researchers in studies.

## Materials and Methods

In an attempt to achieve the purpose of this review a literature search was done in Scopus, PubMed, and Web of Science databases with the following terms: (“Disorder, Temporomandibular Joint” OR “Disorders, Temporomandibular Joint” OR “Joint Disorder, Temporomandibular” OR “Joint Disorders, Temporomandibular” OR “Temporomandibular Joint Disorder” OR “TMJ Disorders” OR “Disorder, TMJ” OR “Disorders, TMJ” OR “TMJ Disorder” OR “Temporomandibular Disorders” OR “Disorder, Temporomandibular” OR “Disorders, Temporomandibular” OR “Temporomandibular Disorder” OR “Temporomandibular Joint Diseases” OR “Disease, Temporomandibular Joint” OR “Diseases, Temporomandibular Joint” OR “Joint Disease, Temporomandibular” OR “Joint Diseases, Temporomandibular” OR “Temporomandibular Joint Disease” OR “TMJ Diseases” OR “Disease, TMJ” OR “Diseases, TMJ” OR “TMJ Disease”) AND (“Laser” OR “Q-Switched Lasers” OR “Laser, Q-Switched” OR “Lasers, Q-Switched” OR “Q Switched Lasers” OR “Q-Switched Laser” OR “Pulsed Lasers” OR “Laser, Pulsed” OR “Lasers, Pulsed” OR “Pulsed Laser” OR “Continuous Wave Lasers” OR “Continuous Wave Laser” OR “Laser, Continuous Wave” OR “Lasers, Continuous Wave” OR “Masers” OR “Maser”) AND (“Occlusal Splint” OR “Splint, Occlu-

sal” OR “Splints, Occlusal” OR “Dental Night Guard” OR “Dental Night Guards” OR “Guard, Dental Night” OR “Guards, Dental Night” OR “Night Guard, Dental” OR “Night Guards, Dental” OR “Mandibular Advancement Devices” OR “Advancement Device, Mandibular” OR “Advancement Devices, Mandibular” OR “Device, Mandibular Advancement” OR “Devices, Mandibular Advancement” OR “Mandibular Advancement Device” OR “Mandibular Advancement Splints” OR “Advancement Splint, Mandibular” OR “Advancement Splints, Mandibular” OR “Mandibular Advancement Splint” OR “Splint, Mandibular Advancement” OR “Splints, Mandibular Advancement”).

After gathering the articles in EndNote X9 (The EndNote Team, 2013, Philadelphia, PA) as reference management two authors independently evaluated the articles using the following inclusion criteria:

1. Evaluating the effect of occlusal splints
2. Evaluating the effect of Laser therapy
3. Evaluating the effects on TMDs caused by myofascial disorders

Furthermore, the articles would be excluded because of being a review type or discussing TMDs with etiologies other than myofascial disorders.

## Results

The literature search resulted in 86 articles in total (Scopus: 43, PubMed: 34, Web of Science: 9). After removing the duplicated articles, two authors independently assessed the 44 articles based on the criteria mentioned in the methods section. Initially, titles and abstracts were evaluated and studies that could respond to the aim of the review were included and the rest were excluded. This made the remaining articles 12. The remaining articles were then fully read and 6 studies were indicated as eligible for review (1, 3, 9-12). One study was excluded due to the lack of accessibility (13). The disagreements between authors were then solved by the Delphi technique.

## Discussion

Altindis et al. evaluated the effectiveness of LLLT and occlusal splints on patients with myofascial-originated temporomandibular disorder. The pain intensity before treatment was measured using an 11 points-scale and the tenderness of 16 muscles was assessed by palpation and a 3 points-scale was assigned for the evaluation. Moreover, thermographic imaging was also obtained for the assessment of muscles. 10 patients were told to use the occlusal splints for 3 weeks every night while the other 10 patients were exposed to LLLT 10 sessions in 3 weeks. According to the findings, the values for muscle sensitivity, and pain intensity were lower in both occlusal splint and LLLT groups. The temperature values for both groups decreased significantly in muscle areas except for the superior Masseter (right) and Temporal in the splint group and Temporal muscle (right) in the LLLT group. This study concluded that both modalities were effective for myofascial TMDs, although LLLT was found to be more advantageous (9). In another study, Azangoo et al. compared the effectiveness of pharmacotherapy with laser therapy and occlusal splints among TMD patients with myofascial pain dysfunction syndrome. In this study, the pharmacotherapy group was the control group and both other groups would receive medicine besides their main treatment. To evaluate the efficacy of these modalities the Visual Analog Scale (VAS) and the maximum opening were used before treatment and after 2 and 4 weeks from the beginning of the treatment and finally 2 weeks after the treatment. The pharmacotherapy group received the following prescription:

1. Methocarbamol 500 mg 3 times a day
2. Naproxen 250 mg twice a day
3. Clonazepam 1 mg once a day

Patients in the laser group received laser therapy with a low-level gallium arsenide diode laser (940 nm wavelength) 3 days a week in 10 sessions along with drugs prescribed for the pharmacotherapy group. Moreover, patients in the occlusal splint group were instructed to

use their splints 8 hours a day within 1 month besides the drugs prescribed for the first group. It was demonstrated that both laser and occlusal splints decrease the pain severity scores, although no significant difference was seen between these two groups in the case of pain severity. Furthermore, this study failed to show any significant difference in the mean maximum opening of study groups. The authors concluded that LLLT is a suitable modality for the treatment of patients with myofascial-originated TMD. However, they didn't find any specific difference between laser and occlusal groups based on pain severity(3). Demirkol et al. also investigated the effect of LLLT and occlusal splints on myofascial pain in TMD patients. In this study, the pain score was assessed using VAS 15 days before the onset of the treatment, the last day of the treatment, and 3 weeks after the treatment. Patients were included in three groups: occlusal splint, LLLT, and placebo. The patients in the occlusal splint group were asked to wear the splint 12 hours a day for 3 weeks. The cases in the LLLT group were exposed to a neodymium-doped yttrium aluminum garnet laser (Nd:YAG, wavelength: 1064 nm) irradiation on trigger points 5 times a week in 10 sessions. For the placebo group, everything was the same as LLLT group except that no irradiation was applied. According to the result of this study, both LLLT and occlusal splints were statistically effective and decreased the pain score of the patients. However, no significant difference was indicated between LLLT and occlusal splint groups and it was concluded that both modalities have the same effect on TMD patients with myofascial pain dysfunction syndrome(1). Maracci et al. compared the effectiveness of rapid LLLT and occlusal splint therapy on patients with myofascial pain according to RDC/TMD. The three groups of this study were occlusal splint, rapid LLLT, and LLLT placebo. Three evaluated factors were spontaneous pain, pain after palpation, and oral health-related quality of life (OHRQoL) before the treatment, 1 month after receiving the splint, and 1 month after the laser therapy. The pain score was reported using a 4-score scale and

the OHRQoL was evaluated with the use of the Oral Health Impact Profile for Temporomandibular Disorders (OHIP/TMD) questionnaire. The occlusal splint group was told to wear the Michigan splint when sleeping at night. The patients in the rapid LLLT group were exposed to a Gallium-Aluminum-Arsenide laser (GaAlAs, wavelength: 808 nm) in painful points diagnosed by palpation for 2 sessions with the interval of 48 hours. The placebo group got the same tip as the active one but did not receive any irradiation. Based on the findings, the reduction of spontaneous pain and pain after palpation was not statistically significant for patients in LLLT and placebo groups, unlike the splint group that had a significant remission. The OHRQoL indicated a significant improvement in the LLLT and splint groups, unlike the placebo group. The authors concluded that the Michigan splint is an efficient treatment for patients with myofascial-originated TMD but rapid LLLT was not as advantageous(10). Molina-Torres et al. assessed the effectiveness of laser therapy and occlusal splints on TMD patients with Fibromyalgia syndrome (FMS) in a single-blinded randomized clinical trial. Patients in the laser group received 50mW laser on the areas that were diagnosed painful, for 12 sessions in 12 weeks. Furthermore, for patients in the occlusal splint group, an occlusal splint was made and patients were told to wear it at night (8 hours a day averagely) during sleep for 12 weeks. For assessment of the effectiveness, VAS, index of widespread pain, symptom severity scale (SSS), Pittsburgh's questionnaire for quality of sleep, and mouth opening were chosen to clarify the outcome. The assessment of indices was done before the treatment and after the 12 weeks of the study. The results of the study indicated that both modalities had similar effects on patients in pain severity, widespread pain, and SSS and both treatments are positively effective on TMD patients with FMS. However, based on the findings, both groups did not demonstrate a major improvement in the maximum size of the mouth opening in active and passive mode(11). Oz et al. compared LLLT with occlusal splints in TMD patients with myofascial pain in a

randomized clinical trial that was double-blinded. The authors mentioned that the patients were divided into two groups: the LLLT group and the control group (occlusal splint). Each patient in the LLLT group was exposed to a diode laser with a wavelength of 820 nm on the trigger points in 10 sessions (2 sessions a week). Moreover, patients in the occlusal splint group were instructed to wear the device 24 hours a day during 3 months. The assessments were done using VAS and pressure pain threshold (PPT). For the LLLT group, the measurement of the scores was done half an hour before the session one and a half hours after the last session. The scores for the occlusal splint group were measured before the first session and 90 days after the first session. Both treatments demonstrated statistically significant improvement in VAS and PPT. However, no significant difference was reported between both groups in the case of tenderness after palpation of the muscles. Eventually, the authors concluded that LLLT had the same effect as occlusal splints on TMD patients with myofascial pain(12).

All concluded studies in this review used the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) to examine their patients and choose the cases. The variety of the methods was extensive toward the type and wavelength of the laser, manufacturing the occlusal splint, duration of treatment, and evaluation indices.

4 of 6 articles that were reviewed agreed that LLLT and occlusal splints have the same effect on the treatment of TMD patients with myofascial pain and can be prescribed alternatively. Two other studies had different conclusions and reported that one of the treatments was more effective than the other(9, 10). However, it should be considered that one of them used rapid LLLT unlike other studies(10).

## Conclusion

Based on the reviewed studies and within the diversity of the methods used by the researchers, it could be concluded that both

LLLT and occlusal splint would be equally a proper treatment for patients suffering from TMD with myofascial pain.

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None

### *Authors' contributions*

**Amirreza hendi:** Conceptualization, Methodology, Writing - Review & Editing **Mahsa Koochaki:** Writing - Original Draft, Data Curation, Supervision **Mohamad Sadegh mohamadi-tabar:** Resources, Investigation, Visualization

### *Conflict of Interests*

The authors declare no conflict of interest

### *Ethical declarations*

Not applicable

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None

### *Availability of data and material*

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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