

## Low-level LASER therapy effects vs. placebo in the treatment of temporo-mandibular joint disorders

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### Abstract

**Aims:** The purpose of this study was to assess the efficiency of low-level LASER therapy (LLLT) in the treatment of temporomandibular joint (TMJ) pain. LLLT therapy was compared with placebo treatment. **Material and methods:** A number of 20 patients with TMJ pain were included in this study. The diagnosis was done according to Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). The patients were divided into two groups. The first group received LLLT (660 nm, 90 mW; LaserHF Surgical Unit, Hager & Werken GmbH & Co.KG, Duisburg, Germany) and the second group placebo therapy. TMJ pain was evaluated at baseline and weeks 1 and 2 after therapy. **Results:** The pain scores decreased for both groups at the 1-week point. At the 2-week point there was a significantly decrease in pain scores for LLLT group compared with the placebo group. Still, according to the Mann-Whitney test, there was no statistically significant difference between the placebo group and the LLLT group. **Conclusion:** Considering these results and the fact that there is no side effect or disadvantage of LLLT, we recommend its use for pain reduction in TMD patients, but with the condition of daily sessions. Further studies are recommended with a larger sample size of patients in order to demonstrate the benefit of LLLT treatment also from a statistical point of view.

**Key words:** temporomandibular joint, pain, low-level LASER therapy, placebo

### Introduction

A temporomandibular disorder (TMD) is defined by the American Academy of Orofacial Pain (AAOP) as a complex term that covers a number of clinical problems and which includes the masticatory muscles, the temporomandibular joint and the associated structures. The AAOP classifies TMDs in two groups: muscular and articular. The most frequent type of TMD is represented by internal derangements, a term that defines an abnormal position of the disc on the condyle [1].

The temporomandibular joint (TMJ) is a diarthrodial synovial joint. Synovitis is a painful inflammation of the synovial membrane and can cause an overproduction of the synovial fluid. Being highly vascularized and innervated, the inflammation of the synovial membrane is a very painful condition. Synovitis can accompany a displaced disc. Usually the synovial fluid accumulates in the direction of the displacement [2].

Pain treatment is mostly conservative and includes: pharmacologic management, self-care, occlusal therapy, physical therapy. The surgical approach is recommended only when all the conservative treatments have failed and is represented by TMJ arthrocentesis [3-5]. Low-level LASER therapy (LLLT) seems to be an effective treatment option for

patients with inflammatory conditions of the TMJ. Still, its use is controversial in literature [6].

### Aims

The purpose of this study was to assess the efficiency of LLLT in the treatment of TMJ pain. LLLT was compared with placebo treatment.

### Material and methods

#### Patients

Over a period of four weeks, a number of 20 patients were included in this study. Inclusion criteria were patients with unilateral TMJ pain on palpation and/or during function. The patients were referred by dentists to a specialist in a private clinic, where the study was conducted. Informed consent was obtained from each subject participating in this study. Patients with pure masticatory muscle disorders and patients under treatment with AINS were not included in this study. A scale from 0 to 10 was used to assess the intensity of the pain, 0 meaning the absence of the pain and 10 unbearable pain. 10 patients received LLLT and 10 patients received placebo treatment. The patients were randomly assigned to one of the two groups. The pain scores were recorded at the baseline, before the treatment (week 0-day 0), at the middle of the treatment (week 1-day 7) and at the end of the treatment (week 2-day 14).

### Clinical examination

The clinical evaluation was performed by a prosthodontic specialist and included an extensive examination of the TMJs, masticatory and cervical muscles, and the dental occlusion (both static and dynamic). The assessment of TMJ pain was based on the patient's history and physical examination. The pain was assessed by palpating the lateral and the posterior pole of the TMJ (fig. 1, fig. 2).



Figure 1. Palpation of the lateral pole of TMJ

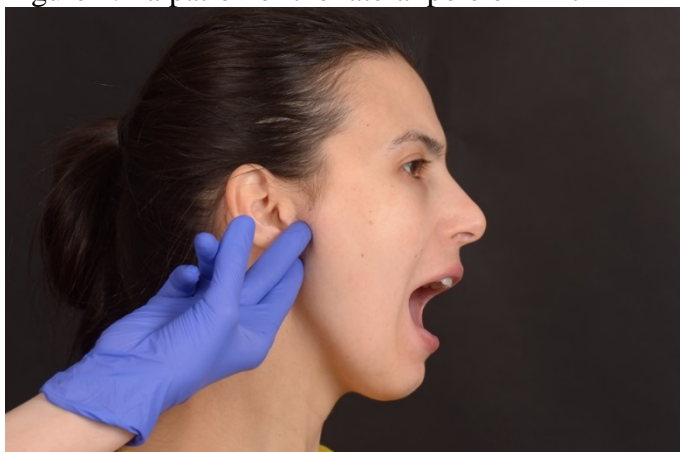


Figure 2. Palpation of the posterior pole of TMJ

When the diagnosis between the muscle pain and TMJ pain was not clear, functional tests described by Okeson were used (fig. 3). The diagnostic decision tree was done according to the Research Diagnostic Criteria for Temporomandibular Disorders [7].

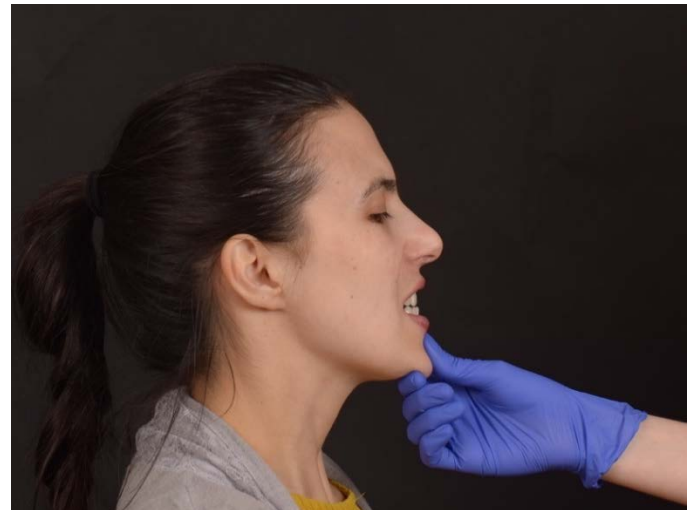


Figure 3. Functional test: protrusion against resistance

### Low-level LASER protocol

In the present study, a diode laser device (660 nm, 90 mW; LaserHF Surgical Unit, Hager & Werken GmbH & Co.KG, Duisburg, Germany) was used. A single-probe LLLT-handpiece of 660 nm was utilized. The laser beam was applied at a 90 degree angle to the skin surface, moving both horizontally, as well as vertically on the area corresponding to the TMJ and its immediate surrounding tissues (fig. 4). The energy intensity was 90 mW and the time of appliance was 80s continuously on each TMJ. The patients were exposed to the LASER at a 2-3 mm distance between the LASER fiber and the skin, while being seated in the dental chair, with their heads laid on the headrest. The sessions were carried out once each day for every patient, five days per week, with a break during the weekend, and for a total of ten sessions. For the placebo group, the LASER device was activated but the LASER beam was directed away from the TMJ area.



Figure 4. Application of LLLT on the area corresponding to the TMJ

### Statistical analyses

The data set was analyzed with the Mann-Whitney and Kruskal-Wallis tests, using SPSS for Windows. The level of significance was set at  $p$  less than 0.05. We calculated the mean, median and standard deviation for each group individually.

### Results

The present study included 20 patients, divided into 2 groups of 10. One group received LLLT and the other group received placebo. The initial pain score ranked from 3 to 7 for the placebo group and from 4 to 10 for the LLLT group. The mean and standard deviation before and after treatment between the groups are presented in table I.

**Table I. The mean and standard deviation between the two groups**

Group	Evaluation period	Mean	Standard deviation
PLACEBO	day 1	5.7	1.19
	day 14	4.2	1.60
LLLT	day 1	6.4	1.74
	day 14	3.2	0.98

The comparison of the pain scores between the 2 groups before and after treatment is presented in fig. 5. The mean value for pain scores decreased for both groups at day 7. On day 14 there was an increase in pain for the placebo group, whereas for the LLLT group there was a continuous decrease in pain intensity.

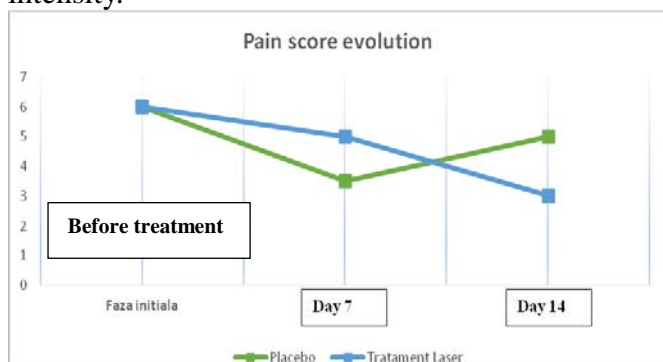


Figure 5. Pain score evolution at different evaluation times for the two groups

According to the Mann-Whitney test, at day 7 the placebo group had lower pain scores than the LLLT group ( $p=0.039$ ). At day 14 there was an improvement in pain scores for the LLLT group compared to placebo ( $p=0.097$ ).

### Discussion

The etiopathogenesis of TMDs is controversial. Regarding TMJ and muscle pain, a multidisciplinary approach was suggested so far: pharmacotherapy, self-care, physical therapy (electrotherapy, ultrasound, transcutaneous electrical nerve stimulation (TENS) or laser therapy), kinetotherapy, occlusal therapy, psychological and behavioral approach[1,2,8]. In the present article, the focus was on the LLLT effect on pain in cases of TMD.

LLLT has been successfully used in cases of pain in large joints (knee, hip). LLLT is used due to its anti-inflammatory, analgesic, regenerative and bio-stimulating effect. There is no side effect for LLLT usage reported in literature [9,10].

The most commonly used LASERS are those with an infrared wavelength due to their greater tissue penetration, with a spectrum ranging from 780 to 904 nm, confirmed by several studies [11-14]. A different approach belongs to Ernschoff et al. [15], who used a spectrum in the red range. Carvalho et al. [16] used both wavelengths, red and infrared. In the present study, a low-level laser with the following characteristics was used: a probe of 660 nm and energy intensity of 90 mW.

In terms of frequency and number of sessions, a consent does not exist among the authors that used this technique to treat or to ameliorate pain in cases of TMD. Mazetto et al. [11] and Venezian et al. [14] mentioned 8 visits, twice per week. Others, like Venancio et al. [17] established only 6 sessions, also twice per week. Çetiner et al. [18] and Fikácková et al. [19] argued for 10 sessions. Consequently, within literature, the number of sessions varied from 1 to 20, and the application frequency ranged from daily for 10 days to 1 time per week for four weeks, as mentioned in the review coordinated by Maia ML et al. [20].

The use of LLLT for TMJ pain is controversial in literature. In studies including a placebo group, some authors obtained no differences between the LLLT group and the placebo group, whereas others obtained better statistical values for LLLT [15,21]. In our study, we obtained lower pain scores at the end of the treatment for the group treated with LLLT. For the placebo group, at day 7, there was an improvement in pain scores, but then, at the end of the treatment the score was the same, or just slightly improved.

For LLLT group, there was a continuous decrease in pain scores, and at day 14 the pain was significantly decreased, except for one case where LLLT had no effect.

According to the Mann-Whitney test, there is no statistically significant difference between the placebo group and the LLLT group, due to the p value being higher than 0.05. The placebo treatment was an effective treatment for some patients who had an important psychogenic component of pain.

One limitation of this study is the small number of the patients and the fact that pain perception is a subjective characteristic to assess.

### Conclusion

Our results demonstrates clinically that LLLT is a good approach in treating TMJ pain. Considering these results and the fact that there is no side effect or disadvantage of LLLT, we recommend its use for pain reduction in TMD patients, but with the condition of daily sessions (at least ten sessions). Further studies are recommended with a larger sample size of patients in order to demonstrate the benefit of LLLT treatment also from a statistical point of view.

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