

# Low-level Laser Therapy in the Management of Temporomandibular Joint Disorder



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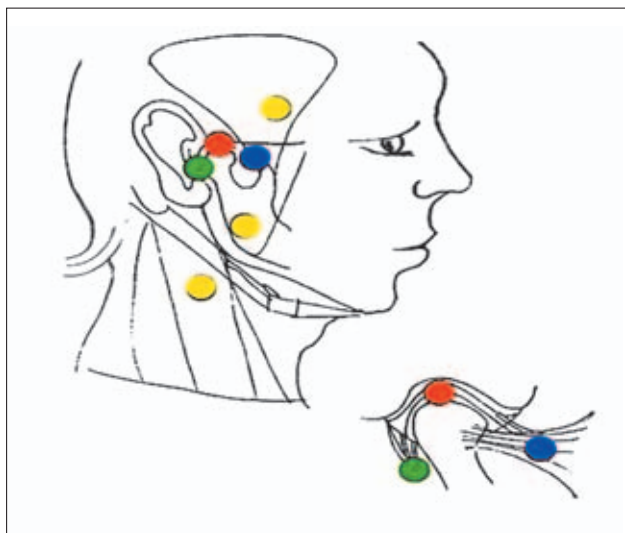
**Purpose:** Temporomandibular joint disorder (TMD) is a collective term used for a number of clinical signs and symptoms that involve the masticatory muscles, the temporomandibular joint (TMJ) and its associated structures. Since TMD is a multifactorial disorder, many modes of management have been reported to be effective in reducing or eliminating patient signs and symptoms (initially pain and clicking). There exists considerable debate, both on the part of the surgeon and the patient, regarding treatment (noninvasive or minimally invasive). These have ranged from occlusal adjustment, splint therapy, arthroscopy, surgery, laser therapy, cryotherapy and acupuncture. Low-level laser therapy (LLLT) has been used for pain control and healing. Use of low-level laser for TMD has been controversial, and shortcomings have been found in previous studies. The aim of this study was to evaluate the effectiveness of LLLT at 980 nm in TMD patients.

**Materials and Methods:** We performed a single-blind clinical trial on 48 TMD patients. Before treatment, all patients were matched based on gender, pain, and clicking. There were no cases of degenerative joint disease (DJD) or parafunction (eg, bruxism) and the patients were otherwise healthy. The patients were randomly divided into experimental and placebo groups. In the study group, the patients were treated with LLL (980 nm, 80 Hz, 6 J) at three points over the TMJ (ie, 2 J per point and 1.5 J at the other sites of muscle pain) for 1 min. In the placebo group, the laser device was adjusted in the same positions but without power emission. Effectiveness of LLLT for pain and clicking in the groups was evaluated immediately, after 2 days, after 4 days, and then at 6 and 12 months using a visual analogue scale. To compare the magnitude of click, the chi-square test was used, and for pain severity the Mann-Whitney U-test was used to analyze the results.

**Results:** The pain severity after treatment on day 4 in the experimental group was  $2.4 \pm 1.36$ , which was significantly less than the placebo group's results of  $4.4 \pm 1.84$  ( $p < 0.001$ ). Click reduction was 23.1% in the placebo group and 76.3% in the experimental group. The results were statistically significant for both pain and clicking without recurrence up to the 2-year follow-up period ( $p < 0.001$ ).

**Conclusion:** Low-level laser therapy (980 nm) was effective in management of TMD signs and symptoms and induced considerable reduction or elimination of pain severity and clicking. LLL applications can be an effective mode of management for selected patients with TMD.

**Keywords:** low-level laser, temporomandibular joint disease, pain and clicking.



**Fig 1** Laser application points.

**T**emporomandibular disorder (TMD) is a term which includes numerous clinical symptoms that affect the teeth, masticatory muscles, and temporomandibular joint (TMJ) resulting in painful conditions and joint clicking. TMJ dysfunction is complex and the role and importance of certain etiological factors are multiple and inadequately defined.<sup>1</sup> TMD is extremely common and most often reported in individuals between the ages of 20 and 40 years.<sup>1</sup> The cardinal sign and symptom of TMD are pain in the masseter muscle, TMJ and/or temporalis muscle region associated with limitation of mouth opening and TMJ sounds. TMJ pain is by far the most common reason patients seek treatment.

TMD affects a significant number of the American population. According to the National Institutes of Health (NIH), an estimated 3% to 5% of Americans suffer from temporomandibular disorders. The majority of TMDs can be treated by conservative methods. A distinction can be made between the TMD and the TMJ disease/dysfunction. In the case of TMD, it most correctly relates to a neuromuscular type of problem in the general area of the TMJ, but may not intrinsically be related to the joint itself. Since TMD is a multifactorial disorder, many factors (even emotional) may have a positive impact on any patient's symptoms.<sup>2</sup>

Today, a large number of potentially reversible conservative therapies are available for TMD patients.<sup>1</sup> There is a growing interest in less invasive surgery, laser therapy, cryotherapy, and acupuncture. Low-level

laser therapy (LLL) has a role in pain control and healing. Although LLL is a physical therapy used in the treatment of musculoskeletal disorders, there is little evidence for its effectiveness in the treatment of TMD. Recent studies suggest that LLL (application of 10 J/cm<sup>2</sup> and 15 J/cm<sup>2</sup>) can be a useful method for the treatment of TMD-related pain.<sup>3</sup>

Patients treated with LLL obtain pain relief and recover function more rapidly compared to untreated patients. Since wavelength is the most important factor in any type of phototherapy, the clinician must consider which wavelengths are capable of producing the desired effects within living tissues. The physiological effects of infrared laser therapy are: 1. biostimulation; 2. improved blood circulation and vasodilation; 3. analgesia; 4. anti-inflammatory and anti-edematous effects; and 5. stimulation of wound healing.<sup>3</sup> There are several reports in the literature regarding the effects of low-level laser therapy on pain control and click elimination. The purpose of this study was to evaluate the effects of low-level laser therapy at 980-nm wavelength on pain and clicking in patients with TMD.

## MATERIALS AND METHODS

A single-blind clinical trial was conducted on 48 (24 male and 24 female) patients with temporomandibular disorders. None of them had degenerative joints (DJD) or systemic diseases. The patients were randomly allocated into 2 groups: an LLL group using a laser diode unit AZOR-2K with an infrared probe (980 nm Ga-As, frequency 80 Hz) at an energy of 2 J per TMJ site plus 1.5 J applied on 3 pain trigger points, and a placebo group. Three points in relationship to the joint itself were treated: (a) the posterior aspect of the joint with the mouth open to treat the posterior articular branches of the auriculotemporal nerve (2 J for 1 min), (b) an area anterior to condyle in the sigmoid notch with the mouth closed for the area of insertion of the lateral pterygoid muscle into the condylar neck and meniscus (2 J for 1 min); and (c) the joint interface with mouth open (2 J for 1 min). Trigger points in the adjacent muscles (Fig 1) were also treated (1.5 J for 1 min). LLL was performed using a direct skin contact technique. Each patient was given 2 treatment sessions with a 48-h interval and one follow-up visit after 4 days and again at 6 and 12 months postoperatively.

Pain was evaluated using the visual analog scale (VAS). Zero denoted no pain and 10 denoted severe pain. Clicking was evaluated with a stethoscope. The difference between pain intensities and clicking before

**Table 1 Patient demographics**

Groups	Gender		Age	Severity of pain before treatment
	Male	Female		
Control: n = 22	13 (59.1)	9 (40.9)	8.6 ± 8.37	8.9 ± 0.5
Case: n = 26	11 (42.3)	15 (57.7)	33 ± 9	9

Numbers in parentheses are percentages.

**Table 2 Results of LLLT in 48 patients with TMD**

Groups	After 4 days		Time After 2 days		Immediately	
	Without pain	With pain	Without pain	With pain	Without pain	With pain
Control (n = 22) Without laser therapy	6 (27.3)	16 (72.6)	4 (18.6)	18 (81.4)	2 (9.9)	20 (90.1)
Case (n = 26) With Laser therapy	20 (76.9)	6 (23.1)	16 (69.3)	10 (30.7)	14 (53.8)	12 (46.2)
Total (n = 48)	(p<0.001)		(p<0.001)		(p<0.001)	

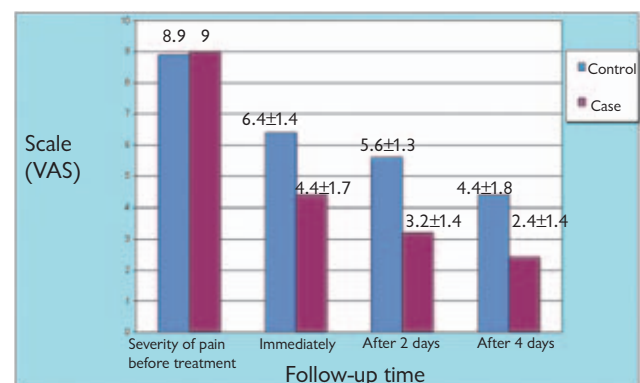
Numbers in parentheses are percentages.

and after LLLT was measured and analyzed using the chi-square and Mann-Whitney U-tests.

## RESULTS

This study was done on 48 TMD patients (26 treated with LLLT and 22 controls). The patients were matched before treatment (Table 1). The intensity of pain in the patients under evaluation with respect to follow-up time and according to treatment type (LLLT or placebo) is presented in Fig 2. We found statistically significant improvement in the laser (n = 26) ( $4.4 \pm 1.7$ ) compared to the placebo group (n = 22) ( $6.4 \pm 1.4$ ) immediately after treatment. Two days later and 4 days later the results were:  $3.2 \pm 1.4$  in the LLLT group and  $5.6 \pm 1.3$  in the placebo group, and  $2.4 \pm 1.4$  in the laser group and  $4.4 \pm 1.8$  in the placebo group, respectively. The Mann-Whitney U-test showed the reductions were statistically significant ( $p < 0.001$ ). The patients remained symptom free during the postoperative follow-up period (Table 2).

The results show that the reduction of clicking in the placebo group was 90.1% and in the laser group 46.2%. Two days later in the placebo group, it was



**Fig 2** Bar diagram of pain intensity assessed in both groups.

81.4% and in the laser group it was 30.7%. On day 4, in the placebo group it was 72.6% and in the laser group 23.1%. The chi-square test showed the differences were significant ( $p < 0.001$ ).

## DISCUSSION

Considerable work has focussed on determining the effects of laser on pain and click management. In 1998, a study on the subject of the effect of low-level laser therapy with wavelengths of 632.8 nm, 670 nm, and 830 nm on 24 TMD patients was done by Pinhero et al; the recovery from pain and clicking was significant.<sup>4</sup> Núñez<sup>5</sup> evaluated the effectiveness of LLLT and transcutaneous electrical neural stimulation (TENS) on the improvement of mouth opening in patients with temporomandibular disorders and found a significant improvement in the range of motion for both therapies immediately after treatment. Comparing the two methods, the values obtained after LLLT were significantly higher than those obtained after TENS ( $p < 0.01$ ). Comparing the two methods, LLLT was stated to be more effective than TENS. In a double-blind clinical trial study on the subject of the effect of low-level laser (730 nm) and frequency (73 Hz), Saheb Jami et al reported that its effect on pain control was significant.<sup>6</sup>

In an experimental study, Plano et al assessed the effectiveness of 670-nm laser on 32 TMD patients. The duration of application was 10 min. His study showed that clicking and pain were significantly reduced.<sup>7</sup>

Venanciorde et al conducted a single-blind clinical trial study on 10 TMD patients with the 670-nm laser at a frequency of 60 Hz and a dose of 3 J, finding that pain reduction was significant.<sup>8</sup>

Mazzetto<sup>9</sup> evaluated the effectiveness of low-intensity laser therapy (LILT) for the control of pain from temporomandibular disorder (TMD) in a random and double-blind research design. He used an infrared laser (780 nm, 70 mW, 10 s, 89.7 J/cm<sup>2</sup>) applied in continuous mode on the affected temporomandibular region, at one point: inside the external auditive duct toward the retrodiscal region, twice a week, for 4 weeks, and showed that LLLT is an effective mode of therapy for the control of pain in subjects with TMD.<sup>9</sup>

In the majority of the above studies, however, the wavelength was between 610 and 904 nm. In these studies, the laser dose was within the biostimulative limit that influences healing, pain, and repair. Saheb Jami et al,<sup>6</sup> in a double-blind clinical trial study on 64 TMD patients, used low-level laser of 830 nm wavelength and a dose 2 J for 2 min per appointment in 15 appointments. Their results showed that the effect on clicking was not significant.<sup>6</sup> That study did not corroborate our study, perhaps because of the wavelength.

## CONCLUSION

With due attention to the physiological effects of infrared laser therapy<sup>3</sup> (see above), our study focused on the efficacy of infrared Ga-As laser at a higher wavelength (980 nm) with an output of frequency 80 Hz on TMD patients. Our study showed that the laser at this intensity using 2 J/min per point at three points around the TMJ plus 1.5 J for 1 min over trigger points in two sessions was significantly effective in reduction of pain and clicking. We had five follow-up assessments (immediately, 2 and 4 days postoperatively, 6 months, and 1 yr). Our study showed that low-level laser therapy at a wavelength of 980 nm on three points over the TMJ and on trigger points was effective for management of pain and clicking.

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