

Assessment of low-level laser therapy in temporomandibular disorder patients: a case report

Haleema Bibi, Zarnab Rizwan, Ghina Rizwan, Syed Hamza Zia

Submitted

June 23, 2023

Accepted

August 15, 2023

Author Information

Dr. Haleema Bibi

Postgraduate Resident
Oral and Maxillofacial
Surgery, Islamic International
Dental Hospital, Islamabad,
Pakistan

Dr. Zarnab Rizwan

Associate Dentist
Dental Destination
Islamabad, Pakistan

Dr. Ghina Rizwan

General Dentist
Islamabad, Pakistan

Dr. Syed Hamza Zia

Post Graduate Resident
Periodontology, Federal
Government Polyclinic
Islamabad, Pakistan
(Corresponding Author)
Email:
syedhamzazia@hotmail.com

Citation: Bibi H, Rizwan Z,
Rizwan G, Zia SH.

Assessment of low-level laser
therapy in temporomandibular
disorder patients: a case
report. J Rehman Med Inst.
2023 Jul-Sep;9(3):24-7.

ABSTRACT

Pain and discomfort in the temporomandibular joint (TMJ) which affects the functions of the whole stomatognathic system fall under the category of temporomandibular disorders (TMDs) which have a plethora of etiological causes. Due to vulnerability of various anatomical parts of the temporomandibular joint, it is a challenge to stick to one mode of treatment hence multiple strategies have to be employed in order to get a favorable outcome.

Lasers, especially low level laser therapy (LLLT) is becoming increasingly popular for reducing pain and boosting tissue repair. LLLT has proven to be a treatment of choice, being drug-free, non-invasive and well-tolerated.

A 20 year old female presented in April 2023, with persistent symptoms of TMD for the past 1 year. MRI revealed anterior disc dislocation without reduction. LLLT opted for a total of 8 sessions with an occlusal splint given in the end. Her mouth opening improved and pain was almost diminished.

Keywords: Temporomandibular Joint; Laser Therapy; Low Level Light Therapy; Facial Pain.

The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.

INTRODUCTION

Temporomandibular disorders (TMDs), which affect the stomatognathic system, are characterized by sporadic pain or discomfort in the temporomandibular joint (TMJ), masticatory muscles, and surrounding tissues. Additionally, it might affect the key orofacial processes of mastication, speaking, and yawning.¹

It is well known that the multifactorial etiology of TMD includes the participation of parafunctional behaviors, trauma, stress, psychological, systemic, genetic, and occlusal factors. But none of these factors has yet shown to be more important than the others.² In the local population, 40% to 75% of healthy individuals can identify at least one TMD symptom, and 33% can identify at least one indication.³

The posterior attachments, collateral ligaments, and periarticular tissues (capsule, synovium, and temporomandibular joint ligaments) are the

anatomical parts of the TMJ that are most commonly impacted by these illnesses. The TMD is the primary cause of orofacial pain that is not brought on by dental arches. Due to the broad origin of these issues, it is common for the treatment to involve multiple strategies in order to maximize any potential outcomes. Examples of these strategies include medication, behavioral therapy, and physical therapy.²

The main goals of TMD treatments are to reduce pain, stop joint clicking, and restore TMJ functioning. These treatments include dietary and behavioral changes, medication, physical therapy, occlusal splint therapy, intra-articular injections, arthroscopy, arthrocentesis, Lasers, or open joint surgery.⁴ Due to the therapeutic benefits of lasers, including as improved local microcirculation and tissue repair, they have found widespread use in dentistry.⁵ Low-level laser therapy (LLLT) is a term for a type of light-based treatment that emits monochromatic, coherent light with a single wavelength.⁶ LLLT is a conservative therapy method that has been applied to TMD patients to enhance function and lessen symptoms.⁷

The soft laser known as LLLT has low energy output and has no effect on skin temperature. The primary impact of LLLT is based on the principle of light absorption. This soft laser's wavelength ranges from 630 to 1300 nm.⁷ Despite LLLT's unknown mechanism of action, direct irradiation activates tissues and has an analgesic and anti-inflammatory impact. Even though LLLT's mechanism of action is uncertain, direct irradiation activates tissues and has an analgesic and anti-inflammatory impact.⁸ The cellular respiratory chain in the mitochondria is impacted by LLLT stimulation, which results in enhanced vascularization and fibroblast production.

In addition to changing the blood microcirculation, LLLT boosts ATP synthesis. The lymphatic flow is increased with LLLT, which reduces edema and lowers prostaglandin E2 and cyclooxygenase-2 levels.⁸ A laser's intensity is halved to 10% of its value at a depth of 1 cm beneath the skin's surface. A laser with a power density of 100 mW/cm² at the skin's surface will thus be 10 mW/cm² at 1 cm below the surface and 1 mW/cm² at 2 cm below the

surface.⁸ According to these findings, LLLT is safe enough to be used in the TMD region, but its impact on the therapeutic process needs to be further studied in a clinical setting.

CASE REPORT

A 20-year-old female patient presented in April 2023 to our department with chief complaint of pain and limited mouth opening on both sides of TMJ region from last 1 year (Figure 1).



Figure 1: Limited mouth opening of the patient.

Medical and dental histories were recorded along with examination. The medical history was unremarkable except that patient was mild anemic. On dental examination there was no tooth loss but on right side molars was in cross bite (Figure 2).



Figure 2: The molar relationship showing cross bite on right side

OPG and MRI was recommended. MRI showed anterior disc dislocation without reduction. Upon questioning there was no history of trauma, any joint disorder, allergy or sleep deprivation but she was preparing for an exam and had clenching, nocturnal and diurnal tooth grinding. She had visited another dentist with the same complaint and dentist advised her to remove all 3rd molar impactions along with medications and splint. Despite

removing all impactions using muscle relaxants, analgesics and splint therapy for 5 months there was not much difference in pain and mouth opening. On clinical examination patient experienced severe pain on mouth opening and lateral excursion. Pain was 10 on VAS, mouth opening measured was 13mm and TMJ along with all muscles of mastication was tender to palpation. On auscultation there were no TMJ noises. Patient was instructed about LLLT and informed consent was obtained from her. LLLT was performed on both sides of TMJ along with muscles of mastication (Figure 3).



Figure 3: The Low Level Laser Therapy in process.

Total 8 sessions were done, 2 sessions per week. Application time was 60 seconds. Wavelength used was 980nm, frequency was 100 HZ, energy and power was 15 j/cm² and 2.0 W/cm². Application sites were temporalis, masseter, medial and lateral pterygoids, along with temporomandibular joint extra orally and intra orally. Treatment protocol was decided according to Abdalwhab Zwiri et.al.³ Pain on VAS along with mouth opening was recorded every week after session. At the end of a treatment, occlusal splint was fabricated as a night guard and explained to the patient regarding its use. Follow up was done after 1 week, 1 month, and 3 months from the end of the last session to investigate the effectiveness and cumulative effect. After the first week, pain on VAS was 7 and mouth opening was 15mm. After the second week, pain on VAS was 4 and mouth opening was 18mm. After the third week, pain on VAS was 3 and mouth opening was 20mm; and after the fourth (final) session pain was 2 and mouth opening was increased to 26mm (Figure 4).



Figure 4: Follow up after the 4th session.

DISCUSSION

The control of pain, slowed wound healing, and inflammations are some of the benefits of low-level laser therapy (LLLT).^{8,9} Additionally, LLLT is frequently utilized in clinical settings to relieve TMJ discomfort. The therapeutic dosages and output power are, respectively, less than 35 J/cm² and 500 mW.¹⁰ In our study, the wavelength used was 980nm, frequency was 100 HZ, energy and power was 15 j/cm² and 2.0 W/cm². However, in a study done by Simel Ayyildiz et al., TMJ area was treated with a diode laser (685 nm, 25 mW, 30s, 0.02 Hz, and 6.2 J/cm²) at three different times points, with one point allotted to intraoral areas and two distinct points allotted to extraoral parts. For a month, these applications were made available three times each week for each patient.⁸ Numerous writers have reported various energy densities in the literature for low-level laser therapy.^{11,12} This value ranges from 1 to 35 J/cm². The energy density of the portable laser therapy device utilized in this case study to treat two patients was 15 j/cm² and 2.0 W/cm²; however this value was within the range of laser devices that other researchers have employed.^{11,12} There is considerable disagreement in the literature regarding the frequency of low-level lasers and the number of laser application sessions.

Regarding the frequency of low-level lasers and the number of laser application sessions, there is still disagreement in the literature. Some authors^{13,14} proposed eight application sessions with frequency of twice weekly application. However, other authors^{14,15} concluded that six sessions with applications occurring twice weekly would be appropriate. Additionally, while several writers concurred that there should be 10 sessions, each one utilized a different frequency.¹⁵ The treatment protocol for the patient in this study was twice weekly for one month. This approach was designed to safeguard the patient's attained mouth openness after each session. As a result, the efficacy of the therapy and patient motivation were improved.

The application points of LLLT in the literature also differ. The masseter, temporalis, and pterygoid muscles' overlying skin serves as the application sites in most cases. There was hardly any intraoral application seen. The study's innovative laser probe enabled intraoral use. As a result, LLLT was applied to both the nearest area within the mouth and the area outside the TMJ. It is also important to note that LLLT helps to reduce pain by altering the permeability of cell membranes, dilating blood vessels, and reducing edema, which block the nerve fibers in response to the production of endogenous opioids (endorphins and enkephalin).

As a result, it encourages a reduction in bradykinin production, histamine, and acetylcholine release.¹⁶ Another contributing element to the effectiveness of LLLT is that it inhibits the

formation of COX-2, prostaglandins, and histamine as well as cytokines and kinins such tumor necrosis factor-alpha (TNF-), transforming growth factor-beta (TGF-), and interleukin-1 and IL-6.¹⁶ In 2003, Kulekcioglu et al., studied the population of Turkey to see whether low-level laser therapy was successful in treating TMD. The study's findings revealed a considerable improvement in the frequency of discomfort spots, maximal mouth opening, and lateral mobility.¹⁷ Kulekcioglu et al., claim that LLLT can be used as an alternative physical modality to treat TMD. Another research by Kogawa et al.¹⁸ discovered that LLLT treatment increased the maximal mouth opening and decreased the patient's discomfort to palpation. The author suggested that LLLT was successful in treating myogenic TMD.

Only a few studies have examined the use of LLLT in the treatment of TMD, despite the fact that it is a form of therapy that is often used in physiotherapy for musculoskeletal diseases.

Dostalova et al.,¹⁹ conducted a study in 2012 to examine the objective effects of LLLT while observing the activity of the TMJ and the tissues around it. The progression of TMD was helped by LLLT, which also helped to significantly reduce pain symptoms. Laser treatment, according to Catao et al.,²⁰ was highly successful in helping TMD patients manage their discomfort and open their mouths. This makes LLLT a successful and efficient therapy for treating TMDs since it results in a reduction in pain intensity, the number of sensitive sites, joint noises, and improvement in the range of jaw movement.²¹

According to the investigations by Mazzetto et al.,¹² Cetiner et al.,²² and Venezian et al.,²³ patients were monitored for up to 30 days following the final laser treatment sessions. According to Cetiner et al.,²² and Venezian et al.,²³ the pain reduction remained statistically significant over this time. Despite these findings, Mazzetto et al.,¹² observed that the final laser treatment session had the lowest palpation sensitivity. For more than 2 years, Lassemi et al.,⁸ monitored the patients and saw significant improvements in pain relief and clicking.

Acupuncture, transcutaneous electrical nerve stimulation (TENS), massage, ultrasound, medication, occlusal splints, and psychosocial therapies have all been employed in the treatment of TMD.² However, LLLT is a non-invasive, drug-free, and well-tolerated procedure. It is a quick procedure that saves both the physician and the patient time, and the patient feels the effects right away.²⁴

CONCLUSION

According to this study, LLLT is a suitable treatment for TMD-related discomfort and restricted mouth opening and should be taken into consideration as a substitute for other techniques.

REFERENCES

1. Kashmoola MA, Mustafa NS, Hayati AFK, Idzhar MI. A pilot study on the use of low level laser therapy in treatment of temporomandibular disorder. *J Int Dent Med Res.* 2018;11(2):669-75.
2. Minervini G, Franco R, Marrapodi MM, Crimi S, Badnjević A, Cervino G, et al. Correlation between Temporomandibular Disorders (TMD) and posture evaluated through the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD): a systematic review with meta-analysis. *J Clin Med.* 2023;12(7):2652. doi: 10.3390/jcm12072652.
3. Zwiri A, Alrawashdeh MA, Khan M, Ahmad WMAW, Kassim NK, Ahmed Asif J, et al. Effectiveness of the laser application in temporomandibular joint disorder: a systematic review of 1172 patients. *Pain Res Manag.* 2020;2020. doi: 10.1155/2020/5971032.
4. Abouelhuda AM, Kim Y-K, Hegazy SA. Non-invasive different modalities of treatment for temporomandibular disorders:

- review of literature. *J Korean Assoc Oral Maxillofac Surg.* 2018;44(2):43-51. doi: 10.5125/jkaoms.2018.44.2.43.
5. De Carli BMG, Magro AKD, Souza-Silva BN, de Souza Matos F, De Carli JP, Paranhos LR, et al. The effect of laser and botulinum toxin in the treatment of myofascial pain and mouth opening: A randomized clinical trial. *J Photochem Photobiol B.* 2016;159:120-3. doi: 10.1016/j.jphotobiol.2016.03.038.
 6. Khairnar S, Bhate K, SN SK, Kshirsagar K, Jagtap B, Kakodkar P. Comparative evaluation of low-level laser therapy and ultrasound heat therapy in reducing temporomandibular joint disorder pain. *J Dent Anesth Pain Med.* 2019;19(5):289. doi: 10.17245/jdapm.2019.19.5.289.
 7. Melis M, Di Giosia M, Zawawi KH. Low level laser therapy for the treatment of temporomandibular disorders: a systematic review of the literature. *Cranio.* 2012;30(4):304-12. doi: 10.25122/jml-2020-0169.
 8. Ayyildiz S, Emir F, Sahin C. Evaluation of low-level laser therapy in TMD patients. *Case Rep Dent.* 2015;2015. doi: 10.1155/2015/424213.
 9. Rathod A, Jaiswal P, Bajaj P, Kale B, Masurkar D. Implementation of low-level laser therapy in dentistry: a review. *Cureus.* 2022;14(9). doi: 10.7759/cureus.28799.
 10. Xu G-Z, Jia J, Jin L, Li J-H, Wang Z-Y, Cao D-Y. Low-level laser therapy for temporomandibular disorders: a systematic review with meta-analysis. *Pain Res Manag.* 2018;2018. doi: 10.1155/2018/4230583.
 11. Hotta PT, Hotta TH, Bataglion C, Bataglion SA, de Souza Coronatto EA, Siéssere S, et al. Emg analysis after laser acupuncture in patients with temporomandibular dysfunction (TMD). Implications for practice. *Complement Ther Clin Pract.* 2010;16(3):158-60. DOI: 10.1016/j.ctcp.2010.01.002.
 12. Mazzetto MO, Hotta TH, Pizzo RCdA. Measurements of jaw movements and TMJ pain intensity in patients treated with GaAlAs laser. *Braz Dent J.* 2010;21:356-60. doi: 10.1590/s0103-64402010000400012.
 13. Furquim LR, Mélo AM, Barbosa AFS, Olivato OP, Silva-Sousa YTC, Leite-Panissi CRA, et al. Application of photobiomodulation for chronic pain-related TMD on pain points versus pre-established points: Randomized clinical trial. *J Photochem Photobiol B.* 2023;238:112612. doi: 10.1016/j.jphotobiol.2022.112612.
 14. Maia MLdM, Bonjardim LR, Quintans JdSS, Ribeiro MAG, Maia LGM, Conti PCR. Effect of low-level laser therapy on pain levels in patients with temporomandibular disorders: a systematic review. *J Appl Oral Sci.* 2012;20:594-602. doi: 10.1590/s1678-77572012000600002.
 15. Shirani AM, Gutknecht N, Taghizadeh M, Mir M. Low-level laser therapy and myofascial pain dysfunction syndrome: a randomized controlled clinical trial. *Lasers Med Sci.* 2009;24:715-20. doi: 10.1007/s10103-008-0624-5.
 16. Nunez S, Ribeiro MS, Segundo A. Laser de baixa potência: princípios básicos e aplicações clínicas na odontologia. Brazil: Elsevier Brasil; 2012.
 17. Kulekcioglu S, Sivrioglu K, Ozcan O, Parlak M. Effectiveness of low-level laser therapy in temporomandibular disorder. *Scand J Rheumatol.* 2003;32(2):114-8. doi: 10.1080/03009740310000139.
 18. Kogawa EM, Kato MT, Santos CN, Conti PCR. Evaluation of the efficacy of low-level laser therapy (LLLT) and the microelectric neurostimulation (MENS) in the treatment of myogenic temporomandibular disorders: a randomized clinical trial. *J Appl Oral Sci.* 2005;13:280-5. doi: 10.1590/s1678-77572005000300015.
 19. Dostalová T, Hlinakova P, Kasparova M, Rehacek A, Vavrickova L, Navrátil L. Effectiveness of physiotherapy and GaAlAs laser in the management of temporomandibular joint disorders. *Photomed Laser Surg.* 2012;30(5):275-80. doi: 10.1089/pho.2011.3171.
 20. Catão MHCdV, Oliveira PSd, Costa RdO, Carneiro VSM. Avaliação da eficácia do laser de baixa intensidade no tratamento das disfunções têmporo-mandibular: estudo clínico randomizado. *Rev CEFAC.* 2013;15(6):1601-8. <https://doi.org/10.1590/S1516-18462013005000052>.
 21. Núñez SC, Garcez AS, Suzuki SS, Ribeiro MS. Management of mouth opening in patients with temporomandibular disorders through low-level laser therapy and transcutaneous electrical neural stimulation. *Photomed Laser Surg.* 2006;24(1):45-9. doi: 10.1089/pho.2006.24.45.
 22. Çetiner S, Kahraman SA, Yücel S. Evaluation of low-level laser therapy in the treatment of temporomandibular disorders. *Photomed Laser Ther.* 2006;24(5):637-41. doi: 10.1155/2015/424213.
 23. Venezian GC, Antônio Moreira Rodrigues da Silva M, Mazzetto RG, Oliveira Mazzetto M. Low level laser effects on pain to palpation and electromyographic activity in TMD patients: a double-blind, randomized, placebo-controlled study. *Cranio.* 2010;28(2):84-91. doi: 10.1179/crn.2010.012.
 24. Manansala C. Predictors of non-pharmacological, non-surgical treatment utilization prior to thoracolumbar spine surgery in Manitoba: A Canadian Spine Outcomes Research Network (CSORN) study. *Musculoskelet Sci Pract.* 2023 Feb;63:102695. doi: 10.1016/j.msksp.2022.102695. doi: 10.1016/j.msksp.2022.102695.