



International Journal of Scientific Research in Dental and Medical Sciences

www.ijsrdms.com



Is Low-Level Laser Therapy Effective for Complications of Mandibular Third Molar Surgery? A Literature Review

Ali Khalighi Sigaroudi^a, Dina Maleki^b, Helia Zare^b, Donya Maleki^{b,*}

^a Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Guilan University of Medical Sciences, Rasht, Iran

^b Student Research Committee, Faculty of Dentistry, Guilan University of Medical Sciences, Rasht, Iran

ARTICLE INFO

Article history:

Received 29 April 2020

Received in revised form 02 June 2020

Accepted 26 June 2020

Available online 04 July 2020

Keywords:

Edema

Low-Level Laser therapy

Pain

Trismus

Third molar

ABSTRACT

Background and aim: Wisdom tooth surgery, as one of the most routine surgeries, has various complications and difficulties for which there is no comprehensive remedy that can compromise all the side effects.

Materials and methods: Low-level laser therapy is a recently recommended method with inconsistent results in different studies done past few decades, but it can be the treatment of choice. By a strategic search of keywords in PUBMED, MEDLINE, and GOOGLE SCHOLAR, 72 articles were explored.

Results: Seventeen randomized clinical trials and preliminary articles were selected based on inclusion and exclusion criteria, such as the coordination of articles with the concept, full-text availability, and clinical trials. (application of laser in fields other than surgery is an exclusion criterion) The data were sorted as four tables after perusal of all the pick-up papers.

Conclusion: Through different sketching of studies and laser applications used, other outcomes are justifiable and reasonable.

1. Introduction

Wisdom tooth surgery is frequent as a minor maxillofacial operation performed under local anesthesia, which its difficulty impressed directly from the tooth position.^[1] Postoperative complaints affecting life quality vary according to their severity^[2, 3] divided into minor and major categories. Minor complaints consist of alveolar nerve inflammation, trismus, bleeding, sepsis, dental fracture, alveolar process damage, edema, and pain, while significant consequences are jaw fracture and persistent sensation changes.^[4] As the anesthesia wears off, pain increases reaching its maximum by 3-5 hours after surgery and continues up to 2-3 days, then falling off after a week.^[4] Edema ascends to its peak by 12-48 hours and then obviates after 5-7 days.^[5] Also, trismus downturns as well as pain and edema. It is important to point out to dry socket as one of the most common postoperative phenomena.^[6] Sensory deficiencies can be indicated as anesthesia, hypoesthesia, hyperesthesia, or even dysesthesia. Lack of sensation, even distribution in taste, is a reported complaint after mandibular 3rd molar surgeries with the incidence of 0.1 to 22 % in the lingual nerve and 0.26 to 4.8 % in the inferior alveolar nerve, which one-third of them are permanent and affect the patients' quality of life.^[7] It seems like there is no acceptable proceeding to prevent the complaints completely and effectually.^[8] Of course, prescribing local and systemic corticosteroids after surgery is effective, but patients should admit digestive

discomfort, risk of frequent bleeding, and allergic reactions as a complication of therapy.^[9] Using the cold pack, long term anesthesia, and various cuts also are effective.^[3, 4, 10] In current decays, the laser has been considered one of the most effective medical field techniques since 1971^[11] and in dentistry since 1988.^[12] Lasers are characterized by high level/hard/hot laser and low level/soft/cold laser, respectively, with a power of more than 500 mW and of less than 250 mW. High levels generate heat made them suitable for surgical procedures. On the other hand, Low levels cause photochemical reactions stimulated tissue repair.^[13, 14] Second class lasers reduce tooth hypersensitivity and toothache and influence postoperative discomfort following periodontal manipulation (gingivoplasty, gingivectomy, frenectomy), orthodontic appliance adjustment wisdom tooth surgery. In addition to treating the sinus and gingiva inflammation while employing these lasers for inferior alveolar nerve inflammation and numbness needs more investigations as there are some controversies. To treat ulceration of aphthous, herpes, and post-chemotherapy and radiotherapy, mucositis, and osteonecrosis of the jaw, low-level laser have been recommended as the neoteric method. Surely we can't escape the wide utilization of introduced procedure in the field of mandibular and maxillary dysfunction and.^[1, 3, 13, 15] Three different theorizations have been put forward to answer the question, "how laser effects?" One of the theories emphasizes the modulation of the inflammatory process by the

* Corresponding author. Donya Maleki

E-mail address: donyamaleki93@gmail.com

Student Research Committee, Faculty of Dentistry, Guilan University of Medical Sciences, Rasht, Iran

<http://doi.org/10.30485/IJSRDMS.2020.229110.1053>



proliferation of lymph vessels, vasodilation, and reduction of permeability of blood vessels^[5] and arteries vasodilation.^[13] The second viewpoint states that lasers mutate peripheral nerve irritability and transition, especially c fibers. The release of the endogenous endorphin under the laser's influence is the main topic of the third opinion.^[13, 16] Therefore based on what we said above, the first theory explained how low-level lasers reduce edema but the second and third theories bold the analgesic impression. It is clear that the reduction of pain and edema eventually leads to the elimination of trismus.^[13] Numerous studies have done recently to find out lasers' effects and complications, but controversies are apparent. Heterogeneity of results, the possibility of bias, and diversity in designs make studies' efficacy questionable.

2. Materials and methods

A randomized clinical trial titled "efficacy of LLLT on postoperative complications after mandibular third molar surgery" was done by the same authors in Guilan, Iran, after obtaining Guilan ethics committee approval. This review article was designed after. A search strategy was developed for

PUBMED, MEDLINE, and GOOGLE SCHOLAR (From 1993 to 2018). By searching keywords such as laser, low-level laser, low-level laser therapy, LLLT, soft laser, third molar, third molar extraction, third molar surgery, mandibular third molar, mandibular third molar surgery, impacted third mandibular molar, pain, swelling, edema, trismus, maximum mouth opening, inflammation, postoperative, 72 articles were found from which 34 papers were selected based on inclusion criteria. 27 English full-text records were obtained, 17 randomized clinical trials (RCT), or preliminary articles were screened. These studies were evaluated based on patient's age and number, inclusion and exclusion criteria, being split-mouth or not, recommendation before surgery, types of laser appliance and they're characterized, differences in laser radiation location (intraoral – extraoral), numbers of radiation points, laser therapy protocols, variables studied, recommendation after study and their results. The number of patients in 16 selected studies was at least 10, 120 in maximum, and 41 on average from 16 to 50 years old. (Table 1: Characteristics of Studies).

Table 1: Characteristics Of Studies.

Article	Age	Sample Size	Drugs prescription	Other consideration	Local anesthesia and vasoconstrictions
1	----	15	-500 Mg Paracetamol (q12h for a week) -Benzylamine HCL -Chlorhexidine Gluconate Gargle Antiseptic Solution	No use of cold pack.	2 ml of 4 % Articaine with Epinephrine 1:100,000
3	16-24	25	600 Mg Ibuprofen	Consume if required.	Block of the Inferior Alveolar nerve: 1.8 ml of Mepivacaine Hydrochloride Block of the Buccinators nerve: 1.8 ml Articaine Hydrochloride with Epinephrine 1:100,000
4	More than 17	22	-500 Mg Amoxicillin (q8h for a week) -600 Mg Ibuprofen (q8h for three days) -Chlorhexidine Antiseptic Mouth Wash (q12h for a week)	-----	Mepivacaine 2% with Norepinephrine 1:100,000
7	18-27	32	-500 Mg Oral Amoxicillin (q8h for five days) -500 Mg Acetaminophen	-----	Articaine HCL 2.5% with 1:100,000 Epinephrine
10	19-32	40	-----	Soft diet No alcoholic or sparkling drinks Use of cold pack for the first 24 hours Keep head elevated to reduce swelling No brushing, rinsing, and splitting on the first day No brushing near the surgical area for the first three days No wound irrigation for the first two days.	Articaine Hydrochloride and Adrenaline Hydrochloride
14	18-30	25	25Mg Codeine Tablets (2 TABs q3h on the day of surgery)	After this period, the use of Codeine is allowed.	Xylocaine/Adrenaline 20 mg/ml + 12.5g/ml
15	18	20	-750 Mg Oral Amoxicillin (q8h for a week) -600 Mg Ibuprofen (2 days q12h for 15 days) Chlorhexidine 0.12% And 575 Mg Metamizole	No use of cold pack.	Three cartridges of 1.8 ml of 4% Articaine with Epinephrine 1:100000
			-250 mg phenoxymethylpenicillin		

17	18-50	64	(q6h for five days) -250 mg erythromycin stearate(q6h for five days) -400 mg ibuprofen (q6h for five days)	-----	-----
18	18-30	30	-1g Oral Amoxicillin (q12h for five days) -80mg Oral Ketoprofen (q12h for two days)	-----	-----
19	18-27	48	-500 Mg Oral Penicillin (Amoxicillin)(q8h for five days) -Benzidamin HCL -Klorheksidin Glukonat Gargle Antiseptic Solution -500 Mg Acetaminophen (q8h for five days)	-----	Articaine HCL 2.5% with 1:100.000 Epinephrine
20	17-29	10	-500 Mg Amoxicillin (q8h for seven days) -600 Mg Ibuprofen (q8h for three days) -500 Mg Paracetamol (q6h for three days)	In case of allergy, 300 Mg Clindamycin q8h for seven days was selected.	-----
21	More than 16	45	-500 mg paracetamol (q12h for 7 days) -benzydamine hydrochloride -chlorhexidine gluconate gargle antiseptic solution	Use of cold pack for first 24 hours.	2 ml of 4% Articaine with 1:100,000 Epinephrine
22	18-30	44	-1gr Oral Amoxicillin (q12h for five days) -1600 Mg Ibuprofen (for two days)	-----	-----
23	18-28	45	-750 Mg Acetaminophen (q8h for three days) -30 Mg Acetaminophen With Codeine Phosphate	Consume if required, but the patient was excluded.	Two cartridges (1.8 ml) of the local anesthetic Mepivacaine 2 % with Epinephrine 1:1,000,000.

Then the patients were chosen based on inclusion criteria:

Healthy patients – ASA1 (without medical history, chronic disease or infection)^[1, 3, 4, 7, 14, 17, 18, 21, 22, 23], Mandibular third molars with extraction indication^[6] (bilateral with same position as the classifications of Pell & Gregory & Winter)^[1, 3, 4, 7, 14, 15, 18, 19, 21, 22, 23] for example B III^[1, 8, 21, 22] or mesioangular position with bone retention^[7, 19] no orthodontic indication,^[23] no use of mental drugs^[3, 15] no alcohol or smoking^[3] no allergy to penicillin^[3, 23] or local anesthesia^[15] good oral hygiene^[3, 4] no infection^[3, 23] and acute pericoronitis^[14] no severe periodontal disease^[15] and no pathologic lesion^[15] The exclusion criteria were mainly:

Contraindication of laser therapy^[1, 21, 22] pregnancy, breastfeeding and use of oral contraception drugs^[1, 10, 20, 21, 22] use of self-prescribed medications before or after surgery (others than antibiotics, anti-inflammatory, and analgesics drugs prescribed in each study's instruction)^[10, 23] high body mass index (BMI = 24)^[10], patients treated with corticosteroid or adrenal cortical suppression drugs over the previous 3 month^[7, 19], use of self-willed antiseptic mouthwashes^[18], undergoing radiotherapy^[23], complication in surgery (bleeding – difficulty – surgery lasts more than 90 minutes)^[23], and teeth with pulp involvement^[22] Patients were informed with research risks and written consents were obtained.

3. Results

Surgical protocol:

Preoperative recommendations were different in studies: in Pol(2016)^[3] study, prophylactic antibiotics were prescribed 1 hour before surgery for all the patients, so there was no need for postoperative antibiotics while in the

investigation of Batinjan(2014).^[10] No antibiotics were used Ferrante(2013)^[18]; however, and Raiesian(2017)^[22] asked all the patients not to consume any painkillers 12 hours before surgery. Also in Fabre(2015)^[20] research, patients received chlorhexidine (0.12%) and povidone-iodine (1%) preoperatively. In studies, surgeries were performed by a specialist with the standard approach of wisdom tooth surgery. In studies where both sides of a patient's wisdom teeth were included, surgeries performed in two separate appointments with 21 days^[4, 23] or one month^[1, 15] intervals. These intervals were considered to eliminate laser therapy systematic effects. To proper anesthesia, variable local anesthesia with or without vasoconstrictions was applied, and it doesn't seem to have effective instruction. Match all postoperative considerations; effective instruction was given.

Laser therapy protocol:

Patients were randomly divided into two groups; a laser group and a control group (in Sierra 2013^[6], there were more than two groups). Nine reports were split-mouth, which means each patient was in both groups (on the side in the laser group and the control group). This design would lead to the elimination of biological variation in response to laser therapy.^[1, 3, 4, 6, 15, 17, 22, 23] while in the other six reports, one patient was in just one group even if the 3rd mandibular molar of the other side was a candidate for surgery. Different laser appliance of other parameters was used, and that will justify the variation of results. The fellow table (Table 2: Characteristics Of Laser Appliance) was design to evaluate reposts on kind of appliance, wavelength, power density, radiation time, energy, radiation mode, and handpiece properties.

Table 2: Characteristics Of Laser Appliance.

Article	Appliance	Wave Length (nm)	Power density (mW)	Time (s)	Energy (J)	Dose (J/cm2)	Mode	Point	Handpiece	Contact
1	GaAlAs diode laser	810	300	40	12	----	Continuous	----	1*3 (cm2)	No contact mode
3	GaAs laser diode dual-source	904-910	500	----	----	----	Pulsed super pulsed.	----	----	----
4	Ga–Al–As, Twin Laser	780	10	----	----	7.5	----	10	----	----
5	GaAlAs LPL single dose	637	50	----	----	4	----	----	----	----
7	16 Ga-Al-As diode	808	100	120	12	----	----	----	1*3 (cm2)	Contact mode
10	High-frequency laser (LaserHF)	660	50	30	1.5	----	----	2	----	No contact mode
14	Biophoton laser	820-830	40	150	6	----	----	----	----	----
15	GaAlAs diode	810	400	32	12.8	4	Continuous	----	2(cm2)	----
17	Conductor laser of 830nm and 30 mW	830	30	33	1	----	----	----	----	----
18	G laser 25 galbaiti	980	300	64	54	----	Continuous	3	600 micron	Contact mode
19	Ga-Al-As diode laser	808	100	120	12	----	----	----	1*3 (cm2)	----
20	Endophoton LLT 0107	660	35	8	----	5	Continuous	4	0.0035 (cm2)	----
21	GaAlAs diode laser	810	300	40	12	4	Continuous	----	1*3 (cm2)	No contact mode
22	G-laser 25 Galbiati	980	30	180	18	----	Continuous	3	600 micron	----
23	Red laser diode	660	100	10	1	----	----	6	0.002826 (cm2)	----

The handpiece was applied to a specific surgical site (intra-orally, extra-orally, or both), and exposure was done on the laser group. The same protocol was done on the control group while the appliance was off [6, 7, 10, 15, 17, 19, 23, 24], but Alan (2016)^[1] preferred not to insert the handpiece on the control group at all. Three and two reports respectively irradiated laser intraoral and

extraoral, whereas six studies did laser therapy intraorally and extraoral. Based on assessed mediators, laser therapy was sketched at different times to prepare the best efficacy. (half of the sixteen types of research discussed their radiation time) (Table 3: Location And Time Of Laser Therapy).

Table 3: Location And Time Of Laser Therapy.

Article	Immediately after surgery	After 24 hours	After 48 hours	Intraoral	Extraoral
1	*	----	*	----	Masseter muscle
3	*	*	*	1 cm from the target tissue	----
4	*	----	----	1 cm from buccal, distal, lingual, and middle sites of the target tissue	Masseter muscle
5	*	----	----	1 cm from the target tissue	----
7	----	----	----	1 cm from the target tissue	The masseter muscle

15	----	----	----	1 cm from the target tissue	----
18	----	----	----	1 cm from vestibular and lingual sites of the target tissue	1 cm from the masseter muscle
19	----	-	----	1 cm from the target tissue	1 cm from the masseter muscle
20	----	*	----	1 cm from the target tissue	----
21	*	----	*	----	Masseter muscle
22	*	*	----	1 cm from the target tissue	Masseter muscle
23	*	*	*	----	The outer atrium of the ear

Then designed variables were measured. evaluate trismus and edema; compared with data obtained after surgery. (Table 4: Assessment Of defined intervals were metered preoperatively considered a baseline Postoperative Complaints).

Table 4: Assessment Of Post-Operative Complaints.

Article	Edema			Pain			Trismus			Another variable		
	By	Time	Appliance	By	Time	Appliance	By	Time	Appliance	By	Time	Appliance
1	Researcher	2 and 7 days after surgery	3D image	Patient	2 and 7 days after surgery	VAS	Researcher	2 and 7 days after surgery	Interincisal distance with a compass	----	----	----
3	Researcher	1, 2, 5, 7 and 14 days after surgery	Subjective VAS	Researcher	----	----	----	----	----	----	----	----
	Patient											
4	Researcher	1,2 and 3 days after surgery	Chin–the lower part of the tragus	Patient	1, 2 and 3 days after surgery	VAS	VAS	1, 2 and 3 days after surgery	Interincisal distance	----	----	----
5	Researcher	Day after surgery	Chin –the lower part of the tragus	----	----	----	----	----	----	----	----	----
6	Three blinded individuals	Two and seven days after surgery	With two different scales	Patient	Two and seven days after surgery	With two different scales	Three blinded individuals	Two and seven days after surgery	With two different scales	----	----	----
7	Researcher	Two and seven days after surgery	Amin & Laskin method	----	----	----	Researcher	Two and seven days after surgery	Interincisal distance with caliper	----	----	----

10	Researcher	Period of seven days after surgery	A-4 point Defined scale	-----	-----	-----	-----	-----	-----	Patient	Period of seven days after surgery	Quality of life OHIP-14-CRO questionnaire
14	Researcher	Three and seven days after surgery	Designed appliance	Patient	-----	VAS	Researcher	Three and seven days after surgery	Designed appliance	-----	-----	-----
15	Researcher	Two and seven days after surgery	Tragus-lip commissure GO-external canthus of the eye	Patient	Every two hours for six hours Then for the next three days, once in the morning and once before going to bed	VAS	Researcher	Two and seven days after surgery	Interincisal distance with a caliper	-----	-----	-----
18	Researcher	1 and 7 days after surgery	Chin -lower part of tragus	Patient	1 and 7 days after surgery	VAS	Researcher	1 and 7 days after surgery	Interincisal distance with caliper	-----	-----	-----
19	Researcher	2 and 7 days after surgery	Amin & Laskin method	-----	-----	-----	Researcher	2 and 7 days after surgery	Interincisal distance with caliper	-----	-----	-----
20	Researcher	Period of 7 days after surgery	Tragus-tragus (Schultz mosquet) ²⁴	Patient	Period of 7 days after surgery	VAS	Researcher	Period of 7 days after surgery	Interincisal distance with a caliper	Present of delayed infection		
21	-----	-----	-----	Patient	-----	VAS	Researcher	2 and 7 days after surgery	Interincisal distance with a compass	-----	-----	-----
22	Researcher	1 and 7 days after surgery	Mandibular angle -PO. mandibular angle - ipsilateral ala. mandibular angle-lateral canthus of eye.	Patient	1 and 7 days after surgery	VAS	Researcher	1 and 7 days after surgery	Interincisal distance with a collis	-----	-----	-----

			mandibular angle-tragus Mandibular angle-lateral canthus of eye.								
23	Researcher	1, 2 and 7 days after surgery	Mandibular angle-lateral canthus of eye.	Patient	1, 2 and 7 days after surgery	VAS	Researcher	1, 2 and 7 days after surgery	Interincisal distance	Local temperature Dysphagia infection	

4. Discussion

The effects of LLLT on postoperative complications have been studied in the past years, and outcomes' controversies are obvious as results of different designs, procedures, measured variables, and used lasers appliances. Some studies reported that LLLT is not capable of a therapeutic approach after third molar extraction.

Lopez-Ramirez et al. presented the efficacy of LLLT in the management of surgical pain, edema, and muscle spasm after the third molar procedure. The laser (Al-As-Ga, 810 nm, 400 MW) was activated over the wound surface after surgery for one of the two operated sides of each patient. The pain level was lower in the side underwent laser therapy than the other side, but it was not confirmed statistically. The trismus and edema at the 2nd and 7th days were not significantly improved after receiving laser. Eventually, the study conducted that LLLT was not of benefits to settle the postoperative problems.^[15]

A previous study reported the extra-oral LLLT (Ga-Al-As laser, 810 nm, 300 MW), which was applied after the operation and two days later, didn't significantly affect the reduction of the edema and trismus in control and laser groups at 2nd and 7th day post-operatively. However, the pain level was meaningfully less in the treated side than the control side on the 7th postoperative day.^[11] A survey by Koparal et al. aimed to observe the difference between single and double sessions LLLT. The LLLT (Ga-Al-As laser, 810 nm, 300 MW) was administered extra orally in a single dose laser for the first group immediately after surgery while the second group was treated with two dose laser after surgery and on two days later, and the control group was asked to apply ice pack. The outcomes indicated that both laser therapy protocols had positive effects on limiting the postoperative pain, swelling, and trismus. Still, only the reduction of pain intensity after a week was significant. Also, comparing three groups, the results of the parameters' measurement were not meaningfully different.^[21]

Meanwhile, other researches showed the ability of laser appliances as equipment for numerous advantages. Aras et al. showed the effects of intraorally and extraoral LLLT (Ga-Al-As diode laser, 808 nm, 100 MW) on trismus and edema after extraction surgery of the third molar. The laser was applied immediately after the extraction, and trismus and edema were measured on post-surgical days 2 and 7. The effect of LLLT on declining the trismus and edema on the mentioned days was significant. However, this study was designed as a non-spilled mouth study, and each patient was not his/her control. Thus, the individual difference was not eliminated.^[7]

Ferrante et al. had done an investigation on the effectiveness of a diode laser (980 nm, 300 MW) on postoperative complaints after impacted mandibular wisdom tooth extraction. The laser therapy was performed intraorally and extraoral after the procedure and the day after. According to the statistical analysis, the improvement in trismus, edema, and the pain was remarkable in the 2nd and 7th days after surgery in the experimental group.

This improvement in the experimental group rather than the control group can be that the study was not blind, and the control group received the conventional treatment instructions. So the effect of psychological factors was not considered.^[18]

Fabre et al. reported significant anti-inflammatory and analgesic influences of a diode laser (AlGalnP laser, 660 nm, 35 MW) applied for four sequential appointments intraorally in the first 24 hours. Their laser therapy protocol was arranged according to the phases of wound healing. In this study, the swelling and trismus returned to the basement 24 hours after surgery in the experimental group. However, it took three days to complete pain reduction.^[20] The promising findings were dependent on the fact that LLLT is more evident in the primary phases of healing.^[15]

In a survey performed by Pol et al., the evidence of the laser's anti-inflammatory and analgesic properties was searched on complaints occurring after the lower jaw wisdom tooth surgery. The laser probe (Ga-As laser, 907 nm, 500 MW) was inserted inside the socket and activated immediately after surgery, 24 hours, and 48 hours after surgery. The pain and swelling were assessed at 1, 2, 5, 7, 14 days after the procedure. The authors found a meaningful reduction in the treated side parameters than the placebo group, especially at the primary 5-day period. In this study, the edema was measured by the VAS scale subjectively. In addition to that, a graph paper in millimeters was used to assess the distance of 4-predetermined-lines objectively. By this method, the edema was evaluated in all possible directions, but the patients' sensation was also involved.^[3]

Landucci et al. designed an investigation to evaluate the effect of single-dose LLLT (Ga-Al-As laser, 780 nm, 10 MW) in reducing pain, swelling, and trismus following third molar extraction surgery, which was a split-mouth RCT study. The surgical site received a laser beam in 10 points (4 intraoral points near the socket and 6 points on masseter muscle) immediately after surgery. It was found that LLLT is significantly suitable to limit pain, edema, and trismus at 48 hours and seven days. Although the laser therapy session was single, the laser was irradiated in more points than other studies, which can be positive.^[4]

In a clinical trial carried out by Aras et al. in 2010, the affectivity of intraoral LLLT was studied in contrast to extraoral LLLT (Ga-Al-As diode laser, 808 nm, 100 MW) on postoperative edema and trismus at days 2 and 7. According to their statistical analysis, the extraoral low-level laser administration had significant beneficial effects on the 2nd and 7th day on swelling and opening mouth. In contrast, the intraoral laser therapy was significantly effective for trismus treatment on the 7th day.^[19]

5. Conclusion

Determining the perfect laser appliances' parameters to assess the best clinical efficiency is somehow confusing. However, the efficacy of LLLT on these complications has been reviewed with more details in recent

investigations, which demonstrate a hopeful improvement.

Conflict of Interest

The authors declared that there is no conflict of interest.

Acknowledgments

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

- [1] Alan H, Yolcu Ü, Koparal M, Özgür C, Öztürk SA, Malkoç S. Evaluation of the effects of the low-level laser therapy on swelling, pain, and trismus after removal of impacted lower third molar. *Head & face medicine*. 2016;12(1):25.10.1186/s13005-016-0121-1.
- [2] Leung YY, Fung PP, Cheung LK. Treatment modalities of neurosensory deficit after lower third molar surgery: a systematic review. *Journal of Oral and Maxillofacial Surgery*. 2012;70(4):768-78.10.1016/j.joms.2011.08.032.
- [3] Pol R, Ruggiero T, Galesio G, Riso M, Bergamasco L, Mortellaro C, Mozzati M. Efficacy of anti-inflammatory and analgesic of superpulsed low level laser therapy after impacted mandibular third molars extractions. *Journal of Craniofacial Surgery*. 2016;27(3):685-90.1097/SCS.0000000000002523.
- [4] Landucci A, Wosny AC, Uetanabaro LC, Moro A, Araujo MR. Efficacy of a single dose of low-level laser therapy in reducing pain, swelling, and trismus following third molar extraction surgery. *International journal of oral and maxillofacial surgery*. 2016;45(3):392-8.<https://doi.org/10.1016/j.ijom.2015.10.023>
- [5] Markovic A, Todorovic LJ. Effectiveness of dexamethasone and low-power laser in minimizing oedema after third molar surgery: a clinical trial. *International journal of oral and maxillofacial surgery*. 2007;36(3):226-9.10.1016/j.ijom.2006.10.006.
- [6] Sierra SO, Deana AM, Ferrari RA, Albarello PM, Bussadori SK, Fernandes KP. Effect of low-level laser therapy on the post-surgical inflammatory process after third molar removal: study protocol for a double-blind randomized controlled trial. *Trials*. 2013;14(1):1-7.10.1186/1745-6215-14-373.
- [7] Aras MH, Güngörmüş M. The effect of low-level laser therapy on trismus and facial swelling following surgical extraction of a lower third molar. *Photomedicine and laser surgery*. 2009;27(1):21-4.10.1089/pho.2008.2258.
- [8] Brignardello-Petersen R, Carrasco-Labra A, Araya I, Yanine N, Beyene J, Shah PS. Is adjuvant laser therapy effective for preventing pain, swelling, and trismus after surgical removal of impacted mandibular third molars? A systematic review and meta-analysis. *Journal of oral and maxillofacial surgery*. 2012;70(8):1789-801.10.1016/j.joms.2012.01.008.
- [9] He WL, Yu FY, Li CJ, Pan J, Zhuang R, Duan PJ. A systematic review and meta-analysis on the efficacy of low-level laser therapy in the management of complication after mandibular third molar surgery. *Lasers in medical science*. 2015;30(6):1779-88.10.1007/s10103-014-1634-0.
- [10] Batinjan G, Zore Z, Čelebić A, Papić M, Pandurić DG, Zore IF. Thermographic monitoring of wound healing and oral health-related quality of life in patients treated with laser (aPDT) after impacted mandibular third molar removal. *International journal of oral and maxillofacial surgery*. 2014;43(12):1503-8.10.1016/j.ijom.2014.09.003.
- [11] Kathuria V, Dhillon JK, Kalra G. Low level laser therapy: a panacea for oral maladies. *Laser therapy*. 2015;24(3):215-23.10.5978/islsm.15-RA-01.
- [12] Merigo E, Clini F, Fornaini C, Oppici A, Paties C, Zangrandi A, Fontana M, Rocca JP, Meleti M, Manfredi M, Cella L. Laser-assisted surgery with different wavelengths: a preliminary ex vivo study on thermal increase and histological evaluation. *Lasers in medical science*. 2013;28(2):497-504.10.1007/s10103-012-1081-8.
- [13] Khalighi HR, Anbari F, Taheri JB, Bakhtiari S, Namazi Z, Pouralibaba F. Effect of low-power laser on treatment of orofacial pain. *Journal of Dental Research, Dental Clinics, Dental Prospects*. 2010;4(3):75.10.5681/joddd.2010.019.
- [14] Roynesdal AK, Björnlund T, Barkvoll P, Haanaes HR. The effect of soft-laser application on postoperative pain and swelling: a double-blind, crossover study. *International journal of oral and maxillofacial surgery*. 1993;22(4):242-5.10.1016/s0901-5027(05)80646-0.
- [15] López-Ramírez M, Vélchez-Pérez MÁ, Gargallo-Albiol J, Arnabat-Domínguez J, Gay-Escoda C. Efficacy of low-level laser therapy in the management of pain, facial swelling, and postoperative trismus after a lower third molar extraction. A preliminary study. *Lasers in medical science*. 2012;27(3):559-66.10.1007/s10103-011-0936-8.
- [16] Bjordal JM, Johnson MI, Iversen V, Aimbire F, Lopes-Martins RA. Low-level laser therapy in acute pain: a systematic review of possible mechanisms of action and clinical effects in randomized placebo-controlled trials. *Photomedicine and Laser Therapy*. 2006;24(2):158-68.10.1089/pho.2006.24.158.
- [17] Fernando S, Hill CM, Walker R. A randomised double blind comparative study of low level laser therapy following surgical extraction of lower third molar teeth. *British Journal of Oral and Maxillofacial Surgery*. 1993;31(3):170-2.10.1016/0266-4356(93)90118-g.
- [18] Ferrante M, Petrini M, Trentini P, Perfetti G, Spoto G. Effect of low-level laser therapy after extraction of impacted lower third molars. *Lasers in medical science*. 2013;28(3):845-9.10.1007/s10103-012-1174-4.
- [19] Aras MH, Güngörmüş M. Placebo-controlled randomized clinical trial of the effect two different low-level laser therapies (LLLT)—intraoral and extraoral—on trismus and facial swelling following surgical extraction of the lower third molar. *Lasers in medical science*. 2010;25(5):641-5.10.1007/s10103-009-0684-1.
- [20] Fabre HS, Navarro RL, Oltramari-Navarro PV, Oliveira RF, Pires-Oliveira DA, Andraus RA, Fuirini N, Fernandes KB. Anti-inflammatory and analgesic effects of low-level laser therapy on the postoperative healing process. *Journal of physical therapy science*. 2015;27(6):1645-8.10.1589/jpts.27.1645.
- [21] Koparal M, Ozcan Kucuk A, Alan H, Asutay F, Avci M. Effects of low-level laser therapy following surgical extraction of the lower third molar with objective measurement of swelling using a three-dimensional system. *Experimental and therapeutic medicine*. 2018;15(4):3820-6.10.3892/etm.2018.5921.
- [22] Raiesian S, Khani M, Khiabani K, Hemmati E, Pouretzad M. Assessment of low-level laser therapy effects after extraction of impacted lower third molar surgery. *Journal of Lasers in Medical Sciences*. 2017;8(1):42.10.15171/jlms.2017.08.
- [23] Sampaio-Filho H, Sotto-Ramos J, Pinto EH, Cabral MR, Longo PL, Tortamano IP, Marcos RL, Silva DF, Pavani C, Horliana AC. Evaluation of low-level laser at auriculotherapy points to reduce postoperative pain in inferior third molar surgery: study protocol for a randomized controlled trial. *Trials*. 2016;17(1):1-9.10.1186/s13063-016-1540-9.

- [24] Schultze-Mosgau S, Schmelzeisen R, Frölich JC, Schmele H. Use of ibuprofen and methylprednisolone for the prevention of pain and swelling after removal of impacted third molars. *Journal of Oral and Maxillofacial Surgery*. 1995;53(1):2-7. 10.1016/0278-2391(95)90486-7.

How to cite this Article: Khalighi Sigaroudi A, Maleki D, Zare H, Maleki D. Is Low-Level Laser Therapy Effective for Complications of Mandibular Third Molar Surgery? A Literature Review. *International Journal of Scientific Research in Dental and Medical Sciences*, 2020;2(3):72-80. doi:10.30485/IJSRDMS.2020.229110.1053.