Official Dental Journal of Suez Canal University
DENTAL SCIENCE Updates
Print ISSN 2636-3836
Online ISSN 2636-3844
www.dsujournals.ekb.eg
DSU — Vol. 4, No. 2, September (2023) — PP. 253:259

COMPARATIVE STUDY BETWEEN LOW LEVEL LASER THERAPY AND ULTRASOUND THERAPY FOR MINIMIZING POSTOPERATIVE TRISMUS AFTER SURGICAL REMOVAL OF MANDIBULAR THIRD MOLARS

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DOI: 10.21608/dsu.2023.165491.1144
Manuscript ID: DSU-2209-1144

KEYWORDS

Impaction, LLLT, Mandibular 3rd, Trismus, Ultrasound therapy

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ABSTRACT

Introduction: Oral and maxillofacial surgeons regularly perform the procedure of extracting impacted mandibular 3rd molars. Unfavorable postoperative side effects, like trismus in the first few days following surgery, are frequently linked to this procedure. **Aim:** In this study, conservative treatment, low-level laser therapy, and ultrasound therapy were compared to each other and standard dental care following the surgical removal of an impacted 3rd mandibular molar. **Materials and methods:** Participants in this study included 30 healthy individuals who had previously undergone surgery to extract partially or completely impacted mandibular third molars. They were split into ten groups of ten patients using a randomization process. After having an impacted third molar surgically removed from their mouths, 10 patients in **Group A;** were given analgesics and antibiotics to treat their pain. In **group B** patients, an impacted lower third molar was surgically removed, and intraoral, and extraoral low-level laser therapy was also administered. There were ten patients in this group (LLLT). **Group C**: After the previous medications were prescribed, ten patients with an impacted lower 3rd molar surgically removed were given low-intensity pulsed ultrasound therapy extra orally. This was done after the impacted lower 3rd molar had been surgically removed. After surgery, patients' truisms were evaluated two and seven days later. **Results:** The outcomes demonstrated that conservative treatment, ultrasound application, and low-level laser therapy all statistically significantly ($p<0.05$) decreased trismus. **Conclusion:** LLLT is more effective than ultrasound and conservative treatment at reducing trismus after surgery to remove impacted mandibular 3rd molars.

INTRODUCTION

The procedures carried out by oral and maxillofacial surgeons are numerous, but one of the most common is the removal of impacted mandibular 3rd molars. In the first few days following surgery, this procedure is frequently accompanied by unfavorable postoperative side effects such as pain, edema, and trismus. These symptoms can last for several weeks after the procedure [(1)].

Postsurgical trismus can impede daily activities such as sleeping, chewing, and eating and may discourage some patients from undergoing further surgery [(2)].

Lasers are electromagnetic radiation-generating devices with uniform wavelength, phase, and polarization; they can be high-powered, low-powered, surgical, or therapeutic. With a long history in medicine, laser therapy is beginning to show a lot of promise in dental applications. There is proof that therapeutic or low-powered lasers have biostimulatory effects on living tissue. Since then, conditions like chronic ulcers, carpal tunnel syndrome, rheumatoid arthritis, osteoarthritis, tendinopathy, ankle sprains, epicondylitis, and lumbalgia have all been treated with it. The use of laser technology has the distinct advantage of enhancing therapeutic methods and promoting the healing process [3].

LLLT has been used in dentistry for various purposes due to these advantages, including pain relief, treating temporomandibular joint disorders' symptoms and signs, and accelerating the recovery of patients who have lost their sense of touch. But earlier studies on the effects of LLLT after third molar surgery had contentious results [4].

Since the 1980s, it has been shown that LLLT can reduce edema, trismus, and pain after the extraction of impacted third molars, but the results of earlier studies were inconsistent. However, others found no advantage to low-power laser therapy following third molar surgery compared to placebo treatment. In some of these studies, the laser was said to have positive effects, but not in others [5].

Due to its superior biologic effect on promoting tissue healing, noninvasive low-intensity pulsed ultrasound, or LIPUS, can be used to lessen postoperative complications following surgical removal of mandibular 3rd molars. Ultrasound therapy is one of the most prevalent and widely used electrophysical agents. This study aimed to compare the efficacy of LLLT and LIPUS after surgical removal of mandibular third molars. Although ultrasound has been used in medicine for more than 60 years, its effectiveness in treating pain, musculoskeletal injuries, and soft tissue lesions is still debatable [6].

MATERIALS AND METHODS

The Faculty of Dentistry's Research Ethics Committee has approved the current study (no. 247/2019). Thirty healthy patients who needed surgical extraction of partially or entirely impacted mandibular 3rd molars underwent this randomized controlled trial study at the outpatient oral and maxillofacial surgery clinic of the Suez Canal University Faculty of Dentistry.

Inclusion criteria:

a. Thirty middle-aged (20 -30 years old) healthy patients.

b. Patients with an impacted lower third molar that needed surgical extraction were selected.

Exclusion criteria:

a. Patients with any contraindicated diseases for any surgical procedure.

b. Patients who are allergic to any drugs.

c. Pregnant and lactating patients.

d. Patients with local radiographic lesions related to the impacted tooth.

Preoperative Preparations:

- Medical, dental histories and history of chief complaint were taken.
- All chosen patients were informed about the procedure, precautions, follow-up appointments, and potential complications. They also signed informed consent.

Preoperative evaluation:

- Before the impacted third molars in the mandible were surgically removed, a digital panoramic radiograph was taken.
- Before surgery, a digital caliper measures the maximum interincisal space between the maxillary and mandibular incisors (**Figure 1A**).

Surgical Procedure:

Each surgery's duration was recorded. Mepecaine - L of mepivacaine 2 percent with levonordefrin 1:20,000 was used for local anesthesia during surgical procedures. The lingual, buccal, and inferior alveolar nerves were all blocked. The result was a full mucoperiosteal flap. Once the cement-enamel junctional line was reached, the osteotomy was performed around the impacted tooth using physiological saline solution to irrigate (3-0 Silk) to suture the flap (**Figure 1B, 1C, and 1D**).

Postsurgical therapy application:

The mandibular angle, the lower border of the mandible along the surgical site, and a point 1.5 cm higher than the lower border of the mandible along the surgical site were all treated with LLLT in Group B. (**Figure 1E**), as well as intraorally on four points surrounding the surgical site: mesial, distal, buccal, and lingual (**Figure 1F**) [7]. The infrared laser device had a 14mm-diameter bio-modulation handpiece and a 635-nm wavelength, output power: 200 mW (0.2W), time of 30 seconds per point, continuous wave mode, and the laser energy was 0.2W X 30s = 6 J per point. Three low-level laser sessions were carried out immediately following surgery and two days later. Throughout the procedure, both the patient and the laser therapist wore protective eyewear.

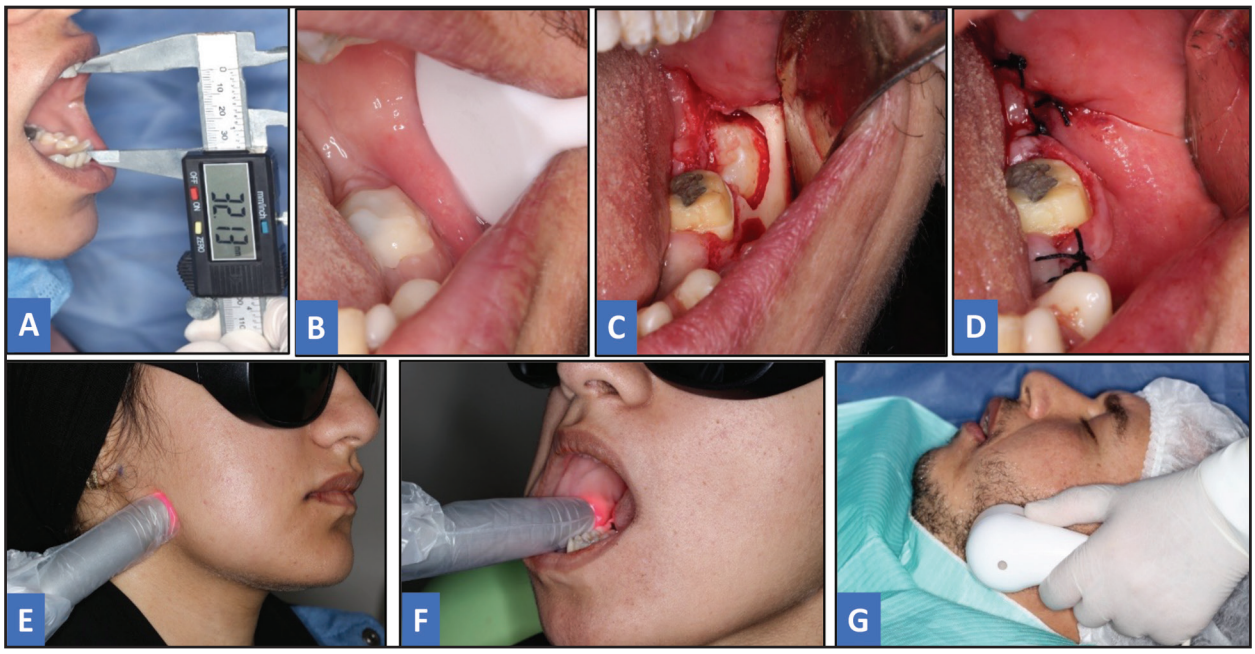

Fig. (1) (A) Before surgery, use a digital caliper to measure the interincisal space between the maxillary and mandibular incisors (B) Preoperative clinical view (C) Bone guttering (D) Suturing after removal of the tooth with 3-0 Silk (E) Application of diode laser on one of the extraoral points (F) Intraoral application of diode laser for patient (G) Application of low-intensity pulsed ultrasound one points of extraoral points

The surgical site's lower mandibular border and a point 1.5 cm higher than the surgical site's lower mandibular border at the mandibular angle, Digisonic low-intensity pulsed ultrasound therapy was applied to Group C. (**Figure 1G**), the ultrasound therapy was administered by a facial head at a frequency of (1 MHZ), by pulsed waves at 20% for 7 minutes [8]. The application of low intensity pulsed immediately after surgery and two days after surgery.

Antibiotic medication (Hibiotic 1g tab twice daily for one week), Flagyl 500 mg 1 tab three times daily for one week, and analgesic medication were prescribed for all patients (Brufen 600 mg by dose one tab twice daily, if needed till the patient felt no pain and each patient took the number of tablets must be recorded from the 1st day till the 7th day postoperatively).

Postoperative Instructions:

- The occurrence of trismus is expected.
- A sterile gauze pack was kept on the wound, and the patients were advised to bite it for two hours.
- Avoid rinsing or spitting for 24 hours after surgery.
- Avoid smoking for 24 hours after the surgery.
- Avoid hot drinks, hot foods, and hard foods, and eating on the operating side.
- On the first day of surgery, apply cold packs for 10 mins/hour for at least 6 hours.
- On the second day of surgery, apply hot packs for 10 mins/hour for at least 6 hours.

Postoperative evaluation:

The degree of trismus was evaluated by measuring the maximum interincisal space between the maxillary and mandibular incisors before surgery, two days after surgery, and seven days after surgery using digital calipers.

Statistical analysis:

The mean, as well as the standard deviation of the data, were computed and presented. Three groups were compared using a two-way ANOVA (mixed). The significance level was set ($P \leq 0.05$).

Utilizing IBM® SPSS® Statistics Version 25 (2017) for Windows, the data was statistically examined (SPSS Inc., IBM Corporation, NY, and USA). The data's normal distribution could be verified using the Shapiro-Wilk test. The normal distribution of the data allowed for the use of parametric statistical tests.

RESULTS

A total of 30 patients (14 female and 16 male) ranged from 20-31 years.

Trismus: After two days, the laser group's mouth opening had significantly decreased by 32.31± 0.19 (P-value< 0.0001), in the ultrasound group by 29.87± 0.97, and in the control group by 26.73± 0.89, respectively. After 7 days, mouth opening significantly increased, similar to what happened in the laser group at 35.35± 0.17, in the ultrasound group was 34.16± 0.37 and in the control, group was 32.98± 0.39 respectively (**Figure 2** &**Table 1**).

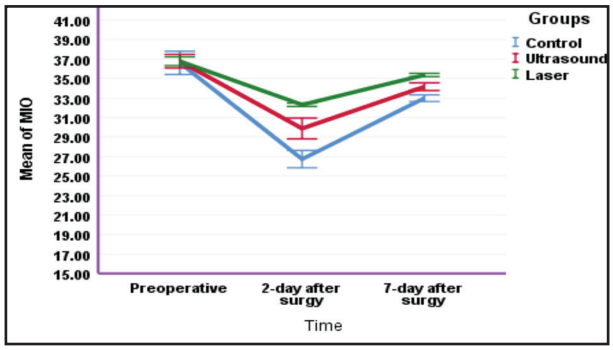

Fig. (2) The effect of groups (control, ultrasound, and laser), time, and the interaction between Group X time and MIO are depicted in a cluster line graph with an error bar.

Table (1) *Comparison between clinical parameters of both groups*

Variables	Pairs	Time	Control		Ultrasound		Laser	
			Mean± SE	P-value	Mean± SE	P-value	Mean± SE	P-value
MIO	Preoperative vs After 2 days	Preoperative	36.59±1.01	0.001**	36.76±0.83	0.001**	36.77±0.44	0.001**
		After 2 days	26.73± 0.89		29.87±0.97		32.31±0.19	
	Preoperative vs After 7 days	Preoperative	36.59±1.01	0.04*	36.76±0.83	0.001**	36.77±0.44	0.001**
		After 7 days	32.98± 0.39		34.16±0.37		35.35±0.17	
	After 2 days vs After 7 days	After 2 days	26.73± 0.89	0.001**	29.87±0.97	0.001**	32.31±0.19	0.001**
		After 7 days	32.98± 0.39		34.16±0.37		35.35±0.17	

DISCUSSION

According to reports, the number of patients who experience pain, swelling, or trismus after wisdom tooth removal is three times that of asymptomatic patients. As a result, many medical professionals have stressed how crucial it is for patients having third molar surgery to manage their pain, swelling, and trismus [9].

Results of our study revealed that there is significant difference between administration of antibiotics, analgesics and anti-edematous versus LLLT and ultrasound therapy for the reduction of postoperative pain. Low level laser therapy and ultrasound therapy were significantly effective in decreasing pain following surgical removal of impacted mandibular third molar as manifested by significant decrease of number of analgesic tablets used as the lowest number of analgesic tablets were taken by patient was in LLLT group followed by ultrasound group and control group respectively, there were significant differences between groups in trismus. Low level laser therapy and ultrasound therapy were significantly effective in decreasing trismus following surgical removal of impacted mandibular third molar as manifested by significant increased Maximum inter-incisal opening MIO as the maximum inter-incisal opening was in Laser group followed by ultrasound group and control group respectively and there were significant differences between groups in edema. Low level laser therapy and ultrasound therapy were significantly effective in decreasing edema following surgical removal of impacted mandibular third molar as manifested by significant decreased in the surface area measured of facial swelling contours as the greatest edema was control group followed by ultrasound group and laser group respectively.

By transferring energy, laser therapy stimulates a biological response that results in anti-inflammatory effects, wound healing stimulation, immune system stimulation, promoting vasodilation, and increasing cellular metabolism, all of which are thought to be highly beneficial properties of this type of laser application [10]**.** Low-intensity light therapy (LLLT) has a photochemical effect as opposed to a thermal effect. It is also known as photobiomodulation (PBM). In the same way that photons are absorbed by cellular photoreceptors and trigger chemical changes in plants, light also triggers biochemical reactions inside cells [11]**.**

Low level Laser Therapy effectiveness results in our study supported by the study carried out by Aras and Gungormus , when they evaluated the effect of LLLT on trismus and edema after lower jaw third

molar surgery where the masseter muscle was irradiated extra-orally just after surgery. The results demonstrated the efficacy of LLLT on trismus and edema reduction at days 2 and 7 after surgery compared to placebo group[12].

Another study was done by Aras and Gungormus, when compared between the effects of extra-oral and intraoral low-level laser therapies (LLLT) on postoperative trismus and edema following the removal of mandibular third molars using diode laser device with a continuous wavelength of 808 nm for both of the LLLT groups; The result demonstrated that extra-oral LLLT is more effective than intraoral LLLT for the reduction of postoperative trismus and swelling after extraction of the lower third molar [13].

Lopez *et al*[13]. conducted a prospective, randomized, double-blind study in 20 healthy patients with two symmetrically impacted lower third molars to evaluate the anti-inflammatory effects of LLLT after surgical extraction of these teeth. A low-level laser with the same settings as in their experiment had no positive effects on discomfort, swell, or trismus after impacted lower 3rd molars were extracted. According to research by Raouaa *et al*. [14] comparing the effects of LLLT and corticosteroid injections on postoperative pain, trismus, and edema following surgical removal of a mandibular third molar, there is no discernible difference between corticosteroid administration and LLLT for the reduction of postoperative pain and trismus. On the seventh postoperative day, dexamethasone was more effective at reducing swelling.

CONCLUSION

The pain, swelling, and trismus experienced by patients after surgical removal of impacted mandibular third molars were significantly alleviated with the help of LLLT, followed by ultrasound and conservative care.

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