ORIGINAL RESEARCH PAPER

Dentistry

EFFICACY OF LOW-LEVEL LASER THERAPY FOLLOWING EXTRACTION OF IMPACTED LOWER THIRD MOLARS

KEY WORDS:

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ABSTRACT

The purpose of this study was to assess the effectiveness of low-level laser therapy (LLLT) in the management of pain, inflammation, and trismus associated with surgical removal of the affected third molars. Forty patients were randomly assigned to two treatment groups, each consisting of 20 patients — group tests (LLLT) and group control (and LLLT) —and were told to avoid consumption of painkillers 12 hours before the procedure. In the experimental group, a 980-nm diode-laser (G-Laser 25 Galbiati, Italy) was used, using a 600-□m hand piece, internally (in tongue and vestibule) 1 cm from the affected area and extraorally at the insertion point of the masseter muscle immediately after surgery and at 24 h. The control group received only routine management. The parameters used for LLLT were: continuous mode, at 300 mW (0.3 W) at a total of 180 s (60 s × 3) (0.3 W × 180 s054 J). The group tests showed an improvement in interincisal opening and a significant reduction in trismus, inflammation and pain intensity in the 1st and 7th day following surgery. Although LLLT has been reported to prevent swelling and trismus after removal of the affected third molars, some of these studies reported a positive laser effect while others did not. All indications for the use of laser therapy in postoperative treatment of third molar surgery use a variety of methods and, in some cases, explanations regarding the selection of their radiation parameters are not provided. This study has shown that LLLT, which has these criterions, is helpful in reducing postoperative discomfort after third molar surgery.

Introduction :

Surgical removal of impacted third molar tooth, usually performed by oral and maxillofacial surgeons, often results in postoperative impediment of jaw function and swelling.

The myriad of factors contributing to these conditions are complex, but they arise from the inflammatory process initiated by surgical trauma [1,2]. The pain attains its maximum intensity 3 to 5 h after surgery, continuing for 2 to 3 days, and gradually subsiding until the seventh day [1, 3, 4]. The swelling reaches its optimum intensity in 12 to 48 hours, resolving between the fifth and seventh days [5].

The use of drugs such as corticosteroids (local or systemic) and Non-Steroidal anti-inflammatory drugs (NSAIDs) are often recommended after surgical extraction used to relieve complication.[6, 7] Although effective, these drugs exhibit side effects such as gastrointestinal irritation, systemic bleeding tendency, and allergic reactions [1,8]. These findings justify attempts to find newer approaches without negative consequences.

Since the introduction of laser therapy in 1971, LLLT has been used to treat a variety of ailments, such as osteoarthritis, carpal tunnel syndrome, tendinopathy, rheumatoid arthritis, lumbago, chronic ulcers and epicondylitis [2,5,6]. The use of LLLT in dentistry also began in the 1970s [7]. Laser therapy has been used to prevent or reduce trismus and swelling following removal of the impacted third molars, and in the treatment of chronic sinusitis, herpes simplex, chronic facial pain, gingivitis, nerve disorders in the inferior alveolar nerve, dentinal hypersensitivity and subsequent pain following periodontal surgery [7].

The exact biological mechanism of the analgesic effect produced by low-level laser therapy (LLLT) is still unclear. Several studies suggest that LLT may promote increased production of serotonin and acetylcholine at a central level and may regulate the production of histamine and prostaglandins at the peripheral level.

Although LLLT has been used to obviate postoperative swelling and trismus after third-molar surgery, the outcomes are controversial. This might be due to diverse study designs, differentiations or complexities in measuring variables related to postoperative sequelae, as well as to various lasers and hand-piece types and different irradiation parameters [1,6, 9–12]. The aim of this study was to assess the efficacy of the therapeutic laser in controlling pain, swelling, and trismus associated with surgical removal of impacted lower third molars.

Materials and method

A total of 40 patients with an age of ≥18 years reported and referred to the department of oral and maxillofacial surgery, Jaipur dental college were enrolled into this study. The study was approved by the Ethics Committee of Jaipur dental college, Rajasthan.

Method of collection of data:

The patients reporting to the department of oral and maxillofacial surgery department, Jaipur dental college, Jaipur with a chief complain of pain, in lower back tooth region were included.

The *inclusion criteria* were: Gender: Male or Female or male, age of >18 years, absence of systemic illness, presence of impacted mandibular third molar(s), and surgical difficulty grade of III B according to the scales of Pell and Gregory [13].

Exclusion criteria include contraindications to laser therapy, systemic illness, local infection, tobacco use, oral contraceptive s use, pregnancy, lactation.

The patients were informed about the procedure to be undertaken and due consent were taken from each patient.

A detailed case history was obtained from all patients in a standardized performa designed to accumulate the various parameters required for meeting objectives of the study.

Patient who reported with pain in lower back tooth region were evaluated to ascertain the cause for this complaint. Diagnosis of impacted third molar was clinically established on the basis of following features:

1. Pain or tenderness of the gums or jaw bone.
2. Redness and swelling gums around the impacted tooth
3. Halitosis
4. Difficulty in opening mouth
5. Prolonged, unexplained headache or jaw ache.

Diagnosis of impacted third molar was radiologically established on the basis of Intra-oral Periapical radiograph and Orthopantogram.

Patient were randomly assigned into 2 groups comprising of 20 patient in each group in order to receive treatment for their affliction. Patients within these groups were treated as follows:

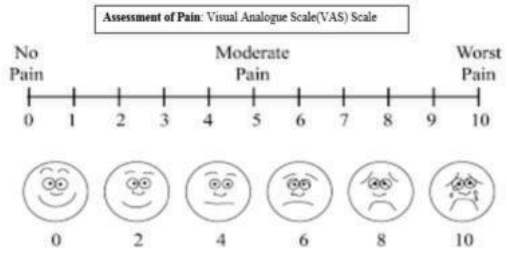
Group 1: patient treated with low level laser after surgical extraction of lower third molar.

Group 2: patient not treated with low level laser after surgical extraction of lower third molar.

Method of application of low-level laser therapy:
The laser was applied with a continuous wavelength of 980 nm was used, and the laser therapy was applied by using a 600-m handpiece. Laser energy was applied at 300 mw (0.3w) for 60 s approximately 1cm from the extraction socket. (Fig 1)

Fig 1. Application of low-level laser therapy

Assessment of pain:
Pain was noted on postoperative days 1st,3rd ,5th . Pain was evaluated using a visual analogue scale (VAS) calibrated from 0 to 10, with 0 as no pain, 1–3 as mild pain, 4 –6 as moderate pain, 7–9 as severe pain, and 10 as worst pain.



Assessment of Swelling:
The size of the postoperative swelling was determined on the 1st,3rd,5th day. The distance between the commissure of lip and the lower part of the auricle lobe was measured. The baseline level was determined pre-operatively. (Fig 2.1, 2.2, 2.3)

Fig 2.1 Assessment of Swelling on 1st postoperative day
Fig 2.2 Assessment of Swelling on 3rd postoperative day
Fig 2.3 Assessment of Swelling on 5th postoperative day

Assessment of trismus:
inter-incisal opening was evaluated by measuring with a caliper the maximal opening between the right maxillary and right mandibular central incisors before surgery and on postoperative 1st,3rd,5th day. (Fig 3.1, 3.2, 3.3)

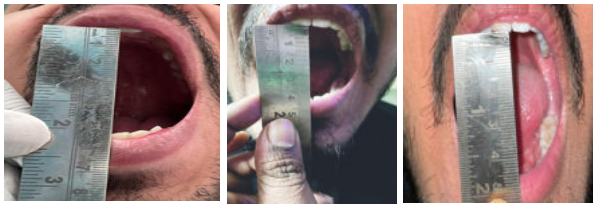


Fig 3.1 Assessment of Trismus on 1st postoperative day
Fig 3.2 Assessment of Trismus on 3rd postoperative day.
Fig 3.3 Assessment of Trismus on 5th postoperative day.

Assessment of healing:
Soft tissue healing assessment was made by color of gingival, bleeding on palpation, presence of granulation tissue, epithelization of the margins on 1,3,5 day and the standardized soft tissue healing potential index was made by Laundry, Turnbull, and Howley. (Fig 4.1, 4.2, 4.3)

Fig 4.1 Assessment of Healing on 1st postoperative day
Fig 4.2 Assessment of Healing on 3rd postoperative day
Fig 4.3 Assessment of Healing on 5th postoperative day

Scores:

Healing Index 1: Very Poor	Healing Index 2: Poor	Healing Index 3: Good
Tissue color: >=50% of gingiva red with suppuration	Tissue color: >=50% of gingiva red	Tissue color: >= 25% and < 50% of gingiva red
Response to palpation: bleeding	Response to palpation: bleeding	Response to palpation: no bleeding
Granulation tissue: present	Granulation tissue: present	Granulation tissue: none
Suppuration: present	Suppuration: absent	Suppuration: absent

Results:
The data was statistically analyzed establishing relationships between the clinical parameter which were assessed by unpaired t- test.

Of the 20 total patients in group 1: Low level laser therapy was given after extraction of third molar surgery. Of the 20 total patients in group 2: No Low level laser therapy was given after extraction of third molar surgery.

Table 1: Distribution of study population according to Pain Score

	Group 1		Group 2		Mean Difference	t-test value	p-value
Pain	Mean	Std. Deviation	Mean	Std. Deviation			
1st day	2.20	0.95	6.20	0.83	-4.00	-14.142	0.001*
3rd day	0.90	0.72	5.25	0.72	-4.35	-19.178	0.001*
5th day	0.35	0.59	4.55	0.69	-4.20	-20.796	0.001*
1st-3rd day	1.30	0.66	0.95	0.69	0.35	1.648	0.108
1st-5th day	1.85	0.81	1.65	0.67	0.20	0.849	0.401
3rd-5th day	0.55	0.60	0.70	0.66	-0.15	-0.751	0.457

The mean Pain score at 1st day, 3rd day, 5th day, 1st-3rd day, 1st-5th day and 3rd-5th day was compared between Group 1 and Group 2 using the unpaired t-test. The mean Pain score at 1st day, 3rd day and 5th day was significantly more among Group 2 compared to Group 1.

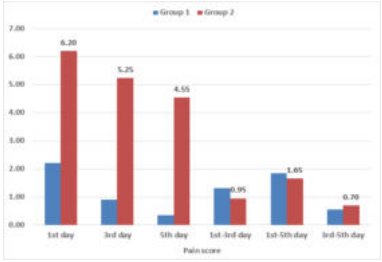


Table 2: Distribution of study population according to Swelling

	Group 1		Group 2		Mean Difference	t-test value	p-value
Swelling	Mean	Std. Deviation	Mean	Std. Deviation			
1st day	11.19	0.10	14.17	0.22	-2.98	-54.147	0.001*
3rd day	11.06	0.11	14.02	0.22	-2.96	-54.644	0.001*
5th day	10.90	0.23	13.93	0.19	-3.03	-45.011	0.001*
1st-3rd day	0.13	0.07	0.15	0.06	-0.02	-1.000	0.324
1st-5th day	0.29	0.25	0.24	0.11	0.05	0.826	0.414
3rd-5th day	0.16	0.24	0.08	0.09	0.07	1.199	0.238

The mean Swelling at 1st day, 3rd day, 5th day, 1st-3rd day, 1st-5th day and 3rd-5th day was compared between Group 1 and Group 2 using the unpaired t-test. The mean Swelling at 1st day, 3rd day and 5th day was significantly more among Group 2 compared to Group 1.

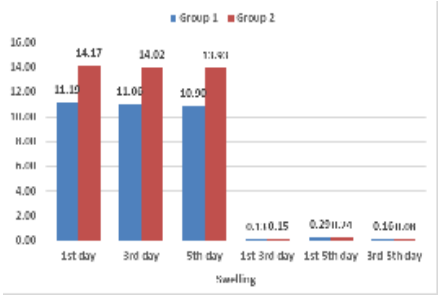


Table 3: Distribution of study population according to Trismus

	Group 1		Group 2		Mean Difference	t-test value	p-value
Trismus	Mean	Std. Deviation	Mean	Std. Deviation			
1st day	2.19	0.25	1.42	0.10	0.77	12.641	0.001*
3rd day	2.38	0.20	1.49	0.10	0.89	17.866	0.001*
5th day	2.57	0.14	1.54	0.09	1.03	27.554	0.001*
1st-3rd day	-0.19	0.13	-0.07	0.06	-0.12	-3.741	0.001*
1st-5th day	-0.38	0.17	-0.12	0.04	-0.26	-6.527	0.001*
3rd-5th day	-0.19	0.11	-0.05	0.07	-0.14	-4.765	0.001*

The mean Trismus at 1st day, 3rd day, 5th day, 1st-3rd day, 1st-5th day and 3rd-5th day was compared between Group 1 and Group 2 using the unpaired t-test. The mean Trismus at 1st day, 3rd day, 5th day, 1st-3rd day, 1st-5th day and 3rd-5th day was significantly more among Group 1 compared to Group 2.

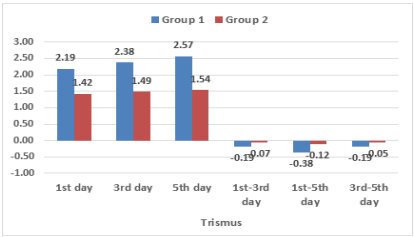
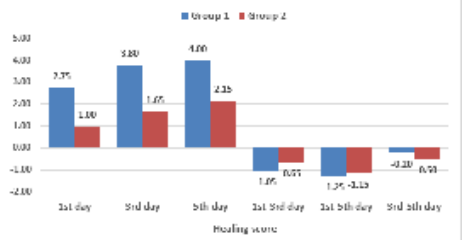


Table 4: Distribution of study population according to Healing of socket

	Group 1		Group 2		Mean Difference	t-test value	p-value
Healing	Mean	Std. Deviation	Mean	Std. Deviation			
1st day	2.75	0.44	1.00	0.00	1.75	17.616	0.001*
3rd day	3.80	0.41	1.65	0.49	2.15	15.055	0.001*
5th day	4.00	0.00	2.15	0.37	1.85	22.584	0.001*
1st-3rd day	-1.05	0.22	-0.65	0.49	-0.40	-3.325	0.002*
1st-5th day	-1.25	0.44	-1.15	0.37	-0.10	-0.777	0.442
3rd-5th day	-0.20	0.41	-0.50	0.51	0.30	2.042	0.058

The mean Healing score at 1st day, 3rd day, 5th day, 1st-3rd day, 1st-5th day and 3rd-5th day was compared between Group 1 and Group 2 using the unpaired t-test. The mean Healing score at 1st day, 3rd day, 5th day and 1st-3rd day was significantly more among Group 1 compared to Group 2.



Overall, the results show that there was improvement in all the parameters such as pain, trismus, swelling and healing by following the protocol in the above mentioned methods within the test group as compared to the control group.

Discussion:

Removal of the third molars is one of the most common procedures performed in maxillofacial surgery. Third molar removal requires intraoral intraoral access and is associated with several complications and postoperative morbidity6. Postoperative complications of third molar extraction surgery

have been reported in a variety of cases and include many symptoms, ranging from minor postoperative pain to more serious complications that require additional treatment (such as hospitalization), which may have permanent damage to the patient. Local signs of inflammation, including pain, usually follow removal of the affected third molars. In addition, this procedure has been widely used as a model for widely used as a model for the evaluation of analgesic efficacy of various drugs or physiotherapeutic means. Although lllt has been reported to prevent swelling and trismus following the removal of affected third molars, some of these studies reported positive laser effects while others did not. Controversy over the bio-stimulation stimulation caused by laser treatment still exists.

Roynesdal et al [14] investigated the effect of soft laser applications on postoperative swelling and trismus, they carried out extraction of both lower third molars similarly impacted in two separate operations, irradiating unilaterally with a 6-j semiconductor laser at 830 nm, 40 mw, and found pain reduction—and decreases in swelling and trismus—at 9 h, without significant statistical differences. The impact of the use of a soft laser only on postoperative swelling has been investigated by Tavbe et al.[15] Clokie et al.[16] and Fernando et al.[17] Fernando et al. carried out the extrusion of both lower molars which was similarly impacted, using a 830 nm, 30 mw laser semiconductor laser, applied intraorally at 4 j, at each surgical site in the experimental group. They reported magnitude of pain and swelling at 24 and 72 hours and on the seventh day, in addition to wound healing. There was a significant difference between groups in pain and swelling levels at 72 h, or in wound healing. [17]

Numerous studies have used lllt in dentoalveolar surgery to reduce facial swelling, pain and trismus. However, there is insufficient evidence to support that lllt use is relatively effective in the absence of active treatment to reduce pain, swelling and trismus following the surgical removal of the impacted mandibular third molar[18]. Studies with positive results, as well as negative results have been reported. For example, carrillo et al [16] reported that there was no significant difference in level pain and swelling levels between laser-treated groups and placebo groups. However, in the same study, lllt (he-ne; 633 nm; density of 10 j / cm2) provided a significant reduction in trismus in the laser-treated group after 7 days.

Amarillas-escobar et al [19] conducted a study, to evaluate the cumulative effect of laser treatment, lllt (nd-yag; 810 nm; 4 j / cm2) that was used as a multiple daily intraoral dose immediately after surgery and postoperatively at 24, 48 and 72h. The results of their study did not show a significant difference in reducing pain, swelling or trismus between laser-treated and control groups. In the present study, patients in group 1 received single doses of lllt, immediately after surgery and postoperatively at 48 hours, and a statistically significant difference was observed in swelling and trismus between groups. A statistically significant difference was also identified in the mean VAS levels between the groups at postoperative day 5th (p=0.001) which was significantly higher in group 2 compared with that in group 1.

The current study evaluated the effect of LLLT on postoperative pain, facial swelling and trismus in patients who underwent the extraction of impacted third molar tooth. It was observed that pain, trismus and swelling in LLLT group were significantly than in the control group.

Conclusion:

The results of this preliminary study show that the intraoral application of a 810-nm diode laser with the parameters used did significantly reduce pain, postoperative swelling, trismus and healing of the socket after a surgical removal of impacted lower third molars. It is imperative to increase the sample size and to contemplate new studies to evaluate the analgesic and anti-inflammatory efficacy of this simple and non-invasive procedure for the patient so as to find ample irradiation parameters and the ideal anatomical area to apply the laser.

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