ijlpr 2022; doi 10.22376/ijpbs/lpr.2022.12.6.SP25.L100-108

International Journal of Life science and Pharma Research

ISSN 2250-0480

Research Article



# Evaluation of Adjunctive Low Level Laser Therapy in Postoperative Management of Pain, Swelling, Trismus Following Surgical Removal of Impacted Mandibular Third Molars

**Sailesh Kumar R[1*] and Manodh.P[2]**

[1]*Senior Lecturer, Dept of Oral and Maxillofacial Surgery,Indira Gandhi Institute of Dental sciences, Sri Balaji Vidyapeeth , Puducherry – India*

[2]*Professor, Dept of Oral and Maxillofacial Surgery,Meenakshi Ammal Dental College,Meenakshi Academy of Higher Education and Research (Deemed-to-be-University), Chennai, India*

**Abstract:** Our aim **is t**o evaluate the effectiveness of Low Level Laser Therapy (LLLT) in the control of postoperative pain, swelling, and trismus associated with the surgical removal of impacted mandibular third molars. This study was carried out as a single centre, prospective study with a sample size of 30 patients to evaluate the effectiveness of LLLT following surgical removal of impacted third molars. Patients were randomly divided into two groups of 15 each. Group 1(Study /LLLT group) consisted of patients undergoing LLLT and with the use of postoperative analgesics and antibiotics. Group 2 (Control) included patients who were administered postoperative analgesics and antibiotics without the concurrent use of LLLT. The predictor variable was the LLLT application following mandibular third molar impaction surgery. The outcome variables namely pain, swelling, and trismus were evaluated on the day of surgery and 1st, 3rd, and 7th postoperative days (POD).Results:The pain was highest on POD 1 and gradually reduced by POD 7 in the study group when compared to the control group. Swelling showed a steep increase on POD 1 and thereafter a gradual reduction was observed on POD 7, when compared to the control group, the study group showed a significant decrease in swelling. Mouth opening was the lowest on POD1 and gradually increased by POD 7 in the study group than in the control group. Conclusion: The results of the study suggest that the application of LLLT to impacted mandibular third molar sockets helps eliminate/or reduce postoperative pain, swelling, and trismus.

**Keywords:** Low Level LASER Therapy, Third Molar Extraction, Adjunctive Therapy, Pain, Swelling and Trismus.

***Corresponding Author**

**Sailesh Kumar R , 1Senior Lecturer, Dept of Oral and Maxillofacial Surgery,Indira Gandhi Institute of Dental sciences, Sri Balaji Vidyapeeth , Puducherry – India**

**Received On 18 September 2022**

**Revised On 11 October 2022**

Accepted On 14 October 2022

**Published On 20 October 2022**

**Funding** This research did not receive any specific grant from any funding agencies in the public, commercial or not for profit sectors.

**Citation** Sailesh Kumar R and Manodh.P , Evaluation of Adjunctive Low Level Laser Therapy in Postoperative Management of Pain, Swelling, Trismus Following Surgical Removal of Impacted Mandibular Third Molars.(2022).Int. J. Life Sci. Pharma Res.12(6), L100-108 http://dx.doi.org/10.22376/ijpbs/lpr.2022.12.6.SP25.L100-108

## 1. INTRODUCTION

The most common procedure done by Oral and Maxillofacial Surgeons in the world is surgical extraction of impacted mandibular third molars under local anaesthesia on an outpatient basis [1,2.] The usual postoperative sequelae following surgical extraction of mandibular third molars have been reported as pain, swelling, and trismus [3]. On occasions postoperative healing complications such as alveolar osteitis, surgical site infection, fever and lymphadenopathy may occur[4]. The factors that contribute to these situations are complex, but they originate from an inflammatory process that is initiated by surgical trauma. The pain reaches maximum intensity 3 to 5 h after surgery, continuing for 2 to 3 days, and gradually diminishing until the seventh day. Swelling reaches peak intensity in 12 to 48 h, resolving between the fifth and seventh days. To reduce the sequelae and infections following third molar surgical extractions, pharmacological and non-pharmacological methods were implicated. Pharmacological methods include the use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), steroids, and antibiotics, are the mainstay of treatment. The use of local or systemic corticosteroids and NSAIDs are often recommended after surgical extraction of impacted lower third molars to eliminate postoperative pain, but some of them may manifest adverse effects such as gastrointestinal irritation, systemic bleeding tendency, and allergic reactions. Non – pharmacological methods include transcutaneous electric nerve stimulation (TENS), electric stimulation, ultrasound, superficial heat, cryotherapy, psychological intervention, and recently Low Level LASER therapy. These observations justify efforts to find a method of postoperative pain control that does not induce these side effects. In this context, the use of Low Level LASER therapy (LLLT), offers promising possibilities. Miaman's initiation of lasers in dentistry in the 1960s prompted ongoing research into the various applications of lasers in dental practise. On just one hand, there are hard lasers like carbon dioxide (CO2), Neodymium Yttrium Aluminum Garnet (Nd: YAG), and Er:YAG, that can provide both hard soft tissue applications but have restrictions because of high costs and the prospects for thermal injury to tooth pulp.,Even though on the contrary, cold or soft lasers centred on semiconductor diode devices, which are portable, low-cost devices used primarily for applications, Low Level LASER therapy (LLLT), also known as photobiomodulation refers to the use of a red-beam or near-infrared with a wavelength between 600 – 1000nm and power from 5 to 500 milliwatts[5]. In contrast, LASER used in surgery utilizes 300 watts of power and burns the tissue they encounter. It is called low level LASER therapy because it uses lower power than the regular settings, to obtain the desired outcome [11]. LLLT has been used for the treatment of a wide variety of disorders including carpal tunnel syndrome, rheumatoid arthritis, osteoarthritis, tendinopathy, ankle sprains, epicondylitis, lumbalgia, and nonhealing ulcers. Laser therapy is still experimental; however, good results have been reported in the treatment of dentin hypersensitivity, temporomandibular joint disorders, paraesthesia of the inferior alveolar nerve after third molar surgery and sagittal split osteotomy, trigeminal neuralgia, herpes labialis, aphthous ulcers, alveolitis, and mucositis after chemotherapy or radiotherapy, among others[1]. Through an anti-inflammatory processes, it stimulates cellular bio stimulation, quickens tissue regeneration, enhances wound healing, and diminishes inflammation and pain by inhibiting interleukin-6, interleukin-10, and tumour necrosis factor-a and monocyte chemotactic protein-1. In this study, we evaluated the effectiveness of LLLT in the postoperative management of pain, swelling, and trismus following surgical extraction of impacted mandibular third molars.

## 2. MATERIALS AND METHODS

This study was carried out as a single centre, prospective study on patients chosen from the ones referred to the Department of Oral & Maxillofacial Surgery of a tertiary care centre of South India. The research was approved by the Institutional Review Board (MADC/IRB/-IX/2016/148 and written, dated informed consent was obtained from all the patients prior to their participation. The sample size of 30 (N=30) patients who were undergoing prophylactic surgical extraction of third molars for orthodontic management was randomly divided into two groups of 15 each (n=15). The type of impaction and degree of impaction were scrutinized with intraoral periapical radiographs and were classified based on in accordance with the Winter's classification and Pell and Gregory classification of impacted third molars. Group 1 consisted of patients who underwent surgical extraction of the third molar and were given LLLT with postoperative analgesics and antibiotics. Group 2 was the Control group which included patients who underwent surgical removal of the third molar without the concurrent use of LLLT. Postoperatively, all individuals were placed on Caps Ibuprofen, 400 mg 8 h for 3 days; Caps Amoxycillin with Clavulanic acid 625 mg, 500 mg 8 h for 3 days, Tabs Metronidazole 400 mg 8 h for 3 days.

### *2.1 Inclusion Criteria*

- Patients over 18 years of age undergoing prophylactic surgical extraction of third molars for orthodontic management.
- Patients with Mesioangular impaction of the third molar, Class II of pell & Gregory Impaction Classification
- American Society of Anaesthesiologist's classification status I patients (ASA I-normal healthy)
- Bony impacted mandibular third molar
- Absence of pericoronitis, caries, and infection.

### *2.2 Exclusion Criteria*

- ASA classification status II, III & IV patients.
- Patients with a history of irradiation to the maxillofacial region.
- Patients with local pathologies such as cyst or tumour associated with impacted mandibular third molar.
- Patients with history of tobacco use,
- Patients with the history of oral contraceptives usage.
- Patients who are pregnant.
- Patients who are unable to come for follow up visits,

All patients were subjected to a standardized treatment protocol. The surgical removal of impacted mandibular third molars and application of LLLT were carried out by two different operators. The patients and surgeons were equipped with protective goggles (Figure 1). All surgical procedures for removal of impacted mandibular third molar were performed under the standard aseptic and surgical protocol. Anaesthesia was secured with 2% Lignocaine Hydrochloride with 1:80,000 adrenaline by inducing inferior alveolar nerve block, lingual nerve block, and long buccal nerve block.

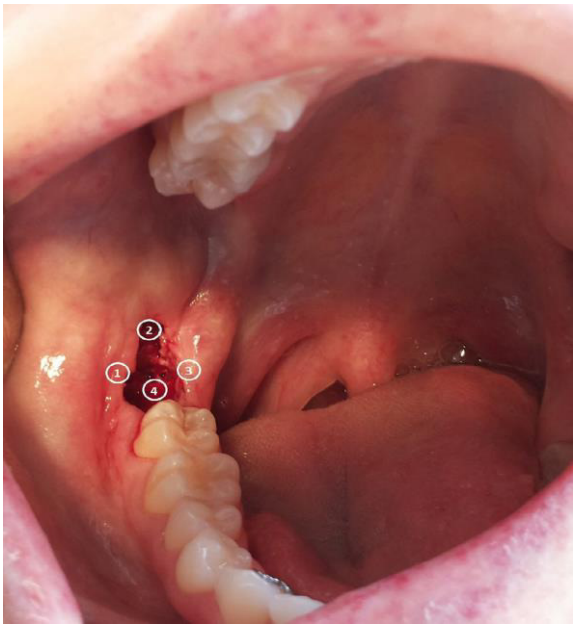


**Fig 1 The patients and surgeons were equipped with protective goggles**

'Terrance Ward" incision was used in all the cases. A full-thickness mucoperiosteal flap was raised. Constant copious irrigation with refrigerated saline was used during bone removal and odontectomy to prevent thermal necrosis. Sectioning of the tooth was done when indicated. Meticulous handling of the tissues, avoidance of unnecessary surgical trauma and copious irrigation of the wound before closure to remove foreign bodies and debris, leaving no potential foci for bacterial infections were of crucial importance in our measures. Primary closure was accomplished using 3-0 silk after achieving haemostasis. All patients were advised to follow standard postoperative instructions.

### *2.3 LASER Device*

In this study, a diode laser device (BIO LASE Diode LASER, EPICTM, California, USA) with a continuous wavelength of 940 nm was delivered using a handpiece. Laser energy was applied using a setting of 700 mW (0.7 W) for a total of 180s and 60s for each point. Protective goggles was worn by both the patient and the operator to prevent irreversible damage to the eye. LLLT was applied intraorally at two points (lingual and buccal) 1 cm adjacent to the extracted socket. Extraorally, it was applied at one point over the insertion of the masseter muscle. LLLT was applied immediately after surgery and at 1st, 3rd, and 7th postoperative days (POD) (Figure 2). Postoperatively, all patients in the experimental group were advised to take rescue medication of Tab. KETOROLAC 10 mg orally only if they had unbearable pain.

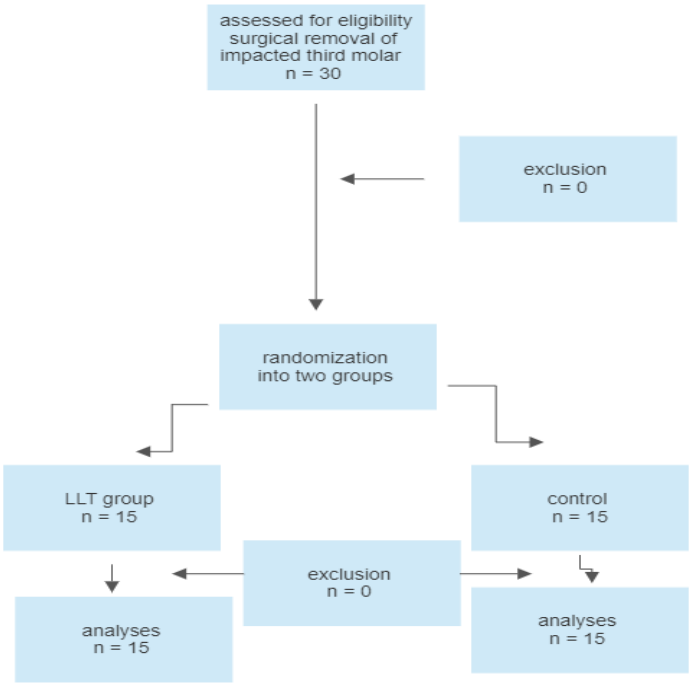
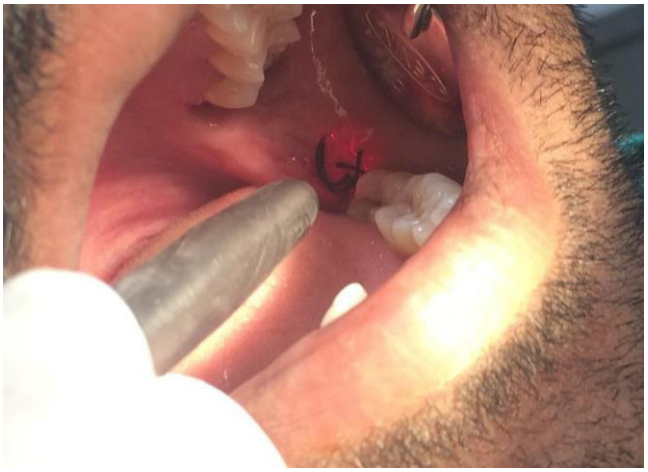



**Figure 2 showing laser treatment**



### *2.4 Pain Scores*

All the parameters were recorded by a single blinded clinical examiner on immediate postoperative, POD 1, POD 3, and POD 7. The pain was estimated subjectively by asking the patients to rate the nociceptive experience on a Numerical visual analogue scale (VAS) [6], of 0 to 10 in the immediate postoperative period, and on the 1st, 3rd and 7th postoperative days.

### *2.5 Swelling Assessment*

Facial edema was evaluated by tape method [7]. The swelling parameters were recorded in the immediate postoperative period, and on the first, third, and seventh postoperative days. The swelling was recorded using the following landmarks

S1 (in mm) - from the tragus to the outer corner of the mouth.
S2 (in mm) - from the tragus to soft tissue pogonion
S3 (in mm) - from lateral canthus of the eye to the angle of the mandible.
S (in mm) - an average of S1, S2, and S3

Mouth opening was recorded as the maximal interincisal opening in millimetres by using Vernier callipers **(Figure 3)**. The reference points were the mesio-incisal angle of the mandibular central incisor and mesio-incisal angle of the maxillary central incisor. Measurements were recorded in the immediate postoperative period and on the 1st, 3rd & 7th postoperative days.

**Figure 3 showing vernier caliper**

## 3. STATISTICS ANALYSIS

Acquired data from the two different groups were analysed using SPSS for windows version 16.0 (SPSS Inc., Chicago, Illinois, USA). The quantitative data obtained in the present study was assessed for normality using Shapiro Wilk's test and was found to be parametric in distribution. Intergroup analysis based on gender was carried out for different parameters using an Independent sample t-test. Intragroup analysis for different parameters at different time intervals was carried out using Repeated Measures ANOVA and pairwise comparison was done using Bonferroni Post hoc test. P-value <0.05 was considered as significant in the present study.

### *3.1 Risk of bias*

The groups were divided randomly by a sealed envelope technique and the single blinding was done. Even though the sample size could have been higher our study seems to less risk of bias.

## 4. RESULTS

### *4.1 Patient Demographics*

The study sample included 21 male and 9 female patients with a mean age of 27.96 years.

| Table 1 with demographics | | | | |
|---|---|---|---|---|
| Age and sex | Total | Male | Female | Mean age |
| Number and mean | 30 | 21 | 9 | 27.96 years. |

### *4.2 Pain*

We analysed pain using a visual analogue scale for accuracy. Pain parameters on POD 1 were 3.4 and 4.86 in study and control groups respectively. On POD 3, it was 2.2 and 2.93 in study and control groups respectively showing a significant decrease of pain on POD 3 in LLLT patients. The pain parameters recorded on POD 7 were 0.33 and 0.7 in the study and control groups respectively. This shows that in the experimental group (LLLT) patients experienced decreased pain to near normal by day 7 when compared with control patients' pain **(Table 2)**. All pain parameters were statistically significant with P VALUE < 0.05.

| Table 2 with pain analyses | | | | | |
|---|---|---|---|---|---|
| | Groups | N | Mean | Std. Deviation | Std. Error Mean |
| VAS0 | LLLT | 15 | 6.8667 | .83381 | .21529 |
| | Control Group | 15 | 7.3333 | .61721 | .15936 |
| VAS1 | LLLT | 15 | 3.4000 | .50709 | .13093 |
| | Control Group | 15 | 4.8667 | .74322 | .19190 |
| VAS3 | LLLT | 15 | 2.2000 | .94112 | .24300 |
| | Control Group | 15 | 2.9333 | .70373 | .18170 |
| VAS7 | LLLT | 15 | .3333 | .72375 | .18687 |
| | Control Group | 15 | .7333 | .70373 | .18170 |

### *4.3 Swelling*

#### *4.3.1 S1- FROM TRAGUS TO OUTER CORNER OF MOUTH.*

On POD 1, S1 showed a significant increase to 11.92mm from the baseline value of 10.20mm which was clinically and statistically significant. Swelling parameters gradually declined on POD 3 to 11.45mm. On POD 7, S1 decreased to 10.80mm, which was close to the baseline value of 10.20mm **(Table 3)**. The S1 was statistically insignificant when compared to the control group.

| Table 3 showing swelling parameters | | | | | |
|---|---|---|---|---|---|
| | Groups | N | Mean (mm) | Std. Deviation | Std. Error Mean |
| S1 Preoperative | LLLT | 15 | 10.2000 | .63117 | .16297 |
| | Control Group | 15 | 10.5000 | .64918 | .16762 |
| S1 POD 1 | LLLT | 15 | 11.9267 | .74399 | .19210 |
| | Control Group | 15 | 11.9600 | .68431 | .17669 |
| S1 POD 3 | LLLT | 15 | 11.4533 | .64128 | .16558 |
| | Control Group | 15 | 11.4867 | .56929 | .14699 |
| S1 POD 7 | LLLT | 15 | 10.8000 | .60356 | .15584 |
| | Control Group | 15 | 11.1000 | .66726 | .17229 |

#### *4.3.2 S2- FROM TRAGUS TO SOFT TISSUE POGONION*

On the POD 1, mean S2 showed a significant increase to 15.26mm from the baseline value of 14.22mm which was clinically and statistically significant. Swelling parameters gradually declined on POD 3 to 14.83mm. On POD 7, S2 showed a value of 14.30mm, which was close to the baseline value of 14.22mm (Table 4). S2 was statistically insignificant when compared to the control group.

| Table 4 showing swelling parameters | | | | | |
|---|---|---|---|---|---|
| | Groups | N | Mean(mm) | Std. Deviation | Std. Error Mean |
| S2 Preoperative | LLLT | 15 | 14.2234 | 1.18952 | .30713 |
| | Control Group | 15 | 14.3200 | 1.06315 | .27450 |
| S2 POD 1 | LLLT | 15 | 15.2667 | .91391 | .23597 |
| | Control Group | 15 | 15.3667 | .96338 | .24874 |
| S2 POD 3 | LLLT | 15 | 14.8333 | .85912 | .22183 |
| | Control Group | 15 | 14.8600 | .84414 | .21796 |
| S2 POD 7 | LLLT | 15 | 14.3003 | 1.19024 | .30732 |
| | Control Group | 15 | 14.3300 | 1.17716 | .30394 |

#### *4.3.3 S3-FROM LATERAL CANTHUS OF THE EYE TO ANGLE OF THE MANDIBLE*

On the POD 1, the mean S3 showed a significant increase to 10.38mm from the baseline value of 9.38mm which was clinically and statistically significant. Swelling parameters gradually declined on POD 3 to 9.99mm. On POD 7 showed a value of 9.81mm, which was close to the baseline value of 9.38mm **(Table 5).** S3 was statistically insignificant when compared to the control group.

**Table 5 showing swelling details**

| | Groups | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| S3 Preoperative | LLLT | 15 | 9.3800 | .52400 | .13530 |
| | Control Group | 15 | 9.7867 | .36227 | .09354 |
| S3 POD 1 | LLLT | 15 | 10.3800 | .77016 | .19885 |
| | Control Group | 15 | 10.6467 | .61629 | .15912 |
| S3 POD 3 | LLLT | 15 | 9.9933 | .67872 | .17525 |
| | Control Group | 15 | 10.2200 | .58943 | .15219 |
| S3 POD 7 | LLLT | 15 | 9.8133 | .48531 | .12531 |
| | Control Group | 15 | 9.9333 | .45774 | .11819 |

### *5.1 Swelling S (S1+S2+S3)*

The mean of swelling parameters showed a steep significant increase from 33.7mm in the immediate postoperative period to 37.48mm on POD 1 and gradually reduced to 36.27mm on POD 3. On POD 7, the swelling parameter was 34.8mm, which is near normal to the immediate postoperative value of 33.7mm (Table 6). The swelling parameter was statistically insignificant when compared to the control group.

**Table 6: Comparison of Group Statistics of Swelling (S1+S2+S3) in LLLT group and Control group**

| Time Intervals | LLLT group (mm) | Control group (mm) |
|---|---|---|
| Preoperative | 33.7 | 34.5 |
| POD 1 | 37.48 | 37.96 |
| POD 3 | 36.27 | 36.56 |
| POD 7 | 34.8 | 35.36 |

### *5.2 Maximal Interincisal Opening (Mio)*

In the study group, MIO was 47.13mm which reduced to 31.6mm on POD 1. The mean MIO on POD 3 and POD 7 was 37.4mm and 44.13mm respectively which were clinically and statistically significant (P-value < 0.04) (Table 7)

**Table 7: Maximal Interincisal Distance**

| Mouth Opening (MO) | Groups | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| MO 0 | LLLT | 15 | 47.1333 | 6.90617 | 1.78317 |
| | Control Group | 15 | 46.9333 | 4.43149 | 1.14421 |
| MO 1 | LLLT | 15 | 31.6000 | 6.43428 | 1.66132 |
| | Control Group | 15 | 25.1333 | 4.65781 | 1.20264 |
| MO 3 | LLLT | 15 | 37.4000 | 4.98283 | 1.28656 |
| | Control Group | 15 | 29.8667 | 4.08598 | 1.05500 |
| MO 7 | LLLT | 15 | 44.1333 | 6.80196 | 1.75626 |
| | Control Group | 15 | 35.7333 | 3.63449 | .93842 |

## 5. DISCUSSION

The postoperative period after third molar extraction experienced by patients is increasingly becoming a health concern. Many clinicians have emphasized the necessity for better control of pain, swelling, and trismus in patients who undergo third-molar surgery [8]. Several studies have shown that therapeutic laser evokes cellular bio-stimulation, helping to accelerate tissue regeneration, wound healing while reducing pain and swelling [9]. Medical lasers can be divided into two main types namely the high-power or hard lasers which include Er: YAG laser, carbon dioxide laser and Er, Cr: YSGG laser. They are used for surgical purposes. The low power or soft lasers which include diode laser, carbon dioxide laser, and Nd: YAG laser are mainly used to promote tissue regeneration [10].They are principally used to relieve pain, reduce inflammation, edema and accelerate healing. Hoon Chung et al [11] stated that LLLT has a wide range of effects at the molecular, cellular, and tissue levels. Within the cell, there is strong evidence to suggest that LLLT acts on the mitochondria to increase adenosine triphosphate (ATP) production, modulation of reactive oxygen species (ROS), and the induction of transcription factors. Several transcription factors are regulated by changes in cellular redox state. Among them are redox factor-1 (Ref-1) dependent activator protein-1 (AP-1) (a heterodimer of c-Fos and c-Jun), nuclear factor kappa B (NF-jB), p53, activating transcription factor/cAMP-response element-binding protein (ATF/CREB), hypoxia-inducible factor (HIF)-1, and HIF like factor. These transcription factors then cause protein syntheses that trigger further effects downstream, such as increased cell proliferation and migration, modulation in the levels of cytokines, growth factors, and inflammatory mediators, and increased tissue oxygenation. The influence of LLLT on the electron transport

chain extends far beyond simply increasing the levels of ATP produced by a cell [11]. Oxygen acts as the final electron acceptor in the electron transport chain and is, in the process, converted to water. Part of the oxygen that is metabolized produces reactive oxygen species (ROS) as a natural by-product. ROS are chemically active molecules that play an important role in cell signalling, regulation of cell cycle progression, enzyme activation, and nucleic acid and protein synthesis [11]. Because LLLT promotes the metabolism of oxygen, it also acts to increase ROS production. In turn, ROS activates transcription factors, which leads to the upregulation of various stimulatory and protective genes. These genes are most likely related to cellular proliferation, migration, and the production of cytokines and growth factors, which have all been shown to be stimulated by low-level light. Among its many effects, LLLT has been shown to cause vasodilation by triggering the relaxation of smooth muscle associated with endothelium, which is highly relevant to the treatment of joint inflammation. This vasodilation increases the availability of oxygen to treated cells, and also allows for greater traffic of immune cells into the tissue. These two effects contribute to enhanced healing. Nitric oxide (NO) a potent vasodilator via its effect on cyclic guanine monophosphate production, and it has been hypothesized that LLLT may cause photodissociation of NO from intracellular stores such as nitrosylated forms of both hemoglobin and myoglobin, leading to vasodilation. Ohno et al [12] in his study on pain suppressive effect of LLLT irradiation stated that effective pain reduction can be achieved via an increase in b-Endorphins, blocked depolarization of C-fiber afferent nerves, increased nitric oxide production, increased nerve cell action potential, axonal sprouting and nerve cell regeneration, decreased bradykinin levels, increased release of acetylcholine or ion channel normalization[13,14]. Controversies over bio-stimulation of tissue induced by LLLT still exist. A lack of uniform reporting of physical and biological variables such as type of laser, output power (continuous or pulsed), frequency of the pulse, wavelength, time and mode of application, distance of the source from irradiated tissue, histologic tissue differences, absorption characteristics and intraoral versus extra oral LLLT application make standardization of results difficult. All references to the use of laser therapy in the postoperative management of third molar surgery employ different methodologies and, in some, explanations as to the selection of their respective radiation parameters are not given. Swelling is likely to influence comfort, function, and aesthetics. Identifying factors and best treatment approaches to limit or avoid trismus and swelling would improve patients' recovery and reduce the burden that third molar surgery places on the patient's comfort in the immediate postoperative period. Our study showed that LLLT therapies have a positive effect on the patients' health during the postoperative healing phase with minimal complications. Pain is a symptom commonly expected after surgery and may vary considerably according to surgical difficulty and individual pain thresholds. Following third molar extraction, the pain intensity peaks after 3–5 h, and the pain continues for 2–3 days postoperatively, gradually diminishing by the seventh postoperative day. A similar pattern of pain occurrence was observed in our study; there was a reduction of pain at POD 3 and POD 7 in both the study and control groups. However, it is important to note the significant pain reduction after LLLT therapy. The findings of a systematic review and meta-analysis carried out by He W.L et al [15] demonstrated the efficacy of LLLT in reducing pain, with the largest effects recorded at 2 days postoperative. In our study, LLLT was applied immediately after surgery (POD 0) and a reduction of pain was observed at POD 3 which was statistically significant. Another meta-analysis done by Neckel et al [16] failed to report any benefits of LLLT in reducing pain and swelling after mandibular third molar extraction, but the researchers did observe a moderate benefit concerning trismus. Similarly, in a clinical trial by Taube et al [17] symmetrically embedded lower wisdom teeth were removed in the same operation. In this cross-over study of 17 patients, the randomly assigned test group was laser (He-Ne) treated for 2 min at a power output of 8 mW in pulsed mode (50 pulses per second). The authors were unable to detect any significant differences in the swelling between the test and the control groups. In contrast, Roynesdal et al [10] applied LLLT unilaterally after two separate third molar extraction procedures. The authors reported a reduction in pain, swelling, and trismus at 9 h postoperative. These findings could not be confirmed statistically; however, this may be explained by the administration of a low irradiation dose (6 J/cm2) and short intervals between assessments. The effect of LLLT on acute pain after injury may be related to the associated reductions in oedema, haemorrhage, neutrophil infiltration, and enzymes. Sabre et al [18] observed an LLLT-induced pain reduction at 48 h postoperative; however, no significant effects on the duration of pain were reported 7 days after surgery. Furthermore, Wathier et al [19] observed a statistically significant effect of LLLT on pain reduction at 1–5 days postoperative. In our study, the pain intensity showed a significant decrease on POD 3 and also decreased to near normal on POD 7 in the study group. Landucci et al [20] in his study observed a significant reduction in swelling on POD 1 and POD 3 across four intraoral and six extraoral points of irradiation. In contrast, other studies [1,21] utilizing different parameters have failed to demonstrate a beneficial effect of LLLT on swelling; however, these studies only applied irradiation intraorally. In addition to irradiation energy levels, irradiation location has a significant influence on the reduction of edema. LLLT has been used to prevent postoperative swelling and trismus after third molar surgery; however, the results are controversial. While some studies reported a positive effect of laser energy, others showed no influence of LLLT. These controversial results may be due to variations in study design and inconsistencies in measuring the variables related to postoperative sequelae after third molar surgery, as well as the use of different lasers and handpiece types and irradiation parameters. Roynesdal et al [10] performed a double-blind cross-over study on the effect of laser application on postoperative swelling and trismus. In their study, they used an 830-nm Biophoton laser (6 J) at 40 mW of power, and they reported that laser treatment had no beneficial effect on swelling and trismus after third molar surgery. In our study, it was observed that the postoperative edema and trismus in the LLLT group was significantly less than that seen in the placebo group up to 7 days post-surgery. In a randomized double-blind study, Carrillo et al [21] using a 633-nm He-Ne laser (0.3 W/cm2) at a dose of 10 J/cm2, reported that the amount of trismus seen in the laser group was significantly less than that seen in the placebo group up to 7 days post-surgery. Besides, they noted that He-Ne laser treatment had no beneficial effects on swelling after third molar surgery. The spot size of the laser beam they used was 1.5 mm, and they applied the laser at six points around the site of the surgical incision. Our findings concerning trismus were similar to those observed by Carrillo et al Contraindications to laser therapy depend on its possible bio-stimulation effect and its effects on benign and malignant cells of a specific area. Absolute contraindications are a danger to eye and thyroid gland irradiation; patients with a malignant

neoplasm, cardiac pacemaker, or epilepsy; and pregnancy. Relative contraindications are local infection, blood disease, photosensitive skin, or use of drugs that cause photosensitivity, and the chance of irradiating the gonads [22, 23].

## 6. CONCLUSION

Application of LLLT to impacted mandibular third molar sockets helps eliminate/or reduce postoperative pain, swelling, and trismus. Laser phototherapy can be easily applied to patients and has relatively short treatment times, depending on the power output of the device, the wavelength used, and the size of the area to be irradiated. There are no known permanent or serious side effects of laser therapy.

To conclude, the findings of our study are

### *6.1 PAIN*

The pain was highest on POD 1 and gradually reduced by POD 7 in the study group. When compared to the control group, the study group showed a significant decrease in pain.

### *6.1 SWELLING*

Swelling showed a steep increase from baseline value on POD 1and thereafter a gradual reduction towards the baseline value was observed on POD 7. When compared to the control group, the study group showed a significant decrease in swelling.

### *6.2 MOUTH OPENING*

Mouth opening was the lowest on POD1 and gradually increased by POD 7. When compared to the control group, the study group showed a significant increase in mouth opening.

## 7. AUTHORS CONTRIBUTION

Sailesh – concept, design and manuscript, Manodh – data collection

## 8. CONFLICT OF INTEREST

Conflict of interest declared none.

## 8. REFERENCES


1. Amarillas-Escobar ED, Toranzo-Fernández JM, Martínez-Rider R, Noyola-Frías MA, Hidalgo-Hurtado JA, Serna VM et al. Use of therapeutic laser after surgical removal of impacted lower third molars. J Oral Maxillofac Surg. 2010 Feb;68(2):319-24. doi: 10.1016/j.joms.2009.07.037, PMID 20116702.
2. Marković AB, Todorović L. Postoperative analgesia after lower third molar surgery: contribution of the use of long-acting local anesthetics, low-power laser, and diclofenac. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006;102(5):e4-8. doi: 10.1016/j.tripleo.2006.02.024, PMID 17052624.
3. Sane VD, Gadre KS, Chandan S, Ramanojam S, Singh V, Halli R. Efficacy of single dose azithromycin as prophylactic antibiotic in surgical removal of mandibular third molars: A clinical study. J Maxillofac Oral Surg. Oct-Dec 2013;12(4):382-6. doi: 10.1007/s12663-012-0464-5, PMID 24431875.
4. Halpern LR, Dodson TB. Does prophylactic administration of systemic antibiotics prevent postoperative inflammatory complications after third molar surgery? J Oral Maxillofac Surg. 2007;65(2):177-85. doi: 10.1016/j.joms.2006.10.016, PMID 17236918.
5. He WL, Li CJ, Liu ZP, Sun JF, Hu ZA, Yin X et al. Efficacy of low-level laser therapy in the management of orthodontic pain: a systematic review and meta-analysis. Lasers Med Sci. 2013;28(6):1581-9. doi: 10.1007/s10103-012-1196-y, PMID 23001570.
6. Berge TI. Visual analogue scale assessment of postoperative pain and swelling. Acta Odontol Scand. 1988;46(4):233-40. doi: 10.3109/00016358809004772, PMID 3188849.
7. Gabka J, Matsumura T. Measuring techniques and clinical testing of an anti-inflammatory agent (tantum). Münch Med Wochenschr. 1971;113(6):198-203. PMID 4925048.
8. Kazancioglu HO, Ezirganli S, Demirtas N. Comparison of the influence of ozone and laser therapies on pain, swelling, and trismus following impacted third-molar surgery. Lasers Med Sci. 2014;29(4):1313-9. doi: 10.1007/s10103-013-1300-y, PMID 23494104.
9. Bamgbose BO, Akinwande JA, Adeyemo WL, Ladeinde AL, Arotiba GT, Ogunlewe MO. Effects of co-administered dexamethasone and diclofenac potassium on pain, swelling and trismus following third molar surgery. Head Face Med. 2005;1(1):11. doi: 10.1186/1746-160X-1-11, PMID 16274480.
10. Røynesdal AK, Björnland T, Barkvoll P, Haanaes HR. The effect of soft-laser application on postoperative pain and swelling. Int J Oral Maxillofac Surg. 1993;22(4):242-5. doi: 10.1016/S0901-5027(05)80646-0.
11. Chung H, Dai T, Sharma SK, Huang YY, Carroll JD, Hamblin MR. The nuts and bolts of low-level laser (light) therapy. Ann Biomed Eng. 2012;40(2):516-33. doi: 10.1007/s10439-011-0454-7, PMID 22045511.
12. Ohno T. Pain suppressive effect of low power laser irradiation. A quantitative analysis of substance P in the rat spinal dorsal root ganglion. J Nippon Med Sch. 1997;64(5):395-400. doi: 10.1272/jnms1923.64.395, PMID 9366142.
13. Byrnes KR. Cellular invasion following spinal cord lesion and low power laser irradiation. Lasers Surg Med. 2002;S14:11.
14. Rochkind S, Shahar A, Nevo Z. GUEST EDITORIAL 9.4. Laser Ther. 1997;9(4):151-2. doi: 10.5978/islsm.9.151.
15. Shapiro RD, Cohen BH. Perioperative pain control. Oral Maxillofac Clin North Am. 1992;4(3):663-74. doi: 10.1016/S1042-3699(20)30625-7.
16. Neckel C, Biostimulation KP. A comparative study in the postoperative outcome of patients after third molar extraction. J Oral Laser Appl;1:215-9.
17. Taube S, Piironen J, Ylipaavalniemi P. Helium-neon laser therapy in the prevention of postoperative swelling and pain after wisdom tooth extraction. Proc Finn Dent Soc. 1990;86(1):23-7. PMID 2385579.
18. Saber K, Chiniforush N, Shahabi S. The effect of low level laser therapy on pain reduction after third molar

surgery. Minerva Stomatol. 2012;61(7-8):319-22. PMID 22976514.

19. Wathier J, Contar CMM, Alanis LRA, Ignácio SA, Machado MÂN. Avaliac¸a˜o da efetividade do laser de baixa poteˆncia na reduc¸a˜o da dor po's-operato´ria em cirurgia de terceiros molares inferiores inclusos. Odonto. 2011;19(38):131-8. doi: 10.15603/2176-1000/odonto.v19n38p131-138.
20. 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. Int J Oral Maxillofac Surg. 2016;45(3):392-8. doi: 10.1016/j.ijom.2015.10.023, PMID 26691932.
21. Carrillo JS, Calatayud J, Manso FJ, Barberia E, Martinez JM, Donado M. A randomized double-blind clinical trial on the effectiveness of helium-neon laser in the prevention of pain, swelling and trismus after removal of impacted third molars. Int Dent J. 1990;40(1):31-6. PMID 2407660.
22. Wu S, Chen Y, Zhang J, Chen W, Shao S, Shen H et al. Effect of low-level laser therapy on tooth-related pain and somatosensory function evoked by orthodontic treatment. Int J Oral Sci. 2018;10(3):22. doi: 10.1038/s41368-018-0023-0, PMID 29967411.
23. Fikáčková H, Navrátilová B, Dylevský D, Navrátil L, Jirman R. Assessment of the effect of non-invasive laser on the process of healing of an extraction wound by infrared thermography [preliminary study]. J Appl Biomed;1(6):175-80. doi: 10.32725/jab.2003.032.