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Efficacy of low level laser for prevention of pain and trismus after impacted mandibular third molar surgery

Mehrnoush Momeni Roochi [1], Hossein Heidar [1], Sheida Kordi [2], Naghmeh Bahrami [1*]

1. Craniomaxillofacial Research center, Tehran University of Medical Sciences, Tehran, Iran. Oral and Maxillofacial Surgery Department, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

2. Dentist, private practice.

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**Corresponding author:*
Naghme Bahrami
Oral and Maxillofacial Surgery Department, School of Dentistry, Tehran University of Medical Sciences, North Amirabad St, Tehran, Iran

Tel: +98-21-84902473
Fax: +98-21-84902473
Email: NaghmehBahrami@Gmail.com

ABSTRACT

Objectives: This study sought to assess the effect of low-level laser (LLL) on pain and trismus after impacted mandibular third molar surgery.

Materials and Methods: This double blind controlled clinical trial was conducted on 40 healthy patients with no underlying disease and impacted mesioangular mandibular third molars with the same level of difficulty. The patients were divided into two groups of intervention and control using block randomization. In the intervention group, LLL was intraoral irradiated to the surgical site 10 minutes after suturing from 1cm distance. Sham laser was used in the control group. The patients were provided with postoperative instructions and were scheduled for visits at two and seven days postoperatively to fill out a questionnaire and for suture removal. Level of pain was determined using a pictorial visual analog scale (VAS) and degree of trismus was measured in millimeters. The data were analyzed using SPSS.

Results: Mouth opening in the laser group was greater than that in the control groupat two days postoperatively, which indicates the efficacy of laser for prevention of trismus. The changes in mouth opening were significant at baseline and at two and seven days postoperatively in the two groups (P=0.000); however, the trend of change was equal in both groups. No significant differences were noted in any variable between patients over and under 24 years of age in the two groups except for the amount of drug intake at two days post-surgery.

Conclusion: The results showed that laser irradiation efficiently decreased trismus and improved mouth opening during the first seven days post surgery. Thus, laser irradiation can shorten the course of recovery after impacted mandibular third molar surgery.

Key words: Gene therapy, Dentistry, Viral vector, Stem cell.

Introduction

Extraction of impacted mandibular third molars is among the most commonly performed oral surgical procedures. Pain, swelling and trismus are among the most common postoperative complications, which occur due to the production of prostaglandins and leukotrienes. These hormones cause pain, swelling, edema and trismus [1]. Decreasing postoperative complications not only leads to patient comfort but also helps in achieving a satisfactory surgical outcome [2].

Decreasing postoperative complications and subsequently improving the quality of life of patients are interesting topics for researchers since pain, swelling and trismus cause functional changes and may temporarily impair

mastication [3-7].

Several factors can cause pain and trismus after impacted third molar surgery, all of which are due to the inflammatory processes caused by surgical trauma [8]. It has been confirmed that inflammatory cells play an important role in muscle injury in both the clinical setting and laboratory animals [9]. Postoperative pain and discomfort may be due to the method of suturing. The suturing technique may lead to primary or secondary healing of surgical wounds [10].

Considering the recent advances in dental science, laser has been increasingly used in dental practice [11]. Goldman and colleagues were the first to use ruby laser with 6940nm wave length in dentistry in 1995. Low level laser is successfully used in medicine and dentistry since it has anti-inflammatory and analgesic properties. It stimulates the immune system and cell proliferation as well [13]. Also, LLL therapy (LLLT) can decrease postoperative bleeding and shorten the recovery period after dental and periodontal surgeries [14]. Moreover, LLLT can decrease or eliminate the need for taking analgesics [14] and can enhance gingival healing and increase the proliferation of fibroblasts under nutrient shortage [15]. In animal models, LLLT can serve as a potential alternative to anti-inflammatory drugs. Evidence shows that in vitro results can be generalized to the clinical setting and LLLT can have similar efficacy to that of non-steroidal anti-inflammatory drugs in decreasing postoperative pain and trismus [16]. Furthermore, LLLT can change cellular functions such as synthesis of ATP, proteins and prostaglandins, release of neurotransmitters, cell growth and proliferation and the membrane charge [17]. It has been reported that LLLT can be used to decrease swelling and trismus following impacted third molar and periodontal surgeries [8]. It has been stated that LLLT has analgesic effects and european researchers have stated that LLL interferes with the transmission of pain signals or stimulates the production of endorphins.

No ideal method has been suggested for prevention of postoperative trismus. Application of LLL at a specific time post surgery may be a suitable modality to treat trismus promptly and efficiently considering the fact that LLL has no side effects [18].

It is believed that the analgesic effects of LLLT are due to the stability of neural membrane and high amounts of lipid bilayer and integral membrane proteinsin the neural membrane.

In addition to the positive clinical efficacy of LLLT in oral surgery, evidence shows that LLLT causes lethal photo sensitization of aerobic and anaerobic bacteria under in vitro and in vivo conditions without damaging the mucosal surfaces or epithelial cells [19]. In contrast to studies pointing to the positive effects of LLLT, some authors did not find evidence to support the positive clinical efficacy of LLLT.

Considering the existing controversy in the results of previous studies regarding the efficacy of LLLT for prevention of complications after impacted third molar surgery, this study sought to assess the effect of LLL on pain and trismus after impacted mandibular third molar surgery.

Materials and Methods

This double blind controlled clinical trial was conducted on 40 patients in 2009-2010. The patients were randomly selected among those presenting to the Oral and Maxillofacial Surgery Department of Tehran University of Medical Sciences requiring impacted mandibular third molar surgery. The inclusion criteria were no systemic diseases, male and female patients in the age range of 19-29 years and having an impacted mandibular third molar scheduled for surgical extraction. Patients with impacted mesioangular third molars with the same level of difficulty (similar level of impaction and angulation) were chosen. The study had a double blind fashion, that is, both the surgeon and patients were blinded to the group allocation. Patients were divided into two groups of 20 using block randomization. The intervention group was subjected to laser irradiation after surgery while the control group received the routine postoperative instructions.

Patients received 2mL injection of 2% lidocaine with 1/80.000 epinephrine for the inferior alveolar nerve block, and triangular flaps were elevated. Patients signed written informed consent forms prior to the study and consented to the use of laser but were not aware of their group allocation. No limitation was set with regard to the use of analgesics. Duration of surgery was less than 30 minutes and approximately similar amount of bone was removed in each patient. All surgical procedures were performed by the same surgeon. Patients in the intervention group received laser irradiation after suturing of surgical wound while laser handpiece in off mode was used for patients in the control group. The surgeon was not aware of the group allocation of patients either. For laser irradiation, patients were transferred to the laser department

and laser was irradiated to the surgical site intraorally 10 minutes after completion of surgery using a laser handpiece at 1cm distance from the surgical site for five minutes. Patients in both groups received postoperative instructions. Gelofen (400mg) was prescribed for pain control and patients were requested not to use any other analgesics. Patients were visited at two and seven days post-surgery for measurement of level of pain and degree of trismus (mouth opening), assessment of analgesic intake and suture removal. A questionnaire was used and level of pain was determined using a pictorial VAS. Degree of trismus was also measured using a ruler and reported in millimeters. Before the surgery, the patients were requested to open their mouths as wide as they could and the distance between the maxillary right central incisor and mandibular right central incisor was measured and recorded. This distance was measured again at 48 hours and seven days after the surgery. To increase the accuracy, measurements were repeated in triplicate and the highest amount was recorded in millimeters and used for statistical analysis. The data were analyzed using SPSS.

Results

Table 1 shows the results of Kolmogorov-Smirnov test for assessment of the normal distribution of variables. Based on the results of table 1, degree of mouth opening (trismus) and level of pain had normal distribution in both groups (P>0.05).

The results showed no significant difference in pain and swelling between the two groups at two days post-surgery.

Discussion

Low level laser therapy is a relatively recent technique and its efficacy for pain control has been documented in several previous studies [3] however, only a small number of studies on this topic had a double blind design and had a control group [5].

The results of the current study showed no significant difference in pain and swelling between the two groups at two days post-surgery. This result was in contrast to the findings of some previous studies [6] But, our findings were somehow similar to those of Carrillo et al, in 1990, who showed lower degree of trismus in the laser group. However, Carrillo et al, separately irradiated soft tissue and bone, and laser irradiation time in their study was 50% longer than that in our study. These factors can probably explain the differences in the results of the two studies. They explained that this finding, which was in contrast to their other findings, was probably due to the effect of laser irradiation at the time of incision. In our study, LLLT decreased trismus with no side effects [20].

A major effect of LLLT is to promote nerve biostimulation and increase local microcirculation. Carillo et al. showed that LLLT had anti-trismus effects while roynesdal et al. found no positive effect for LLLT. Goranjovanovic et al, in 2004 applied laser to the surgical wound as well as some specific extra-oral points including the angle of the mandible, mental foramen, periauriculararea and nasolabial point in the nasolabial sulcus. These points are considered as therapeutic points and serve as abiostimulative microsystem where less stimulation can lead to optimal results [21].

Group	*Variable*	*Z statistic*	*P value*
Control group	*Trismus at baseline*	*.794*	*.554*
	Trismus at two days post-surgery	*.579*	*.891*
	Trismus at seven days post-surgery	*.715*	*.686*
	Pain at two days post-surgery	*.976*	*.297*
	Pain at seven days post-surgery	*.732*	*.658*
Laser group	*Trismus at baseline*	*.966*	*.308*
	Trismus at two days post-surgery	*.520*	*.905*
	Trismus at seven days post-surgery	*.826*	*.503*
	Pain at two days post-surgery	*.811*	*.527*

Table 1. The results of Kolmogorov-Smirnov test.

It appears that laser irradiation of the surgical wound and its margins with 10-15 J energy per cycle yields the best results; however, it takes approximately 35 minutes. Since this duration of time is too long for the patients, lasers with over 30mw output power must be used to decrease the duration of time to 10 minutes. This protocol has no adverse thermal effects.

Based on the results, LLL is completely safe and efficient for treatment of trismus [22]. In our study, positive effects of laser were more prominent from the second postoperative day on. In contrast, in a study by Kreisler et al, [23] although laser irradiation had positive efficacy until the end of the follow up period, the difference was only significant at day one post surgery. An in vitro study also confirmed these findings, which were somehow contradictory to our findings.

It is not exactly known what percentage of the irradiated laser is reflected, absorbed or transmitted by the tissues in different individuals and these percentages depend on the thickness and molecular composition of tissues. The correlation of depth of bone defect and the amount of removed bone with laser efficacy has yet to be fully understood as well [24].

Oral surgery may cause muscle spasms especially in the masseter. Intraoral irradiation of laser does not directly affect the masseter. In some previous studies, LLL was only irradiated intraoral after impacted third molar surgery; however, another study irradiated laser both intra-orally and extra-orally and it was reported that both trismus and swelling in the extra-oral laser group were significantly less than those in the placebo group at seven days post surgery.

Application of LLL after impacted third molar surgery significantly decreases post-surgical pain [25]. This effect seems to be dose dependent. Evidence shows that laser output power less than 4J/cm^2 has no effect on post-surgical pain. Since postoperative analgesia plays an important role in patient satisfaction and comfort, based on the current results and those of previous studies, it seems that LLL and long-acting local analgesics are efficient for this purpose. If laser irradiation is feasible and the patient can tolerate long-lasting anesthesia of the lower lip after surgery, use of non-steroidal anti-inflammatory drugs may not be necessary after all [24].

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