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Effects of Low-level-laser Therapy versus Corticotherapy on Pain, Trismus and Edema after Surgical Removal of Third Mandibular Molars: A Comparative Study

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Abstract

Objective: Low-level laser therapy (LLLT) is a treatment commonly used in oral surgery for biostimulation. The aim of this study was to compare the effects of LLLT and corticosteroids on postoperative pain, trismus and edema following surgical removal of mandibular third molars.

Background data: LLLT and corticosteroids have been effective in reducing pain, trismus and edema; thus improving the quality of patients' lives.

Patients and methods: Sixty patients who were to undergo surgical removal of their lower third molars were studied. They were randomly assigned to two groups of thirty patients each. A diode laser device (Whitening laze II) with a continuous wavelength of 808 nm and a maximal output power of 100 mW was used. Patients in the LLLT group received 3.3 J (fluence of 120 J/cm2) intraorally at the operation site and the same dose extraorally. Patients in the corticosteroids group received postoperative parenteral injection of Dexamethasone. Pain, interincisal opening and facial swelling were evaluated on the third and seventh postoperative days.

Results: The levels of pain, trismus and facial swelling at the third and seventh postoperative days were lower in the corticosteroids side than in the LLLT side, though without statistically significant differences except for edema at seventh postoperative day.

Conclusion: This study demonstrates that there is no significant difference between administration of corticosteroids and LLLT for the reduction of postoperative pain and trismus but dexamethasone was more effective to reduce swelling on seventh postoperative day.

Keywords: Third mandibular molar; Low-level-laser; Corticosteroids; Pain; Trismus; Edema

Introduction

In oral surgery, postoperative pain, trismus and edema are common phenomena particularly frequent after surgical removal of third mandibular molars. They are consequences of direct trauma to bone, muscular attachments, blood and lymph vessels. This condition represents fluid accumulation in the interstitial area due to transudation from injured blood vessels and fibrin obstruction of lymph drainage [1]. Sequentially, there is a release of mediators from mast cells, the vasculature and other cells. Histamine and serotonin appear first, followed by bradykinin and later prostaglandins and other eicosanoids [2].

Several methods have been used to inhibit these postoperative sequelae, including the use of local or systemic corticosteroids, nonsteroidal anti-inflammatory drugs, tube drains and recently low-level laser therapy (LLLT) [3]. The application of low-energy lasers in the field of dentistry and oral surgery has been popular since the 1970s. It has been demonstrated that therapeutic laser has a direct action on blood and lymph vessels [1]. Despite this, these results are still controversial. This might be due to varying study designs or difficulties in the measurement of postoperative sequelae as well as to different lasers types and irradiation parameters [4]. The purpose of this study was to compare the effects of low-level laser therapy and corticosteroids on postoperative, pain, trismus and edema following the removal of mandibular third molars.

Materials and Methods

Sixty patients (18 men, 42 women) between 18 and 30 years of age who were to undergo surgical removal of mandibular third molars having partial bone impaction were studied. The sample size was determined using a power test. A complete medical history and an oral examination were performed, including a panoramic radiograph. For standardization of the sample, we used the following clinical criteria:

1. Age between 18 and 30 years,
2. Impacted third molars in the mesioangular position and with class B of average depth (Pederson's classification [5]),
3. Equivalent degree of surgical difficulty (score 5 by Pederson's classification),
4. Equivalent level of hygiene (O'Leary's index less than 30%),
5. No use of medication that could interfere with one of the two treatments,
6. No systemic disease
7. Absence of cystic or tumoral complication on third molars,
8. Absence of acute pericoronitis, severe periodontal disease or associated pathology on the adjacent teeth,

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9. Absence of allergy to local anesthetics or to the medication prescribed in the study.

The study was approved by the local ethics commission and informed written consent was obtained from all patients. The participants were assigned into one of two groups: low-level laser therapy or corticosteroid group. For a randomized trial, we chose to include the first thirty patients into LLLT group and the second thirty patients into corticosteroids group. Medicaïn plus 1: 100.000 epinephrine was used for inferior alveolar and buccal nerve blocks. All operations were performed by the same surgeon who used a standardized technique on all patients and was blinded to experiment. Another person has applied laser and took measures. In the study, a diode laser device (Whitening laze II of DMC Equipments LTDA (Spain) with a continuous wavelength of 808 nm and maximal output power of 100 mW for a total of 33 s was used. Patients in the LLLT group (n=30) received 3.3 J (fluence of 120 J/cm2) intraorally at the operation site 1 cm from the target tissue and the same dose extraorally at the insertion of the masseter muscle immediately after the operation. Patients in the corticosteroids group (n=30) received postoperative parenteral injection of Dexamethasone for three days with a dose of 4 mg if weight is less than 60 kg, otherwise 8 mg. Patients of two groups received postoperative prescription of antibiotic (2 g of amoxicillin, daily dose) applied per os every 8 hours for 7 days, analgesic (paracetamol 3 g, daily dose) applied per os every 8 hours for 2 days then taken when necessary, and antiseptic mouthwash (rinsing twice a day for 10 days). Another prescription of analgesic (paracetamol with codein) was delivered to all patients and used when necessary.

The variables studied were operation time, intraoperative degree of difficulty as reported by Parant's classification [5] (easy I, easy II, difficult III, difficult IV), level of postoperative pain, facial swelling and trismus. The duration of the surgery was determined by the time lapse between incision and completion of suturing.

The pain level was estimated by asking the patient to rate the nociceptive experience on a visual analog scale of 10 mm on the third and seventh postoperative days, to report the number of analgesic tablets taken during the first 3 days, to precise the need for a higher level of analgesic (paracetamol with codeine) and the time exact of beginning of pain.

Swelling was evaluated using a measuring tape by a modification of a 3 line measurements using 5 fixed points on surgical side of the face and finding the average as described by Bello et al. [2]. The fixed points used were A; the most posterior point at the midline on the tragus, B; lateral canthus of the eye, C; the most lateral point on the corner of the mouth, D; soft tissue pogonium which is the most prominent point at the midline on the chin and E; most inferior point on the angle of the mandible. The three lines were AC, AD and BE. The difference between the postoperative and preoperative measurements was calculated. The assessment of the postoperative edema was carried out at the third and seventh days after the procedure.

The interincisal opening was evaluated by measuring with a vernier caliper the maximal opening between the right maxillary and mandibular central incisors. Baseline measurements were taken just before the surgery and similar readings were carried out on days 3 and 7 postoperatively.

Data analysis was carried out with Statistical Package for Social Sciences (SPSS) 17.0 for Windows. A multivariate analysis of the effect of laser therapy and corticosteroids on pain, swelling and trismus was also carried out. The level of significance used in the statistical decisions was of 5%.

Results

Sixty patients of both genders aged between 18 and 30 years (mean 22.8 years in laser's group (1) and 23.03 years in corticosteroid's group (2) with impacted lower third molars comprised the sample of this study. None of the patients showed any adverse reactions to the applied treatment. It has no statistical differential between sex, age, patient's hygiene and degree of retention with both treatments. The duration of surgery in the first group was 15,31 minutes and in the second group was 22.87 minutes without statistical differential among them (P=0.55). The distribution of degree of difficulty on the two groups is shown in Table 1. Teeth in group 2 are more difficult to remove than in group 1 with statistically significant difference (P=0.03<0.05).

	Frequency in LLLT group (1)	Frequency in corticosteroids group (2)
Easy I	0	1
Easy II	8	1
Difficult III	20	22
Difficult IV	2	6

Table 1: Distribution of the difficulty of extraction in the sample according to Parant [4].

Treatment		Time of beginning of pain	Number of analgesic tablets	Level of pain on third day	Level of pain on seventh day
LLLT	mean	95.83	12.87	22.23	4.17
	S D	60.23	5.55	25.71	8.18
corticosteroids	mean	138.30	10.93	13.07	3.20
	S D	74.64	5.79	15.70	9.65
p-value		0.04	0.14	0.34	0.26

Table 2: Results of the effects of corticosteroids and LLLT on the pain parameters.

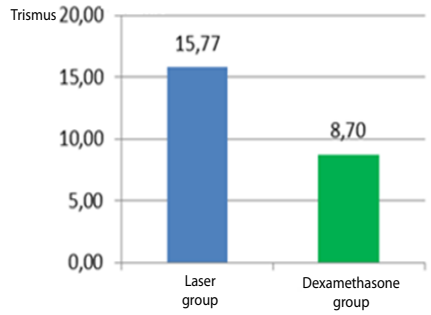

Figure 1: The average amplitudes of trismus on third postoperative day in both groups (p-value 0.29).

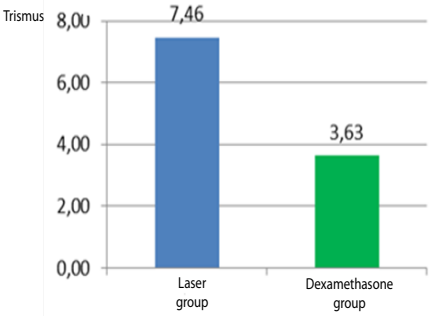

Figure 2: The average amplitudes of trismus on seventh postoperative day in both groups (p-value 0.52).

In relation to pain, the results of the different parameters are reported in Table 2. In laser group, three patients needed a higher level of analgesic (paracetamol with codein). This value was similar in corticosteroids group (4 patients).

On the third postoperative day, the average swelling in the LLLT group was 3.35 ± 2.80 mm and in the corticosteroids group it was 1.81 ± 2.21 mm. On the seventh postoperative day, the average swelling in the LLLT group was 0.23 ± 1.17 mm and in the corticosteroids group it was -0.28 ± 1.34 mm. Postoperative swelling was not significantly different at the third postoperative day between two groups (p=0.52). However, it was significantly less in the corticosteroids group compared with the LLLT group on the seventh postoperative day (p=0.05).

The results of trismus measures are reported in Figures 1 and 2.

Discussion and Conclusions

Postoperative pain, edema and trismus can always be expected after impacted lower third molar surgery. Nevertheless, it is difficult to evaluate these phenomena comparatively. In this study, all the procedures were performed by only one experienced surgeon. Despite this, operative trauma was not similar in the study groups with regard to the need for tooth separation and duration of surgery. The patient did not recognize which type of treatment he received. Only the person who took measures recognized the treatment administered. Certain drugs were recognized for reducing these postoperative complications. Concerning the use of steroids, dexamethasone was chosen for the study because it has already proved its effectiveness. Low Level Laser Therapy has been reported to prevent pain, swelling and trismus following the removal of impacted third molars. But, some studies reported a positive laser effect while others did not (Table 3). These controversial results call into question its efficacy. So far, the parameters of ideal radiation for this purpose have not been determined due to the great diversity of variables.

It was clear from the results that there was no difference between the laser and corticosteroids treated groups for pain at third and seventh days after surgery. Markiewicz et al. [16], in its systematic review, found that intra-operative administration of corticosteroids has no significant effect on pain. In all scientific trials, except those of Brissart [6], Clokie et al. [9], Saber et al. [14] and Ferrante et al. [15], Low Level Laser had no effect on pain. Brignardello [17], in his systematic review of the last five years, concluded that therapeutic laser could not reduce pain after surgical extraction. In our study, we found that pain appeared earlier in patients of LLLT group compared to those of dexamethasone group. This may be explained according to Fikackova by hyperemia caused by active laser [11].

For trismus, in our study there was no difference in either group on third and seventh days. However, these results are consistent with other scientific trials that have reported a moderate efficacy of both dexamethasone and therapeutic laser on trismus. Markiewicz et al. [16], in his systematic review, found that intra-operative administration of corticosteroids significantly reduces trismus after mandibular third molars extraction. On the other hand, numerous studies except that of Braams et al. [18], Amarillas-Escobar et al. [12] and Lopez-Ramirez [13] confirmed the efficacy of LLLT to control mouth opening limitation. Brignardello-Petersen et al. [17], in his meta-analysis, found that therapeutic laser has a moderate efficacy on trismus.

According to own results, level of edema was less pronounced in corticosteroids group compared to LLLT group. This difference was not statistically significant except for swelling on seventh day postoperatively. These results are not shared by Markovic and Todorovic [1] who compared the effectiveness of Low-Level-Laser and dexamethasone, used locally and systemically, in minimizing edema and found that the best anti-edematous effect was achieved by the combination of Low Level Laser (LLL) irradiation and local intramuscular (internal pterygoid muscle) application of dexamethasone. The combined use of LLL irradiation and systemically applied dexamethasone did not exert a statistically better anti-edematous effect than use of LLL only. They concluded that systemic use of steroids after lower third molar surgery is not justified if LLL irradiation has already been applied. While, in our issue, we found that when only dexamethasone was systemically administered, it was more effective than laser to reduce swelling.

In this trial, some levels of edema and trismus on seventh day postoperatively were negative. This may be due to existing subclinical chronic inflammation or biased measures.

This study showed the superiority of dexamethasone treatment in the control of postoperative edema. It did not show statistically significant difference between corticosteroids treatment and laser therapy in reducing pain and trismus after third mandibular molar extraction. Favorable characteristics of Low-Level-Laser therapy are uncomplicated and painless application and its possible combination with other drugs.

Authors	Laser wavelengths (nm)	Laser output power (mW)	Dose/energy (J)	Number of application	Application method
Brissart [6]	632.8	10	2.4	1 preop	intraorally
Carrillo et al. [7]	632.8	300	10 J/cm2 -	1 postop (6 points)	intraorally
Taube et al. [8]	632.8	8	0.96	1 postop	intraorally
Clokie et al. [9]	632.8 He-Ne	10	1.8	1postop	Intraorally
Roynesdal et al. [4]	820-830 GaAlAs	40	6	1 preop 1postop	Intraorally
Fernando et al. [10]	830	30	4	1 during surgery	Intraorally
Fikackova et al. [11]	830 GaAlAs	100	36 12 J/cm2	3: j0,j1,j3	Intraorally + submandibular region
Amarillas-Escobar et al. [12]	GaAlAs 810	100	4 J/cm2	4 postop à Jo, J1, j2, j3	Jo: intraorally J1, j2, j3: extraorally
Lopez Ramirez et al. [13]	810 GaAlAs	500	12,8 5 J/cm2	1postop	Intraorally
Saber et al. [14]		100		1 post-op	Intraorally
Ferrante et al. [15]	980 diode	300	54	J0 , j1	Intraorally and extraorally

Table 3: The methods and laser parameters of LLLT in previous studies.

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