

Postoperative healing after treatment with diode laser in oral surgery

C. N. CUMPATA, M. RAESCU^{a,*}, F. E. CONSTANTINESCU^b, M. V. CONSTANTINESCU^c

Senior Lecturer, Department of Oral and Maxillo-Facial Surgery, Faculty of Dental Medicine, "Titu Maiorescu" University, 67A Gheorghe Petrascu st., Sector 3, Bucharest RO-031593, Romania

^aAssociate Professor, Department of Preventive Dentistry and Oral Health, Faculty of Dental Medicine, "Titu Maiorescu" University, 67A Gheorghe Petrascu st., Sector 3, Bucharest RO-031593, Romania

^bPhD Student, Private practice, European Society of Neuromuscular Prosthodontics, 102-104 Mihai Eminescu st., Sector 2, Bucharest RO-20082, Romania

^cAssociate Professor, Department of Prosthetic Dentistry, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, 12 Ionel Perlea st., Sector 1, Bucharest RO-010209, Romania

Laser treatment in oral surgery may be an isolated treatment or a treatment additional to conventional therapy. Diode laser treatment in oral surgery addresses both the pathological tissue removal, decontamination of infected areas, and the rapid stimulation of healing of the postoperative wound healing. The comparative result of immediate and long-term postoperative healing between the isolated or additional laser treatment and intraoperative and postoperative conventional treatment demonstrates the benefits to the patients undertaking this type of treatment.

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1. Introduction

Diode laser treatment in oral surgery can be successfully used during the interventions supporting the endodontic, periodontal treatment, the pre and pro-prosthodontic treatment, excision of benign tumors and in implantology. By using the diode laser, the patients benefit of a speedy recovery, decrease of the risk of postoperative recurrence, the risk of infection, chronic inflammation and the risk of occurrence of unaesthetic scars [1]. These goals are particularly important and possible especially when the laser treatment is combined with conventional surgery and also when laser therapy is used isolated for a faster and without risk of infection postoperative healing to be obtained [2,3].

We will present our research in the use of diode laser as isolated treatment and as treatment additional to the conventional surgery. Additional laser treatment was performed with high-power laser diodes, which are indicated in endodontic surgery for the excision of the periapical process and decontamination of periapical area. The removal of periapical process was done continuously, 2-4W, where the most important was air cooling and abundant irrigation with saline solution in order to remove tissue debris and to prevent thermal damage to the bone. Decontamination of periapical area was carried out continuously, 0.5-1W.

Single laser treatment was also carried out with the same type of diode, continuously at a dose of 2-4 J/cm², in

order to ensure faster and without risks postoperative healing.

The question that can be addressed to this study if there is a demonstrated benefit of the diode laser type treatment in oral surgery and the possibility to assess in an objective and reproducible manner the results obtained.

2. Materials and methods

This is a prospective, randomized, experimentally controlled, comparative study between the conventional therapy and laser therapy accompanied or not accompanied by conventional therapy. The healing success was assessed based on clinical and radiological aspects. Clinical aspects were: postoperative pain, local edema, postoperative ecchymosa, wound infection or dehiscence, postoperative wound healing time, local recurrence. Radiologic aspect was controlled at 5-7 days after surgery and after 16 weeks.

Using the laser technique

By randomization, one group of patients was treated with high-power diode laser (980 nm with loop diameter of 320 micrometers) both intraoperatively, additional to the conventional treatment, for excision of residual periapical process and decontamination of periapical area [4,5], and postoperatively, as singular laser treatment, to stimulate the healing [6]; the other group of patients by comparison, has received only conventional surgery

treatment and after surgery through the daily washing with chlorhexidine gluconate solution 2% for 5 days.

Parameter settings for the laser diode were:

Periapical tissue debris removal: continuous, in contact mode, 4W. In this case, very important was the air cooling and abundant irrigation with saline solution in order to remove tissue debris and to prevent thermal damage to the bone.

Being a wavelength that acts in depth and due to increased absorption in hemoglobin of this wavelength supplementary irrigation with saline solution or distilled water is required, which is provided by the operator.

Decontamination periapical area: continuous, noncontact mode, 1W power, under cooling with saline solution. Laser beam was oriented parallel to the target tissue to avoid excessive in depth penetration of the laser radiation [7].

Stimulation of postoperative healing: continuous, noncontact mode, with a dose of 2-4 J/cm², once a day immediately after surgery and for another 4 days.

The result of the two modes of treatment was assessed by clinical and laboratory examination.

Graphic expression of clinical signs of postoperative healing was done by analyzing the symptoms of postoperative pain, postoperative edema, postoperative bruising and time elapsed until surgical healing with suture threads suppression. For the assessment of postoperative pain intensity a scoring system from 0-7 was used, 0 being similar to no pain and 7 to unbearable pain: 0 - no pain, 1 - painful embarrassment, 2 - mild pain, 3 - moderate pain, 5 - increased intensity pain, 6 - live, strong pain, 7 - unbearable pain (Fig. 4). For the assessment of postoperative edema a scoring system from 0 to 5 was used, 0 - no postoperative edema, 1 - small, localized edema, 2 - moderate oral edema, 3 - marked oral and dermal edema, 4 - great skin edema, 5 - large neighborhood edema both orally and in the skin (Fig. 5). For the assessment of postoperative ecchymosis sites a scoring system from 0-5 was used: 0 - no bruises, 1 - local small bruising, 2 - moderate local bruising, 3 - extensive oral bruising and small skin bruising, 4 - large facial skin bruising, 5 - cervical bruising (Fig. 6).

In this comparative trial a total of 36 subjects were involved with dentoparodontal diseases of the type of chronic apical periodontitis, which could not benefit of or failed to response to endodontic treatment and thus required surgery.

A group "A" of 18 subjects received additional laser treatment together with intraoperative conventional surgery treatment and postoperative singular laser treatment, and the other group "B" of 18 patients received both surgical and postoperative conventional treatment only. Exclusion criteria were: subjects with uncontrolled diabetes, subjects receiving treatment with systemic steroids within 13 days prior to surgery, subjects with acute or chronic oral mucosal diseases that might negatively affect the wound healing, subjects with a history of clinically significant hypersensitivity to drugs used in this study, subjects who used or have taken experimental drugs within the last three months, pregnant

women. The subjects were 22 males and 16 females, presenting a mean age of 33 years.

Drug treatment was the same for the entire group of 36 subjects: general anti-inflammatory treatment meloxicam 7.5 mg every 12 hours for 3 days and it was observed by all the subjects. All the 36 subjects reached the end of treatment of 10 days under observation and 25 subjects were evaluated after 16 weeks.

3. Results

The results demonstrated a more rapid postoperative recovery, without local bruising, without pains, infections or dehiscence as compared to the group conventionally treated with poorer results in terms of postoperative bruising and inflammation.

Postoperative images are presented after oral surgery in an interval of 24 hours (Fig. 1) and after 48 hours after surgery (Fig. 2).



Fig. 1. Postoperative aspect after 24 hours without edema or bruises.



Fig. 2. Postoperative aspect after 48 hours.



Fig. 3. Radiologic aspect after 7 days.

Also, the group treated with diode laser in addition to the conventional therapy, followed by single laser

treatment immediately after surgery and continued for 4 days have performed better with respect to the occurrence of postoperative pain, which was not present in a total of 12 subjects, and in the remaining subjects the pain was present for one or two days in the form of local painful discomfort. The subjects in the group treated conventionally faced moderate local pain for two to three days, sometimes even up to 5 days postoperatively.

Postoperative pain intensity is shown in Table 1. Results were obtained from subjects, by completing a questionnaire using the grading system mentioned above.

Table 1. Postoperative pain intensity for "A" and "B" group.

Pain	Group A		Group B	
	n	%	n	%
0	12	75	10	56,25
1	2	12,5	2	12,5
2	2	12,5	2	12,5
3			2	12,5
4			1	6,25
5			1	5,25
6				
7				

Likewise, the clinical expression of postoperative edema and bruising are highlighted in Table 2 and 3. The results were obtained also by the physician using the scoring system described for each symptom.

Table 2. Postoperative edema intensity for "A" and "B" group.

Postoperative edema	Group A		Group B	
	n	%	n	%
0	14	77,7	9	50
1	4	22,3	3	16,6
2			3	16,6
3			2	11
4			1	5,5
5				

Table 3. Postoperative ecchymosis sites for "A" and "B" group.

Postoperative Ecchymose	Group A		Group B	
	n	%	n	%
0	16	88,89	10	77,78
1	2	11,11	3	16,6
2			2	11
3			1	5,5
4			1	5,5
5			1	5,5

It is obviously to recognize that already from the first day after surgery, the group of subjects in which diode laser was used in the treatment had a more rapid postoperative recovery, without pain (75%) in most cases. Superiority continues throughout the period of treatment.

4. Discussions

It is difficult to select an ideal surgical treatment of periapical lesions. In general in oral surgery there is the conventional surgery treatment by removal of pathological periapical tissue and of infected bone by means of rotary instruments and hand currettes, but also the surgical treatment of periapical and bone lesions removal by means of ultrasonic instruments, piezotome or laser that are generally less traumatic, the risk of bone necrosis by bone overheating is minimized, and postoperative healing and recovery is much faster and with no risk of infection, dehiscence, chronic inflammation, the risk of recurrence or occurrence of fistulas or unaesthetic scars.

Additional laser treatment in case of periapical lesions addresses both the pathological tissue removal and decontamination of periapical area. It greatly reduces the risk of relapse due to cystic epithelial membrane remnants that may remain in place without bone surface decontamination [8-11].

Rapid postoperative healing is favorable and if the relevant parameter settings of high power diode laser are observed. Therapeutic action of the laser diode used alone immediately postoperatively and then for another 4 days with a single daily application produces an analgesic, anti-inflammatory and tissue repairing effect, stimulation of micro-circulation and edema reducing. The manner of application of laser was punctually in the center of the wound and scanning along it to stimulate tissue repair. Energy dose used was 2-4 J/cm² an only application per day at an interval of 24 hours between sessions.

One of the main problems the doctor is facing in case of using laser in specialty therapy is to know the depth of penetration of laser radiation in biological tissue and its defects on the main constituents of tissue irradiated.

It is very important to apply a precise predetermined dose of laser energy on a given tissue. The degree of absorption of laser energy and the effects on tissues, depends on the structure of the tissue, the fluid content and the quantity of hemoglobin [12,13]. Laser - tissue interaction is determined by the wavelength, power, energy dose and duration of irradiation. For the calculation of the maximum power applied in a session the patient's age, the nutrition and moisture status, as well as the type of tissue to be irradiated is to be taken into account. In order to apply the correct work methodology, the response of every patient should be monitored and evaluated for each treatment session [14].

After the first day of treatment, the group of subjects in which diode laser was used as part of the surgery treatment followed by a noncontact laser sessions to stimulate the healing was postoperative painless in 75% of cases (12 subjects), and after two days they were completely gone also in the remaining of the subjects. Comparatively, the subjects in the conventionally treated group had no pain at the rate of 56.25% (9 subjects) and the remaining of the patients had a moderate local pain for two to three days, sometimes up to 5 days after surgery without laser treatment to stimulate postoperative healing (Fig. 4).

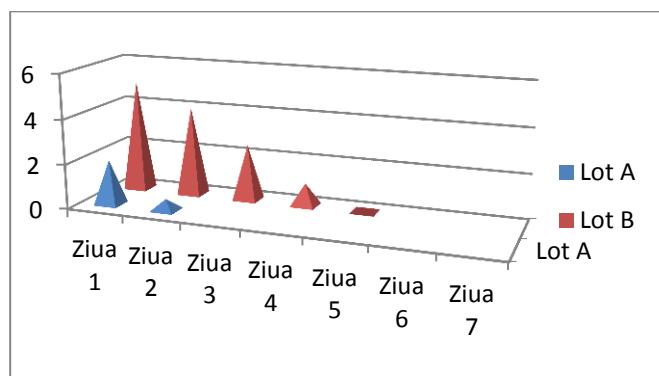


Fig. 4. Postoperative pain intensity for "A" and "B" group.

Regarding the postoperative edema in the group of subjects in whom diode laser was used, 87.5% (14 cases) of subjects showed no postoperative edema after the first day and after two days it was not present any more in any subject. Comparatively, the subjects in the conventionally treated group had no postoperative edema in a proportion of 50% (8 cases), 5 subjects exhibited moderate edema after two days of surgery and three subjects had oral and dermal edema after three days (Fig. 5).

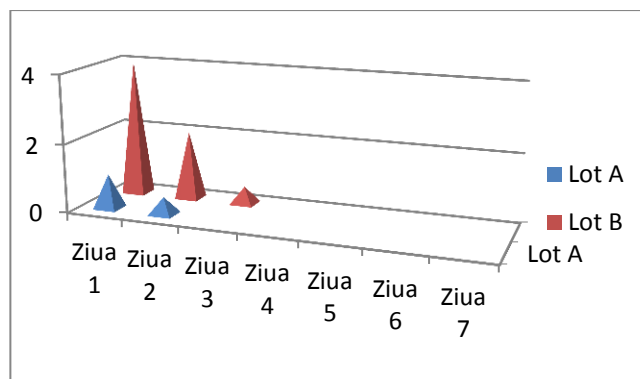


Fig. 5. Illustrating postoperative edema for "A" and "B" group.

Mucous postoperative ecchymosis was present in 2 cases in the subjects in group "A" (12.5%) and persisted until two or three days after surgery. Comparatively, in the case of the group "B" postoperative bruising was present in 4 subjects (25%) up to a maximum of 6 days after surgery, in this case it is about a cervical ecchymosis (Fig. 6).

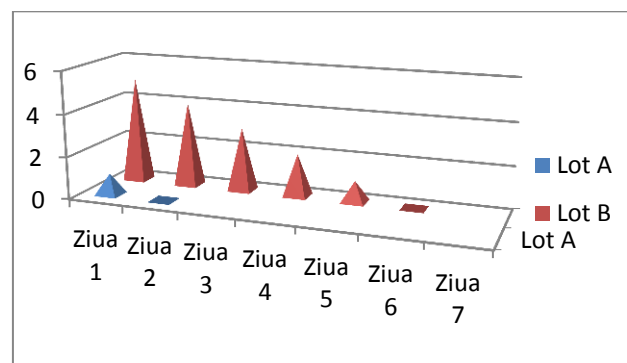


Fig. 6. Illustrating postoperative ecchymosis for "A" and "B" group.

The suture threads in case of the group "A" were invariably removed at an interval of 5 days considering the postoperative wound surgically healed. Comparatively, in the case of the group "B" the suture threads were removed after 5-7 days sometime after 10 days of the surgical operation, the postoperative wound having a slow healing as compared to group "A".

Regarding the wound dehiscence, it was present in only two cases in subjects belonging to group "B" with postoperative wound infection in one of these cases.

Wound recurrence occurred in only one subject in group "B" after 9 weeks after surgical operation.

In direct comparison with standard, conventional treatment, additional and singular diode laser treatment leads to a remarkable and rapid recovery of the aspects of the interested oral tissues, with excellent tolerability and minimal irritation potential, it seeming to be indicated almost ideally.

To answer the research question: Diode laser treatment in oral surgery clearly improves postoperative surgical healing.

5. Conclusions

The results of this comparative study of surgical techniques have demonstrated an improved functional benefit of using diode laser in oral surgery by a rapid postoperative recovery, remarkable and without risks. Last but not least, it is a safe, free of postoperative infectious risk or local recurrence, with a benefit clinically demonstrated by this study.

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*Corresponding author: mihaela.raescu@gmail.com