Low level laser therapy used to enhance the bone regeneration

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The aim of this study is to assess the clinical effectiveness of a low level laser therapy (LLLT) with respect to the acceleration of bone regeneration after regenerative periodontal treatment in intrabony defects. Thirty patients with intrabony defects, aged between 25-65, non-smokers, good health condition present at the time of the surgery, were included in this study. randomly divided in two groups, control, fifteen patients, and test group, fifteen patients. Informed consent was obtained. Each patient presented at least one periodontal defect treated by bone allograft. The test group received postsurgical treatment with low lever laser therapy (LLLT). The equipment used was OsseoPulse AM300, at an intensity of 20mW/cm^2, for 20 minutes per day, for 21 consecutive days. The control group received no treatment with LLLT. The bone formation was evaluated in both groups at baseline and 6 months postoperative by the means of tissue biopsy followed by a histological analysis. Radiographic evaluation showed more rapid bone regeneration in the test group compared with the control. Clinical data indicate the possibility of more rapid wound closure and subsequent healing in zones treated with LLLT as compared with control. Radiographic evaluation showed more rapid bone regeneration in the test group compared with the control.

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1. Introduction

Periodontitis is an infectious disease which, left untreated, results in progressive attachment and bone loss and ultimately leads to dental loss. Periodontitis seriously affects various aspects of the quality of life in many individuals. The conservative periodontal therapy can lead to predictable pocket reduction and stop further disease progression. However, the therapy is usually associated with an increase in soft tissue recession and bone loss. Conventional periodontal treatments such as scaling and root planing are generally followed by periodontal repair, thus implying healing without restoration of the tooth attachment apparatus, and are often associated with the formation of a long junctional epithelium [1, 2].

Regeneration is defined as a reconstruction of part of the body in such way that the structure and function of the lost or injured tissue are completely restored.

Regenerative periodontal therapy aims to predictably reconstruct the hard and soft supporting tissues lost following periodontal disease or trauma, thereby significantly improving the quality of life of the patients [3].

Laser is an asyncrom for "Light Amplification by Stimulated Emission of Radiation". LLLT are designed by following parameters: laser power which ranges from 10^{-3} to 10^{-1}, wavelength which ranges from 300 to 10.600 nm. Pulse rate can range from 0 to 5000 Hz, the duration of pulse can range from 1-500 miliseconds [4]. Therapeutic lasers are within visible red to near visible red electromagnetic spectrum ranging from 630 to 980 nm. The simplest way to categorize lasers is according to their wavelength. The depth of laser penetration varies, and oral mucosa is quite transparent on the wavelengths, bone and skin are quite transparent, whereas muscles absorb the most light [4]. Biological effects caused by low level lasers are due to low energy deposited into tissues where deposited energy results in primary, secondary and general therapeutic effects. This results in the analgesic and anti-inflammatory effects as well as in improvement in healing [5].

The aim of this study is to assess the clinical and radiological efficiency of low level laser therapy (LLLT) with respect to the acceleration of bone regeneration after regenerative periodontal treatment of intrabony defects.

2. Materials and methods

Thirty patients with intrabony defects, aged between 25-65, non-smokers, good health condition present at the time of the surgery, were randomly divided in two groups. Each patient had at least one periodontal defect treated by bone allograft. Informed consent was obtained from each patient. The patients in both group received regenerative periodontal treatment. The surgery technique was selected according to the individual clinical condition. Conventional periodontal surgery principles were fully observed during regenerative therapy.

Regenerative therapy with bone allograft was performed using the papilla preservation technique, as described by Cortellini [6]. The principles of the surgical procedure are the following: a vertical incision is performed on the buccal aspect of the involved teeth. The

sites are conditioned with 24% EDTA for 2 minutes to remove smear layer. After carefully rinsing with sterile saline, bone allograft is applied. The mucoperiosteal flaps are replaced and sutured so that a primary closure and wound stability is achieved (Fig. 1).

Test group – received postoperative treatment with the OsseoPulse AM300, at an intensity of 20mW/cm^2, for 20 minutes per day, for 21 consecutive days (Fig.2).

Control group – received no treatment with the OsseoPulse AM300 device.

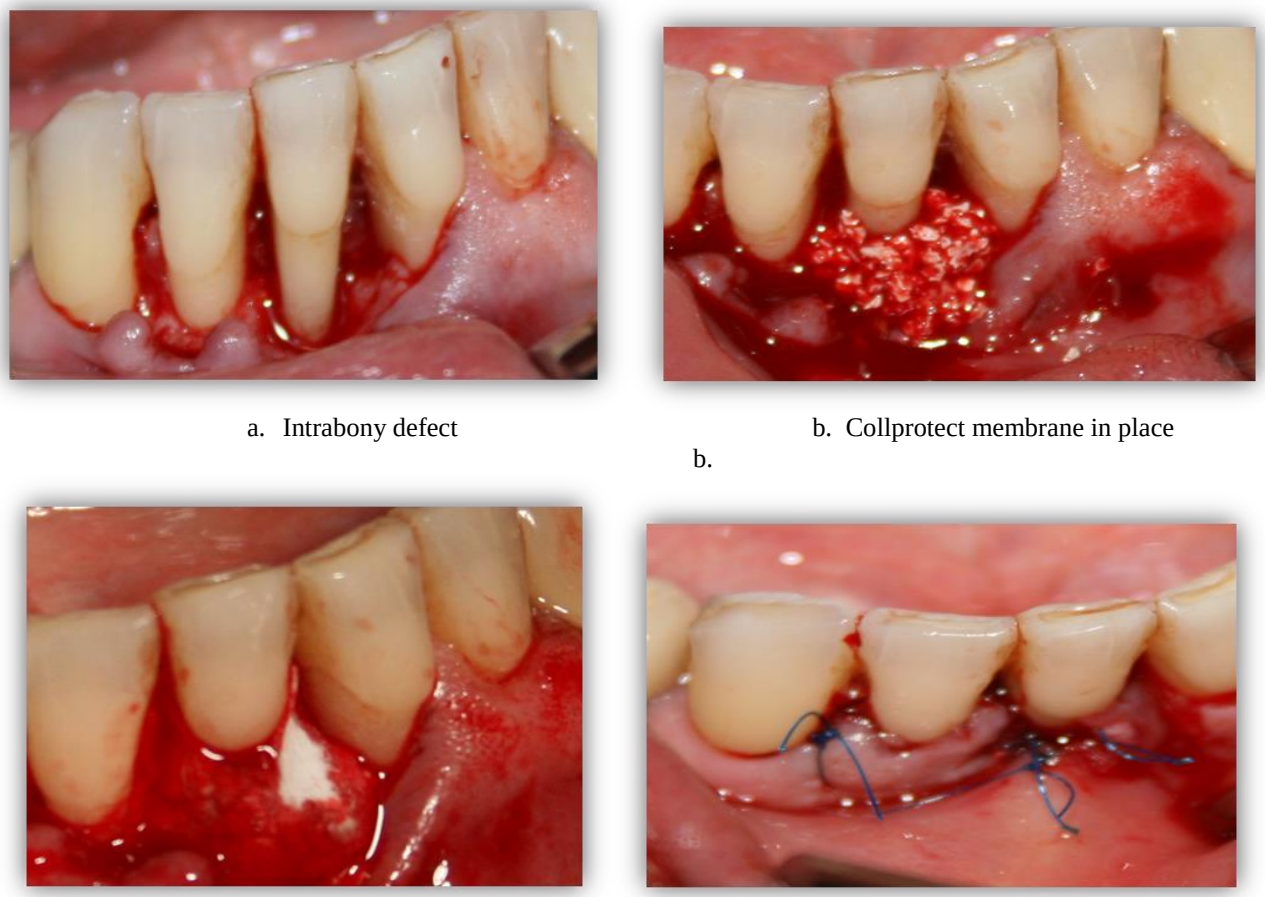
The following parameters were recorded at baseline and after 6 months: bone reduction based on x-rays, bleeding on probing by using a probe, probing depths (PD), clinical attachment level and fill level of the intrabony defects.

Patients are instructed for postoperative maintenance care.

3. Results

Clinical healing of the surgical wound after regenerative therapy followed by LLLT is usually rapid and associated with minor postoperative inflammation or other discomfort.

The mean probing depths and clinical attachment level in the test group decreased in comparison with the control group ($p<0.05$). However, the decreased was not significant due to the short time after surgery. That is known that the clinical results are evidence after one year.



a. Intrabony defect

b. Collprotect membrane in place

b.

c. Defect filling with cerabone granules

d. Saliva-proof wound closure

Fig. 1.The surgery techniqye

Fig. 2. Postoperative treatment with the OsseoPulse phototherapy for 20 min/day for 21 days

X-ray examinations evidenced more favorable outcomes overtime. Re-entry measurements have also demonstrated substantial bone fill after regenerative surgery followed by LLLT. Radiographic evaluation showed more rapid bone regeneration in the test group compared with the control (Fig 3, Fig.4, Fig.5).

Fig. 3. Control group: baseline

Fig. 4. Control group: 6 months postsurgery

Fig. 5. Test group: baseline

Fig. 6. Test group: 6 months postsurgery

4. Discussions

Our results reported in the present study are consistent with the outcomes published by other authors. Similar results were obtained by Obradovic et al. [7], who used LLLT additionally in the conventional periodontal treatment of patients with diabetis and periodontal diseases. Their histological data showed that both healing and homogenization of the gingival lamina propria improved after LLLT.

Theodoro et al. [8] used LLLT in patients with chronical periodontal diseases. Significant changes in terms of presence of periodontal pathogens both in control group and test group were observed after 6 months. However, neither group showed any significant difference in terms of clinical results.

Rotundo et al. [9] published similar conclusion, showing that no important gain in clinical attachment was obtained after 6 months as compared with patients in the control group who reveived only supragingival scaling.

Lui et al. [10] found out that there were no differences in periodontal parameters after 3 months of therapy between persons who had laser therapy and those who had not. There was a significant differences after a week and months in those treated with laser.

However, Pejčić et al. [11] demonstrated LLLT to be benefic in patients with periodontal disease, as they obtained a significant alteration of the plaque index, gingival index and periodontal pocket depth after 6 months.

5. Conclusions

LLLT can be considered a valuable support improving the outcomes of the surgical treatment.

Clinical data indicate the possibility of more rapid wound closure and subsequent healing in zones treated with LLLT as compared with control.

In the site treated with LLLT there is very limited or no inflammatory reaction.

For a continued and focused development of the regenerative periodontal concept for predictable use in more challenging periodontal defects, can be performed an additional treatment with LLLT.

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