

Anti-inflammatory effect of low level laser treatment on chronic periodontitis

Ana Pejcić^{a,*}, Dimitrije Mirković^b

^aDepartment of Periodontology and Oral Medicine, Faculty of Medicine, University of Nis, dr Z. Djindjica Blvd 81, 18000 Nis, Serbia

^bFaculty of Medicine – Dentistry Group, University of Nis, dr Z. Djindjica Blvd 81, 18000 Nis, Serbia

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Abstract

Background: Periodontitis is an inflammatory disease of the supportive tissue of teeth caused by specific microorganisms. Periodontitis is a typical example of a chronic inflammatory reaction which cannot develop without an associated inflammation, since it is always attended by gingivitis with marked inflammation. The aim of the paper is to show the anti-inflammatory effects on gingiva by combined therapy (conservative therapy complemented with laser therapy).

Material and methods: A total of 34 patients were examined who had been diagnosed with chronic periodontitis. In the experimental group 17 patients were treated using conservative methods (scaling and root planing) followed by a low level laser therapy (LLLT) with a Scorpion-SM-405-7A system (OPTIKA-LASER; Sofia, Bulgaria), and the patients of the control group ($n = 17$) were treated only with scaling and root planing (SRP).

Clinical measurements included probing pocket depth (PPD), bleeding on probing (BOP), clinical attachment level (CAL), as well as supragingival plaque measurements (PL) and gingival crevicular fluid (GCF) measurements in pockets and were undertaken before therapy (baseline), and three and six months, respectively after the therapy had been completed.

Results: All the subjects in each group completed all phases of the study. Six months after the therapy, the average PPD, CAL and GCF reduction in the experimental group with LLLT was significantly greater ($p < 0.05$) than for the patients receiving only conservative therapy. The reduction in CAL and GCF at the treated sites was greater than at the SRP sites, although the difference was statistically significant for the six month visit only ($p < 0.05$).

In the group using only conservative therapy, histological findings of gingivae showed a reduction in the number of inflammatory cells and partial stroma collagenization, while histological findings in gingivae after the laser therapy indicated completely regenerated gingival tissue with few inflammatory cells as well as marked collagen tissue homogenization.

Conclusion: Based on the results obtained, it can be concluded that the use of LLLT as an adjunct procedure in the conservative treatment of periodontitis is very successful in reducing gingival tissue inflammation.

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Keywords: Periodontitis; Low level laser; Clinical parameters; Histopathology

Introduction

Chronic periodontitis is an inflammatory disease that results in the destruction of the soft tissue and supporting

bone structure of the periodontium (periodontal membrane and alveolar bone), with the formation of periodontal pockets and gingival recession [1].

Certain Gram-negative bacteria have been implicated in the pathogenesis of this disease including *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* and *Tannerella forsythensis* [2]. These microorganisms, found in

*Corresponding author. Tel.: +381 64 25 72 178; fax: +381 18 536 736.
E-mail address: dpejca@open.telekom.rs (A. Pejcić).

the gingival sulcus, are responsible for the first pathological changes in the inflamed gingiva. The first damage is the widening of the intracellular spaces, which during the early phase of gingival inflammation enables aggressive bacteria and their products to penetrate into the connective gingival tissue [3].

The disease starts with gingival inflammation which develops through several phases to the point that it affects other parts of periodontium, and finally results in periodontitis. The changes, taking place at the blood vessels level, appear as the first manifestations of gingival inflammation ('initial lesion'). The capillaries dilate and there is an increase in the blood flow [4]. In the 'early lesion', the changes noted in the 'initial lesion' become more marked, the volume of inflammatory infiltrate also increases which clinically results in gingival enlargement [5]. A 'developed lesion' occurs as a consequence of dental plaque persistence when some of the bacteria may penetrate into the host tissue. Perivascular accumulation of chronic inflammatory cells is evident at this stage [6]. However, there is still no loss of the bone or connective tissue attachment. Chronic periodontitis is characterized by the loss of the connective tissue attachment and alveolar bone. Clinically, the process is manifested as formation of a periodontal pocket [2].

Periodontitis manifests itself as a disease which cannot develop without the associated inflammation because it is always preceded by gingivitis with marked inflammation.

Only a decade ago laser therapy was thought to be an absolute novelty in Serbian dentistry, a little bit futuristic, promising but still controversial. Today it is a standard dentistry procedure with clearly defined indications and contraindications and has lost the label of an experimental medical procedure.

A laser is considered to be basically effective for treating periodontal diseases because of its excellent physical properties, namely ablation, hemostasis, killing of bacteria and cell stimulation. The low level laser light has wide range of proved therapeutic possibilities in oral medicine and periodontology. Nakova et al. [7] noted a significant reduction of gingival inflammation, which is the result of anti-inflammatory, anti-edematous laser activity, as well as intensification of humoral and cellular immunity and acceleration of reparatory and regeneratory capabilities.

This therapeutic laser treatment, also referred to as low level laser therapy (LLLT), offers numerous benefits. Along with the primary benefit of being non-surgical, it promotes tissue healing and reduces edema, inflammation, and pain [8–10].

Dental laser therapy has been in use for over 30 years and more than 90% of the available literature reports positive effects [11–13]. Sometimes it is used as a part of a therapy, and sometimes it is used as monotherapy [14,15].

The aim of the study was to evaluate the efficacy of LLLT combined with conservative therapy in the treatment of periodontitis patients and to analyze the clinical results and histopathological findings as well as to confirm its use as an adjunct to scaling and root planing (SRP).

Material and methods

Patient population

Thirty-four patients, 20 males and 14 females, with an average age of 45 years were randomly selected to take part in the study. One criterion for inclusion in the study was that all patients were scheduled for the extraction of at least one tooth because of prosthetic and/or orthodontic reasons. All the patients were registered at the Department of Periodontology and Oral Medicine of the Clinic of Dentistry in Nis. They all gave their written consent to be included in the study. The protocol of investigation was approved by the Scientific Ethical Committee of Medical Faculty in Nis (No: 01-2800-5).

All the patients suffered from chronic periodontitis with marked clinical symptoms of gingival inflammation. The diagnosis of periodontitis was made on the basis of classic diagnostic methods: anamnesis, clinical presentation, an index of gingival oral hygiene, and radiographs.

Persons excluded from the research were those suffering from any systemic disease, smokers, pregnant women, subjects currently under periodontal therapy, subjects taking antibiotics or those who had taken antibiotics six months prior to the research. A split-mouth design was not considered for the investigation.

The group was divided into two groups of 17 patients each. The first group of patients was the experimental (E) group given combined therapy (conservative complemented with laser therapy), which means that conservative treatment (SRP) preceded the LLLT. The second group, the control (C) group, was made up of 17 patients who were only treated with conservative methods (SRP). They were treated following the same principles and schedule as the experimental group, but without additional application of the low level laser.

Clinical measurements were carried out before therapy (baseline), as well as three and six months after the therapy had been completed.

Clinical measurements

Clinical response was assessed by measuring periodontal probing depth (PPD) (from free gingival margin to the bottom of the periodontal pocket), clinical attachment level (CAL) (from enamel cement margin to periodontal pocket), and plaque score (PI) based on a modified score of 0–3. The PIs were recorded as follows: '0' = no plaque present; '1' = plaque covering not more than one third of the tooth; '2' = plaque covering more than one third but not more than two thirds of the exposed tooth surface; '3' = plaque covering more than two thirds of the exposed tooth surface. Moreover, bleeding on probing (BOP) was evaluated using a scoring scheme, where '0' = no bleeding; '1' = bleeding within 10 s after probing; '2' = bleeding within probing; '3' = spontaneous bleeding. The plaque index was measured

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