

## Diode Laser as Adjunct to Scaling and Root Planing

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### ABSTRACT

**Objective:** The aim of this study was to evaluate clinical efficacy of InGaAsP diode laser as adjunct to traditional scaling and root planing. **Background Data:** The use of laser is one of the most recent methods in non-surgical periodontal treatment. Efficacy and side effects of each type of laser treatment have yet to be determined. **Methods:** Thirty patients suffering from moderate periodontal disease have been considered. They were randomly selected to undergo either scaling and root planing with curets, or scaling and root planing combined with InGaAsP laser (980 nm and 2 W). The papilla bleeding index (PBI), bleeding on probing (BOP), and clinical attachment level (CAL) were registered at the beginning and end of treatment. **Results:** At the end of treatment, PBI average in the group treated with laser was 0.24 versus 0.43 in the group under conventional treatment ( $p = 0.014$ ). In the group undergoing scaling and root planing, BOP decrease is 19.55% less ( $p < 0.0001$ ) than in the group also treated with laser. Nevertheless, CAL differences cannot be considered significant between both groups ( $p = 0.67$ ). **Conclusions:** Scaling and root planing in combination with laser produce moderate clinical improvement over traditional treatment.

### INTRODUCTION

#### SCALING AND ROOT PLANING

Scaling and root planing are used to restore gingival health by removing plaque, calculus, and endotoxins adhered to tooth roots, causing gum inflammation. This, along with the patient's instruction for correct oral hygiene, constitutes the basis of non-surgical periodontal treatment.<sup>1</sup> Nevertheless, this type of therapy has its own limits, and so, many researchers have proposed the use of several kinds of laser as a more efficient method of root planing.<sup>2</sup> The possibility of substituting conventional treatments for laser therapy is still very controversial.<sup>2,3</sup> One of the most successful clinical uses in daily practice is the combination of laser treatment and conventional treatment with manual instruments. The beam of laser light would be capable of completing scaling and root planing started by hand, fulfilling a delicate cuttillage, preventing dentine hypersensitivity, and sterilizing the gingival sulcus.<sup>4</sup>

Good clinical results have been reached with the use of Er:YAG<sub>2,5</sub> and Nd:YAG<sub>6</sub> laser, but these techniques are restricted due to the cost of the necessary systems and possible side effects. Moritz et al.<sup>7</sup> have proved significant bacterial decrease

and reduction of inflammation when using a diode laser of 805 nm wavelength combined with scaling and root planing. Other

authors<sup>8,9</sup> have proved good results with the use of diode laser

to decontaminate during periodontitis and perimplantitis surgical treatments. Nevertheless, Yilmaz et al.<sup>3</sup> have not found additional benefit in the use of gallium arsenide laser with regard to other types of periodontal treatment. Other authors have suggested that the use of laser for the periodontal treatment could be more harmful than beneficial.<sup>10,11</sup>

The objective of this study is to confirm whether the use of diode laser as adjunct to traditional scaling and root planing improves the results of traditional therapy.

### MATERIALS AND METHODS

In this prospective double-blind study, 30 patients were included. They presented moderate periodontal disease. They were randomly selected to undergo either scaling and root planing with manual instruments, or scaling and root planing with manual instruments combined with diode laser following the

described protocol. Degree of gingival inflammation was evaluated according to the papilla bleeding index (PBI) and amount of bleeding on probing (BOP), since histological studies confirm gingival bleeding as an accurate indicator of gingival inflammation.<sup>12,13</sup> Clinical attachment level (CAL), gingival recession, and probing depth have also been measured.<sup>12</sup>

Data were recorded at the beginning and 6 weeks after the end of treatment. This last time, patients were asked about their impression on the treatment.

Every patient underwent the same treatment protocol. On the first place, they were instructed in a good dental hygiene. To evaluate this parameter, patient's hygiene performance (PHP) index was used.<sup>12</sup> Patients were kept in this stage until they improved their PHP at least 50% from its first value. Afterwards, patients were explored and the clinical variables above mentioned were registered. Then, they were randomly assigned to one of the study groups. Both groups underwent supragingival calculus removal with ultrasonic instruments. On the next session, the group treated without laser underwent scaling and root planing with cures of Gracey type. The other group of patients was treated with InGalAsP diode laser (Intermedic. Barcelona. Spain) applied through optic fiber of 2 mm of diameter. Wave length was 980 nm and 2 W power was applied with pulse system (100-msec pulse and stop of 50). This type of laser is provided with a refrigeration pump which works with saline serum, hooked to a manual piece to avoid any undesired increase in temperature. The clinical procedure is as follows:

- Periapical anesthesia using lidocaine 5% and adrenalin 1:100,000.
- Conventional scaling and root planing with manual instruments in order to remove calculus and ease the following use of laser optical fiber.
- Laser procedure. The optical fiber becomes introduced and ascending and descendant movements are practiced. Those movements should be slow to increase laser efficacy, since it works with low intensity (the maximum power of this diode laser is 15 W). Special attention has to be paid to the direction of the optical fiber, since it has to be always parallel to the tooth main axis. The same procedure has to be performed in the whole dental perimeter, roughly 10 sec by tooth face. Access to interproximal and furcation areas is easy due to scarce thickness of the optical fiber.
- Repetition of scaling is done to remove detritus and calculus remnants within the sulcus. It is extremely simple since the remnants are loose.
- As in the first procedure, the second laser procedure is done to remove calculus remnants, prevent sensitivity of the

working area, and undergo curettage of periodontal pocket.

Every time the laser is applied with abundant irrigation. In some cases, it becomes necessary to clean the tip of the fiber with a humidified lint in saline serum.

After 6 weeks, patients were examined by another practitioner who did not know the procedure each patient had undergone.

### Statistical analysis

The statistical tests carried out were mean differences with Student's *t* test for independent and related variables, for PBI, CAL, and BOP, which followed normal distribution. All the tests were carried out with the aid of the statistical packet SPSS, version 10.0 (SPSS, Inc., Chicago, IL). Unless otherwise indicated,  $p < 0.05$  is considered statistically significant.

## RESULTS

PBI average value was reduced from  $1.38 \pm 0.61$  (mean  $\pm$  SD) to  $0.43 \pm 0.22$  ( $p < 0.0001$ ) and BOP average value was reduced from  $58.97 \pm 17.71$  to  $27.71 \pm 14.41$  ( $p < 0.0001$ ) in the group undergoing conventional treatment. The group treated with laser had PBI decrease from  $0.95 \pm 0.57$  to  $0.24 \pm 0.13$  ( $p < 0.0001$ ) and decrease in the BOP average value from  $39.37 \pm 19.90$  to  $11.02 \pm 7.36$  ( $p < 0.0001$ ) (Table 1).

The average PBI at the beginning of the study was similar in both groups ( $p = 0.065$ ). Six weeks after the treatment had finished, average PIB in the group undergoing conventional treatment was 0.43 versus 0.24 in the group which was treated with laser, having a statistically significant difference of  $p = 0.014$  (Fig. 1). The group undergoing scaling and root planing presented a BOP reduction 19.55% smaller than the group treated with laser ( $p < 0.0001$ ). CAL average value at the beginning of treatment was  $4.78 \pm 1.25$  mm in the group undergoing traditional treatment while  $5.12 \pm 1.14$  mm in the group treated with laser, being both groups similar ( $p = 0.71$ ). At the end of treatment, CAL average value decreased in both groups (up to  $3.93 \pm 1.14$  mm and  $4.17 \pm 1.17$  mm respectively,  $p < 0.0001$  in both instances) but there are not statistically significant differences between both groups ( $p = 0.67$ ) (Table 1).

Clinically, the group treated with laser had an important reduction of sensitivity and patients undergoing this type of treatment reported less discomfort during treatment as well as an important decrease in sensitivity previous to periodontal treatment.

TABLE 1. CLINICAL INDICATOR CHANGES (95% CONFIDENCE INTERVAL)

	PBI baseline	PBI 6 weeks	<i>p</i> value <sup>a</sup>	CAL baseline <sup>b</sup>	CAL 6 weeks <sup>b</sup>	<i>p</i> value <sup>c</sup>
RSP	1.01-1.75	0.29-0.57	<0.0001	4.02-5.54	3.24-4.62	<0.0001
RSP + laser	0.66-1.25	0.16-0.31	<0.0001	4.53-5.71	3.57-4.68	<0.0001
<i>p</i> value:	NS	0.014		NS	NS	

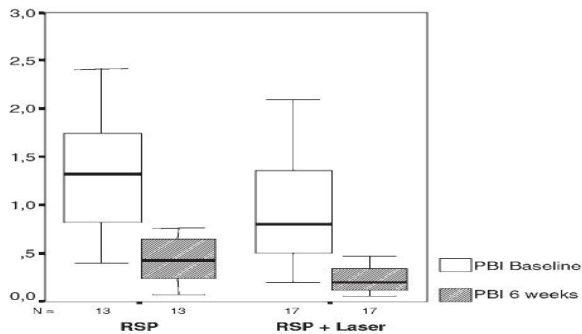
<sup>a</sup>Between baseline and 6 weeks.

<sup>b</sup>In millimeters.

<sup>c</sup>Between no laser and laser groups.

NS, not significant; PBI, papilla bleeding index; RSP, root scaling and planing; CAL, clinical attachment level.

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**FIG. 1.** Bleeding scores. PBI, papilla bleeding index; RSP, root scaling and planing.

## DISCUSSION

Like Moritz et al.<sup>7</sup> using diode laser and Schwarz et al.<sup>2</sup> with Er-YAG laser, we have observed that those patients treated with laser as adjunct to SRP presented a more significant clinical improvement than those conventionally treated. In our study, a statistically significant reduction of PBI and CAL is confirmed in both groups after the treatment was completed but the group undergoing laser treatment showed a statistically more significant improvement on bleeding on probing.

The clinical protocol we followed is more simple than the one described by Moritz et al.<sup>7</sup> and so, easier to adapt to the daily clinical practice. It is also important to mention that we used a wavelength of 980 nm, while theirs was of 805 nm. On the other hand, we have observed statistically significant differences in clinical indexes between both groups while they only refer to the average of patients who showed a reduction on bleeding on probing and depth of the periodontal pocket. These results contrast with those obtained by Yilmaz et al.<sup>3</sup> as they state that the laser procedure does not provide additional clinical benefits to the conventional treatment. The differences this study presents, can be due to several reasons such as different design of the research (quadrants instead of the whole mouth like in ours), small number of patients (only 10 were included), selection of single rooted teeth where the implementation of SRP is more effective and also, that the evaluation of treatment was done 32 days after the beginning of treatment versus 48 days later in our research (estimated time for regeneration of connective tissue).

In our study, we have not observed any clinical side effect caused by the use of diode laser in the periodontal pockets. Although the use of Nd:YAG and Er:YAG diode lasers has been proposed for tissues adjacent to the periodontal pocket, their use can be detrimental.<sup>10,11,14</sup> According to Radvar et al.,<sup>6</sup> damage is unlikely to occur when the laser beam of light is used in parallel to the root surface and adequate intensity is applied.<sup>11</sup> Moreover, we have used low intensity in pulse mode with ex-

posure times of less than 10 sec and additional refrigeration to minimize possible negative side effects. On the whole, more exhaustive research needs to be done on the effects of different types of laser as well as on their different wavelengths and intensity over the tissues we want to remove and those we want to keep.<sup>14</sup>

One of the most important side effects in periodontal treatment is the increase of tooth hypersensitivity.<sup>15,16</sup> Laser treatment of the root surfaces to ease hypersensitivity has been proved to be highly effective.<sup>17-19</sup> Our group of patients stated a much lower sensitivity after undergoing treatment than the group which was not treated with laser. Nevertheless, the data needs to be carefully evaluated since it is based upon subjective impression of patients and it is not based on objective proof.

## CONCLUSION

The results of this research seem to prove that the use of the diode laser on periodontal pockets as a complement to scaling and root planing treatment produces a qualitative improvement in the clinical indexes compared to conventional treatment. This data should be confirmed with a larger number of patients and a longer follow-up period. The differences shown in the subjective perception of discomfort during and after treatment are indicative of the importance of carrying out more research evaluating this parameter.

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