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ORIGINAL ARTICLE

Evaluation of the Efficacy of Diode Laser as an Adjunct to Scaling and Root Planing in the Treatment of Chronic Periodontitis: A Clinical and Microbiological Study

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ABSTRACT

Aim: To evaluate the clinical and microbiological effects of diode laser used as an adjunctive therapy to scaling and root planing (SRP) to that of SRP and laser alone for the treatment of chronic periodontitis (CP).

Materials and methods: Forty patients with chronic generalized periodontitis were recruited for the study, out of which 120 sites are treated and grouped as follows: group I (40 sites were treated with SRP), group II (40 sites were treated with SRP followed by adjunctive diode laser therapy), and group III (40 sites were treated with diode laser alone). The following clinical parameters were evaluated at baseline and 10 weeks after therapy: gingival index (GI), plaque index (PI), probing pocket depth (PPD), and clinical attachment level (CAL). Subgingival plaque samples were collected into a vial containing 1 mL transport medium, i.e., thioglycolate broth medium and transported to laboratory for anaerobic culture.

Results: At 10 weeks, all groups demonstrated significant enhancements with respect to every single clinical parameter contrasted to baseline (all $p < 0.05$). There were no significant differences among groups as far as changes of clinical parameters in any time interval (all $p > 0.05$). Likewise at 10 weeks after treatment, the microbiological examination demonstrated a statistically significant reduction in bacterial count (BC) compared with baseline ($p < 0.05$), but there were no significant differences among groups with respect to BC in any time interval (all $p > 0.05$).

Conclusion: Taking everything into account, the present study demonstrated that the use of diode laser as an adjunct to conventional periodontal treatment (i.e., SRP) and diode laser alone demonstrated no extra advantages contrasted with conventional periodontal treatment (i.e., SRP).

Keywords: Chronic periodontitis, Diode laser, Scaling and root planing.

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INTRODUCTION

Periodontal disease results from inflammation of the supporting structures of the teeth in response to chronic infections caused by various periodontopathic bacteria.[1] The primary objective in the treatment of periodontal disease is the removal of bacterial deposits to stop the disease progression.[2]

Nonsurgical treatment of such disruptive periodontal disease depends on the abolishing of bacterial deposits clung to tooth surfaces, essentially by methods for SRP.[3] Although SRP produces huge clinical enhancement in patients with CP, but the thorough elimination of bacterial deposits can be hard to achieve.[4]

Indeed, mechanical therapy alone is unable to remove pathogenic bacterial niches in the soft tissue and in regions that are difficult to reach to periodontal instruments, e.g., deep pockets, furcation areas, root depressions, because of the pathogenicity and/or resistance of the microorganisms, or even due to systemic conditions which may compromise host response to the treatment.[5] To overwhelm these constraints of traditional mechanical treatment, several adjunctive treatments have been developed.

Among these, the utilization of lasers has been proposed for its bactericidal and detoxification impacts and for its ability to reach sites that conventional mechanical instrumentation cannot.

Because of its attributes and other known advantages, such as low cost and practicality, the diode laser has been contrasted with other lasers, and has been a subject of a variety of studies expected to assess its potential in connection to its biocompatibility and to its capacity in reducing BC.[6,7]

Diode laser is demonstrated for the treatment of soft tissues and has a bactericidal effect, but does not remove

calculus on the root surface; hence it might be valuable as an adjunctive means for SRP because of its bactericidal and detoxification effect.[7,8] The results have been controversial; Caruso et al[9] and De Micheli et al[10] did not locate any extra advantages by utilizing the diode laser during nonsurgical periodontal treatment. Other investigations have indicated positive outcomes, both clinically and microbiologically, utilizing a similar kind of laser. The divergence of results may be related to the different methods used by the authors.

The aim of the present study was to evaluate clinical and microbiological effects of diode laser used as an adjunctive therapy to SRP to that of SRP and laser alone for the treatment of CP.

MATERIALS AND METHODS

Selection of Patient

Forty patients (29 males, 11 females, age range of 30–50 years, all nonsmokers), each of whom presented with untreated CP, were recruited for this study. The inclusion criteria of the study were as follows: (a) Systemically healthy patients, (b) patient should have more than 20 teeth remaining, (c) more than 30% of sites involved, and (d) presence of periodontal pocket in no less than two teeth with a probing depth of ≥5 mm in each quadrant. Exclusion criteria were: (a) Patients with history of systemic diseases affecting the periodontium, (b) smokers and alcoholic patients, (c) patients on any medication taken within the last 6 months which may alter the periodontal status, (d) pregnant and lactating women, and (e) patients who have experienced periodontal treatment 6 months before the examination.

Study Design

The study was performed according to a split-mouth design, and each patient (i.e., 120 sites for 40 patients) was randomly allocated to one of the following groups:

Group I (SRP): Forty sites were treated with SRP alone.

Group II (SRP + laser): Forty sites were treated with SRP followed by adjunctive diode laser [Picasso LitePlus (AMD Lasers)] (Fig. 1) therapy.

Group III (laser–): Forty sites were treated with diode laser (Fig. 1) alone.

All patients were treated by the same experienced operator.

Clinical Measurements

At baseline, the following clinical parameters were recorded at the experimental sites:

- Gingival index by Loe and Silness.
- Plaque index by Silness and Loe.
- Probing pocket depth using graduated William's periodontal probe.
- Clinical attachment level measured from cementoenamel junction to the base of the pocket.

Again at 10 weeks after completing periodontal therapy, clinical parameters were recorded.

Microbiological Evaluation

Subgingival plaque was collected with a paper point in the deepest site of each quadrant at baseline and at 10 weeks after completing periodontal therapy. Cotton rolls were placed to isolate the area and a sterile paper point was inserted into the pocket for 30 seconds before being removed and immersed into a vial containing 1 mL transport medium, i.e., thioglycolate broth medium and transported to laboratory for anaerobic culture. These samples were processed within 48 hours after collection. The anaerobic blood agar is inoculated with the sample and incubated in anaerobic jar (GasPak) for 35°C overnight. Subcultures (Fig. 2) are made from thioglycolate broth if growth is observed onto anaerobic blood agar. Plates should be incubated for at least 48 hours before

Fig. 1: Diode laser (Picasso Lite)

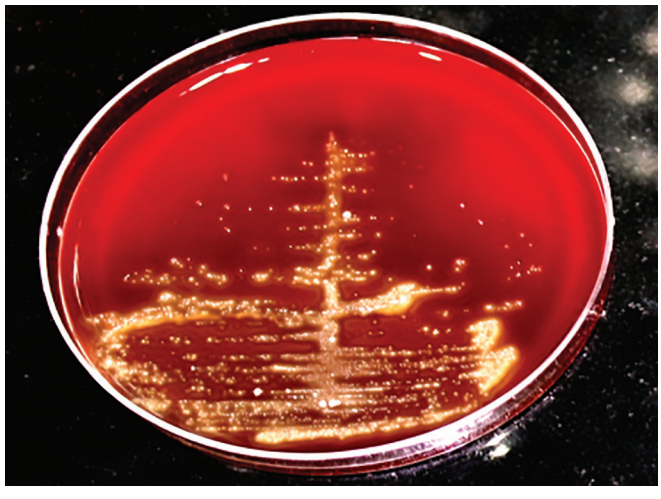

Fig. 2: Microbiological culture

Table 1: Gingival index and PI scores at baseline and 10 weeks after treatment

Index/treatment	*Baseline*	*10 weeks*	*p-value*
GI			
SRP	2.30 ± 042	1.40 ± 0.36	<0.001*
SRP + laser	2.29 ± 0.43	1.38 ± 0.38	<0.001*
Laser	2.19 ± 0.38	1.24 ± 0.34	<0.001*
p-value	NS	NS	
PI			
SRP	2.04 ± 0.34	1.27 ± 0.38	<0.001*
SRP + laser	2.03 ± 0.36	1.25 ± 0.32	<0.001*
Laser	2.01 ± 0.32	1.22 ± 0.33	<0.001*
p-value	NS	NS	

*p < 0.05; NS: Not significant

Table 2: Probing pocket depth and CAL at baseline and 10 weeks after treatment

Index/treatment	*Baseline*	*10 weeks*	*p-value*
PPD			
SRP	6.57 ± 0.94	5.53 ± 1.01	<0.001*
SRP + laser	6.50 ± 1.38	5.50 ± 1.33	<0.001*
Laser	6.50 ± 1.55	5.27 ± 0.30	<0.001*
p-value	NS	NS	
CAL			
SRP	6.23 ± 0.94	5.27 ± 0.91	<0.001*
SRP + laser	6.37 ± 1.33	5.30 ± 1.39	<0.001*
Laser	6.13 ± 1.48	5.20 ± 1.27	<0.001*
p-value	NS	NS	

*p < 0.05; NS: Not significant

Table 3: Bacterial count at baseline and 10 weeks after treatment

	Baseline	*10 weeks*	*p-value*
BC			
SRP	10.13 ± 1.35	8.95 ± 1.49	<0.001*
SRP + laser	9.69 ± 0.95	7.89 ± 1.30	<0.001*
Laser	9.76 ± 1.45	7.96 ± 1.36	<0.001*
p-value	NS	NS	

*p < 0.05; NS: Not significant

processing and reincubate for 2 to 4 days before reporting negative. Make smear from the specimen, Grams stain the smear, observe under microscope, and record the findings.

Treatment Procedure

All the treatments were performed in two sessions, with intervals of 1 week between sessions. Initially, all the subjects in groups I and II received fundamental periodontal treatment, including SRP and oral hygiene instructions where group III received only supragingival scaling and oral hygiene instructions. Baseline measurements of the GI (Silness and Loe), PI (Loe), PPD, and CAL were recorded before the SRP. Subgingival plaque samples were collected from the deepest site of each quadrant at baseline and 10 weeks after SRP.

At the second session (i.e., 1 week after the first session), groups II and III received laser (Fig. 1) debridement. Pockets in groups II and III were exposed to diode laser (wavelength: 810 nm, output power: 1.2 W) using a 300 μm fiberoptic tip for 10 seconds in each site. The treatment was done in six sites for every tooth totaling 1 minute of treatment for each tooth.

All the subjects were reviewed for professional prophylaxis and assessment of the clinical parameters 10 weeks after the treatment.

Statistical Analysis

The statistical analysis was performed using commercially available software (Statistical Package for the Social Sciences, version 15.0, Stata 8.0, Medical 9.0.1 and Systat 11.0). Mean values and standard deviation were calculated. Kruskal–Wallis analysis of variance (ANOVA) was used to compare groups I, II, and III with respect to GI and PI scores at different time intervals. The intergroup comparison of groups I, II, and III with respect to PPD, CAL, and BCs at different time intervals from baseline to 10 weeks was assessed by one-way ANOVA. Comparisons between and within the groups as for the treatment interims were performed using the Wilcoxon two-sample paired signed rank test and paired t-test. Differences were considered statistically significant when the p-value was <0.05.

RESULTS

All 40 patients completed the 10 weeks clinical trial, with no patients reporting postoperative complications, such as infections, suppuration, or abscesses, at any of the follow-up appointments.

The intragroup comparison with respect to GI and PI at different time intervals showed significant reduction in GI and PI scores from baseline to 10 weeks (p-value ≤ 0.001) but the intergroup comparison shows a nonsignificant difference between the three treatments groups, i.e., groups I, II, and III (Table 1).

At 10 weeks evaluations all treatments groups (i.e., groups I, II, and III) yielded significant improvements in terms of PPD reduction and CAL gain compared with baseline values (p ≤ 0.001) but no significant differences were found between the three treatment groups (i.e., groups I, II, and III) at baseline and 10 weeks (Table 2).

Bacterial count at baseline and at 10 weeks shows no significant difference between the treatments groups, i.e., groups I, II, and III (Table 3). Compared with the baseline, BC reduced significantly at 10 weeks in all the treatments groups (p < 0.001).

DISCUSSION

The adjunctive use of lasers has been explored in the treatment of periodontitis and peri-implantitis, among other

oral conditions in the course of the last few decades.[11-13] The present investigation was intended to assess the viability of diode laser as an adjunctive treatment to SRP to that of SRP and laser alone for the treatment of CP. The result demonstrated that all the treatment modalities led to significant improvement in all the clinical parameters and significant reduction in microbial load from baseline to 10 weeks but without significant difference between groups for any parameters.

The results of present examination have demonstrated that 10 weeks after baseline, all the three treatment groups (SRP, SRP + diode laser, and diode laser alone) have advanced comparable advantages in all the clinical parameters and reduction in microbial load with no statistical difference between the groups. Comparative outcomes were reported by Caruso et al,[9] who compared the viability of diode laser utilized as adjunctive treatment of SRP to that of SRP alone for nonsurgical periodontal treatment in patients with CP.

In the present investigation, there was a significant reduction of PI, as observed by Kamma et al[14] in which past oral hygiene instruction was performed. There is no proof that laser treatment can repress biofilm development once a tooth has been irradiated. Cobb[15] established that SRP is an adequate treatment and that very few pockets do not show some sign of improvement after nonsurgical treatment.[16] The SRP accomplished attractive outcomes with or without the use of diode laser.

Our study results show significant reduction in the PPD and gain in CAL from the baseline till the 10 weeks follow-up in all the three groups (Table 2). Similar to result was reported by Jepsen et al., who treated a total of 10 patients either with an erbium-doped yttrium aluminum garnet (Er:YAG) laser or with SRP. The mean value of the PD decreased in both groups from 3.9 ± 0.8 mm at baseline to 2.9 ± 0.6 mm after 3 months. The mean CAL gain after 3 months in the laser group was 0.3 ± 0.2 and 0.4 ± 0.3 mm in the SRP group.[17] The results were statistically and clinically significant compared with baseline. No statistically or clinically significant differences in any of the researched parameters were seen between the two groups.

In another controlled clinical trial, Schwarz et al treated an aggregate of 20 patients either with an Er:YAG laser or with SRP. The mean value of the PD diminished in the laser group from 4.9 ± 0.7 mm at baseline to 2.9 ± 0.6 mm after 6 months and in the SRP group from 5.0 ± 0.6 mm at baseline to 3.4 ± 0.7 mm after 6 months. The mean value of the CAL diminished in the laser group from 6.3 ± 1.1 mm at baseline to 4.4 ± 1.0 mm after 6 months and in the SRP group from 6.5 ± 1.0 mm at baseline to 5.5 ± 1.0 after 6 months. The outcomes were statistically and clinically significant compared with baseline.[18]

In this study for microbiological investigation, microbiological culture was picked because it is the highest quality level technique for distinguishing and counting of the colonies. Reduction in BC was seen in all the three treatment groups from baseline to 10 weeks, which was statistically significant (Table 3).

Similar result was narrated by Slots et al,[19] Hakkarainen et al,[20] and van Winkelhoff et al,[21] where significant reduction of the bacterial flora was observed due to SRP.

Few studies evaluated the reduction of the bacterial mass occurring after use of laser in moderate to deep pockets. Cobb et al[22] and Radvar et al[23] achieved a decrease in the number of periopathogens in pockets treated by neodymium-doped YAG laser alone or in combination with SRP.

The present results have indicated that nonsurgical periodontal therapy with both diode laser + SRP and diode laser alone may lead to significant improvements in all clinical parameters and microbiological analysis investigated but the treatment with diode lasers + SRP and diode laser alone did not seem to additionally improve the outcome of the therapy compared with conventional periodontal treatment (i.e., SRP).

CONCLUSION

Within the limit of this study, the present investigation showed that the use of diode laser as an adjunct to conventional periodontal treatment (i.e., SRP) and laser alone demonstrated no extra advantages contrasted with conventional periodontal treatment (i.e., SRP).

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