# *Evaluation of Clinical Effects of a 940nm Diode Laser as Adjunctive Therapy in the Treatment of Periodontal Pockets*

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## ABSTRACT

**Background**: Periodontal diseases are multifactorial, inflammatory diseases that, when left without treatment may results in the destruction of tooth-supporting structures and finally may cause tooth loss. Diode laser therapy as an adjunct to non-surgical periodontal treatment of periodontal pockets has been increasingly encouraged by some researches but experimental proves have not yet supported the use of laser therapy.

**Aim:** The objective of this single controlled clinical study was to assess the effect of a 940-nm diode laser as an adjunct to scaling and root planing (SRP) therapy in the treatment of periodontal pockets.

**Methods**: Fifteen patients in need of periodontal treatment with periodontal pocket ≥ 4 were selected for this split-mouth clinical study. Quadrants were enrolled into either control group treated by conventional scaling and root planning or test group treated by diode laser 940nm as an adjunct with SRP in contralateral quadrants. Baseline data, including plaque index (PI), gingival index (GI), probing pocket depth (PPD) were recorded before the treatment and 3 months post treatment.

**Results:** plaque index (PI), gingival index (GI), probing depth (PD) were significantly reduced after 3 months in both groups. No significant differences were found in reduction mean of PI, GI, PPD.

**Conclusion***:* The use of the diode laser as an adjunct to scaling and root planing did not offer any superior clinical benefits over conventional scaling and root planning.

## KEYWORDS

Dental scaling; Diode lasers; laser therapy; periodontal pocket

## INTRODUCTION

Periodontal diseases are caused by microbial biofilm generally Gram-negative anaerobic bacteria.[1] For the treatment of inflammatory periodontal diseases different surgical and nonsurgical periodontal approaches are available[2]. Mechanical subgingival therapy are used to reestablish periodontal health this is achieved by scaling and root planning by eliminating plaque, calculus, and bacterial endotoxins at the tooth surface and induce changes in the numbers of microorganisims in the subgingival microbiota[3]. Studies have revealed that non-surgical therapy improves periodontal health as measured by clinical parameters, represented by reductions in probing depth (PD) and bleeding on probing (BOP), and gain in clinical attachment level (CAL)[4]. However, nonsurgical therapy alone has its own limits and may not be effective to eradicate the pathogenic microorganisms in the periodontal pockets[5,6]. After scaling and root planing the root surface is consistently covered by a smear layer, that contain remnants of calculus, contaminated root cementum, bacteria, bacterial endotoxin, and plaque[7-9]. The use of laser has been proposed as an adjunct to nonsurgical periodontal therapy by many studies[10]. Laser therapy was proved by some studies to cause resolution of gingival inflammation this is due to some advantages of laser including bactericidal, detoxification effects and biostimulation effect that enhance healing[11].

## MATERIALS AND METHODS

### Study design and population

This study was a single randomized split mouth design controlled clinical study. The study was conducted at the dental clinic of the department of biomedical applications, institute of laser for postgraduate studies, University of Baghdad. The total population of this study consisted of fifteen patients (four women and eleven men) with mean age of 45.8 years old were enrolled in this study. The inclusion criteria included any adult who had one or more periodontal sites with ≥ 4 mm probing depth and bleeding on probing, had at least two quadrants with periodontal sites (ideally opposite side same jaw). Who had received no active or maintenance periodontal therapy at least 3-months prior. Individuals had received no systemic antibiotic therapy in the previous 3 months.

Exclusion criteria included: subjects who were uncontrolled diabetics, had used antibiotics within the prior 3-months, regularly used nonsteroidal anti-inflammatory medications, required antibiotic prophylaxis for therapy, pregnant women, individuales with severe systemic diseases and psychological disorders or patients using anticonvulsant, anticoagulant drugs. Individuals who had recent history of periodontal surgery, (within the last 2years).

### Treatment Protocol

Quadrants were enrolled into either control group

treated by conventional scaling and root planning or laser group treated by diode laser 940nm as an adjunct with SRP in contralateral quadrants. Patients were given oral hygiene instructions and periodontal clinical parameters were collected and recorded before the treatment and 3 months after the treatment. Clinical parameter that were measured were probing pocket depth (PPD), plaque index (PI), gingival index (GI). At the same appointment following the data collection, the active study therapy was performed. Supragingival scaling was performed for patient using hand instruments scalars and ultrasonic devices. Subgingival scaling and root planing under local anesthesia was done in the same visit for each individual by Gracey curettes. SRP and diode laser therapy was performed in the same visit. Laser treatment was performed by using a 940 nm diode laser (epic10, Biolase, USA). A 300 µm fiber optic delivery system was used for irradiation and power of 0.8 W was applied with continuous mode. Then the fiber was inserted into the base of the periodontal pocket 1mm less than the value of periodontal pocket depth obtained by clinical measurement at baseline. It should be introduced parallel to the root surface, and the fiber was moved slowly from apical to coronal in a sweeping motion during laser irradiation and moved around the tooth surfaces, for about 20s for each tooth. The periodontal pocket was irrigated with normal saline solution before irradiation to rinse periodontal pocket from blood to prevent collateral damage to the root and periodontal tissues. The tip of the fiber was cleaned with humidified gauze in saline solution. Oral hygiene instructions were reinforced every session including home care instructions (tooth brushing, dental flossing) and motivation. Laser irradiation was done at first visit, at second week and third week. There was a follow up period of 3 months and final assessment session.

**Statistical analysis**

Collected data from both control and laser groups were tabulated in excel tables (Microsoft office 2010).For statistical analysis, Means, standard deviations and p values were calculated using IBM SPSS version17.00 statistical package. To identify any changes between baseline and 3-months post-treatment intra-group analyses was performed by paired t-test. Inter-group analyses were performed to compare the differences between therapies (SRP + L or SRP alone) at 3-months post treatment by unpaired t-test. The level of significance was set at $P < 0.05$.

## RESULTS

**Probing pocket depth assessment (PPD)**

At baseline the mean PPD for control group was 4.64 ± 0.77. Three months analysis of control treated group revealed a mean PPD of 3.13 ± 0.97. There was a mean PD reduction of 1.63 ± 0.98mm. At baseline the mean PPD for laser group was 4.76 ± 0.82. Evaluation of laser group at 3 months had revealed a mean PPD of 3.13 ± 1.03. There was a mean PD reduction of 1.63 ± 0.98mm. There was a significant difference after treatment between baseline and 3 months assessment in respect to PD in both the control and test groups. No statistical significant differences were detected between the laser and control treated groups at 3 months assessment as shown in (Table 1.).

**Table 1. (Mean ± SD) of PPD and at baseline and at 3 months**

| *Treatment* | *Baseline* | *Three months* | *Difference* | *P*-value |
|---|---|---|---|---|
| **Laser** | 4.76 ± 0.82 | 3.13 ± 1.03 | 1.63 | < 0.001 |
| **Control** | 4.64 ± 0.77 | 3.13 ± 0.97 | 1.51 | < 0.001 |
| ***P*-value** | (n.s.) 0.06 | (n.s.) 0.8 | (n.s.) 0.1 | |

**n.s.: not significant**

**Gingival index (GI)**

At baseline the mean GI for control group was 1.93 ± 0.27. Three months analysis of control treated group revealed a mean GI of 1.27 ± 0.44. At baseline the mean GI for laser group was 1.91 ± 0.30. Evaluation of laser group at 3 months had revealed a mean GI of 1.9 ± 0.30. There was a significant difference after treatment between baseline and 3 months assessment in respect to GI in both the control and laser groups. No statistical significant differences were detected when compared the laser and control treated groups at 3 months assessment as shown in (Table 2.).

**Table 2. (Mean ± SD) of GI at baseline and at 3 months.**

| *Treatment* | *Baseline* | *Three months* | *Difference* | *P*-value |
|---|---|---|---|---|
| Laser | 1.91 ± 0.30 | 1.39 ± 0.49 | 0.52 | < 0.001 |
| Control | 1.93 ± 0.27 | 1.27 ± 0.44 | 0.66 | < 0.001 |
| ***P*-value** | (n.s.) | (n.s.) | (n.s.) | |

**n.s.: not significant**

**Plaque index (PI)**

At baseline the mean PI for control group was 1.73 ± 0.42. Three months analysis of control treated group revealed a mean PI of 0.19 ± 0.44. At baseline the mean PI for laser group was 1.36 ± 0.44. Evaluation of laser group at 3 months had revealed a mean PI of 0.17 ± 0.11. There was a significant difference after treatment between baseline and 3 months assessment in respect to PI in both the control and laser groups. No statistical significant differences were detected when compared the laser and control treated groups at 3 months assessment as shown in (Table 3.).

**Table 3. (Mean ± SD) of PI at baseline and at 3 months.**

| *Treatment* | *Baseline* | *Three months* | *Difference* | *P*-value |
|---|---|---|---|---|
| Laser | 1.36 ± 0.45 | 0.17 ± 0.11 | 1.19 | < 0.001 |
| Control | 1.37 ± 0.43 | 0.19 ± 0.10 | 1.18 | < 0.001 |
| ***P*-value** | (n.s.) | (n.s.) | (n.s.) | |

**n.s.: not significant**

## DISCUSSION

The literature reports the use of laser in periodontics. The studies demonstrate the bactericidal effect of lasers in nonsurgical periodontal treatment due to its thermal energy [12] . When laser energy is absorbed by tissue a photothermal interaction occurs, which raise the temperature of the tissue. This cause dehydration of water from bacterial cell, and finally lysis of bacterial cell wall. That is the main reason diode laser is used in non-surgical periodontal treatmen[13] . The results of this study reported that the adjunctive use of a 940nm diode laser in non-surgical periodontal treatment did not improve clinical parameters over scaling and root planning alone. There were improvements in both groups in respect to PD, PI and GI from baseline to 3 months with no statistical significant difference between the laser and control groups. These results are not in agreement with the results obtained by Kamma et al. in his study the laser group demonstrates superior results over the control group[14]. The results from Kreisler, M., describes the laser treatment effects on the survival rate of human gingival fibroblasts could help to justify our findings[15]. It states that using diode laser for decontamination of the periodontal pockets may cause damage to the surrounding soft tissue if the power and treatment duration are not adequate[15]. Kreisler, M., also stated that diode laser irradiation at 1 W for 20s did not have a beneficial and therapeutic effect to form a new attachment of periodontal ligament cells[16] . In agreement with our results a clinical study by Yilmaz et al. reports laser assisted therapy provided no additional microbiological and clinical benefits over conventional therapy[17] . Contrary to our finding Moritz found treatment with diode laser effective clinically[19]. The evidence about the adjunctive use of diode laser in nonsurgical periodontal treatment is not enough related to changes in clinical parameters[18].

## CONCLUSION

Within the limitations of the this study and after analyzing the clinical outcomes, the adjunctive use of a 940-nm diode laser with scaling and root planing did not show better clinical beneficial effects compared with conventional therapy alone at 3-months post treatment assessment.

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