# Evaluation of Effectiveness of Diode LASER for the Treatment of Periodontal Pocket

Thakare Kaustubh S[1], PuriSneha S[2], BhongadeManohar L[3]

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[1]Senior Lecture
[2]Post Graduate student
[3]Prof. and Head of the Department
Dept. Of Periodontics
SharadPawar Dental College
Sawangi (M), Wardha - 442005

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**Email for correspondence:**
kaustubhthakaremds@gmail.com

**ABSTRACT:**

**Background and Aim:** The aim of the present study was to evaluate the effectiveness of diode laser in the treatment of periodontal pocket.

**Method and Material:** The split mouth, controlled clinical trial was carried out over a period of 3 months .A total of 70 sites with probing depth ?5 mm were randomly assigned to test sites (35) while other to control sites (35) with the help of coin flip. The test sites were treated with diode laser, whereas control sites were treated by scaling and root planing. Clinical parameters recorded at baseline and at 3 months were plaque index (PI), papillary bleeding index (PBI), probing pocket depth (PPD), clinical attachment level(CAL) and gingival recession (GR). The diode LASER was used with a thin flexible light guide with a diameter of 0.4 mm and a wavelength of 660 nm at an output power of 0.8 W.

**Results:** The mean PPD at 3 months post operatively in the test group wasreduced to 4 mm from 7.9 mm whereasin control group it was reduced to 4.5 mm from 8.2 mm. The mean CAL gain at 3 months post operatively was 4.5 mm in test group and 3.5 mm in control group.

**Conclusion:** The comparison of both the groups showed that diode LASER has an additional benefit in reducing probing pocket depth possibly by reducing bacterial load which will help to resolve inflammation.

**Key words:** diode laser, periodontal pocket, scaling and root planing

## INTRODUCTION:

Re-establishment of connective tissue attachment to the root surface of teeth with a history of periodontal disease is the major goal of periodontal therapy. Periodontally affected root surfaces are hypermineralized and contaminated with cytotoxic and other biologically active substances[1,2]especially endotoxins[2]which play a pivotal role in preventing new connective tissue attachment to the exposed root surface. In the initial phase of periodontal therapy, debridement of the diseased root surface is nonsurgically treated by mechanical scaling and root planing, primarily by using manual or power-driven instruments. However, following root

planing the instrumented root surface is invariably covered by a smear layer,[3] containing remnants of dental calculus, contaminated root cementum, bacterial endotoxin, and subgingival plaque. Furthermore, conventional mechanical debridement using curettes is still technically demanding and time consuming and power scalers sometimes cause discomfort and stress in patients as a result of noise and vibration.

In recent years, the use of laser irradiation has been expected to serve as an alternative or an adjunctive treatment to conventional, mechanical periodontal therapy. Various advantageous characteristics, such as haemostatic effects, selective calculus ablation, or bactericidal effects against periodontopathic pathogens might has been suggested a possible reason for improving treatment outcomes.[4,5.6]

Diode LASERs (810) have been used in the treatment of periodontal diseases, if a pilot study on diode laser treatment yielded very favourable results regarding bacterial reduction of actinobacillusactinomycetemcomitans, Porphyromonasgingivalis, and Prevotella intermedia.[7] The diode LASER reveals a bactericidal effect and helps to reduce inflammation in the periodontal pocket in addition to scaling. Furthermore amongst various LASER systems Diode LASER radiation is absorbed by superficial layer while as other LASER systems are absorbed by deeper tissue layers. Thus have a better effect on sites affected by periodontal disease. Laser therapy, or laser-assisted pocket therapy, may be promising new approaches in Periodontics, Therefore the present study was carried out with aim ofevaluating the effect of diode LASERsin the treatment of periodontal pocket.

**Method and Materials:**

A total of 30 patients with moderate to severe chronic periodontitis with the age range of 30-50 years (mean range 40.2±7.24 years) were selected.The patients were included in the study using following criteria.

1. Systemically healthy patients.
2. Presence of bilaterally atleast one or two sites with PPD e" 5 mm and CAL e" 5 mm following initial therapy.
3. Radiographic evidence of marginal bone loss e" 30% affecting atleast 50% of dentition Patients with following criteria were excluded from the study

**1.** Patient with antibiotic therapy during last 3 months.

**2.** Pregnant females or lactating mothers.

**3.** Smokers or who use any tobacco products.

**4.** Patients with unacceptable oral hygiene (PI>1).

**5.** History of periodontal surgical therapy of the selected site.

Patients meeting the above selection criteria were selected for the study and an informed consent was signed by the patients agreeing to the treatment. The study protocol was approved by ethical committee of DattaMeghe Institute of Medical Science, Sawangi (Meghe), Wardha.

Information concerning their dietary status, mouth cleaning habits, gingival and periodontal status along with other routine clinical data was recorded in the specially designed chart. Patients were examined under good illumination with the help of mouth mirror, tweezer, and Williams graduated periodontal probe and with the pellets of cotton.

**Initial therapy:**

After proper examination and diagnosis, initial therapy consisting of oral hygiene instructions, supra gingival scaling, polishing was carried out. Plaque control instructions were repeated until patients achieved 80-85% of plaque control. A re-evaluation examination was performed 6 weeks following completion of initial therapy.

**Study design:**

The split mouth, controlled clinical trial was carried out over a period of 3 months. A total of 70 sites in 30 patients each having 2-3 sites with PPD e"5mm in bilateral quadrant were found to be suitable after supragingival and subgingival scaling. One quadrant in each patient was randomly assigned to test group while other to control group with the help of coin flip. The test group was treated by scaling and root planing and irradiation with diode LASER, while control group was treated by scaling and root planing only.

**Clinical measurements:**

Clinical measurements recorded were plaque index (Turskey, Gilmore, Glickmann modification of Quigley Hein plaque index, 1970)[8] as an expression of the level of full mouth supragingival plaque accumulation. Gingival inflammation was assessed by Papillary bleeding index (PBI).[9] The probing measurements recorded were PPD, CAL,and GRby using Williams graduated periodontal probe (Hufriedy,U.S.A). These probing measurements were recorded only on the teeth to be treated. The cementoenamel junction was used as a fixed reference point. All the clinical measurements were recorded at baseline and again at 3 months postoperatively.

**Treatment Procedure:**

Initially full mouth supragingival and subgingival scaling was performed by using ultrasonic scaler (EMS+mini PIEZON). At 6 week in the test group, root planing was performed by using Hoe scalers& standard GraceyCurrettes under local anesthesia. Instrumentation was carried out until the root surface was considered smooth and clean according to the operator's clinical judgement. All the pocket sites were then irradiated with the diode LASER having a thin flexible light guide with a diameter of 0.4 mm and a wavelength of 810 Nm at a power of 0.8W was used for lasing. Each tooth was divided into 4 sites, each of which was lased separately as follows: The tip of the optical fiber was inserted at the bottom of the pocket. Illumination was started by keeping optical fibre parallel to the root surface. The fibre was passed both in vertical and horizontal directionscovering both the epithelial surface and connective tissues.The duration of lasing depended on the depth of the respective periodontal pocket. The pocket depth in mm was corresponds to the exposure time in seconds. Therapy was terminated when there was light bleeding. The sites in the control group were treated by only scaling and root planing without use of laser.

**Statistical analysis**

The means and standard deviations of GR, PPD, CAL at baseline and at 3 months post-surgery was calculated for both groups. The Student's paired t-test was used to compare the data from the baseline to those at 3 months for each treatment group. Comparisons between treatment groups at baseline and 3 months post-surgery was accomplished with the Student's unpaired t-test. If the probability value (p) was more than 0.05, the difference observed was considered non-significant and if less than 0.05, it was considered significant.

**Results:**

35 sites in patients of test group were irradiated with diode laser while 35 sites in patients of control group were treated by root planning. During the course of the study, wound healing was uneventful. None of the selected patients dropped out before the termination of the study. In general, patients showed good oral hygiene throughout the study. The mean plaque score at baseline was 0.94 and at 3 months post-opeartively was 0.56. The mean papillary bleeding index score was 1.72 and 3 months post-operatively was 0.80.

**Baseline Characteristics of Test & Control groups:**

Baseline mean probing pocket depth (PPD) was 5.66 mm in the test group and 5.73 mm in the control group. Similarly, baseline mean clinical attachment level (CAL) was 6.05 mm in the test group and 6.03 mm in the control group. Baseline mean gingival recession (REC) was 0.39 mm in the test group and 0.32 mm in the control groups. At baseline, no statistically significant-differences in any of the investigated parameters were observed between the test and control groups, indicating that the randomization process was effective.

**Outcomes of the therapy at 3 months**

**1) Probing Pocket Depth (PPD):**

In the test group, the mean PPD at baseline was 5.66 mm, and that at 3-month was 2.60 mm. In the control group, the mean PPD at baseline was 5.73 mm, and that at 3-month was 3.19 mm. At 3-month, the mean PPD reduction was 3.06 mm for the test group and 2.54 mm for the control group. Student's paired t-test indicated that both the test and control groups showed significantly greater mean PPD reduction at 3-month compared to baseline ($p<0.05$).

When the differences in mean PPD reductions for the test group (3.06 mm) versus control group

(2.54 mm) at 3-month were analyzed by student's unpaired t-test, significant difference was noted ($p<0.05$) a greater reduction in mean PPD was demonstrated in test groups compared to the control groups. All additional benefit of 0.52 mm PPD reduction was observed in test group. The mean residual probing pocket depth at 3-month was 2.60 mm for the test group and 3.19 mm for the control group.

**2) Clinical Attachment Level (CAL):**

Inthe test group, the mean CAL at baseline was 6.05 mm and that at 3-month was 3.80 mm. Inthe control group, the mean CAL at baseline was 6.03 mm and that at 3-month was 4.45 mm. The mean CAL gain of 2.25 mm was observed in the test groups, while the control group displayed mean CAL gain of 1.58 mm. The observed differences between baseline CAL and 3-month CAL were analyzed by student's paired t-test, and were found to be statistically significant in both the groups ($p<0.05$).

When the differences in CAL gain for the test groups (2.25 mm) versus control groups (1.58 mm) were analyzed by student's unpaired t-test, significant difference ($p< 0.05$) was observed. The mean CAL gain observed in the test groups was significantly greater than the control groups. The additional benefit of CAL gain was 0.67 mm.

**3) Gingival Recession (REC):**

At 3-month, the mean increase in gingival recession was 1.19 mm in the test group and 1.25 mm in the control group. A statistically significant increase in gingival recession was found in both the groups ($p<0.05$). No statistically significant difference was found in the increase in gingival recession between the test and control groups ($p>0.05$).

**Discussion:**

LASERs have been introduced to the periodontal field in the last decades and have demonstrated ability to significantly reduce bacterial species, leading to possible reduction of the probing pocket depth. In particular, diode laser (810nm) has been used in the treatment of periodontal disease because of the characteristic antibacterial effects[10,7,12] without inducing dramatic changes in the underlying tissue. The present study was carried out to evaluate the effectiveness of diode laser in the treatment of periodontal pocket.

The PI score and PBI score remained low during the study period (<1). It has been pointed out that clinical outcomes of various forms of periodontal therapy are influenced by general level of oral hygiene.[13]

In the present study the mean probing pocket depth reduction in the test group was 3.06 (2.6 mm from 5.6 mm) at 3 months whereas in control group it was 2.54 mm (3.19 mm from 5.73 mm). *Crispi et al, (*2007)[14] reported statistically significant reduction of PPD in test group compared to control group for pockets of 1 to 4 mm, 5 to 6 mm, and e"7mm. *Schwarz et al* (*2006*)[15]reported mean PPD reduction of 4.9 mm at baseline to 2.9 mm at 6 months in the laser group and in the SRP group from 5.0 mm at baseline to 3.4 mm at 6 months. However, *Rafael et al (2007)*[16] reported lesser PPD reduction of 1.43 mm in laser group and in SRP group it was 0.94mm only. In all previous studies and in present study, the possible reason for significant reduction in the probing pocket depth in LASER group may be due to the reduction in periodontopathic bacteria like Aggregatibacteractinomycetemcomitans, Porphyromonasgingivalis and PrevotellaIntermedia as well as increase in number of cocci and non-motile rods (Schwarz et al 2006).[15]

The effectiveness of scaling and root planing in the treatment of periodontal disease to reduce bacterial plaque on the root surface is universally accepted.[17] *Sbardone et al (1990)*[18] reported that diseased sites treated with a single episode of scaling and root planing was repopulated with potentially pathogenic microbes at 21 day after treatment. However, the sites treated with diode laser were not repopulated with potentially pathogenic microbes even after 28 days. *Pick et al (1985)*[19]reported that LASER light not only eliminates bacteria but also inactivates bacterial toxins diffused in root cementum. Diode LASER is expected to have a disinfecting thermal effect on the bacteria that was basically limited to root surface.

In the present study, the mean clinical attachment level gain was 2.25 mm in the test group,


**Fig.1:** diode laser used in the present study

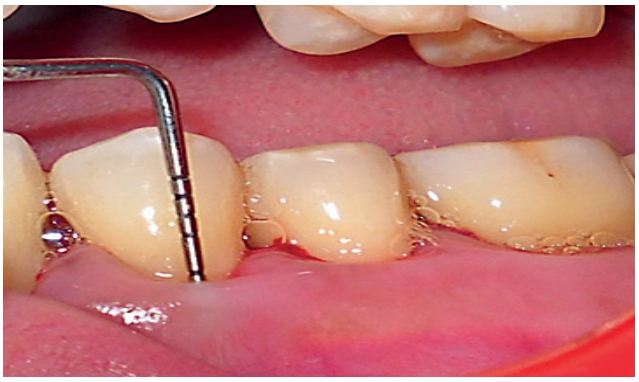

**Fig.2:** preoperative showing pocket depth

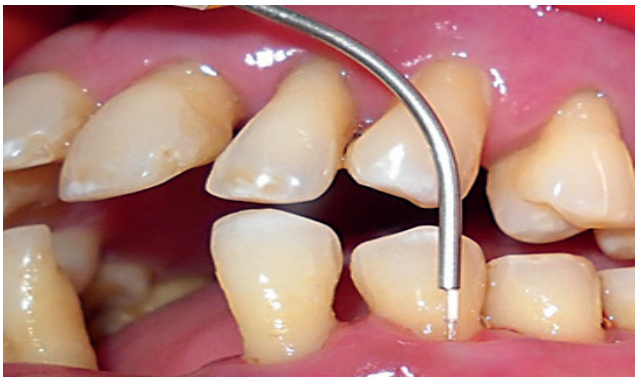

**Fig.3:** LASER irradiation in periodontal pocket

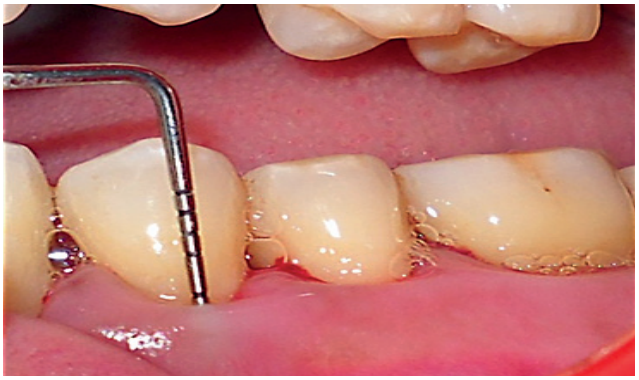

**Fig.4:** case 1- preoperative view at baseline

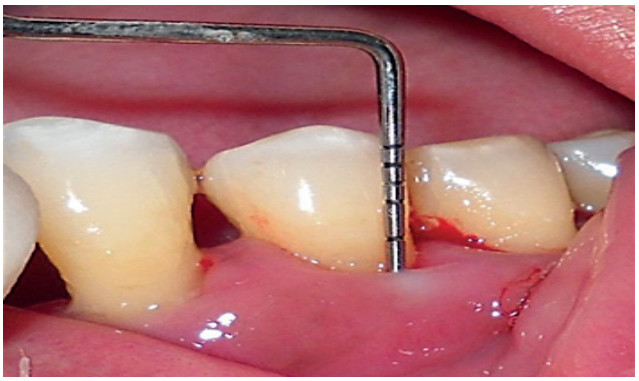

**Fig.5:** case 1- postoperative view at 3 months

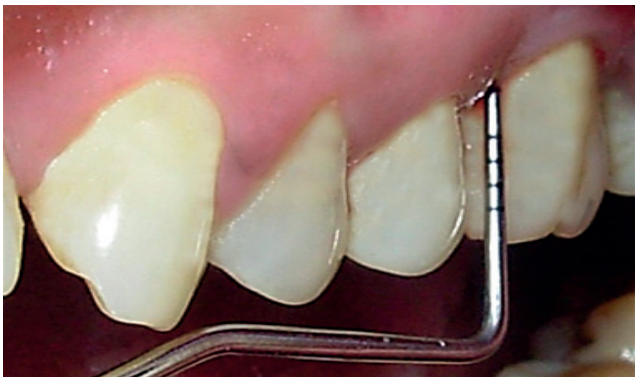

**Fig.6:** case 2- preoperative view at baseline

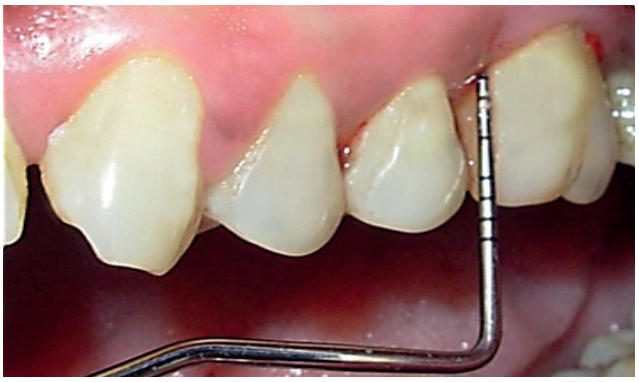

**Fig.7:** case 1- postoperative view at 3 months

whereas in the control group it was 1.58 mm.These findings are supported by similar studies by *Schwarz et al (2006)*[15] who reported decrease in mean CAL in the laser group from 6.3 mm at baseline to 4.4 mm at3 months and in the SRP group from 6.5 mm at baseline to 5.5 mm at3 months. *Crispi et al (2007)*[14] also reported decrease in mean RCAL from 9.93 mm at baseline to 8.74 mm at 3 months in laser group, and in the SRP group, from 10.53 mm at baseline to 9.01 mm at 3 months. In the present study, mean gingival recession was 0.39 mm, which was increased to 1.19 mm at 3 months in the test group, whereas in the control group it was 0.32 mm, which was increased to 1.25 mm at 3 months. The reason for more gain in CAL in the test group may be due to ability of Diode LASER to enhance epithelial removal, leading to retardation of epithelial migration, which had enhances connective tissue attachment. In addition, because of adequate coagulation provided by use of LASERs,[20] damage to the surrounding healthy tissues might have reduced which might have stimulated new bone formation.

These results may justify the interest in the application of the laser in general, to the field of periodontology. The effects of laser treatment on periodontal tissue basically depends on the wavelength, pulse energy, frequency, and spot size used.When these factors are taken in account, diode laser can be considered as an interesting alternative to conventional scaling and root planing in periodontal treatment. Furthermore amongst various LASER systems Diode LASER radiation is absorbed by superficial layer, while other LASER systems are absorbed by deeper tissue layers. Thus have a better effect by diode laser on sites affected by periodontal disease.

From the analysis of the results, and within the limitations of the present study, following conclusions were drawn-:-

1) Both the treatment group resulted in significant reduction in Probing pocket depth (PPD), and gain in Clinical Attachment level (CAL).
2) Use of LASERs adjuvant to non surgical periodontal therapy (SRP) was found to be significantly more effective than SRP alone in terms of CAL gain PPD reduction.
3) Use of lasing for treatment of periodontal pocket was found to be good patient acceptance since it involves minimal pain.
4) Therefore, LASERs in combination with local periodontal therapy may represent a new approach in long term management of periodontal pocket with chronic periodontitis.

**Limitations**

Following limitation were noted in the present study,

1. The small sample size has limited the statistical analysis of the results.
2. Long term analysis is required to determine the stability of the results.
3. Further well controlled study needed to confirm the findings of the present study.

**Table 1**
Mean Plaque (PI) and Papillary bleeding Index (PBI) scores between Baseline and 3 months (MV SD).

| Parameters | Baseline | 3 months | Difference | P-value |
|---|---|---|---|---|
| PI | 0.94±0.06 | 0.56±0.28 | 0.38±0.22 | 0.002 S |
| PBI | 1.72 ±0.42 | 0.80 ±0.26 | 0.90±0.37 | 0.000 S |

S =p <0.05

**Table 2**
Comparison of Clinical parameters between Test and Control sites at baseline (Mean ± SD)

| Parameters | Test Site | Control Site | Difference | P- value |
|---|---|---|---|---|
| PPD(mm) | 5.66 ±0.50 | 5.73 ± 0.22 | 0.06±0.17 | 0.7 NS |
| CAL(mm) | 6.05 ±0.25 | 6.03 ±0.45 | 0.02±0.16 | 0.9 NS |
| GR(mm) | 0.39 ±0.26 | 0.32 ±0.22 | 0.06±0.11 | 0.55 NS |

S =p <0.05, NS=p>0.05

**Table 3**
Comparison of Clinical parameters of Test site between Base line and 3 month
(Mean ± SD)

| Parameters | Baseline | 3 month | Difference | P value |
|---|---|---|---|---|
| PPD(mm) | 5.66±0.50 | 2.60±0.33 | 3.06±0.30 | 0.000 S |
| CAL(mm) | 6.05±0.25 | 3.80±0.23 | 2.25±0.09 | 0.000 S |
| GR(mm) | 0.39±0.26 | 1.19±0.20 | 0.80±0.28 | 0.000 S |

S =p <0.05

**Table 4**
Comparison of Clinical parameters of Control site between Base line and 3 month
(Mean ± SD)

| Parameters | Baseline | 3 month | Difference | P value |
|---|---|---|---|---|
| PPD(mm) | 5.73 ± 0.22 | 3.19 ± 0.13 | 2.54±0.10 | 0.000 S |
| CAL(mm) | 6.03 ±0.45 | 4.45 ±0.30 | 1.58±0.25 | 0.000 S |
| GR(mm) | 0.32 ±0.22 | 1.25 ±0.19 | 0.93±0.15 | 0.000 S |

S =p <0.05

**Table 5**
Comparison of Clinical parameters between Test and Control sites at 3 month
(Mean ± SD)

| Parameters | Test Site | Control Site | Difference | P- value |
|---|---|---|---|---|
| PPD reduction (mm) | 2.60 ±0.33 | 3.19 ± 0.13 | 0.58±0.11 | 0.000 S |
| CAL gain (mm) | 3.80 ±0.23 | 4.45 ±0.30 | 0.65±0.12 | 0.000 S |
| GR increase (mm) | 1.19 ±0.20 | 1.25 ±0.18 | 0.06±0.08 | 0.477 NS |

S =p <0.05

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