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Comparative evaluation of effect of diode laser as an adjunct to scaling and root planing in periodontal pockets - A randomized control clinical trial.

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Abstract

Background: Period ontal diseases are chronic inflamma tory processes, which are characterized by progressive, site-specific destruction of the Perio dontium. The primary goal of periodontal therapy is removal of supra and subgingival bacterial deposits.

The complete removal of bacteria and their toxins from periodontal pockets is not always achieved with conventional mechanical treatment.

Laser when used as an adjunctive therapy along with scaling and root planing may help in better resolution of periodontal disease.

Methodology: A split mouth randomized controlled study was planned to evaluate the adjunctive effect of diode laser along with scaling and root planing in patients with periodontal pockets.

Twenty subjects who were enrolled in the study contributed a total of 40 sites. The selected sites were randomly divided into two groups, Group A (control) received scaling and root planing alone. Group B (test) received application of diode laser as an adjunct to scaling and root planing.

Clinical parameters like plaque score, bleeding score, probing pocket depth and relative attachment level were

assessed prior to the treatment at baseline and 6 weeks after the treatment in both the groups.

Result: Intra group comparison showed statistically significant improvement in the assessed clinical para meters from baseline to 6th week in both the groups. Results were not statistically significant on intragroup comparison at 6 weeks post-operatively.

Conclusion: The use of diode laser as adjunctive therapy to scaling and root planing provided no additional clinical benefit over conventional mechanical treatment.

Keywords: Scaling and root planing, diode laser, pocket disinfection, probing pocket depth, relative attachment level.

Introduction

Period ontal disease is a chronic inflammatory process, which is characterized by progressive, site-specific destruction of the supporting tissues of the tooth, resulting in period ontal pocket formation, gingival recession, and ultimately leading to the loss of the tooth.1 Mechanical debridement is considered as the "gold standard" for the treatment of periodontitis.

However, complete removal of bacterial deposits and toxins from root surfaces and periodontal pocket is not always feasible with the use of conventional mechanical methods.

So, in order to overcome these shortcomings, various adjunctive methods have been tried to improve the success of the conventional periodontal therapy.

These techniques include use of local and systemic antibiotics, photo dynamic therapy. Recently laser therapy which have been tried as adjunct therapy to scaling and root planing (SRP) with various success rates.[2]

'LASER' is an acronym for Light Amplification by Stimulated Emission of Radiation. Laser has several benefits, as it can achieve excellent tissue ablation with strong bactericidal and detoxification effects which facilitates wound healing, reduce bacterial load in Perio dontal pocket, laser can reach sites that conventional mechanical instru mentation cannot reach.[3]

Since diode laser is predo minantly absorbed by haemoglobin and pigmented bacteria and poorly absorbed by hydroxy a patite in teeth and bone, it is considered as a safe and suitable treatment modality in period ontal therapy.

It transmits energy through thin fibre that can easily penetrate deep periodontal pockets and deliver therapeutic effects to underlying tissues.[4]

However, literature also cites several contradictory conclusions regarding the added benefits of diode laser as an adjunct for treatment of chronic periodontitis over conventional therapy.

As a result, the use of diode laser for periodontal therapy remains a debatable area in the field of dentistry and also opens up the opportunity for future explorations as well. This study is planned to investigate the adjunctive effect of diode laser along with conventional scaling and root planing in deep periodontal pockets.

Aim and objective

To evaluate and compare the effect of diode laser as an adjunct to scaling and root planing over scaling and root planing alone in the treatment of periodontal pockets.

Materials and Methods

A split-mouth randomized controlled clinical trial was conducted in the Department of Periodontology to evaluate the effect of diode laser as an adjunct to scaling and root planing in the treatment of periodontitis.

Ethical clearance was obtained from the Institutional ethical review board (KDCRC/IERB/12/2020/12) and written consent was obtained from all the participants.

Study subjects / sample

Twenty subjects (6 males, 14 females) with the mean age of 40.4 years (age range 26-60 years) were enrolled for the study after fulfilling the eligibility criteria. Selected 20 subjects contributed a total of 40 sites for the study.

Inclusion criteria

As the study was site specific, the selection of sites was done according to the following criteria

Inclusion criteria

1. Chronic periodontitis patient with probing pocket depth ≥5mm, 2. Clinical attachment loss ≥3mm,

3. Bleeding on probing ≥ score 1 (modified sulcular bleeding index by Mombelli et al., 1987).

Exclusion criteria

1. The study excluded

2. Patients with any systemic disease,

3. Those who have undergone periodontal therapy during last 6 months,

4. Patients who used antibiotics or mouth wash containing anti microbials for periodontal treatment during last 3 months,

5. Pregnant and lactating mothers

6. Tobacco consumers.

Clinical parameters

Clinical parameters recorded at baseline and 6 weeks follow-up included

1. Plaque index (Silness and Loe)

2. Modified sulcular bleeding index (Mombelli et al)

3. Periodontal pocket depth (PPD)

4. Relative attachment level (RAL) Periodontal pocket depth (PPD) and relative attachment level (RAL) were the primary outcome measures assessed [Fig. 1,2]. Plaque index (PI) and sulcular bleeding index (SBI) were the secondary outcome measures assessed.

In order to attain the reproducibility of the probing, a customized acrylic stent was used for measurements of the experimental sites. All data collection and procedures were performed by a single examiner.

Fig 1: Recording of probing pocket depth and relative attachment level in the test site at baseline visit.

Fig 2: Recording of probing pocket depth and relative attachment level in the control site at baseline visit.

Methodology

Forty selected sites were randomly divided into two groups by chit method, Group A (control) and Group B (Test) with each group comprising 20 sites.

- Group A (control group) – sites treated with scaling and root planing (SRP) alone.
- Group B (Test group) – sites treated with diode laser as an adjunct to SRP.

After giving proper oral hygiene instructions, both the study groups were subjected to SRP following which pockets were irrigated with normal saline.

Fig 3: Diode laser unit.

The test group along with the phase I therapy were additionally subjected to diode laser irradiation [Fig. 3]. A 320 µm diameter laser fibre optic tip was inserted 1 mm short of the probing pocket depth with the help of endodontic stopper [Fig.4]. Laser tip was kept parallel to the long axis of the tooth [Fig. 5], and activated in a contact mode.

The laser tip was then slowly moved coronally in a sweeping motion during laser light emission by using following parameters (Power-2 W, Pulse frequency-20 Hz, Ignition mode of laser light Gated, On time-10 seconds, Time off-10 seconds, Average power-1 W)

The laser tip was regularly inspected and cleaned with damp sterile gauze to remove build-up of soft tissue debris on the tip during lasing.

All the laser safety measures were followed. In the control site, the same procedure was done, but without the activation of the laser, as a sham procedure performed to assure blinding.

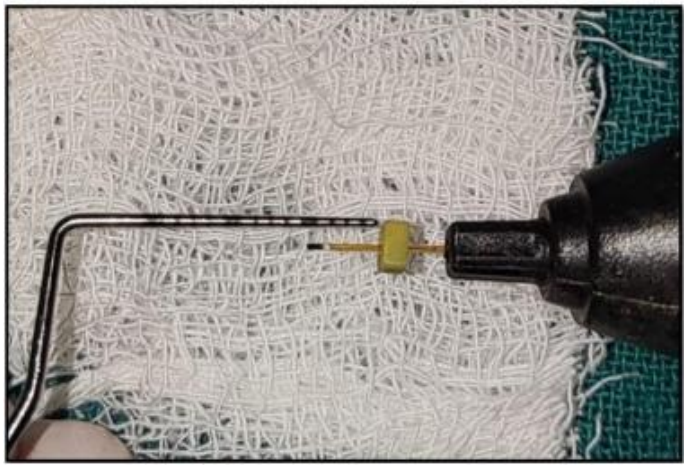


Fig 4: Placement of rubber stopper on the laser tip

Fig 5: Placement of laser tip in the test site at baseline visit

Patients were recalled after 6 weeks post operatively and the parameters were reassessed and oral hygiene instructions were reinforced [Fig. 6,7]

Fig. 6: Assessment of probing pocket depth and relative attachment level in the test site at 6th week follow-up visit.

Fig 7: Assessment of probing pocket depth and relative attachment level in the control site at 6th week follow-up visit

Statistical analysis

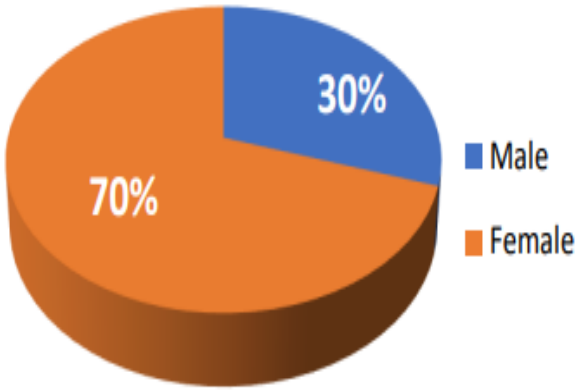
All the data was collected and analysed. The statistical software SPSS 16.0 is used for analysis of data. The descriptive statistics like mean, median, S.D. and frequency distribution of data was calculated.

The normality of data was tested by Shapiro Wilks test. The test of significance of PPD (mm), RAL (mm), SBS, PS at any time interval between test and control group (Inter group comparison) was done by independent t-test and Intra group comparison was done by Paired t-test. The 95% C.I. and 5% level of significance was used for analysis of data.

Results

Twenty patients were enrolled in this randomized controlled clinical trial and they contributed a total of 40 sites. There was no drop-out throughout the study protocol and no missing data for the statistical analysis as all the 20 patients completed the study protocol. Data collected was statistically evaluated and have been described in the following tables and graphs.

The demographic details of the study participants are shown in Table 1, among 20 participants of which 14 were female and 6 were male (Graph 1, Table 1) with mean age of 40.4 years (Table 2).



Graph 1: Frequency distribution (%) of male and female.

Table 1: Distribution of Mean ± Standard deviation of Age.

	N	Mean ±S.D.	Minimum	Maximum
Age	20	40.4000±11.97541	26.00	60.00

* N- sample size; S.D.- standard deviaton.

Table 2: Frequency distribution N (%) of male and female.

Gender	N	%
Male	6	30
Female	14	70

* N- sample size

Although at baseline, no significant differences were seen in the values of the clinical parameters evaluated between control and test group (Table 3).

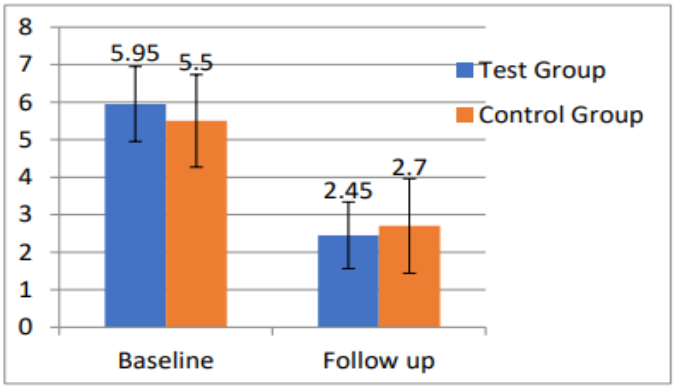
At 6th week follow up, intra group analyses showed both control and test group had a statistically significant reduction in probing pocket depth, relative attachment level, bleeding and plaque score (Table 4,5) (Graph 2,3,4,5).

However, at 6th week follow-up inter group analyses showed no statistically significant difference in the measured clinical parameters between control and test group (Table 6).

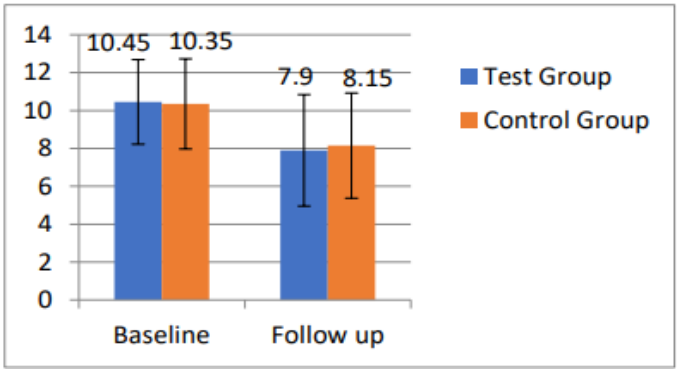
Table 3: Distribution and intergroup comparison of Mean ± Standard deviation and mean difference of parameters at baseline among two groups.

Baseline	Group	N	Mean ± S.D.	Mean Difference ± S.E.M.	t-value	p-value
PPD (mm)	Group B (Test)	20	5.95±0.999	0.450±0.299	1.506	0.140**
	Group A (Control)	20	5.50±0.889			
RAL (mm)	Group B (Test)	20	10.45±2.235	0.100±0.826	0.121	0.904**
	Group A (Control)	20	10.35±2.943			
SBS	Group B (Test)	20	1.65±0.671	-0.150±0.190	-0.789	0.435**
	Group A (Control)	20	1.80±0.523			
PS	Group B (Test)	20	2.00±0.649	0.050±0.211	0.237	0.814**
	Group A (Control)	20	1.95±0.686			

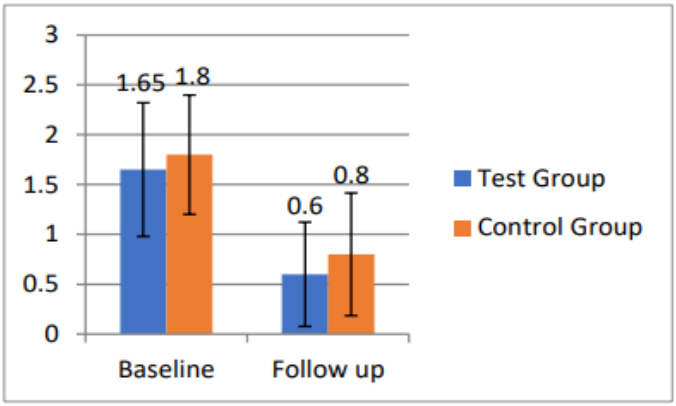
N- sample size; S.D.- standard deviation; S.E.M.- standard error mean; PPD- probing pocket depth; RAL- relative attachment level; SBS- sulcular bleeding score; PS- plaque score; p-value- level of significance; **- non significant (p>.05)



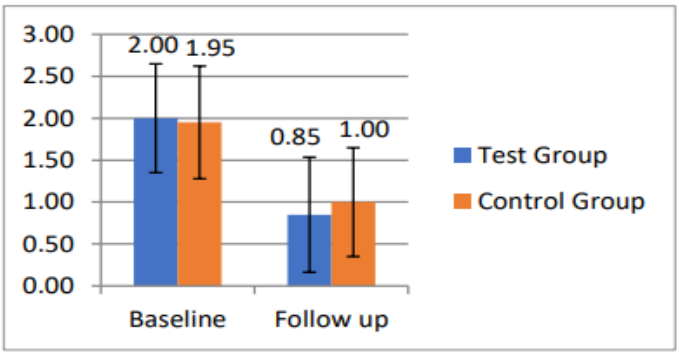
Graph 2: Distribution of Mean ± Standard deviation of probing pocket depth (mm) at baseline and 6th week follow-up of Test and Control group.



Graph 3: Distribution of Mean ± Standard deviation of relative attachment level (mm) at baseline and 6th week follow-up of Test and Control group.



Graph 4: Distribution of Mean ± Standard deviation of sulcular bleeding index at baseline and 6th week follow-up of Test and Control group.



Graph 5: Distribution of Mean ± Standard deviation of plaque score at baseline and 6th week follow-up of Test and Control group.

Table 4: Distribution and intergroup comparison of Mean ± Standard deviation, and Standard error mean of parameters at 6th week follow-up among two groups.

Follow up	Group	N	Mean ±S.D.	Mean Difference ± S.E.M.	t-value	p value
PPD (mm)	Group B (Test)	20	2.45±1.234	-0.250±0.395	-0.634	0.530**
	Group A (Control)	20	2.70±1.261			
RAL (mm)	Group B (Test)	20	7.90±2.382	-0.250±0.818	-0.306	0.762**
	Group A (Control)	20	8.15±2.777			
SBS	Group B (Test)	20	0.60±0.598	-0.200±0.192	-1.042	0.304**
	Group A (Control)	20	0.80±0.616			
PS	Group B (Test)	20	0.85±0.671	-0.150±0.209	-0.719	0.477**
	Group A (Control)	20	1.00±0.649			

PPD- probing pocket depth; RAL- relative attachment level; SBS- sulcular bleeding score; PS- plaque score; N- sample size; S.D.- standard deviation; S.E.M.- standard error mean; p-value- level of significance; ** statistically non-significant (p>.05).

Table 5: Intra group comparison of parameters of Test group between baseline and 6th week follow-up by Paired t-test.

Test group	Paired Differences				t-value	p-value
	Mean ±S.D.	S.E.M.	95% Confidence Interval of the Difference			
			Lower	Upper		
Baseline PPD (mm) - Follow up PPD (mm)	3.500±1.100	0.246	2.985	4.015	14.226	0.000*
Baseline RAL (mm) - Follow up RAL	2.550±1.504	0.336	1.846	3.254	7.585	0.000*
Baseline SBS - Follow up SBS	1.050±0.826	0.185	0.664	1.436	5.688	0.000*
Baseline PS - Follow up PS	1.150±0.745	0.167	0.801	1.499	6.902	0.000*

PPD- probing pocket depth; RAL- relative attachment level; SBS- sulcular bleeding score; PS- plaque score; S.D.- standard deviation; S.E.M.- standard error mean; p-value- level of significance; *statistically significant (p<.05).

Table 6: Intra group comparison of parameters of control group between baseline and 6th week follow-up by Paired t-test.

Control group	Paired Differences				t-value	p-value
	Mean ±S.D.	S.E.M.	95% Confidence Interval of the Difference			
			Lower	Upper		
Baseline PPD (mm) - Follow up PPD (mm)	2.800±1.642	0.367	2.032	3.568	7.628	0.000*
Baseline RAL (mm) - Follow up RAL (mm)	2.200±1.196	0.268	1.640	2.760	8.223	0.000*
Baseline SBS - Follow up SBS	1.000±0.858	0.192	0.598	1.402	5.210	0.000*
Baseline PS - Follow up PS	0.950±.826	0.185	0.564	1.336	5.146	0.000*

PPD- probing pocket depth; RAL- relative attachment level; SBS- sulcular bleeding score; PS- plaque score; S.D.- standard deviation; S.E.M.- standard error mean; p-value- level of significance; *statistically significant (p<.05).

Discussion

Period ontal disease is a multifactorial inflammatory disease of the supporting tissues of the teeth that leads to the progressive destruction of the period ontal ligament and alveolar bone, with pocket formation and/or recession.[5]

The current gold standard for non-surgical treatment modality of period ontal disease is scaling and root planing (SRP).[6]

However, complete removal of subgingival plaque and calculus is hindered with increasing periodontal probing depth (PPD) and furcation involvement and this limits the effectiveness of SRP. Thus, the persistence of bacteria and calculus on the surface of the pockets are considered as the main cause for the failure of non surgical period ontal treatment. This has led to emergence of various adjunct treatment modalities, such as local drug delivery, low level laser therapy and laser pocket disinfection.[5,6,7,8]

Lasers have several dental applications, especially in periodontics. As it can be used for periodontal pocket disinfection, excision of tissues, depigmentation, and other procedures.8,9,10 Several reports indicate that laser sulcular debridement following scaling and root planing leads to improvement in clinical parameters, which could be due to bactericidal effect on sub gingival micro flora.[11,12]

However, literature also cites several contradictory conclusions regarding the added benefits of diode laser as an adjunct for treatment of chronic periodontitis over conventional therapy.13,1,4,15 So, the present study was Control group Paired Differences t-value p-value Mean ±S.D. S.E.M. 95% Confidence Interval of the Difference Lower Upper Baseline PPD (mm) - Follow up PPD (mm) 2.800±1.642 0.367 2.032 3.568 7.628 0.000* Baseline RAL (mm) - Follow up RAL (mm) 2.200±1.196 0.268 1.640 2.760 8.223 0.000* Baseline SBS - Follow up SBS 1.000±0.858 0.192 0.598 1.402 5.210 0.000* Baseline PS

- Follow up PS 0.950±.826 0.185 0.564 1.336 5.146 0.000* Table 6: Intra group comparison of parameters of control group between baseline and 6th week follow-up by Paired t-test carried out to evaluate the effect of diode laser as an adjunct to scaling and root planing.

In the present study, baseline clinical parameters such as probing pocket depth, relative attachment level, sulcular bleeding score and plaque score were similar in both the groups. On intra group comparison, there was a signifi cant improvement in the measured parameters from baseline to 6th week follow-up in both the groups. But on intergroup comparison, there was no statistically significant difference in the measured parameters at 6th week follow-up between the two groups. This shows that both SRP and adjunctive diode laser therapy had a similar effect on the measured clinical parameters and diode laser therapy has no added benefit when used as an adjunct to SRP.

One of the possible reasons for not finding added benefit of diode laser could be due to immediate exposure of laser after scaling and root planing. As the pockets will be filled with blood after scaling and root planing and the diode lasers have high absorption affinity for haemo globin, this could hamper the therapeutic benefits of laser.3,16 A study by Crispi no et al.17 suggested a laser regime allowing a few days interval gap between SRP and laser irradiation or the use of saline irrigation to remove blood from the pocket before irradiation.

In the present study 2W power was used, which is in accordance to Borrajo et al.18 who has used 980 nm wavelength diode laser with a power setting of 2W and a follow-up period of 6 weeks and reduction was seen more in the laser irradiated group compared to the control group. But Kreisler et al.19 stated that power setting of 1.5W and higher cause thermal damage and attachment loss, which might be the reason for not obtaining added beneficial effect of laser in the test group of the present study

The other possible reason for limited clinical outcomes in the present study could be due to improper exposure of laser in the subgingival environment. when laser is used in a serpentine motion in pulsed mode there is a possibility that laser light might not have contacted all the areas.

The results obtained in the present study are in agreement with those obtained by Yadwad et al.20 Yilmaz et al.21 and Nguyen et al.22 where no significant difference was detected between the test and control groups.

So, it is noteworthy that due to a wide methodological heterogenicity in the available literature regarding laser parameters used for subgingival irradiation (power, modes of irradiation) laser treatment efficacy in chronic periodontitis management, as a monotherapy or as an adjunct to nonsurgical periodontal therapy has been a challenge to interpret.[6]

Limitations of the study

In the present study both scaling and laser application was done on the same day at baseline, which could alter the effect of laser as it gets absorbed by the blood present sub-gingivally after scaling and root planing.

Conclusion

Within the limitations of this study, authors would like to conclude that diode laser when used as an adjunct to scaling and root planing has no additional benefit in periodontal therapy. Further, randomized controlled clinical trials are necessary to verify the potential benefit of diode laser as an adjunct to scaling and root planing in management of periodontal therapy.

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