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Comparative evaluation of diode laser as an adjunct to nonsurgical periodontal therapy during maintenance phase.

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Abstract

Aim: The aim of the study was to determine and compare the plaque index (PI), pocket depth (PD), relative attachment level (RAL) and community period ontal index (CPI) in patients with scaling and root planning (SRP) alone and along with diode laser.

Material and methods: The study was carried out on 34 subjects. Group I :17 patients treated with scaling and root planning (SRP) along with diode laser irradiation. Group II:17 patients treated only with scaling and root planning (SRP). the clinical parameters were plaque index (PI), pocket depth (PD), relative attachment level (RAL) and community period ontal index (CPI)recorded at base line ,7 days and after 1 month. Statistical analysis was done using Mann-Whitney Test.

Results: The use of diode laser as an adjunct to SRP during maintenance phase showed better results when compared to SRP alone. The study shows demonstrated that diode laser results in significant improvement in

clinical parameters (PI, PD, RAL, CPI) after 30 days compared with that of SRP alone.

This can be recommended as an appropriate treatment for periodontitis. there was no significant changes in deep periodontal pocket with severe attachment loss in both group.

Clinical significance: The study shows that the specified laser parameter and the modality of application of the same results in faster healing. This can be recommended as an appropriate treatment for moderate pockets.

Keywords: Dental laser, Laser dentistry, Laser dentistry treatments, Laser uses in dentistry.

Introduction

Periodontitis is a chronic inflammatory disease of period ontium, which is of multi factorial origin that is caused due to accumulation of plaque biofilm and calculus on the root surface of the tooth, which leads to continuous destruction of period ontal ligament and alveolar bone, along with formation of pocket, recession, or both.[1]

According to the American Academy of Period ontology, Periodontal Maintenance Therapy (PMT) is an extension of active periodontal therapy, it begins directly after therapy and continues at regular intervals for the entire period in which the teeth remain in the mouth. PMT aims ‘‘to minimize the recurrence and progression of period ontal disease in individuals who have been treated previously for both gingivitis and period ontitis, to reduce the incidence of tooth loss by monitoring the dentition and prosthetic replacements of the natural teeth, and to increase the probability of periodically locating and treating other diseases and conditions found in the oral cavity. Periodontal maintenance (formerly referred to as Supportive Period ontal Therapy [SPT), Preventive Main tenance, Recall Maintenance): Procedures per formed at selected intervals to assist the period ontal patient in maintaining oral health. As part of period ontal therapy, an interval is established for periodic, ongoing care. Maintenance procedures are under the supervision of the dentist and typically include an update of the medical and dental histories, radio graphic review, extra oral and intra oral soft tissue examination, dental examination, period ontal evaluation, removal of the bacterial flora from crevicular and pocket areas, scaling and root planning where indicated, polishing of the teeth, and a review of the patient's plaque control efficacy. (Glossary of Periodontal Terms, 2001). There are various methods used for supportive periodontal therapy which includes scaling and root planning (SRP), oral hygiene instructions, polishing, Irrigation with chemicals such as antiseptic agents, use of anti-biotics like tetracyc line fibres for local drug delivery, low level laser therapy (LLLT), photo dynamic therapy.[2]

Diode Laser is a solid-state semiconductor laser that generally uses a combination of gallium (Ga), Arsenide (Ar) and other elements such as aluminium (AL) and indium (In) to change electrical energy into light energy the wave length ranges from about 800 to 980nm.it is emitted in continuous wave and gated-pulsed modes and is usually operated in a contact method.

since diode laser does not interact with hard tissue but is excellent as soft tissue surgical laser, indicated for cutting and coagulating gingiva and oral mucosa and soft tissue curettage or sulcular debride ment.[3] Diode laser has detoxifying and bactericidal effects it does not erode calculus on the root surface hence can be useful as supportive means for Scaling and root planning (SRP)[4]. Laser treatment has lot of advantages when compared to conventional methods which include low tissue in flammation, sterilization of operating site, reduced pain after operating, low cellular loss, low hemo stasis,

excellent tissue ablation, sterilization of operating site and patients acceptance.[5,6] Many Studies have been reported advantages of using of SRP + Laser in treatment of periodontitis but there are few studies on use of Diode Laser but there are no reports evaluating the use of diode laser in maintenance phase with described parameters and hence this study was conducted to determine the effectiveness of diode laser as an adjunct to SRP during maintenance phase.

Materials and methods

Patients' selection and study design

Patients were selected from the department of Perio dontics and oral implant logy, Late shri Yashwantrao Chavan memorial medical & rural development foundation's dental college & hospital and Ahmednagar. The inclusion criterias were adult Perio dontal main tenance patient with a history of treatment for chronic Perio dontitis who had received no active or main tenance Perio dontal therapy at least 6-month prior to the study, systemically healthy subjects, subjects aged from 25 to 60 years, one or more period ontal sites with pocket depth ≥4 mm, relative attachment level (RAL) ≥3 mm, bleeding on probing (BOP) and subjects who were compliant with terms of study. Exclusion criterias were pregnant women and lactating mothers, smokers, use of antibiotics and analgesics within 6 months prior to study. This study was a randomized clinical trial. This trial has been registered in Clinical Trials Registry India and the CTRI number is CTRI/2016/06/007013.

Thirty-four patients were included in the study asper the inclusion and exclusion criteria. The selected patients were assigned into any of the following 2 groups randomly. (Group I-17 patients and group II-17 patients). Period ontal pockets in each patient were divided into two sub groups according to baseline probing pocket depth (PD) and RAL: (1) Pocket depths of 4 to 6 mm (moderate pockets) and relative attachment loss of 7 to 9 mm (moderate loss) (2) pocket depths of ≥7 (deep pockets) and relative attachment loss ≥10 (severe loss). Patients were explained in detail about the nature and aim of the study and a signed written informed consent was obtained.

Clinical parameters

All the clinical parameters were measured at baseline, 7th day and 1 month. Plaque index (PI) (Gilmore and turkey) was recorded at four sites around each tooth. Probing pocket depth was assessed by Williams Probe on 4 surfaces of the teeth (mesiobuccal, buccal, dis to buccal and palatal or lingual surfaces). It was measured from the gingival crest to the base of the pocket by using the occlusal level as a reference point. Relative attach Ment level was measured using William's probe. Here the term RAL indicates the measurement from the occlusal level as a fixed point to the base of the pocket and BOP as present or absent.

Periodontal therapy

SRP procedure was performed using ultrasonic unit and with the appropriate tips and curettes were also used and time spent in SRP on each tooth was not restricted then group I patients were treated with diode laser.

Laser Treatment

Diode laser (DR SMILE) with wavelength of 940 nm set at 2W power and average of 0.66 W. Irradiation was Performed using a 300 µm fiber optical delivery system which was moved from the coronal to the apical side of the interdental pocket. Laser was used from mesial to distal in buccal pockets and from distal to mesial in lingual or palatal pockets. Sweeping motion was used in lasing the Perio dontal pocket in parallel path with an inclination of approximately 20° toward gingival wall reaching a total of 30 seconds for each tooth. The pocket was lased for 30 second twice. The fiber tip was

regularly inspected and cleaned with damp sterile gauze to remove build-up of soft tissue debris on the tip during lasing. Normal saline was used in irrigation after each session of irradiation.

Statistical Analysis

All the results were documented in Microsoft Excel sheet and using Mann-Whitney Test and p value <0.05 was considered significant

Results

The use of diode lasers as an adjunct to SRP during main tenance phase showed better results when compared to SRP alone. Moderate period ontal pockets with moderate attachment loss showed significant improve Ment in group I than in group II. There was no change in deep pockets with severe attachment loss in both groups. In group I, comparison of PI and BOP showed significant reduction at all time periods. There was significantly improve Ment in moderate PD from baseline to 30th day and 7th day to 30th day, and deep pockets did not show any statistically significant change.

Statistically significant difference was observed from baseline to 7th day and from 7th day to 30th day for moderate RAL. And no statistically significant changes were observed in severe RAL.

In group II, comparison of PI and BOP showed significant reduction at all time periods except for the PI value between 7th day and 30th day. Clinically reduction was observed in moderate PDs from baseline to 30th day and 7th day to 30th day but was not statistically significant. And deep pocket did not show any significant difference. Grade II Relative attachment levels showed no statistically significant difference for both moderate and severe RAL. On comparing both the groups, PI showed statistically significant reduction and BOP and CPI showed reduction in both the groups but at baseline and 7th day the reduction was statistically significant in the group I (Table 1). Pocket depths were reduced in both groups when compared from baseline to day 30th, there was a statistically significant reduction in pocket depth in the group I when compared to group II on 30th day for moderate pocket, but was not so when compared on 7th day for moderate pocket. Deep pocket ≥7 mm in both the treatment modalities showed no statistically significant reduction (Table 2). There was a statistically significant difference in RAL in group I when compared to group II at baseline and 7th day for moderate RAL but severe RAL did not show any statistically significant attachment gain. (Table 3)

Discussion

In present study, diode laser led to significant improvement of clinical parameters (PD, RAL, BOP, CPI) after 30 days compared with that of SRP alone. Ultrasonic scalers as well as curettes were used for SRP and for removal of subgingival calculus. Ultrasonic scalers were found to be effective in removing subgingival biofilm and calculus. It is known that endotoxins are loosely adsorbed on the root surface and its removal can be done using ultrasonic tips.[7] Dukic[8] at (2021) also has similar results in maintenance phase. Other laser, such as Er: YAGF [9,10] Nd: YAG[11] have been tried in period ontal maintenance patients but they failed to show any additional benefits over conventional therapies. Moderate pockets were reduced only in group I which is in accordance with various studies.[12]It was observed that this reduction was more at 30th day and was not seen at 7th day which may be indicative of healing period of the treated pocket. The reduction in PD can be due to the availability of new site for the attachment of connective tissue.[13] In cases of deep PDs, both the treatment modalities were not able to improve the condition. Ambrosini et al (1998) also did not observe any improvement in deep pockets. This may be

due to incomplete elimination of microbial plaque.[14]A study done by Kreisler et al[15](2005) stated that more reduction in PD might be due to the de-epithelization of the pockets leading to an enhanced connective tissue attachment. Laser therapy also increases the levels of vascular endo thelial growth factor, transferring growth factor β and mRNA expression of insulin growth factor on hGF resulting in a predominant role on the connective tissue metabolism,[16]taking together it may be inferred that the laser leads to epithelial changes where epithelium modulates the connective tissue turnover during wound healing.[17,18] So epithelial connective tissue interactions are important for periodontal structure homeostasis. Coagulation and blood clot stabilization is also shown by various studies.[19,20] Sal gam, et al in 2014 found that both SRP alone and SRP with an adjunct diode laser resulted in significant improvements in all clinical parameters after period ontal treatment.

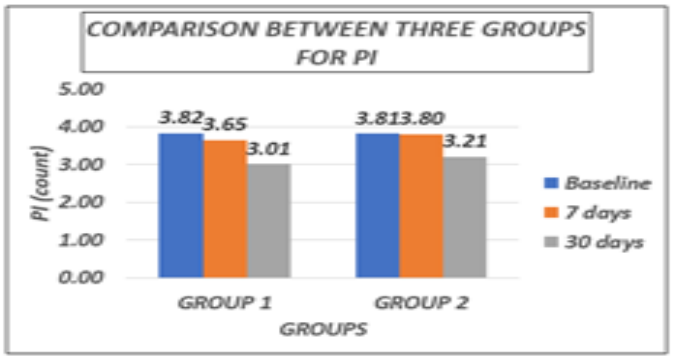
However, the whole-mouth clinical reduction was greater in the test group compared to the control group. In general, these changes were not accompanied with differences between groups suggesting that other mechanisms (e.g., bactericidal) in addition to the in flammation may regulate the wound healing process in response to laser therapy. One possibility is a localized impact on the gingival crevicular epithelium.[21]

This was first suggested by Romanos, et al. in a pig model.[22]In their work, in strumentation of the soft period ontal tissues with a diode laser (980 nm) led to complete epithelial removal in comparison to con ventional treatment methods with hand instruments. In patients with aggressive period ontitis, some studies have demonstrated that DL as an adjunct of SRP led to an improvement in some clinical parameters.

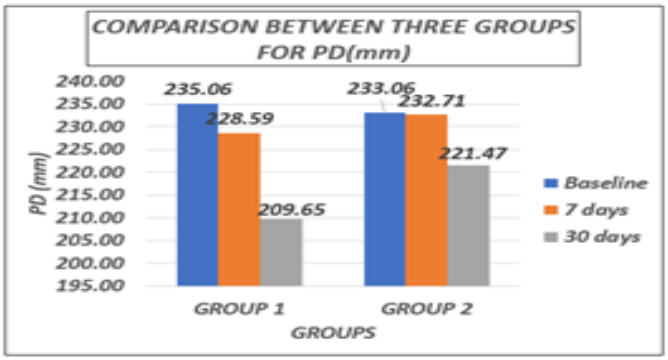
Never the less, regarding gingival inflammation clinical parameters, some studies did not find positive results. Unlike SRP, conflicting results have been found in numerous clinical trials that evaluated the clinical efficacy of DL [23,24]. Gupta et al (2008) evaluated the effectiveness of DL on PI, GI, PPD and CAL and microbial count in CP patients and compared the outcome with SRP alone. He stated that the DL at a higher, but clinically safe frequency (940 nm) at repeated intervals showed a better efficacy in ensuring a better periodontal heath as compared to SRP alone.[25]

Conclusion

During maintenance phase the use of diode laser as an adjunct to SRP showed effective results when compared to SRP alone. Moderate periodontal pocket with moderate attachment loss showed significant improve Ment in laser group alone. There was no significant changes in deep period ontal pocket with severe attach Ment loss in both groups. The use of Diode Laser as an adjunct can be recommended as an appropriate treatment for moderate pocket.



Graph 1:



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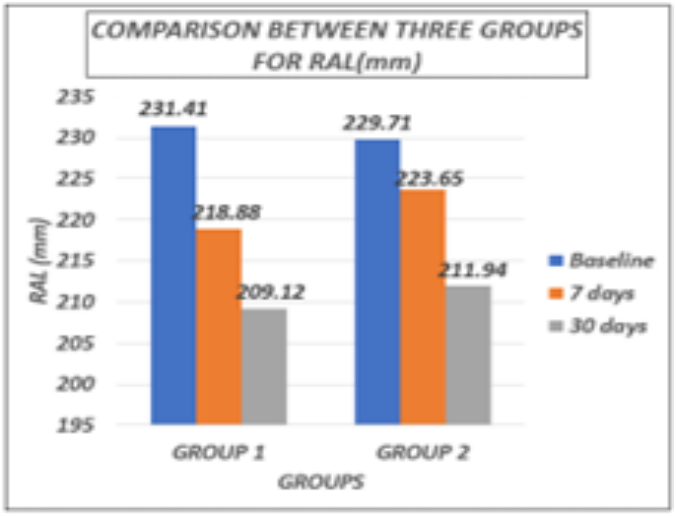
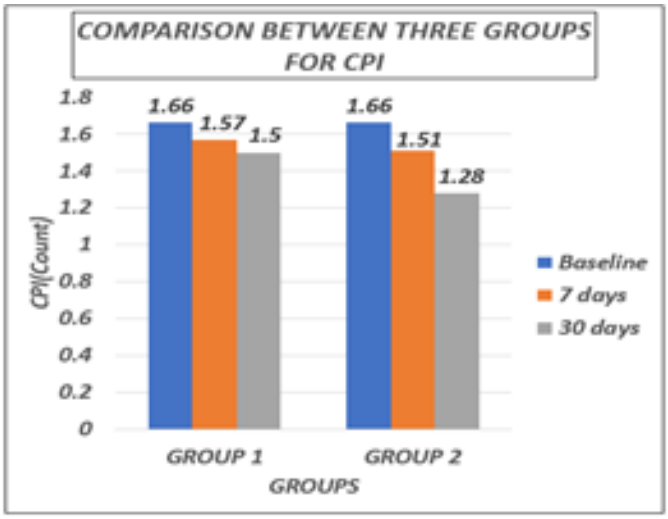


Graph 3:



Graph 4:

Results

Table 1: Comparison of PI, PD, RAL, CPI IN GROUP I AND II

Descriptive Statistics						
Groups		N	Minimum	Maximum	Mean	Std. Deviation
1	B pi	17	2.1000	5.4200	3.822941	1.0679406
	7 days pi	17	2.0600	5.3600	3.649412	1.1013484
	30 days pi	17	1.6900	4.8000	3.011176	1.1028366
	B pd	17	210	260	235.06	15.254
	7 days pd	17	205	290	228.59	21.584
	30 days pd	17	187	335	209.65	34.005
	B ral	17	197	285	231.41	31.155
	7 days ral	17	180	275	218.88	30.961
	30 days ral	17	165	265	209.12	31.605
	B cpi	17	1.56	1.72	1.6565	.04623
	7 days cpi	17	1.42	1.70	1.5694	.07972
	30 days cpi	17	1.3300	1.6000	1.501176	.0824532
2	B pi	17	2.0000	5.2200	3.813529	.9995058
	7 days pi	17	2.5300	5.9000	3.817059	1.0271488
	30 days pi	17	1.5500	5.8500	3.210000	1.1809265
	B pd	17	210	252	233.06	12.906
	7 days pd	17	208	310	232.71	23.299
	30 days pd	17	200	240	221.47	13.389
	B ral	17	197	295	229.71	32.596

	7 days ral	17	187	283	223.65	31.189
	30 days ral	17	130	278	211.94	37.472
	B cpi	17	1.56	1.72	1.6600	.04796
	7 days cpi	17	1.31	1.60	1.5088	.08645
	30 days cpi	17	1.1000	1.4500	1.281765	.1102404

Table 2: Mann-Whitney Test

Ranks						
	Groups	N	Mean Rank	Sum of Ranks	X^2	P value
B pi	1	17	17.47	297.00	144.000	.986
	2	17	17.53	298.00		
	Total	34				
7 days pi	1	17	16.44	279.50	126.500	.535
	2	17	18.56	315.50		
	Total	34				
30 days pi	1	17	16.62	282.50	129.500	.605
	2	17	18.38	312.50		
	Total	34				
B pd	1	17	18.06	307.00	135.000	.742
	2	17	16.94	288.00		
	Total	34				
7 days pd	1	17	16.50	280.50	127.500	.558
	2	17	18.50	314.50		
	Total	34				
30 days pd	1	17	11.94	203.00	50.000	.001
	2	17	23.06	392.00		
	Total	34				
B ral	1	17	17.76	302.00	140.000	.877
	2	17	17.24	293.00		
	Total	34				
7 days ral	1	17	16.32	277.50	124.500	.491
	2	17	18.68	317.50		
	Total	34				
30 days ral	1	17	16.29	277.00	124.000	.480
	2	17	18.71	318.00		
	Total	34				

B cpi	1	17	17.06	290.00	137.000	.795
	2	17	17.94	305.00		
	Total	34				
7 days cpi	1	17	21.21	360.50	81.500	.029
	2	17	13.79	234.50		
	Total	34				
30 days cpi	1	17	25.12	427.00	15.000	.000
	2	17	9.88	168.00		
	Total	34				
P < 0.05 - significant						

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