Original Article

Effect of Diode Laser-assisted Flap Surgery on Postoperative Healing and Clinical Parameters: A Randomized Controlled Clinical Trial

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Abstract

Background and Objectives: Lasers have been widely used because of several potential benefits such as antibacterial effect and stimulation of wound healing. In addition, lasers help in hemostasis and delaying epithelial migration which may facilitate the outcome of flap surgery. Hence, this study is aimed to investigate the adjunctive effect of diode laser irradiation on conventional access flap surgery in the treatment of periodontal disease. **Materials and Methods:** A total of 23 patients requiring periodontal flap surgery in two sextants with probing pocket depth ≥5 mm in at least three teeth post-phase I therapy were selected for a split-mouth study. Flap surgery with adjunctive diode laser irradiation was performed in the test quadrant while conventional access flap surgery was done in the control quadrant. Procedural pain and tissue response of the patients were evaluated at 3, 7, and 14 days postoperatively. Clinical parameters including probing depth, clinical attachment level, plaque index, and gingival index were recorded at baseline, 3 months, and 6 months following treatment. **Results:** There is no significant difference between the groups with respect to healing response of tissues; however, patients experienced more pain in test sites compared to control sites. Intragroup comparisons showed a statistically significant reduction of all clinical parameters from baseline to 6 months without any significant difference between the groups. **Conclusion:** Overall within the limitations of the study, diode lasers did not show any significant added benefits over conventional access flap surgery.

Keywords: *Diode laser, pain, periodontitis, wound healing*

Introduction

Periodontitis is a chronic inflammatory disease that affects the supporting structures of the teeth. It is characterized by progressive destruction of periodontal-supporting tissues with apical migration of the epithelial attachment resulting in pocket formation and destruction of the alveolar bone.

The ultimate goal of periodontal therapy has been the regeneration of the supporting tissues lost as a consequence of inflammatory periodontal disease. This implies the formation of a new connective tissue attachment, i.e., new cementum with inserting collagen fibers, at previously diseased (denuded) root surfaces and also, preferably, the regrowth of alveolar bone. This new connective tissue attachment can only be achieved when the epithelial migration can be prevented on the treated root surface. Unfortunately, attempts at achieving this goal often resulted in a rapid epithelial migration and a long junctional epithelium precluding new connective tissue attachment.[1,2]

Materials and Methods

In view of these findings, numerous techniques have been attempted to retard epithelial downgrowth.[2-9] In contrast to these conventional treatments, the current literature shows that ablating the inflamed lesions and epithelial lining of the soft-tissue wall within periodontal pockets with a laser retards epithelial migration and promotes periodontal regeneration.[10] Furthermore, a part of the laser energy scatters and penetrates during irradiation into periodontal pockets which might then stimulate the cells of surrounding tissue, resulting in a reduction of the inflammatory conditions, in cell proliferation, improving the periodontal tissue attachment and possibly reducing postoperative pain.[11]

In the last decade, it has been suggested that laser irradiation alters cellular behavior by affecting the mitochondrial

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respiratory chain or membrane calcium channels, and that it can facilitate collagen synthesis, angiogenesis, and growth factor release, which eventually accelerate wound healing.[12-16] Recently, diode lasers have been used for the treatment of periodontal disease and have shown that complete epithelial removal and irradiation of periodontal pockets have been shown to have an antimicrobial effect termed as laser bacterial reduction. This complete removal of epithelium could delay epithelial downgrowth and allow connective tissue attachment to occur leading to new attachment.[17]

However, the evidence available so far is conflicting. Systematic reviews till date have not shown any additional beneficial effect of lasers over conventional mechanical debridement modalities in nonsurgical therapy,[18] and very few trials have been conducted on the use of diode lasers as an adjunct to periodontal surgery. Hence, the aim of the present study was to evaluate the effectiveness of use of a diode laser as an adjunct to conventional access flap surgery.

A split-mouth, randomized single-blinded clinical trial was conducted to compare postoperative healing and the clinical parameters of diode laser-assisted access flap surgery with access flap surgery alone.

Patient selection

A pilot study was done to evaluate the feasibility of project proposal, recruitment of subjects, and data analysis. Based on the results of the pilot study, sample size was evaluated for the trial. This split-mouth study was conducted in 23 patients aged between 25 and 60 years requiring periodontal flap surgery for at least two sextants in the mouth. The study was approved by the institutional research committee, and ethical clearance was obtained from the institutional ethical committee. Informed consent was obtained from all the patients. Systemically healthy patients aged between 25 and 60 years requiring periodontal flap surgery for at least two sextants in the mouth with persistent probing depth >5 mm in at least 3 teeth and two or more nonadjacent interproximal sites with attachment loss >4 mm were included in the study [Figure 1].

Patients with uncontrolled systemic diseases, on long-term steroidal and antibiotic therapy, smokers, patients with a history of previous periodontal surgery in the past 6 months, pregnant and lactating women, and those who require extensive osseous manipulation were excluded from the study.

All the periodontal parameters, i.e., plaque index, gingival index, probing pocket depth (PD), and relative attachment level (RAL), were recorded using a periodontal probe (CP UNC-15 probe Hu-Friedy).

All patients included in the study received initial treatment which consisted of scaling and root planing and oral

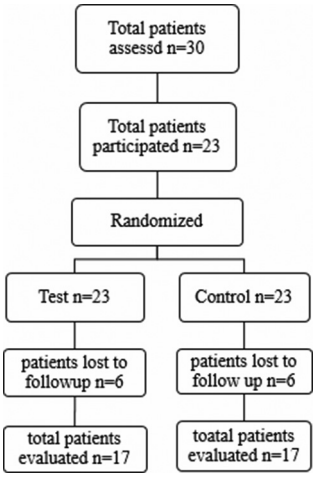

Figure 1: Patient selection

hygiene instructions. Four–six weeks following phase 1 therapy, periodontal evaluation was performed to confirm the suitability of sites for periodontal surgery. Two surgical sites requiring periodontal flap surgeries were selected and were randomly assigned to the test and control groups by simple randomization method using coin toss, and the conventional access flap surgery was performed first and the second periodontal flap surgery (laser-assisted access flap surgery) was done at least 1 week after the first surgery.

Surgical procedure

All the surgeries were performed under local anesthesia with 2% lignocaine containing adrenaline at a concentration of 1:200,000, under aseptic conditions. In both the test and the control sites, conventional access flap surgery was performed using crevicular and interdental incisions. A full-thickness mucoperiosteal flap was reflected and thorough debridement was done. Resective or regenerative procedures were carried out based on the type of osseous defect [Figure 2].

However, in the test sites, the inner surface of the flap was lased using semiconductor diode laser (wavelength 810 nm, Denlase-SY-A.3) with a power setting of 1.5 W in a continuous mode. A 320-μm-diameter tip was used to lase the inner side of the flap from the free gingival margin to the bottom of the apical aspect of the flap (both labial and lingual/palatal). The treatment was performed from the coronal to the apical aspect in parallel paths, and the laser emission was interrupted for 30 s after irradiation exceeded 10 s. The resultant char layer was totally removed with moist gauze before replacing the flaps. Care was taken to avoid any laser contact to the root surface or the alveolar bone and aiming the laser (810 nm) beam at a 45°C to the soft-tissue flap. Direct loop sutures were placed and no periodontal dressing was given [Figure 3].

Routine postoperative instructions were given. All the individuals received postoperative analgesics (combination

Figure 2: Control group showing preoperative probing depth of 10 mm in relation to 46. Flap elevation and debridement was done. Combined intrabony defect of 5 mm depth was seen, demineralized freeze-dried bone graft placed into the defect and the flap approximated with simple interrupted sutures

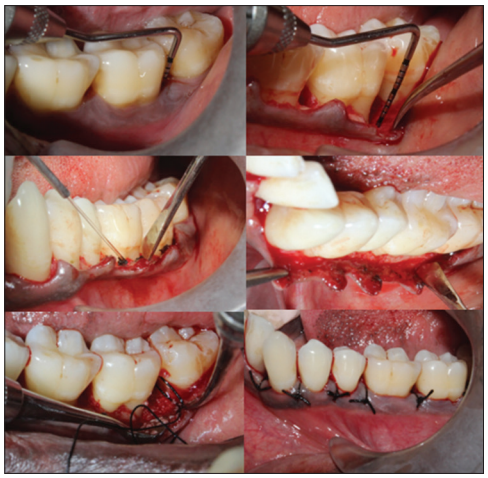

Figure 3: Test group showing preoperative probing depth of 10 mm in relation to distobuccal of 37. Flap elevation and complete debridement was done, inner side of flap lased with 810 nm diode laser. Intrabony defect of 3 mm depth seen in relation to 37, demineralized freeze-dried bone graft placed into the defect approximated with simple interrupted sutures

of ibuprofen 400 mg and paracetamol 325 mg) and were instructed to take only if they experience pain. The patients were refrained from tooth brushing at the surgical site for 1 week and were instructed to rinse mouth with 0.2% chlorhexidine gluconate mouthwash twice daily for 1 week.

In 1-week postoperative checkup, sutures were removed and all the individuals were recalled monthly for 6 months postsurgery to reinforce oral hygiene instructions and plaque control.

Postoperative pain using visual analog scale ranges from 0 (no pain) to 10 (worst pain). Pain medication consumption (ibuprofen 400 mg + paracetamol 325 mg), tissue edema (TE), tissue color (TC), and early healing index (EHI) (Wachtel *et al*., 2003) were assessed to evaluate the postoperative healing on 3rd, 7th, and 14th days posttreatment. The periodontal parameters, i.e., plaque index, gingival index, probing PD (measured from gingival margin to the base of the pocket), RAL (measured from a fixed point on the stent to the base of the pocket), and gingival recession (determined by assessing the distance between the gingival margin and cementoenamel junction), were recorded 3 months and 6 months after surgery.

Statistical analysis

Descriptive statistics were expressed as mean ± standard deviation. Statistical analysis of data was comparative and nonparametric. The Mann–Whitney U-test was used to determine the possible intergroup differences. The Wilcoxon signed-rank test was used to analyze if the clinical parameters were different between intervals of time (intragroup differences: baseline–3 months, baseline–6 months, and 3–6 months). A level of significance of 5% was assumed ($P < 0.05$). The data were analyzed using the Statistical Package for the Social Sciences (SPSS version 20.0 software, SPSS, IBM^{R}) using nonparametric tests.

Results

The demographic characteristics of the 17 individuals included in the study are summarized in Table 1. The age of the patients ranged between 29 and 65 years, with the mean age of 40.56 + 12.22. A total of 8 males and 9 females participated in the study.

Periodontal variables

The mean plaque score at baseline was slightly higher in control site which was not statistically significant ($P = 0.63$). At 3 and 6 months, there was no significant difference between the two groups ($P = 0.86$ and 0.58, respectively) [Table 2]. The intergroup comparisons of the mean gingival index scores did not show any significant difference between the groups at any time point ($P > 0.05$) [Table 3].

A significant difference in the mean pain scores was noticed between the groups at 3 days ($P = 0.0021$) with a higher score noted in the test group. The 7- and 14-day mean pain scores did not show any statistically significant difference between the groups ($P > 0.05$) [Table 4].

TC and TE at surgical sites were evaluated at 3rd, 7th, and 14th days after surgery. With respect to TE and TC, 43.75% and 37.50% of the control and test group scored 1 and 50% and 62% patients scored 2 at day 3 with no statistically significant difference between the groups. At 7 and 14 days, there was no difference between the groups with respect to TE and TC, with 100% of both the groups showing a score of 1 ($P > 0.05$). There was no significant difference between the groups at any time point ($P > 0.05$) [Tables 5 and 6].

The EHI scores at 3 days were 68.75% and 81.25% in control and test sites, respectively, for score 1 with a slightly better healing in the test group. Similarly, the

Table 1: Distribution of demographic variables

Sex	*n* (%)	Age Mean±SD
Male	8.00 (50.00)	38.50±13.90
Female	9.00 (50.00)	42.63±10.82
Total	17.00 (100.00)	40.56±12.22

SD: Standard deviation

Table 2: Intergroup comparison of plaque index scores at baseline, 3 months, and 6 months' time points by Mann–Whitney U-test

Time points	CAPF		LAPF		*P*
	Mean±SD	Mean rank	Mean±SD	Mean rank	
Baseline	0.73±0.46	17.28	0.65±0.46	15.72	0.6376
3 months	0.66±0.42	16.22	0.69±0.46	16.78	0.8653
6 months	0.67±0.46	17.41	0.58±0.42	15.59	0.5847
Baseline–3 months	0.07±0.41	17.16	−0.03±0.40	15.84	0.6923
Baseline–6 months	0.06±0.47	16.34	0.07±0.41	16.66	0.9249
3-6 months	−0.01±0.57	15.84	0.11±0.54	17.16	0.6923

CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap; SD: Standard deviation

Table 3: Intergroup comparison of gingival index scores at baseline, 3 months, and 6 months' time points by Mann–Whitney U-test

Time points	CAPF		LAPF		*P*
	Mean±SD	Mean rank	Mean±SD	Mean rank	
Baseline	0.83±0.61	16.72	0.75±0.44	16.28	0.8951
3 months	0.54±0.37	16.25	0.58±0.43	16.75	0.8802
6 months	0.43±0.32	16.69	0.44±0.34	16.31	0.9100
Baseline–3 months	0.29±0.58	16.88	0.17±0.46	16.13	0.8211
Baseline–6 months	0.40±0.57	16.84	0.31±0.38	16.16	0.8358
3-6 months	0.11±0.38	16.66	0.14±0.41	16.34	0.9249

CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap; SD: Standard deviation

control and test groups showed 31.25% and 18.75% of score 2, respectively, with no statistically significant difference between the groups ($P = 0.6$). At 7th and 14th days, 100% of both the groups scored 1 without any significant difference ($P > 0.05$) [Table 7].

At 3 days, the average number of analgesics consumed was 1.69 + 1.92 and 3.13 + 2.19 for the control and test groups, respectively, which was higher in test group but was not statistically significant ($P = 0.059$). At 7 and 14 days postoperatively, there was no difference between the groups [Table 8].

The RAL showed no significant reduction in the groups from 3 to 6 months ($P > 0.05$). The difference in RAL change in the two groups at 3 months and 6 months, however, was statistically insignificant ($P > 0.05$) [Table 9].

Table 4: Intergroup comparison of pain scores at 3 days, 7 days, and 14 days' time points using Mann–Whitney U-test

Time points	CAPF		LAPF		*P*
	Mean±SD	Mean rank	Mean±SD	Mean rank	
3 days	1.19±1.38	11.41	2.56±0.96	21.59	0.0021*
7 days	0.38±0.62	16.66	0.31±0.48	16.34	0.9249
14 days	0.00±0.00	16.50	0.00±0.00	16.50	1.0000
3-7 days	0.81±0.98	11.22	2.25±1.06	21.78	0.0015*
3-14 days	1.19±1.38	11.41	2.56±0.96	21.59	0.0021*
7-14 days	0.38±0.62	16.66	0.31±0.48	16.34	0.9249

*$P<0.01$ - statistically highly significant. CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap; SD: Standard deviation

Table 5: Intergroup comparison of tissue edema at different time points using Chi-square test

Time	Status	Conventional access flap surgery (%)	Laser-assisted access flap surgery (%)	Total (%)
3 days	Score 1	7 (43.75)	9 (56.25)	16 (50.00)
	Score 2	9 (56.25)	7 (43.75)	16 (50.00)
χ^2, *P*		0.5001, 0.4802		
7 days	Score 1	15 (93.75)	15 (93.75)	30 (93.75)
	Score 2	1 (6.25)	1 (6.25)	2 (6.25)
Yates corrected χ^2, *P*		0.0000, 1.0000		
14 days	Score 1	16 (100.00)	16 (100.0)	32 (100.0)
	Score 2	0	0	0
Yates corrected χ^2, *P*		0.0000, 1.0000		
Total		16 (100.00)	16 (100.0)	32 (100.0)

Table 6: Intergroup comparison of tissue color at different time points using Chi-square test

Time	Status	CAPF (%)	LAPF (%)	Total (%)
3 days	Score 1	7 (43.75)	6 (37.50)	13 (40.63)
	Score 2	8 (50.00)	10 (62.50)	18 (56.25)
	Score 3	1 (6.25)	0	1 (3.13)
χ^2, *P*		1.2994, 0.5223		
7 days	Score 1	15 (93.75)	16 (100.0)	31 (96.88)
	Score 2	1 (6.25)	0	1 (3.13)
	Score 3	0	0	0
Yates corrected χ^2, *P*		0.0000, 1.0000		
14 days	Score 1	16 (100.0)	16 (100.0)	32 (100.0)
	Score 2	0	0	0
	Score 3	0	0	0
χ^2, *P*		0.0000, 1.0000		
Total		16 (100.0)	16 (100.0)	32 (100.0)

CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap

The control and test groups showed a percentage reduction in PD of 54.45 and 46.77 at 3 months and 59.267 and 58.32 at 6 months, which was statistically highly significant ($P < 0.05$).

Table 7: Intergroup comparison of early healing index at different time points using Chi-square test

Time	EHI	CAPF (%)	LAPF (%)	Total (%)
3 days	Score 1	11 (68.75)	14 (81.25)	25 (75.00)
	Score 2	6 (31.25)	3 (18.75)	9 (25.00)
Yates corrected χ^2				
7 days	Score 1	17 (100.00)	17 (100.0)	34 (100.00)
	Score 2	0	0	0
Yates corrected χ^2, *P*		0.1674, 0.6833		
14 days	Score 1	17 (100.00)	17 (100.0)	34 (100.00)
	Score 2	0	0	0
Yates corrected χ^2, *P*		0.0000, 1.0000		
Total		17 (100.00)	17 (100.0)	34 (100.00)

EHI: Early Healing Index; CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap

Table 8: Intergroup comparison of total number of analgesics consumed using Mann–Whitney U-test

Groups	*n*	Mean±SD	Mean rank	*P*
CAPF	16	1.69±1.92	13.38	0.0595
LAPF	16	3.13±2.19	19.63	

SD: Standard deviation; CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap

However, intergroup comparisons showed no difference in probing PD reduction at any time point [Table 10].

Discussion

Periodontal therapy is directed at disease prevention, slowing or arresting disease progression, regeneration of lost periodontal tissues, and maintaining the achieved therapeutic objectives. Longitudinal clinical trials of various conventional treatment techniques such as modified Widman flap and full-thickness flap procedure with or without osseous recontouring have shown to be effective in treating moderate-to-advanced periodontitis. Thus, flap surgery in deeper pockets results in greater pocket reduction and attachment gain.[19]

In recent years, the use of laser therapy has been investigated as an alternative or adjunctive tool to conventional, mechanical procedures commonly employed in the treatment of periodontal and peri-implant diseases. Mechanical instrumentation of root surface for the reduction of bacteria and removal of soft- and hard-tissue deposits results in partial removal of pocket epithelium and healing by formation of a long junctional epithelium. Lasers used in this regard have shown to retard epithelial downgrowth and help in formation of new connective tissue attachment.[17] A significant reduction of periodontopathogenic bacteria has been demonstrated, regardless of laser wavelength.[20,21]

De-epithelialization with the laser retards epithelial downgrowth following periodontal surgery for up to

Table 9: Intergroup comparison of relative attachment level at baseline, 3 months, and 6 months' time points using Mann–Whitney U-test

Time points	CAPF		LAPF		*P*
	Mean±SD	Mean rank	Mean±SD	Mean rank	
Baseline	9.23±1.31	17.19	9.08±1.43	15.81	0.6785
3 months	7.45±0.71	15.63	7.69±1.11	17.38	0.5977
6 months	7.24±0.64	16.56	7.24±1.20	16.44	0.9699
Baseline–3 months	1.79±1.04	18.47	1.39±0.91	14.53	0.2352
Baseline–6 months	1.99±1.28	16.91	1.84±1.01	16.09	0.8065
3-6 months	0.20±0.53	15.13	0.45±0.46	17.88	0.4070

SD: Standard deviation; CAPF: Conventional access periodontal flap; LAPF: Laser assisted periodontal flap

Table 10: Intergroup comparison pocket depth at baseline, 3 months, and 6 months' time points using Mann–Whitney U-test

Time points	Conventional access flap surgery		Laser-assisted access flap surgery		*P*
	Mean±SD	Mean rank	Mean±SD	Mean rank	
Baseline	4.48±0.81	17.22	4.43±1.03	15.78	0.6647
3 months	2.04±0.48	17.13	2.36±1.63	15.88	0.7063
6 months	1.81±0.31	16.25	1.84±0.43	16.75	0.8802
Baseline–3 months	2.44±0.81	17.28	2.07±1.92	15.72	0.6376
Baseline–6 months	2.67±0.85	16.97	2.58±0.92	16.03	0.7774
3-6 months	0.23±0.47	16.38	0.51±1.53	16.63	0.9399

SD: Standard deviation

14 days longer than conventional flap techniques. This delay in epithelialization is due to laser-induced thermal necrosis of the wound margin and formation of a firm eschar that impedes epithelialization.[22] Whereas, it was found that a delay in onset of epithelial migration, not a decreased rate of migration, was responsible for the delayed epithelialization. It was speculated that the reduced inflammatory response retards the stimulus for epithelial migration by sealing the small vasculature and lymphatics and not allowing release of chemical mediators.[23]

There are, however, conflicting reports on the use of lasers as an adjunct to the nonsurgical treatment of periodontal disease, with several systematic reviews showing no additional advantage of laser use in general.[18] However, published reports on the use of diode lasers in periodontal flap surgery are relatively few until date. Thus, the present study was intended to evaluate the effectiveness of diode laser-assisted access flap surgery on postoperative healing and clinical parameters.

In the present study, diode laser was used as an adjunct to conventional access flap surgery and it was found that diode laser did not lead to postoperative complications or to impaired tissue response, indicating that diode

laser can be safely used as an adjunct to conventional therapy. Periodontal ligament cell attachment to the root surface treated with an 810 nm diode laser does not have any deleterious effect on the root surface.[24] It has been observed that a diode laser also facilitates bacterial elimination from periodontal pockets, resulting in better healing, and was also reported that pocket irradiation with a diode laser (805 nm) following scaling produced considerable bacterial elimination from periodontal pockets.[25] These findings indicate that the diode laser can be safely used in proximity of hard tissues.

The plaque index was recorded to monitor the oral hygiene status of the patients, which showed no statistically significant difference from baseline to 6 months. Gingival index showed no significant difference between the groups at any time point. This is in accordance with few previous studies where diode laser was used as an adjunct to nonsurgical periodontal therapy in which no difference was observed between the case and the control groups with respect to gingival index scores.[26] Whereas, in contrast to the present study, one study showed a significant difference between the groups with a greater reduction of gingival inflammation in the laser group which was attributed to the bacterial reduction achieved by the use of laser.[27]

In the present study, postoperative healing and tissue response was evaluated using TC, TE, and EHI, and in addition, patients' perception of pain was evaluated using visual analog scale (VAS).

The EHI did not show statistically significant difference between the groups. At day 3, 81.25% of test sites showed primary closure compared to 68.75% of control sites with no difference between groups at days 7 and 14. This is in accordance with previous studies[28,29] where the authors reported that diode laser significantly promoted healing of various periodontal surgical procedures. However this is in contrast to some studies[30,31] in which it was found that diode laser did not improve healing. This difference in healing might have occurred because various lasers, intervals of application, surgical procedures, and methods of evaluating wound healing were used.

Patients discomfort or pain perception was recorded on 3rd, 7th, and 14th days postoperative using VAS, which is subjective and highly dependent on individual experience. However, the patient served as both the control and the test. Interestingly, it was found that patients experienced more pain in test sites compared to the control sites at 3 days posttreatment with a similar pattern of consumption of analgesics, i.e., higher after test group surgery. This is in accordance with another study in which similar results were reported.[27] However, in contrast to the present study, one study reported significantly less pain experienced by patients in the test sites with a mean score of 2.4 + 1.9 compared to the control sites 3.6 + 2.7 which was attributed to the biostimulation effect of laser.[32] However, a few studies[30,33] reported no statistically significant differences in pain scores between the sites. This difference could be due to different modes of laser applications used.

The RAL showed a percentage decrease of 21.55 and 20.25 in the control and the test sites, respectively, from baseline to 6 months, indicating a gain in attachment level. This is in accordance with another study in which the authors reported a percentage change of 28.8 and 23.6 in the control and the test sites, respectively.[27] In another study in which diode laser was used as an adjunct to mechanical debridement, the authors found no significant difference between the groups at 3 months, but there was a statistically significant reduction in colony-forming units of obligate anaerobes in the test group as compared to the control group.[34]

In the present study, the percentage decrease in probing depth was 54.45 and 46.77 at 3 months and 59.67 and 58.38 at 6 months in the control and the test sites, respectively, which was statistically significant. However, in one patient, a persistent probing depth was noted in the test site at distobuccal site of tooth # 37 due to mesioangularly impacted 38 for which the patient was not willing for extraction. However, there was no significant difference between the groups ($P > 0.05$). These findings are in agreement with a study in which a percentage reduction in PD of 53.2 and 57.4 at 3 months and 58.2 and 60.2 at 6 months was reported in the control and the test sites, respectively.[27] However, the lack of microbial analysis in our study did not allow us to evaluate the effect of diode laser on bacterial count reduction.

All the above-discussed findings may suggest that the use of diode laser did not significantly benefit the treatment outcome on the whole. However, the use of diode laser did not lead to postoperative complications or to impaired tissue response. In the present study, no significant difference in gingival index was recorded in contrast to the previous study[27] in which significant reduction in gingival inflammation was noted. However, clinical outcomes of the use of lasers are still unclear, and little is known regarding the optimal type, wavelength, power, energy delivered, and method of using lasers in conjunction with periodontal surgery. Thus, the high investment cost for the laser equipment has to be weighed along with the benefits and has to be used cautiously to prevent damage to vision and other potential hazards.

In the present study, lasing of the flap was done only once using 810 nm diode laser at 1 W power for 10 s, whereas in a previous study,[32] a second laser application at 0.1 W power was done wherein patients experienced less postoperative discomfort, and also, the type of laser selected in this study would have not resulted in better results. Other limitations of the study are that sample size

was small and hence the results cannot be generalized and there is a lack of microbial evaluation.

To assess whether lasers will provide additional benefits to periodontal treatment, further controlled clinical trials with larger sample sizes using varied wavelengths and power settings are needed to clarify the effectiveness and outcomes of laser periodontal therapy and to support its application in clinical practice.

Conclusion

Within the scope of the present study, the use of diode laser as an adjunct to periodontal flap surgery did not significantly enhance the treatment outcome on the whole. Thus, the high investment cost for the laser equipment has to be weighed along with the proven clinical benefits.

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Conflicts of interest

There are no conflicts of interest.

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