LASER AS AN ADJUNCT IN PERIODONTAL FLAP SURGERY

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ABSTRACT

Aim: To evaluate and compare the post-operative pain and tissue healing between conventional flap surgery with diode laser assisted flap surgery

Materials and Method: Eighteen subjects participating in this study were treated using a split-mouth design in a randomised selection. In one quadrant, conventional flap surgery (Group A - control), and on the other side, conventional flap surgery assisted by diode laser was used and sutured (Group B - test). Plaque Index (PI), Gingival Index (GI), Relative Attachment Level (RAL) and Healing Index (HI), Visual Analogue Scale (VAS) were monitored from baseline, 3rd month, 6th months.

Result: No statistical differences on clinical parameters (PI, GI and PPD reduction) and statistically significant differences for clinical parameters (RAL, HI and VAS) were seen between test and control sites.

Conclusion: A diode laser (810nm) has no detrimental effects when used in conjunction with Conventional Flap Surgery and overall within the limitations of the study, diode lasers did not show any significant added benefits over conventional access flap surgery.

Keyword: Laser, adjunct, Periodontal, surgery

INTRODUCTION:

Periodontitis is defined as “an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both”. The therapeutic objectives include disease prevention, slowing or arresting disease progression, regeneration of lost periodontal tissues. Complete removal of bacterial deposits and their toxins from the root surface is not always possible by conventional mechanical therapy because of limited access. In order to overcome this limitation laser therapy for soft tissues manipulation and as an adjunct in the management of infective aspects of periodontitis. The term “Laser Assisted Periodontal Therapy” (LAPT) includes many beneficial properties over conventional scalpel. Lasers used primarily for soft tissue treatments are Carbon dioxide (CO₂), Neodymium: YAG (Nd:YAG) and diode lasers. The main use for the 810 dental diode Laser in the periodontal therapy is the removal of diseased pocket lining epithelium and disinfection of periodontal pockets^[1]. Optic fibre delivery systems, with 200-320 µm fibre diameters, enable

extremely easy access into the periodontal pocket. Hence, the present study was aimed to compare the clinical effectiveness of diode laser assisted flap surgery with that of conventional flap surgery^[33].

MATERIALS AND METHODS:

For this proposed study, a total of 18 subjects were selected from the Outpatient Department of Periodontics, Daswani Dental College and Research Centre, Kota, Rajasthan, India. An ethical approval for the study was obtained from the ethical committee of the institution. Each subject was given a detailed verbal and written description of the study and all the selected subjects were required to sign an informed consent form prior to commencement of the study.

A split mouth, randomised single-blinded clinical trial was conducted to compare the post-operative pain and tissue healing of diode laser assisted flap surgery and conventional flap surgery.

PATIENT SELECTION:

Patients having moderate to advanced periodontitis, indicated for periodontal flap surgery, were randomly distributed into two groups in this split-mouth study.

1. Group A (Control Group)–
Kirkland Flap Surgery using blade and BP handle.

2.Group B (Experimental Group)– Laser Assisted Kirkland Flap Surgery

All subjects had a non-contributory medical history with chronic periodontitis under the age group of 20-60 years having minimum 18 natural teeth in their mouth with periodontal pocket more than 4mm and less than 7mm were included in the study

Patients with history of systemic condition, long term – antibiotic and immunosuppressive therapy, smokers, patients with history of previous periodontal surgeries, pregnant and lactating women were excluded from the study

All the subject received one session of scaling and root planning and instructions and reinforcement in personal mechanical plaque control procedures as part of phase I (nonsurgical) therapy. One week after nonsurgical therapy, baseline data was recorded and then phase II (surgical therapy) therapy was started.

Surgical procedure:

The quadrants were randomly assigned to the test and control sites in this split- mouth study design. The surgical site was anaesthetized with the help of a 2% lignocaine and 1:2,00,000 adrenaline.

In the control site Kirkland flap surgery was done and curettes were used to debride the granulation tissue and other debris. After complete debridement, the surgical site was sutured with 3-0 silk sutures.

In the test site, the inner surface of the flap was treated with 810nm diode laser with a power setting of 1.8 watt in continuous contact mode for minimum 1 min to prevent charring of connective tissue and to remove any residual epithelium. After complete debridement, the surgical site was sutured with 3-0 silk sutures, post-operative instructions were given and subject was asked to report back after 1 week for suture removal.

After completion of the laser-assisted pocket therapy, All the subjects were put on antibiotics and Non-Steroidal Anti-inflammatory Drugs (NSAIDs) after the surgical procedure. The subjects were given a **Visual Analogue Scale** questionnaire to assess the pain level postoperatively for the presence of any pain after 24 hours and after 1 week.

Subjects were reviewed for proper maintenance of oral hygiene every month and recordings were made at baseline (0 day), 3 months and at 6 months interval for Plaque Index (PI) (Silness J

&Loe H 1964), Gingival Index (GI) (Loe H & Silness J 1963), Relative Attachment Level (RAL)

While Healing Index (HI) (Landry RG, Turnbull RS and Howley T 1988) was recorded after 24 hours, at 1 week, 1 month, 3 months and at 6 months interval. Visual Analogue Scale (VAS) (Wong DL, Eaton MH, Wilson D, Winkelstein ML, Schwartz P 2001) 136 were recorded after 24 hours and after 1 week.

STATISTICAL ANALYSIS:

Descriptive statistics were expressed as mean $\pm$ 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[®]) using nonparametric tests.

RESULT:

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). Comparisons of the mean gingival index scores and periodontal pocket depth did not show any significant difference between the groups at any time point. The VAS scores on control and the test site showed statistically significant difference. Interestingly, it was found that patients experienced more pain in test sites after 24 hours compared to the control sites. Significant difference in relative attachment gain was evident at 3rd month after surgery and no difference was evident at 6th month.

Comparison between Control (Group A) and Test Group (Group B)

Plaque Index (PI): (Silness P and Loe H 1964) (Table I)

TIME POINTS	Mean value (Group A)	Mean value (Group B)	Mean difference (Group A and Group B)	P value
Baseline	0.53 $\pm$ 0.31	0.49 $\pm$ 0.24	0.04 $\pm$ 0.12	0.63
3 rd month	0.90 $\pm$ 0.36	0.91 $\pm$ 0.36	-0.01 $\pm$ 0.03	0.92
6 th month	0.67 $\pm$ 0.37	0.66 $\pm$ 0.50	0.01 $\pm$ 0.09	0.86

Gingival Index (GI) : (loe H and Sillness P 1963) (Table II)

TIME POINTS	Mean value (Group A)	Mean value (Group B)	Mean difference (Group A and Group B)	P value
Baseline	0.67 ± 0.59	0.58 ± 0.26	0.09 ± 0.11	0.07
3 rd month	1.02 ± 0.17	1.04 ± 0.15	-0.02 ± 0.03	0.89
6 th month	0.77 ± 0.27	0.71 ± 0.39	0.06 ± 0.09	0.78

Pocket Probing Depth (PPD)(Table III)

TIME POINTS	Mean value (Group A)	Mean value (Group B)	Mean difference (Group A and Group B)	P value
Baseline	4.85±1.56	4.84±1.19	0.01 ± 0.11	0.43
3 rd month	2.90± 1.17	2.43 ± 0.63	0.47 ± 0.03	0.168
6 th month	2.25 ± 0.69,	1.91 ± 0.34	0.34 ± 0.09	0.145

Relative Attachment Level (RAL)(Table IV)

TIME POINTS	Mean value (Group A)	Mean value (Group B)	Mean difference (Group A and Group B)	P value
Baseline	7.37 ± 1.16	8.37 ± 1.14	-1.00 ± 0.11	0.002
3 rd month	5.92 ± 1.13	6.57 ± 0.65	-0.65 ± 0.03	0.035
6 th month	5.43 ± 0.70	5.48 ± 0.49	-0.05 ± 0.09	0.384

Healing Index (HI): (laundry RG. Turnbull RS and Howley T 1988)(Table V)

TIME POINTS	Mean value (Group A)	Mean value (Group B)	Mean difference (Group A and Group B)	P value
Baseline	2.95 ± 0.39	3.45 ± 0.51	-0.50 ± 0.11	0.002
3 rd month	4.00 ± 0.46	4.55 ± 0.51	-0.55 ± 0.03	0.002
6 th month	5.00 ± 0.00	5.00 ± 0.00	0.00 ± 0.02	1.00

Visual Analogue Scale (VAS) (Wong DL et al 2001) (Table IV)

TIME POINTS	Mean value (Group A)	Mean value (Group B)	Mean difference (Group A and Group B)	P value
24 hours	2.95 ± 0.83	1.00 ± 0.56	1.95 ± 0.11	0.001
1 week	0.60 ± 0.68	0.00±0.00	0.60 ± 0.03	0.001

Graph 1 : The bar diagram showing the mean values of Plauque Index and Gingival Index of different groups at different time intervals

DISCUSSION:

Among the various techniques used for periodontal therapy, laser-assisted periodontal therapy has emerged as a limelight technique in periodontal use. 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 modification have shown to be effective in treating moderate-to-advanced periodontitis^[2]. Thus, open flap debridement surgery in deeper pockets results in greater pocket reduction and attachment gain.

In recent years, the use of laser therapy has been investigated as an alternative or adjunctive tool to conventional, mechanical procedures commonly administered 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 initiation of a long junctional epithelium formation^{[3][4]}. Lasers used in this regard have shown to inhibit epithelial downgrowth and help in formation of new connective tissue attachment. De-epithelialization with the laser retards epithelial downgrowth following periodontal surgery for up to 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 hinders epithelialization. The delay in onset of epithelial migration was speculated that reduced inflammatory response retards the stimulus for epithelial migration by sealing the small vasculature and lymphatics and not allowing release of chemical mediators^[25].

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. However, published reports on the use of diode lasers in periodontal flap surgery are relatively few until date^{[5][6][10]}. Thus, the present study was intended to evaluate the effectiveness of diode laser-assisted access flap surgery on

postoperative healing and clinical parameters.

The clinical parameters used in the present study included the PI, GI, HI apart from the probing depth (PD) and RAL.

The **PI** index was used to identify the plaque and more objective definition of each numerical score^[6].

The **GI** index has validity, reliability, and ease of use and also demonstrates sufficient sensitivity to distinguish between groups of mild and severe gingivitis^[7].

Pocket is an important clinical feature of periodontitis, so measure of pocket depth becomes important in the evaluation of progression or regression of the disease posttreatment. However, pocket depth depends on the position of gingival margin; its position may alter with change in the level of gingival margin without giving actual gain in attachment^{[8][9]}.

Thus, **level of attachment** which is the distance from a fixed point on crown to the base of the pocket is a better indicator of periodontal destruction. Before treatment, a customized acrylic stent was fabricated on the study cast for each patient. The stent was grooved in an

occlusal apical direction. This was done to minimize change in the direction of probing at subsequent recordings. All these measurements were made from a fixed reference point on the stent in accordance with the study by Schwarz *et al*^[13]

Patients discomfort or pain perception was recorded on 24 hours, 1 week, and 1 month 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 posttreatment with a similar pattern of consumption of analgesics, i.e., higher after test group surgery^{[14][15]}. This difference could be due to different modes of laser applications used

The **HI** showed statistically significant difference between the groups during 1st week and not during 1st month and no difference where the authors reported that diode laser significantly promoted healing of various periodontal surgical procedures. This difference in healing might have occurred because various lasers, intervals of application,

surgical procedures, and methods of assessing wound healing were used^[16].

Conventional surgical procedure was followed with Kirkland flap. This technique prevents extensive sacrifice of noninflamed tissues and apical displacement of the gingival margin. Thus, the root surfaces are not markedly exposed, and thus, the said method is considered good for aesthetic reasons and useful in the anterior regions of the dentition^[20].

The changes seen with laser therapy might be attributed to the fact that due to the laser's ablation action, the epithelium lining the soft tissue walls of the pockets and the adjacent inflammatory cell infiltrates might have been removed^{[21][24]}. In addition, the low-dose radiation that scatters into the surrounding tissues might possess a beneficial effect on the healing process^[27]. Furthermore, laser therapy might have resulted in improved proliferation of the fibroblasts and their adhesion to the root surfaces, leading to CAL gain. There is less collagen remodelling, faster healing, and minimal scar tissue with laser-assisted pocket therapy, which might explain why less gingival recession takes place in the said situations.

The current evidence does suggest that the use of the diode, Nd: YAG, or Er: YAG lasers for the treatment of periodontitis might be equivalent to scaling and root planning with respect to reduction in the probing depth^[25]. 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 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^[27]. 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^[31]. 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.

Limitations of the present study

1. A longer follow-up in the present study would have enhanced the ability of the present study to confirm the stability and sustainability of the clinical outcome
2. A smaller sample size was another big limitation of the present study
3. Gingival recession and bleeding index were also not taken into consideration. They would have further added the ability of the present study to assess and confirm the stability and sustainability of the clinical outcome post-procedurally.

CONCLUSION:

A diode laser (810nm) use did not lead to postoperative complications or to impaired tissue response, indicating that this type of laser (810nm) has no detrimental effects when used in conjunction with Conventional Flap Surgery. No statistical differences on clinical parameters (PI, GI and PPD reduction) were seen between test and control sites. Statistically significant differences for clinical parameters (RAL,

HI and VAS) were seen between test and control sites. The tissue oedema and postoperative pain were reduced with significant attachment gain (RAL) with the use of the diode laser (810nm) was seen. The differences were statistically different.

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