ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)
IJDSIR : Dental Publication Service
Available Online at: www.ijdsir.com
Volume – 3, Issue – 1, February - 2020, Page No. : 326 - 332

Effect of photobiomodulation on post operative healing in periodontal flap surgery

[1]Dr Bhavya B, Associate Professor, Department of Periodontology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences, Bengaluru, Karnataka

[2]Dr Safiya Fatima Khan, Post Graduate, Department of Periodontology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences, Bengaluru, Karnataka

Corresponding Author: Dr Bhavya B, Associate Professor, Department of Periodontology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences, Bengaluru, Karnataka

Citation of this Article: Dr Bhavya B, Dr Safiya Fatima Khan, "Effect of photobiomodulation on post operative healing in periodontal flap surgery", IJDSIR- February - 2020, Vol. – 3, Issue -1, P. No. 326 – 332.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Laser is considered basically effective for treating periodontal diseases because of its excellent physical properties namely ablation, hemostasis, bacterial killing and cell stimulation. Laser ablation of diseased periodontal tissues using the Laser is widely performed, partly expecting a simultaneous photo-bio-modulation effect (LLLT) in the surrounding tissues. In periodontal pocket therapy, laser can not only ablate the diseased tissues but also stimulate or activate the surrounding gingival and bone tissues, which would result in improved pocket healing and tissue regeneration. By elucidating the photo-bio-modulation effect in detail, this effect could be used more effectively and laser therapy would be more advantageous in non-surgical and surgical therapies of periodontitis as an adjunctive or alternative means to current mechanical treatment. As a future strategy of periodontal therapy, the photo-therapy using photo-bio-modulation/activation and photo-dynamic effects could be developed increasingly for prevention and control of periodontal diseases.

Keywords: Photobiomodulation, Periodontal Flap Surgery, Healing, Lasers.

Introduction

Undisplaced flaps are one of the most common periodontal surgeries for correcting anatomical factors that predispose patients to periodontal disease.[1]

The ultimate goal of periodontal therapy has been regeneration of the supporting tissues lost as a consequence of inflammatory periodontal disease. This implies the formation of new connective tissue attachment at previously diseased root surfaces.[2]

Previous studies have shown that 30% of patients who undergo periodontal surgeries complain of postsurgical pain, particularly within 1 week after surgery. Inflammatory chemical intermediates are released upon tissue injury caused by either periodontal diseases or treatments and play important roles in developing post-surgical side-effects such as pain. Different methods have been used to control secretion of these inflammatory intermediates. Taking non -steroidal anti-inflammatory drugs (NSAIDs) is one of the common ways to prevent and alleviate the post-surgical pain, but these drugs may cause platelet function disorder and digestive problems. Newer NSAIDs (Coxib) selectively inhibit the cyclooxygenease 2 enzyme and significantly decrease digestive problems, but the chances of Myocardial infarctions (MI) and nephrotoxicity are higher. [1]

The application of photobiomodulation of lasers is another method to control the secretion of inflammatory intermediates. Photobiomodulation lasers emit radiation with wavelengths in the red or infrared spectrum, which are absorbed weakly by water and can penetrate into soft and hard tissues to depths of 3 to 15 mm.

The main enzyme of this reaction is cytochrome C oxidase, which has both stimulatory and inhibitory effects on immunological, inflammation and pain mediators. Low-intensity lasers are most commonly used for their photobiomodulation effects such as the alleviation of pain, reduction of inflammation and swelling and acceleration of healing.[1]

The application of photobiomodulation lasers with different wavelength has become popular for pain reduction and healing acceleration after surgeries. The penetration depths are enhanced by increasing the wavelength. The probable factors behind the working mechanisms of these lasers include the consistency of neural cell membrane, enhancing cellular resuscitation system, increasing ATP production and decreasing prostaglandin E2. Considerable pain is caused by periodontal surgery and there is no constructed protocol for alleviating pain using photobiomodualation.

Materials and Method

5 patients were recruited from department of periodontology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences, Bangalore. Inclusion criteria: Bilateral pockets with depths of 5 to 7mm and the affected teeth similar on both sides of the mandible. No medical histories of previous surgeries or reports of systemic disease. Smokers, patients with history of long-term use of antibiotics and corticosteroids, and pregnant women were excluded from the study.

Patient selection

This split-mouth study was conducted in 5 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.

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., Bleeding on Probing (BOP), Tissue edema (TE), Tissue color (TC), Early Wound Healing Index (EHI) and Visual Analogue Scale (VAS) scores, were recorded.

All patients included in the study received initial treatment which consisted of scaling and root planing and oral 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. However, in the test sites, the inner surface of the flap was lased using diode laser (wavelength 965 nm) with a power setting of 1.5 W in a continuous mode. A 200-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 (965 nm) beam at a 45°C to the soft-tissue flap. Direct loop sutures were placed and no periodontal dressing was given

Routine postoperative instructions were given. All the individuals received postoperative analgesics (combination 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 post-surgery 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), bleeding on probing, 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.

Statistical Analysis

McNemars was used to determine the possibleintergroup differences.The Wilcoxon signed rank test was used to analyse the VAS scores .A level of significance of 5% was assumed (p<0.005).The data were analysed using SPSS version.

Results

Table no. 1 Comparison of Bleeding on Probing scores between SHAM & LASER sites using McNemar's Test

BOP	SHAM		LASER		P-Value
	n	%	n	%	
Score 2	3	60%	3	60%	1.00
Score 3	2	40%	2	40%	

Table no. 1 represents the comparison of bleeding on probing scores between SHAM & LASER sites and it was found that Score 2 was most predominant (60%) as compared to score 3 (40%) in both the sites. And there was no significant difference between 02 sites with respect to bleeding on probing scores. [Refer Figure no. 1]

Table no. 2 Comparison of Tissue Edema scores between SHAM & LASER sites using McNemar's Test

Tissue Edema	SHAM		LASER		P-Value
	n	%	n	%	
Score 0	0	0%	1	20%	0.89
Score 1	5	100%	4	80%	

Table no. 2 represents the comparison of Tissue Edema scores between SHAM & LASER sites and it was found that all SHAM sites were having Edema score 1 (100%) as compared to LASER site with score 1 in 80% sites and with 20% of no edema score. However, there was no significant difference between 02 sites with respect to Tissue Edema scores. [Refer Figure no. 2]

Table no. 3 Comparison of Gingival Color scores between SHAM & LASER sites using McNemar's Test

Color	SHAM		LASER		P-Value
	n	%	n	%	
Score 0	0	0%	1	20%	0.89
Score 1	5	100%	4	80%	

Table no. 3 represents the comparison of Gingival color scores between SHAM & LASER sites and it was found that all SHAM sites were having Edema score 1 (100%) as compared to LASER site with score 1 in 80% sites and with 20% of score 1. However, there was no significant difference between 02 sites with respect to gingival color scores. [Refer Figure no. 3].

Table no. 4 Comparison of Early Wound Healing Index scores between SHAM & LASER sites using McNemar's Test

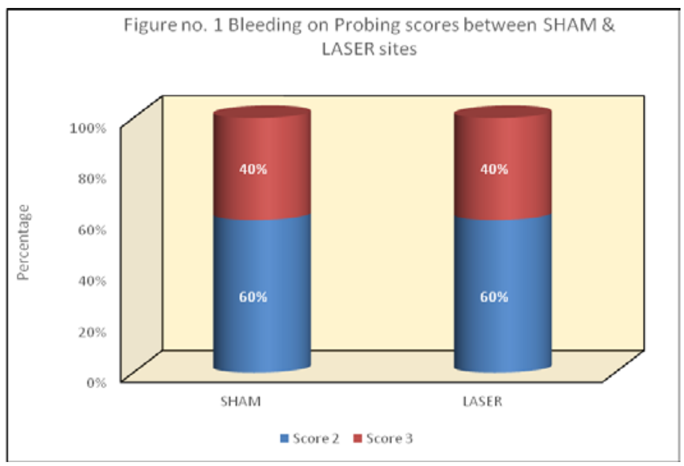
EWHI	SHAM		LASER		P-Value
	n	%	n	%	
Score 0	0	0%	1	20%	0.89
Score 1	5	100%	4	80%	

Table no. 4 represents the comparison of Early Wound Healing Index scores between SHAM & LASER sites and it was found that all SHAM sites were having Edema score 1 (100%) as compared to LASER site with score 1 in 80% sites and with 20% of score 1. However, there was no significant difference between 02 sites with respect to Early Wound Healing Index scores. [Refer Figure no. 4]

Table no. 5 Comparison of mean VAS scores between SHAM & LASER sites using Wilcoxon Signed Rank Test

Sides	N	Mean	SD	Mean Diff	Z	P-Value
SHAM	5	0.40	0.55	0.20	0.577	0.56
LASER	5	0.20	0.45			

Table no. 5 represents the comparison of mean VAS scores between SHAM & LASER sites and found that the SHAM site has higher mean VAS score [0.40 ± 0.55] as compared to LASER sites [0.20 ± 0.45]. However, there was no significant difference in the mean VAS scores between 02 sites. [Refer Figure no. 5]



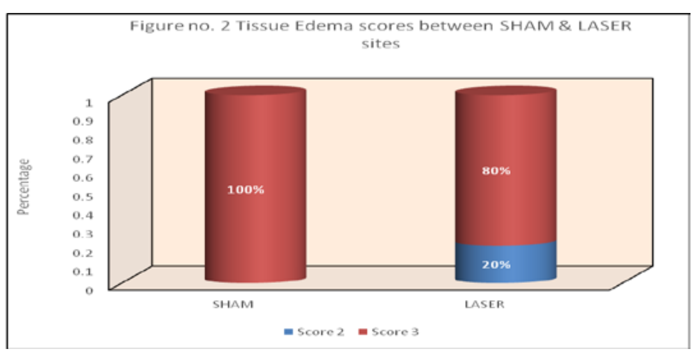


Figure no. 3Gingival Color scores between SHAM & LASER sites

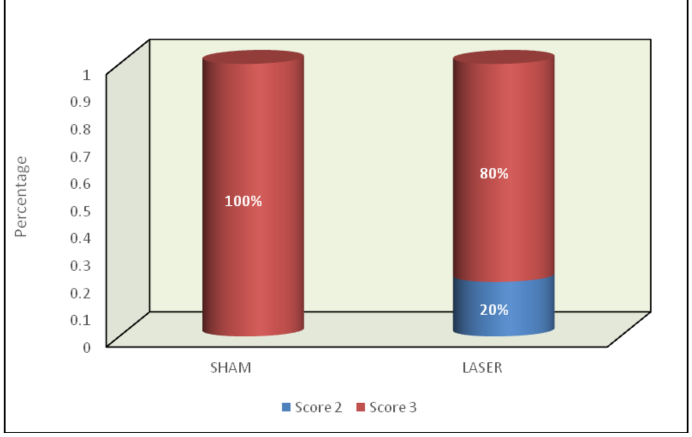


Figure no. 4 Early Wound Healing scores between SHAM & LASER sites

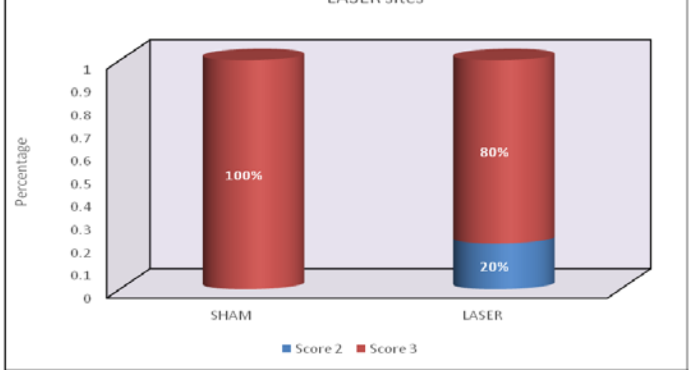


Figure no. 5 Mean VAS scores between SHAM & LASER sites

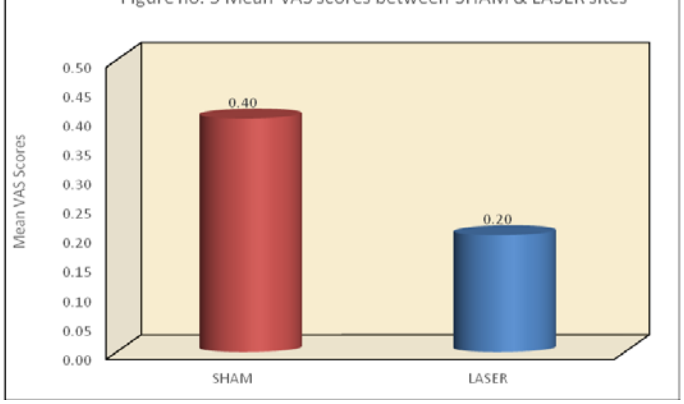


Table no. 1 represents the comparison of bleeding on probing scores between SHAM & LASER sites and it was found that Score 2 was most predominant (60%) as compared to score 3 (40%) in both the sites. And there was no significant difference between 02 sites with respect to bleeding on probing scores. [Refer Figure no. 1]

Table no. 2 represents the comparison of Tissue Edema scores between SHAM & LASER sites and it was found that all SHAM sites were having Edema score 1 (100%) as compared to LASER site with score 1 in 80% sites and with 20% of no edema score. However, there was no significant difference between 02 sites with respect to Tissue Edema scores. [Refer Figure no. 2]

Table no. 3 represents the comparison of Gingival color scores between SHAM & LASER sites and it was found that all SHAM sites were having Edema score 1 (100%) as compared to LASER site with score 1 in 80% sites and with 20% of score 1. However, there was no significant difference between 02 sites with respect to gingival color scores. [Refer Figure no. 3].

Table no. 4 represents the comparison of Early Wound Healing Index scores between SHAM & LASER sites and it was found that all SHAM sites were having Edema score 1 (100%) as compared to LASER site with score 1 in 80% sites and with 20% of score 1. However, there was no significant difference between 02 sites with respect to Early Wound Healing Index scores. [Refer Figure no. 4]

Table no. 5 represents the comparison of mean VAS scores between SHAM & LASER sites and found that the SHAM site has higher mean VAS score [0.40 ± 0.55] as compared to LASER sites [0.20 ± 0.45]. However, there was no significant difference in the mean VAS scores between 02 sites. [Refer Figure no. 5]

Discussion

Periodontal therapy is directed at disease prevention, slowing or arresting disease progression, regeneration of lost periodontal tissues, and maintaining the achieved therapeutic objectives. 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 pocket epithelium and healing by formation of long junctional epithelium. Lasers used in this regard have shown to retard epithelial down growth and help in formation of new connective tissue attachment[6].

De-epithelialization with the laser retards epithelial down growth 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 impedes epithelization[7]. Whereas, it was found that a delay in onset of epithelial migration, not a decreased rate of migration, was responsible for the delayed epithelization. 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[8].

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. 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 (850nm) following scaling produced considerable bacterial elimination from periodontal pockets[9]. 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. Gingival index showed no significant difference between the groups. 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[10, 11].

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. This is in accordance with previous studies[11,12] where authors reported that diode laser significantly promoted healing of various periodontal surgical procedures.

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. 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 worth periodontal surgery.

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.

References

1. Heidari, M. Fekrazad, R. Sobouti, F. Moharrami, M. Azizi, S. Nokhbatulfoghahaei, H, et al., Evaluating the effect of photobiomodulation with a 940nm diode laser on post operative pain in periodontal flap surgery. Lasers in medical science, [online], vol. 33, no. 8, 2018, pp.1638-1645. Available at :

https://www.ncbi.nlm.nih.gov/pubmed/29978268 [Accessed 16 November 2018]

2. Jonnalagadda, B. Gottumukkala, S. Dwarakanath, C. Koneru, S, Effect of diode laser assisted flap surgery on post operative healing and clinical parameters : A randomized control clinical trial. Contemporary clinical dentistry [online], vol. 9, no. 2, 2018, pp. 205-212. Available at : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5968684/ [Accessed 16 November 2018]
3. Sanz-Moliner, J.D. Nart, J. Cohen, R. Ciancio, S., The Effect of an 810 nm diode laser on postoperative pain and tissue response after modified Widman flap surgery: A Pilot Study in humans. Journal of Periodontology [online], vol. 84, no. 2, 2013, pp.152-158. Available at: https://www.ncbi.nlm.nih.gov/pubmed/22524327 [Accessed 16 November 2018]
4. Hagenaars, S. Louwerse, PH. Timmerman, MF. Van der Welden, U. Van der Weijden, GA, Soft-tissue wound healing following periodontal surgery and Emdogain application. Journal of Clinical Periodontology [online], vol. 31, no. 10, 2004, pp.850-856. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15367188
5. Wachtel, H. Schenk, G. Bohm, S. Weng, D. Zuhr, O. Hurzeler, M.B., Microsurgical Access Flap and Enamel Matrix Derivative for the treatment of Periodontal Intrabony defects: A Controlled Clinical Study. Journal of Clinical Periodontology [online], vol. 30, no. 6, 2003, pp.496-504. Available at: https://www.ncbi.nlm.nih.gov/pubmed/12795787
6. Romanos GE, Henze M, Banihashemi S, Parsanejad HR, Winckler J, Nentwig GH, et al, Removal of epithelium in periodontal pockets following diode (980nm) laser application in the animal model: An invitro study, Photomedicine and Laser Surgery, vol. 22, no.3, 2004, pp.177-183.
7. Fisher SE,Frame JW,Browne RM,Tranter RM A comparative histological study of wound healing following CO2 laser and conventional surgical excision of canine buccal mucosa, Archives of Oral Biology, vol. 28, no. 4, 1983, pp.287-291.
8. Moreno RA, Hebda PA, Zitelli JA, Abell E, Epidermal cell outgrowth from CO2 laser and scalpel cut explants: Implications for wound healing, Journal of Dermatologic Surgery and Oncology, vol. 10, no. 11, 1984, pp.863-868.
9. Moritz A, Gutknecht N, Doertbudak O, Goharkhay K, Schoop U, Schauer P, et al., Bacterial reduction in periodontal pockets through irradiation with a diode laser: a pilot study, Journal of clinical laser medicine & surgery, vol. 15, no. 1, 1997, pp.33-37.
10. Zare D, Haerian A, Molla R, Vaziri F, Evaluation of the effects of diode (980 nm) laser on gingival inflammation after nonsurgical periodontal therapy, Journal of lasers in medical sciences, vol. 5, no. 1, 2014, pp.27.
11. Ozcelik O, Cenk Haytac M, Kunin A, Seydaoglu G, Improved wound healing by low-level laser irradiation after gingivectomy operations: a controlled clinical pilot study. Journal of clinical periodontology, vol. 35, no. 3, 2008, pp.250-254.
12. Faria Amorim JC, Sousa GR, Silveira LD, Prates RA, Pinotti M, Ribeiro MS, Clinical study of the gingiva healing after gingivectomy and low-level laser therapy, Photomedicine and Laser Therapy, vol. 24, no. 5, 2006, pp.588-594.