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Evaluation of Effectiveness of Soft Tissue Diode Laser as an Adjunct to Scaling and Root Planning in the Treatment of Chronic Generalized Periodontitis – A Randomized Split-Mouth Clinical Study

Supriya Bharti[1], Anuj Singh Parihar[2], Sumit Narang[3], Anirudh Baraskar[4], Anuj Khandelwal[5], Pragya Manushree[6]

[1]Postgraduate Student, Department of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India (Corresponding Author)

[2]Reader, Department of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India

[3]Professor and Head, Department of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India

[4]Postgraduate Student, Department of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India

[5]Postgraduate Student, Department of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India

[6]Senior Lecturer, Department of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India

Corresponding Author: Dr. Supriya Bharti

KEYWORDS

Periodontal Diseases, Scaling And Root Planing, Diode Laser, Randomized Clinical Study

ABSTRACT:

Background: To evaluate the clinical outcomes of diode laser (DL) used alongside scaling and root planing (SRP) compared to SRP by itself in the management of individuals with chronic generalized periodontitis.

Material and Methods: Ten subjects aged 25 – 55 years participated in this randomized split-mouth clinical study. All subjects with 80 selected sites were randomly divided into 2 equal groups depending on the treatment provided. SRP alone (Group I control group) and soft tissue diode laser as an adjunct to SRP (Group II test group). The assessment of clinical parameters plaque index (PI), gingival index (GI), probing pocket depth (PPD), and clinical attachment level (CAL) were evaluated at baseline, on day 30, and again at 90 days.

Results: The mean values of PPD from baseline to three months exhibited a highly significant difference between groups I and II on both the mesial and distal aspects ($p < 0.02$). Similarly, the mean values of CAL from baseline to three months revealed a significant difference between the two groups on the distal and buccal aspects ($p < 0.02$). In terms of intragroup comparisons, both groups demonstrated a reduction in the mean differences of PI, GI, and individually from baseline to three months, with a significance level of ($p < 0.001$).

Conclusion: The adjunctive use of 970 nm DL with SRP provides moderate additional clinical benefit in moderate periodontal pockets 4-6 mm.

Introduction

Periodontal disease is a chronic inflammatory condition which can lead to gingivitis, gingival recession, the development of periodontal pockets, and vertical and horizontal resorption of alveolar bone, ultimately leading to the tooth mobility and loss. If not diagnosed, gingivitis can lead to periodontitis. Therefore, mechanical plaque control acts as a therapeutic strategy to prevent the transition from gingivitis to periodontitis. The use of both manual and powered instruments for plaque removal has proven effective in eliminating plaque biofilm and calculus from root surfaces, thereby decreasing the bacterial load within periodontal

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pockets.[1,2]Plaque removal performed using manual and powered instruments has shown effective removal of plaque biofilm and calculus from the root surfaces, thereby the bacterial load in periodontal pockets will be reduced.Complete removal of subgingival plaque biofilm and calculus is not possible while carrying out the instrumentation in deep periodontal pockets and furcations, The total elimination of subgingival plaque biofilm and calculus is unattainable during instrumentation in deeper periodontal pockets and furcations, as it remains uncertain whether the instruments can adequately access the root surfaces of the teeth. Consequently, various local or systemic antibiotics are employed in the treatment of periodontitis.[3] The aim of this study is to evaluate the clinical outcomes of using Diode laser in conjunction with SRP compared to SRP alone in the management of patients with chronic generalized periodontitis.

Materials and Methods

This study was a randomized, Split-Mouth clinical study. It was conductedin Department of Periodontology and Oral Implantology, People's Dental Academy, Bhopal.The purpose of this study was to evaluate the effectiveness of soft tissue diode laser as an adjunct to scaling and root planning in the management of chronic generalized periodontitis. The clinical trial approval was given by the Institutional Ethics Committee (2023/900/01 dated 01/05/2023). Informed consent was obtained from each of the subjects, after providing them with a detailed information brochure regarding the study.

Source of Sample and Study Period: The study group comprised of 10 systemically healthy patients who were diagnosed with chronic periodontitis and who reported to the outpatient Department of Periodontology, People's Dental Academy, Bhopal for the management of their periodontal condition. Clinical parametersPlaque index (PI) by Silness J and Loe H 1964, Gingival index (GI) by Loe H and Silness J 1963, Probing pocket depth (PPD), and Clinical attachment level (CAL) were recorded using UNC-15 periodontal probe and will be assessed at the base line, 1month and 3 months.

Selection Criteria: Inclusive criteria- Ten Systemically healthy subjects**,** Patients should be within the age group of 25 – 55 years, Subjects with chronic generalized periodontitis with atleast 20 remaining natural teeth, Quadrant with probing pocket depth in between 4mm – 6mm, Patients with established willingness and ability to perform adequate oral hygiene, Patients who are not on antibiotics medication for the last 6 months. **Exclusion criteria-** Subjects who are suffering from any known systemic disease or immune-compromised, Subjects who received any surgical or non -surgical therapy six months prior the start of the study, Subjects who had received any antibiotic therapy in the last six months, Pregnancy and lactation subjects, Subjects with habit of betel-nut, pan masala, tobacco chewing, smoking, and alcohol consumption, Subjects who are prone to photosensitivity.

Randomization and study group: Patients who were eligible for the study was randomly selected. Patient divided in two groups of categories: **Group A:** Patient with chronic generalized periodontitis and undergoing scalingand root planning (SRP). **Group B:** Patient with chronic generalized periodontitis and undergoing laser therapy along with scaling and root planning (SRP+L).

Results

At baseline, there were no statistically significant differences between Group A (SRP alone) and Group B (SRP with diode laser) in terms ofPI, GI, PPD, and CAL. At the one-month interval, both groups demonstrated significant improvements across all clinical parameters. However, Group B showed significantly greater reductions in PI, GI, and PPD, along with more notable CAL gain compared to Group A ($p < 0.05$). By the three-month follow-up, the improvements continued in both groups, but Group B consistently exhibited superior clinical outcomes.Specifically, PI reduced to 0 in both groups at three months, but reductions at earlier time points were significantly greater in Group B. Similarly, GI scores were lower in Group B at both one and three months, although the difference at three months was not statistically significant. PPD and CAL showed highly significant reductions in Group B at both one and three months compared to Group A. Repeated measures ANOVA and Post Hoc tests confirmed these intra-group improvements were statistically significant over time.Overall, the results indicate that diode laser therapy as an adjunct to SRP enhances periodontal

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healing more effectively than SRP alone in patients with chronic generalized periodontitis (Table 1-4)

Table 1: Comparison of plaque index between the groups at different time interval

	Group	N	Mean	Std. deviation	T value	P value
Baseline	A	10	1.25	0.25	0.590	0.559
	B	10	1.30	0.22		
One month		10	0.50	0.22	2.64	0.012
	B	10	0.27	0.31		
Three month	A	10	0.00	0.00		
	B	10	0.00	0.00		

Table 2: Comparison of Gingival Index between the groups at different time intervals

	Group	N	Mean	Std. deviation	T value	P value
Baseline	A	10	1.87	0.33	1.21	0.23
	B	10	1.73	0.36		
One month		10	1.15	0.45	2.36	0.023
	B	10	0.76	0.57		
Three month	A	10	0.11	0.38	0.67	0.500
	B	10	0.06	0.27		

Table 3: Comparison of pocket probing depth between the groups at different time intervals

	Group	N	Mean	Std. deviation	T value	P value
Baseline	A	10	5.39	0.29	1.66	0.104
	B	10	5.51	0.1		
One month		10	3.31	0.37	3.28	0.02
	B	10	2.63	0.84		
Three month	A	10	1.81	0.45	3.99	0.001
	B	10	1.23	0.46		

Table 4: Comparison of Clinical Attachment Loss between the groups at different time intervals

	Group	N	Mean	Std. deviation	T value	P value
Baseline	A	10	5.72	0.35	1.01	0.317
	B	10	5.84	0.36		
One month		10	3.52	0.59	3.52	0.001
	B	10	2.72	0.82		
Three month	A	10	1.99	0.55	3.70	0.001
	B	10	1.32	0.59		

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Discussion

This study evaluated the efficacy of soft tissue diode laser as an adjunct to scaling and roots planing (SRP) in the management of chronic generalized periodontitis. Both treatment groups showed significant improvements in clinical parameters—Plaque Index (PI), Gingival Index (GI), Probing Pocket Depth (PPD), and Clinical Attachment Level (CAL) - at 1and 3 months post-treatment. However, the group receiving adjunctive laser therapy demonstrated slightly greater reductions in PPD and more gain in CAL than the SRP-only group. These findings are in agreement with studies by Moritz et al[5], Kreisler et al[6], Romeo et al[7], Tomasi et al[8],and Birang et al[9], which reported enhanced clinical outcomes with diode laser use. The bactericidal and detoxifying properties of the diode laser, along with its ability to access difficult anatomical areas, may explain the additional benefits. Laser therapy also appears to support faster healing through enhanced fibroblast activity and collagen formation. Nevertheless, the differences between the two groups were modest, and some studies have found no statistically significant advantage with laser use. Variability in laser parameters and techniques may account for the inconsistencies in results across studies. Further long-term randomized controlled trials with larger populations and standardized protocols are needed to determine the full potential of diode lasers in periodontal therapy.

Conclusion

This study demonstrated that the adjunctive use of soft tissue diode laser with scaling and root planing (SRP) leads to greater clinical improvements in managing chronic generalized periodontitis. Significant reductions in probing pocket depth (PPD) and improvements in clinical attachment level (CAL) were observed in the laser-treated group compared to SRP alone. However, no notable differences were found in plaque index (PI) and gingival index (GI) between the two groups. These findings support the potential of diode lasers as a beneficial adjunct to nonsurgical periodontal therapy. Further research is recommended to confirm these results in larger, long-term clinical trials.

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