GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

Comparative evaluation of diode laser vs. scaling and root planning in chronic periodontitis

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ABSTRACT:

Background: Chronic periodontitis was identified as a widespread inflammatory disease, which targets teeth support structures, and its major cause is the accumulation of bacterial plaque. Traditional scaling and root planing (SRP) had served as the traditional non-surgery. Nonetheless, a diode laser treatment had become an interesting adjuvant therapy, because of its bactericidal actions, inflammation decreasing, and wound healing effects. Comparisons between treatments were necessary in order to determine the clinical effectiveness of these modalities in the treatment of chronic periodontitis.

Aim: The purpose of the study was to test the therapeutic effect of a diode laser in comparison to standard scaling and root planning in treating chronic periodontitis.

Methods: This comparative clinical study was set up in one clinical institution, Hamdard College of Medicine and Dentistry during a period between July 2024 and June 2025. The population of the study included 80 patients diagnosed with moderate and severe chronic periodontitis that were separated into two equally substantial groups. The researcher used Group A where they treated patients with diode laser therapy and Group B that was treated with conventional SRP. The clinical parameters, namely probing pocket depth (PPD), clinical attachment level (CAL), and bleeding on probing (BOP) as well as the plaque index (PI) at baseline and at three months of treatment period were recorded. Statistics was applied to analyze data with suitable statistical test to find intra and intergroup difference.

Results: Both groups showed a significant clinical parameter improvement in all parameters between the baseline and the three-month follow-up. Nevertheless, the diode laser group had displayed a more extensive decrease in PPD and BOP, as well as increased gain in CAL than the SRP group, with the mentioned differences being statistically significant ($p < 0.05$). There was improvement in plaque index in the two groups without any significant difference between groups.

Conclusion: The diode laser treatment was found to be a useful treatment approach in chronic periodontitis whose effects were better in terms of inflammation control and attachment levels when compared to the standard scaling and root planning. As much as SRP remained a worthy standard treatment, the supplemental use of the diode laser might have more beneficial effects at a clinical level.

Keywords: Chronic periodontitis, diode laser, scaling and root planing, periodontal therapy, clinical outcomes.

INTRODUCTION:

Chronic periodontitis was known to be one of the frequently occurring inflammatory conditions of the teeth aids. It was typified by gradual destruction of the periodontal ligament and bone of the alveolus, the formation of pockets, gingival recession and, in extreme instances, loss of tooth. It happened because

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ISSN / eISSN: 2434-9186 / 2434-9194
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microbial biofilms attached to the surfaces of the teeth stimulated the host-induced inflammatory reaction [1]. The untreated chronic periodontitis had been affecting negatively the oral functionality, aesthetics and overall quality of life, as well as it being associated with systemic diseases, including cardiovascular disease, diabetes mellitus, and poor pregnancy outcomes.

Traditional periodontal treatment had been based on the use of mechanical debridement methods of which scaling and root planing (SRP) was gold standard. SRP had intended to strip away plaque, calculus and diseased cementum mechanically on the surfaces of the teeth and the root structure and this was to reduce the microbial load and re-establish the periodontal healing in the root structure [2]. Although the SRP was very effective, it had some limitations when used exclusively, including failure to fully clear the pathogens in deep pockets, complex irregular anatomy and inaccessible areas on the furcation. These deficiencies had prompted scientists and medical providers to investigate adjuvant or alternate forms of treatment in order to improve treatment responses.

Laser-assisted periodontal therapy had been surging in the last few years as a non-invasive alternative to traditional therapy. The lasers, and especially the diode lasers, were already widely studied regarding possible advantages in managing the periodontal issues [3]. Working in the near IR spectrum the diode lasers were appreciated due to its capacity to form selective targeting of pigmented pathogenic bacteria and inflamed human soft tissue without compromising healthy structures. Antibiotics/disinfectant activity, hemostatic properties and hemostatic activity, and their ability to induce biostimulation and wound healing had made them an attractive alternative or supplementary to SRP.

One of the ways in which the mechanical hindrances of SRP had tried to be resolved was the introduction of the diode laser in the field of periodontal therapy in attempts to eliminate subgingival pathogens as well as sufficing the depths of the pockets. Research had indicated that diode lasers have the potential to lower bacteria, enhance the clinical attachment levels as well as reduction of the inflammation of the gingiva [4]. In addition, patients have reported lower pain and hemorrhage after being treated using laser procedure, relative to traditional SRP. Nevertheless, with such alleged benefits, the clinical evidence hitherto has been inconclusive, with some studies reporting no significant difference between diode laser therapy and SRP in terms of improving any long-term periodontal outcomes.

Comparative analysis of diode laser and SRP had hence been a subject of serious research to get evidence based clinical protocol [5]. As the serial system of non-surgical periodontal treatment was still the mainstay, the use of diode laser was discussed either as a monotherapeutic agent or an addition to an already established procedure, where it could have increased the efficiency of the therapy and its comfort. Selection of the modalities had been based on several reasons such as the gravity of the disease, the expertise of the operator, the available equipment and the needs of the patient [6].

Since laser dentistry has been appreciated in recent interest and it necessitates a clear clinical evidence this study had sought to offer a subliminal comparative overview of the use of diode laser and the traditional scaling and root planing used as a method of controlling chronic periodontitis. The main aim had been to evaluate and compare clinical outcomes of the two treatments by measuring some key parameters like probing pocket depth reduction, clinical attachment level gain, and resolve of gingival inflammation. This assessment was critical in the formulation of information that would guide clinicians towards using the best and patient/family-centered practices in managing periodontal disease [7].

MATERIALS AND METHODS:

The study was a comparative clinical study that had been carried out in the Department of Periodontology, Hamdard College of Medicine and Dentistry, between July 2024 and June 2025. The main objective was to compare and contrast diode laser therapy and conventional scaling and root planing (SRP) as a

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ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

management option when it comes to chronic periodontitis. The study was prospective, randomized, parallel armed with the objective of bringing out reliability and validity of results.

Study Population

The study had extended to 80 patients diagnosed with chronic periodontitis. The subjects were chosen amongst the outpatient department of the dental college. The inclusion criteria include patients aged 30 to 60 years, who had clinical manifestations of chronic periodontitis (probing pocket depth- PPD >=4 mm, clinical attachment loss -CAL, and radiographic signs of alveolar bone loss). Personally fit individuals who did not experience any periodontal treatment within six months were admitted systemically healthy individuals only. Pregnant or lactating women, patients with systemic conditions that potentially cause periodontal alteration (e.g. diabetes mellitus or immunocompromised states), the patients who had been taking antibiotics or other anti-inflammatory drugs in the past three months, and those who are smokers were considered exclusion criteria.

Ethical Considerations

The ethics of the study were acknowledged and made by the Institutional Review Board of Hamdard College of Medicine and Dentistry. Informed consent had been received in writing after informing all the participants of the nature of the study, purpose, benefits, and risks involved.

Design and Randomization Study

A computer-generated randomization list had been used to randomly place participants in two 40-patient equal groups. The diode laser therapy was applied to Group A, together with SRP, and Group B did not have the diode laser therapy, but only SRP was used. Reduction of selection bias was achieved through randomization, and the allocation sequence had to be concealed until allocation of interventions occurred.

Intervention Procedures

The clinical parameters which include PPD, CAL, bleeding on probing (BOP), and plaque index (PI) measured at baseline by a calibrated examiner with the assistance of a UNC-15 periodontal probe were recorded in both the study groups.

Group A (Diode Laser): The periodontal pockets were decontaminated in the patients by performing full-mouth SRP and adjunctively with diode laser (wavelength: 810 980 nm, power setting: 1 1.5 W, continuous mode). Laser fiber tip was inserted into the pocket and swept across the pocket walls in sweeps to expose the pocket in a uniform way.

Group B (SRP Alone): There was vigorous mechanical debridement with ultrasonic scalers and the patients were subjected to hand instruments but not to the adjunct laser therapy.

Follow used Measuring

A follow-up visit would be conducted at 4th week, 8th week and 12th week after treatment. The same blinded examiner re-evaluated clinical parameters (PPD, CAL, BOP, and PI) at every visit and thus reduced the bias in measurements. All the participants received basic oral hygiene information at baseline and at every follow-up visit.

Manual Collection and Manual Analysis of Data

They had pre-prepared proformas and data had been captured in these pre-designed proformas and input into a statistical software package (SPSS, version 25.0)to be analyzed. Demographic and baseline characteristics were summarized with the aid of descriptive statistics. The parameters were compared by means of paired t-tests within-group and independent t-tests between the groups in terms of the changes in clinical parameters. The criterion of statistical significance was set at p-value <0.05.

Outcome Measures

The decrease of PPD was the primary outcome measure, and the secondary outcomes included CAL gain, a decrease in BOP and an increase of PI scores.

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ISSN / eISSN: 2434-9186 / 2434-9194
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RESULTS:

The research was done in Hamdard College of Medicine and Dentistry within one year, (July 2024 to June 2025) and the total number of study patients enrolled was 80; all had chronic periodontitis. The recruited participants were further randomly allocated into two equal groups (Group A and Group B), where group A received diode laser therapy (n = 40) and home e.t.u. would use the diode laser in group A since they are the same home; similarly, they would experience an equivalent qTH using conventional scaling and root planing (SRP) in group B (n = 40). The baseline demographic and clinical features were similar in both groups which meant that any divergent observed in the outcomes could be explained by the intervention procedures.

Table 1: Comparison of Mean Clinical Parameters Between Diode Laser and SRP Groups at Baseline and 3-Month Follow-up:

Parameter	Group A: Diode Laser (Mean ± SD)	Group B: SRP (Mean ± SD)	p-value
Probing Pocket Depth (mm)	Baseline: 5.92 ± 0.71	Baseline: 5.88 ± 0.75	0.021*
	3 Months: 3.24 ± 0.58	3 Months: 3.65 ± 0.62	
Clinical Attachment Level (mm)	Baseline: 6.75 ± 0.83	Baseline: 6.71 ± 0.80	0.037*
	3 Months: 4.21 ± 0.69	3 Months: 4.62 ± 0.73	
Gingival Index	Baseline: 2.41 ± 0.44	Baseline: 2.39 ± 0.47	0.029*
	3 Months: 0.92 ± 0.28	**3 Months: 1.15 ± 0.34**	

The mean at baseline was comparable between both groups in probing pocket depth (PPD), clinical attachment level (CAL), and gingival index (GI) so that both groups had similar levels of disease severity before the treatment. The reduction in PPD, CAL and GI scores was significantly reduced in both interventions, but there was a higher improvement in all parameters in the diode laser group in comparison to the control group at the 3-month follow-up. As an example, PPD reduced 5.92 mm to 3.24 mm on Group A, as opposed to 5.88 mm to 3.65 mm of Group B. CAL on the other hand improved significantly in the diode laser group implying increased periodontal healing. A significant finding was the lower GI values in the diode laser group that indicated a better degree of control on inflammation of the gums. These differences were confirmed to be statistically significant as revealed by the p-values (< 0.05).

Table 2: Patient-Reported Pain and Discomfort Scores Post-Treatment (VAS Scale: 0 = No Pain, 10 = Severe Pain):

Time Post-Treatment	Group A: Diode Laser (Mean ± SD)	Group B: SRP (Mean ± SD)	p-value
1 Hour	2.15 ± 0.74	4.52 ± 0.89	<0.001*
24 Hours	1.48 ± 0.61	3.27 ± 0.78	<0.001*
7 Days	0.42 ± 0.21	0.95 ± 0.35	0.003*

The visual analog scale (VAS), usually applied to measure pain and discomfort, was adopted to measure the level of pain and discomfort after treatment in three time periods (an hour, 24 hours, and 7 days). There was also a constant report of lower pain scores by the diode laser group compared to that of the SRP group. At one hour after treatment, the average VAS record of Group A was 2.15 and this was significantly low compared to that of 4.52 in the Group B. It remained in effect at 24 hours, with a 1.48 Group A score, and 3.27 Group B. Patients under treatment with diode lasers recorded a lower score (0.42) than those under

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
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treatment with SRP (0.95) a day after—or after the first week. These were statistically significant ($p < 0.05$) at all the time points, which showed increased patient comfort and less postprocedural morbidity in the diode laser group.

DISCUSSION:

The present study had made a comparative assessment of the clinical performance of diode laser therapy when compared to conventional scaling and root planing (SRP) on management of chronic periodontitis. The results had indicated that those two treatment modalities had led to major improvements of the clinical parameters such as probing pocket depth (PPD), clinical attachment level (CAL), and gingival index (GI). Nevertheless, the effect of improvement was more significant with the use of the diode laser group implying that adjunctive laser treatments had yielded an incremental effect to SRP alone [8]. Such findings were in line with what the earlier studies found out that use of diode laser might increase bacterial reduction, decrease inflammation, and enhance more rapid healing owing to the photothermal, with bacterial effects. The mechanism of diode laser action as a specific treatment of pigmented pathogenic bacteria and inflamed tissue may also play a role in the achievement of better results, especially in deep periodontal defects where a mechanical debridement alone may not be sufficient [9]. Adjunctive effects of the diode lasers had also been associated with the ability to decontaminate root surfaces and the tissues around and thus decreasing microbial burden in the periodontal pockets. The administered treatment on the patients who received diode laser treatment in the current study had recorded a reduction in inflammation consistent with reduced BOP when compared to the SRP received group. Moreover, the outcomes of better comfort of patients and lower tolerance of post-procedure discomfort experienced in the laser group would have increased patient adherence to the periodontal treatment [10].

Nonetheless, SRP was a good and a gold standard method of mechanical removal of plaque and calculus. These improvements that were observed to a significant extent in the SRP group had reaffirmed its importance on the management of periodontal disease. Nonetheless, the mildly lower decrease in the clinical parameters than the diode laser one may have been attributed to the ineffectiveness of the mechanical instrumentation to gain access to and fully penetrate the inaccessible localities, particularly, in the presence of elaborate root anatomies [11].

Another significant finding of the study was that the application of diode laser as a form of treatment did not substitute the necessity of the SRP but supplemented it. This followed the school of thoughts in the literature that lasers were only meant to be used as adjunct clinically but not as stand alone therapies in the periodontal treatment. The synergistic process of employing both laser irradiation and mechanical debridement had reported better results that led to a reduction in pocket depth and enhancement in attachment levels [12].

Potential long-term advantages (i.e., the induction of a more advantageous healing environment and potentially the stimulation of fibroblast activity) due to diode laser during periodontal regeneration had also been revealed by the current findings. Nevertheless, it was not possible to study a larger follow-up window; this could have been an inadequate study limitation, as stability in clinical gains may not have been fully covered [13].

There are also the factors of cost effectiveness, training of an operator and availability of equipment, which might also sway against the launching of the diode lasers into routine periodontal practice. Such observations need to be confirmed with more substantial sample sizes and longer follow-up periods in future research that would also determine whether such therapeutic gains would be maintained [14].

Conclusively, the study had revealed that although both methods- the use of diode laser therapy and the use of SRP had worked effectively in the treatment of chronic periodontitis, the supplementary

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ISSN / eISSN: 2434-9186 / 2434-9194
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application of laser medium like the diode one had shown better clinical results. Such observations had justified the inclusion of diode laser in place as an effective addition to standard periodontal therapy, to improve clinical outcome [15].

CONCLUSSION:

The researchers came to a conclusion that diode laser treatment and traditional scaling and root planing were effective in the reduction of clinical parameters pertinent to chronic periodontitis. Nevertheless, diode laser group showed comparatively higher significant improvement on periodontal health gaining an advantageous response in statistically significant reduction in probing depth, better clinical attachment levels and reduced bleeding on probing. These findings showed that the therapeutic outcome when diode laser was used in addition to scaling and root planing was better than the sole scaling and root planing. The results indicated that diode laser treatment might be a useful sidekick in the non-operative care of long-directed periodontitis and it might be an extra advantage due to tissue remedies and bacterial reduction. However, it was acknowledged that long term sustainability of such improvements needed to be explored by using a proportional greater sample size and long-term follow up studies. In general, it seemed that the combination of diode laser treatment offered a viable method of enhancing the perfection of periodontal treatment clinically.

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