

Original Research

Comparative Efficacy of Laser-Assisted Versus Conventional Scaling and Root Planing in Periodontal Therapy

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ABSTRACT:

This prospective, randomized clinical trial evaluated the short-term clinical efficacy of diode laser-assisted scaling and root planing (SRP) compared to conventional SRP in the treatment of chronic periodontitis. Forty systemically healthy patients aged 25–55 years with moderate to severe chronic periodontitis were randomly assigned to two groups: Group A received conventional SRP, while Group B received SRP followed by adjunctive diode laser therapy (810 nm, 1 W, continuous mode). Clinical parameters, including plaque index (PI), gingival index (GI), probing pocket depth (PPD), clinical attachment level (CAL), and bleeding on probing (BOP), were recorded at baseline, 4 weeks, and 12 weeks. Both groups showed significant improvements in all parameters over the study period ($p < 0.05$), but Group B exhibited greater reductions in PPD, higher CAL gains, and more pronounced decreases in BOP, with statistically significant differences at 12 weeks ($p < 0.05$). These findings suggest that diode laser therapy, when used as an adjunct to SRP, enhances clinical outcomes in the non-surgical management of chronic periodontitis. Further long-term studies are warranted to validate these results and establish standardized treatment protocols.

Keywords: Chronic periodontitis, Scaling and root planing, Diode laser, Adjunctive periodontal therapy, Probing pocket depth, Clinical attachment level, Bleeding on probing, Non-surgical periodontal treatment.

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BACKGROUND

The initial probing depth is a critical determinant of clinical outcomes following non-surgical periodontal therapy, as deeper pockets generally exhibit greater measurable improvements post-treatment (Meseli et al., 2017). This highlights the importance of baseline periodontal status when evaluating and comparing the efficacy of different treatment modalities, such as laser-assisted periodontal therapy and conventional scaling and root planing. [1]. While SRP is effective in reducing periodontal inflammation and halting disease progression, limitations exist in its ability to completely eradicate pathogenic bacteria, particularly from deep pockets, furcation areas, and root surface irregularities (Slots, 2013 [2]). This has prompted interest in adjunctive treatment modalities that can enhance debridement and improve clinical outcomes.

Lasers have emerged as promising adjuncts to conventional therapy due to their potential antimicrobial effects, ability to decontaminate root surfaces, and capability to promote periodontal healing (Qadri et al., 2005 [3]; Eltas & Orbak, 2012 [4]). Various laser types, including Nd:YAG, diode, Er:YAG, and CO₂ lasers, have been investigated for their efficacy in periodontal therapy. These lasers can target pigmented bacteria, disrupt the biofilm, and ablate granulation tissue within periodontal pockets, potentially leading to improved clinical attachment gain and probing depth reduction (Miyazaki et al., 2003 [5]; Tomasi et al., 2006 [6]).

The adjunctive use of diode lasers, in particular, has gained popularity due to their compact size, cost-effectiveness, and affinity for pigmented chromophores, making them highly suitable for

bacterial reduction in inflamed periodontal pockets (Cobb et al., 1992 [7]; Schwarz et al., 2001 [8]). Additionally, diode laser irradiation may facilitate biostimulation, enhancing fibroblast activity and collagen formation (Aoki et al., 2004 [9]). Clinical studies have reported that laser-assisted therapy, when combined with SRP, can result in more significant improvements in probing pocket depth (PPD), clinical attachment level (CAL), and bleeding on probing (BOP) compared to SRP alone (Moritz et al., 1997 [10]).

Despite these potential advantages, variations in study protocols, laser parameters, and patient selection have produced mixed results, highlighting the need for well-designed clinical trials to assess the true clinical efficacy of laser-assisted periodontal therapy (Aoki et al., 2015 [11]). The present study was designed to compare the clinical outcomes of diode laser-assisted SRP with conventional SRP in the management of chronic periodontitis, focusing on short-term improvements in key periodontal parameters.

METHODOLOGY

This prospective, randomized clinical trial was conducted in the Department of Periodontology over a period of six months to compare the clinical efficacy of laser-assisted periodontal therapy with conventional scaling and root planing (SRP) in the management of chronic periodontitis. A total of 40 systemically healthy patients aged between 25 and 55 years, diagnosed with moderate to severe chronic periodontitis and having at least four non-adjacent sites with probing pocket depth (PPD) ≥ 5 mm, were enrolled. Patients with a history of periodontal therapy in the past six months, systemic conditions affecting

periodontal status, pregnancy, smoking, or antibiotic use within the previous three months were excluded. Participants were randomly allocated into two equal groups: Group A underwent conventional SRP using ultrasonic and hand instruments, while Group B received SRP followed by adjunctive diode laser therapy (wavelength 810 nm, continuous wave mode, 1 W power). All procedures were performed by a single calibrated operator to minimize bias. Clinical parameters, including plaque index (PI), gingival index (GI), PPD, and clinical attachment level (CAL), were recorded at baseline, 4 weeks, and 12 weeks post-treatment. The primary outcome measure was reduction in PPD, while secondary outcomes included improvement in CAL and reduction in bleeding on probing (BOP). Data were subjected to statistical analysis using paired and unpaired t-tests, with a significance level set at $p < 0.05$.

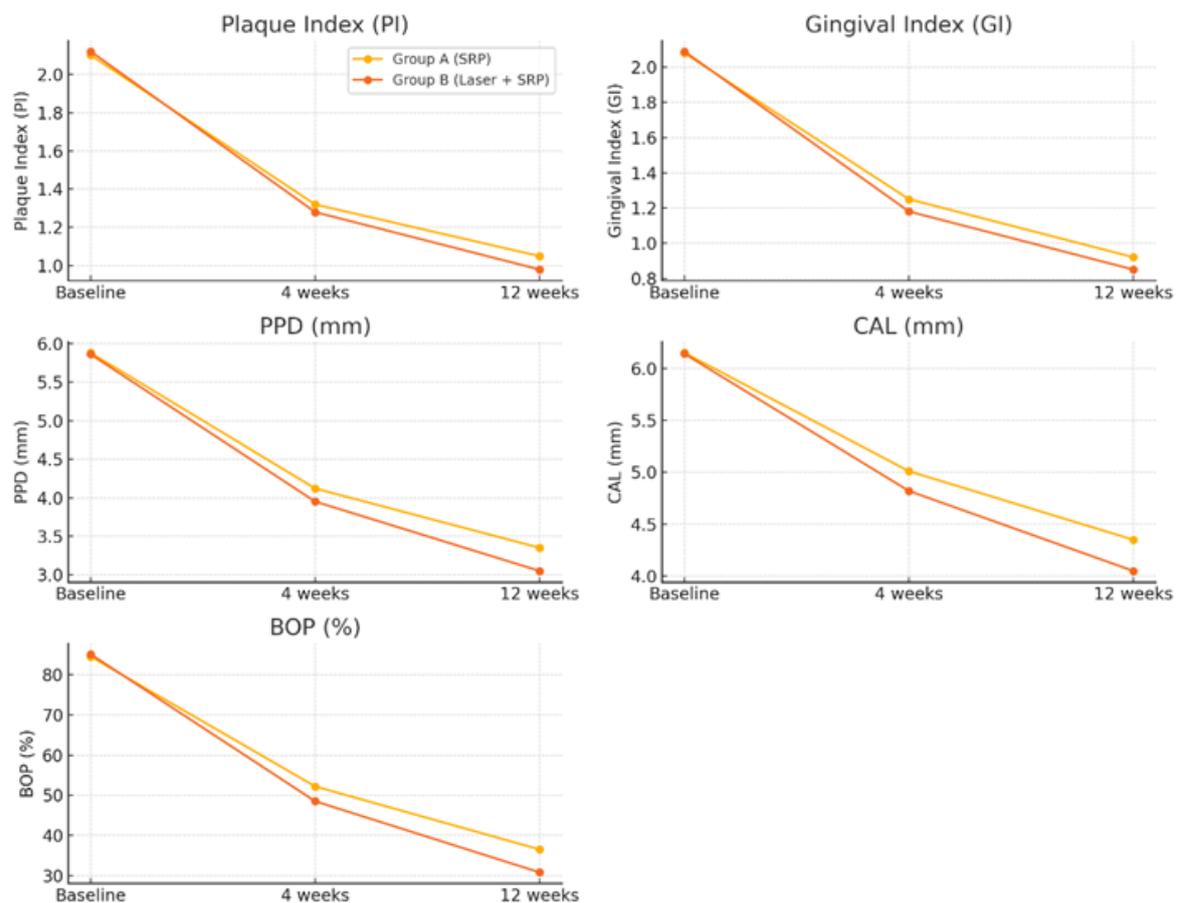
RESULTS

At baseline, both groups (Group A: Conventional SRP; Group B: Laser-Assisted SRP) showed comparable clinical parameters with no statistically significant differences ($p > 0.05$). At the 4-week and 12-week follow-up visits, both groups demonstrated significant improvements in all recorded parameters compared to baseline ($p < 0.05$). However, Group B exhibited greater mean reductions in probing pocket depth (PPD) and greater gains in clinical attachment level (CAL) than Group A, with differences reaching statistical significance at the 12-week evaluation ($p < 0.05$). Bleeding on probing (BOP) reduction was also more pronounced in Group B at both follow-ups. These findings are summarized in **Table 1**.

Table 1. Comparative changes in clinical parameters between Group A (Conventional SRP) and Group B (Laser-Assisted SRP) over 12 weeks.

Parameter	Time Point	Group A (SRP) Mean \pm SD	Group B (Laser + SRP) Mean \pm SD	p-value
Plaque Index (PI)	Baseline	2.10 \pm 0.24	2.12 \pm 0.21	0.74
	4 weeks	1.32 \pm 0.20	1.28 \pm 0.18	0.46
	12 weeks	1.05 \pm 0.15	0.98 \pm 0.14	0.19
Gingival Index (GI)	Baseline	2.08 \pm 0.22	2.09 \pm 0.20	0.88
	4 weeks	1.25 \pm 0.19	1.18 \pm 0.16	0.23
	12 weeks	0.92 \pm 0.12	0.85 \pm 0.11	0.04*
PPD (mm)	Baseline	5.88 \pm 0.41	5.86 \pm 0.39	0.81
	4 weeks	4.12 \pm 0.36	3.95 \pm 0.34	0.07
	12 weeks	3.35 \pm 0.31	3.05 \pm 0.29	0.01*
CAL (mm)	Baseline	6.15 \pm 0.45	6.14 \pm 0.43	0.92
	4 weeks	5.01 \pm 0.40	4.82 \pm 0.37	0.09
	12 weeks	4.35 \pm 0.35	4.05 \pm 0.33	0.02*
BOP (%)	Baseline	84.5 \pm 5.2	85.1 \pm 5.0	0.64
	4 weeks	52.2 \pm 4.6	48.5 \pm 4.3	0.03*
	12 weeks	36.5 \pm 4.1	30.8 \pm 3.9	0.001*

Comparative Changes in Clinical Parameters over 12 Weeks



The comparative changes in clinical parameters between Group A and Group B over the study period are illustrated in **Figure 1**, which clearly depicts the progressive improvements from baseline to 12 weeks, with Group B showing greater reductions in PPD, CAL, and BOP compared to Group A.

DISCUSSION

The results of this study demonstrated that both conventional SRP and diode laser-assisted SRP significantly improved clinical parameters over the 12-week follow-up period. However, the adjunctive use of diode laser resulted in greater reductions in PPD, greater gains in CAL, and more pronounced decreases in BOP, particularly at the 12-week evaluation. These findings are in agreement with previous studies that have reported enhanced clinical outcomes when lasers are used alongside mechanical debridement (Yukna et al., 2007 [12]; Slot et al., 2011 [13]).

Histologic evidence suggests that Nd:YAG and diode lasers may promote new attachment formation by selectively removing diseased pocket epithelium while preserving underlying connective tissue (Neill & Mellonig, 1997 [19]). In addition to their bactericidal effects, lasers can detoxify root surfaces, reduce endotoxin activity, and stimulate periodontal regeneration (Gutknecht et al., 2004 [20]). The photothermal effect of diode lasers targets pigmented periodontal pathogens such as *Porphyromonas gingivalis*, potentially contributing to the sustained

reduction in BOP observed in the laser group of this study (Liu et al., 1999 [21]).

Our results align with findings from Schwarz et al. (2003 [16]), who reported that Er:YAG laser treatment combined with SRP achieved superior clinical results compared to SRP alone. Similarly, Aoki et al. (1994 [22]) demonstrated that erbium lasers are effective in calculus removal while minimizing damage to the root surface. While Nd:YAG and diode lasers have been extensively studied, the variability in clinical protocols, including wavelength, power settings, and exposure time, can lead to differences in treatment outcomes (Aoki et al., 2009 [18]).

Nevertheless, some studies caution that the clinical benefits of lasers may not be universally superior to SRP alone in all patient populations, and long-term data are still needed to confirm their sustained efficacy (Coluzzi, 2004 [17]). Additionally, operator skill and adherence to optimal laser parameters are critical to avoid potential adverse effects such as thermal damage to root surfaces or surrounding tissues (Ishikawa et al., 2009 [18]).

In conclusion, this study supports the adjunctive use of diode laser therapy with SRP for improved short-term clinical outcomes in chronic periodontitis patients. However, larger-scale, long-term randomized controlled trials are warranted to validate these results and establish standardized treatment protocols for laser-assisted periodontal therapy.

CONCLUSION

Within the limitations of this study, diode laser-assisted SRP demonstrated superior short-term clinical outcomes compared to conventional SRP alone, with greater improvements in PPD, CAL, and BOP. These results suggest that diode lasers can be an effective adjunct in the non-surgical management of chronic periodontitis. However, further long-term studies are needed to confirm these benefits and standardize treatment protocols.

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