Comparative Efficacy of Nd:YAG, Er,Cr:YSGG Lasers vs SRP for Periodontal Pocket Reduction in Rajasthan

[1*] Dr. Jyoti Bhati, [2] Dr. Jitender Sharma, [3] Dr. Sweta Soni, [4] Dr. Pravesh Gautam, [5] Dr. Rushikesh Phunde, [6] Dr. Saumya Mishra

[1*]3rd year Post graduate in the Department of Periodontology and Implantology, Vyas Dental College, Jodhpur (Raj). Email: drjyotibhati828@gmail.com

[2]Professor and Head of Department of Periodontology and Implantology, Vyas Dental College, Jodhpur (Raj). Email: jeetusharma2@yahoo.com

[3]Professor in the Department of Periodontics And Implantology, Vyas Dental College, Jodhpur (Raj). Email: swetasonidr@gmail.com

[4]MDS in Periodontics And Implantology, Jodhpur (Raj). Email: dr.gautam165@gmail.com

[5]2nd year Post graduate in the Department of Periodontics And Implantology, Vyas Dental College and Hospital, Jodhpur (Raj). Email: rushikeshphunde41@gmail.com

[6]1st year Post graduate Department of Periodontics And Implantology, Vyas Dental College and Hospital, Jodhpur (Raj). Email: academywings42@gmail.com

**Corresponding Author: Dr. Jyoti Bhati (MDS in Periodontology & Implantology)*

ABSTRACT

As we know that from past studies, laser treatment over SRP has the superior ability to kill the bacterial, reduced recolonization, and 1.2-2.2 mm greater long-term closure despite SRP's established 2.5-3.5 mm gain. Thus, in this study we have decided to compare & assess the pocket depth reduction post-operatively with Nd:YAG as group1, Er,Cr:YSGG as group 2 and SRP as group 3 in total of 15 patients. They were further equally divided in each group and were recalled after 1 week, 1month, 6month and 1 year respectively. We have found that, both lasers demonstrated superior reductions versus SRP (Nd:YAG: 4.6±0.4 mm; Er,Cr:YSGG: 4.4±0.3 mm; SRP: 3.4±0.6 mm at 1 year; $p<0.001$), achieving final pockets of 1.4-1.6 mm versus 2.6 mm. Laser superiority was evident from week 1 ($p=0.02$-0.04), with no significant differences between laser group respectively. Therefore, we have come to conclude that, Nd:YAG and Er,Cr:YSGG lasers provide significantly enhanced long-term pocket closure compared to conventional SRP in moderate periodontitis.

Keywords: Nd:YAG, Er,Cr:YSGG**,** SRP, Pocket Depth, Periodontitis

How to cite this article: Bhati J, Sharma J, Soni S, Gautam P, Phunde R, Mishra S. Comparative Efficacy of Nd:YAG, Er,Cr:YSGG Lasers vs SRP for Periodontal Pocket Reduction in Rajasthan. Int J Drug Deliv Technol. 2026;16(10s): 770-773; DOI: 10.25258/ijddt.16.10s.90

INTRODUCTION

Periodontitis remains a major global health concern, affecting approximately 50% of adults worldwide and serving as the primary cause of tooth loss in adults.[1] Moderate chronic periodontitis, characterized by probing pocket depths of 4-6 mm, represents a pivotal stage where non-surgical periodontal therapy can effectively halt disease progression and achieve clinically significant pocket closure.[2] Conventional scaling and root planing (SRP) using ultrasonic and hand instruments constitutes the cornerstone of treatment, reliably reducing pocket depths by 2.5-3.5 mm while addressing subgingival biofilm and calculus.[3] However, persistent residual pockets (>4 mm), microbial recolonization, and incomplete root detoxification often compromise long-term stability, particularly in high-risk populations with poor oral hygiene compliance.[4] Laser-assisted periodontal therapy has gained traction as a promising adjunct, leveraging distinct photothermal and photomechanical properties to enhance clinical outcomes.[5] Nd:YAG lasers (1064 nm) excel in deep tissue penetration and bactericidal effects through lasing chromophores in black-pigmented bacteria, while Er,Cr:YSGG lasers (2790 nm) provide precise hard/soft tissue ablation with minimal thermal damage via water-mediated hydrokinetic energy.[6] Systematic reviews indicate lasers augment SRP gains by 0.5-1.2 mm,[7] yet head-to-head comparisons between these wavelengths versus conventional SRP remain scarce, particularly in Indian cohorts where aggressive periodontal pathogens and limited access to advanced technology prevail.

This study addresses the critical need for direct comparative evidence on Nd:YAG laser, Er,Cr:YSGG laser, and conventional SRP efficacy for moderate pocket reduction in Jodhpur, Rajasthan patients, aiming to establish clinically relevant superiority

thresholds and guide evidence-based laser integration into resource-constrained periodontal practice.

AIM

To compare the efficacy of Nd:YAG laser, Er,Cr:YSGG laser, and conventional SRP in reducing periodontal pocket depths up to 6 mm over 1 year.

MATERIAL AND METHODS

We have conducted a prospective randomized controlled trial in the Department of Periodontology and Oral Implantology at Vyas Dental College, Jodhpur, Rajasthan. 15 patients with baseline pocket depths of 6 mm were equally allocated to three groups of five each i.e. group 1 received Nd:YAG laser irradiation, group 2 underwent Er,Cr:YSGG laser debridemend and group 3 received conventional SRP alone using ultrasonic instruments under local anesthesia as needed. All patients received oral hygiene instructions and were recalled at 1 week, 1 month, 6 months, and 1 year for post perative pocket depth reduction.

INCLUSION CRITERIA

1. 30-60 year
2. Moderate chronic periodontitis
3. At least 4-6 sites per quadrant with probing depth ≤6 mm
4. Systemically healthy
5. No periodontal treatment in past 6 month
6. Good oral hygiene compliance

EXCLUSION CRITERIA

1. Systemic diseases (e.g., diabetes, rheumatoid arthritis) affecting periodontium.
2. Smoking
3. Pregnant lady
4. Lactating lady
5. Antibiotics/anti-inflammatories in past 3-6 months.
6. Pockets >6 mm or <4 mm
7. inability to attend follow-ups

STATSTICAL ANALYSIS

Data were analyzed using one-way repeated measures ANOVA to compare pocket depth changes across time points and groups, accounting for within-subject correlations, followed by post-hoc tests (e.g., Bonferroni) for inter-group differences. Non-parametric Friedman test was applied if assumptions violated; $p<0.05$ significant.

RESULT

FOLLOW-UP	Nd:YAG	Er,Cr:YSGG	SRP
1WEEK	2.2 ± 0.4 mm (p<0.001)	2.0 ± 0.5 mm (p<0.001)	1.6 ± 0.3 mm (p=0.002)
1 MONTH	3.4 ± 0.5 mm (p<0.001)	3.2 ± 0.4 mm (p<0.001)	2.4 ± 0.6 mm (p<0.001)
6 MONTH	4.2 ± 0.3 mm (p<0.001)	4.0 ± 0.4 mm (p<0.001)	3.0 ± 0.5 mm (p<0.001)
1 YEAR	4.6 ± 0.4 mm (p<0.001)	4.4 ± 0.3 mm (p<0.001)	3.4 ± 0.6 mm (p<0.001)

TABLE 1 : INTRA GROUP COMPARISON

Table 1 illustrates highly significant intra-group pocket depth reductions from baseline 6 mm across all treatments ($p<0.001$ except SRP 1 week $p=0.002$), confirming efficacy of Nd:YAG laser (4.6±0.4 mm at 1 year), Er,Cr:YSGG laser (4.4±0.3 mm), and SRP (3.4±0.6 mm). Lasers demonstrated superior early healing (2.0-2.2 mm at 1 week vs 1.6 mm SRP) and sustained closure (~75% reduction vs 57% SRP), achieving clinically successful residual pockets <3 mm.

COMPARISON	1 WEEK	1 MONTH	6 MONTH	1 YEAR
G1 vs G2	F=0.8, p=0.45	F=1.2, p=0.31	F=1.5, p=0.25	F=1.1, p=0.35
G1 vs G3	F=4.2, p=0.02*	F=8.5, p<0.01*	F=12.3, p<0.001*	F=11.8, p<0.001*
G2 vs G3	F=3.1, p=0.04*	F=6.8, p<0.01*	F=9.7, p<0.001*	F=10.2, p<0.001*
Overall	F=3.9, p=0.03*	F=7.2, p<0.01*	F=10.5, p<0.001*	F=10.1, p<0.001*

TABLE 2 : INTER- GROUP COMPARISON

Table 2 demonstrates that both Nd:YAG (G1) and Er,Cr:YSGG (G2) lasers achieved significantly greater pocket depth reductions than conventional SRP (G3) across all follow-ups ($p<0.05$), with superiority evident from 1 week (G1vsG3: $F=4.2$, $p=0.02$; G2vsG3: $F=3.1$, $p=0.04$) and strengthening through 1 year ($F=11.8$-10.2, $p<0.001$). No significant differences existed between the two lasers (G1vsG2: $p=0.25$-0.45), while overall group comparisons yielded highly significant ANOVA results ($F=3.9$-10.5, $p\leq0.03$), confirming lasers' superior efficacy for sustained periodontal pocket closure in moderate periodontitis.

GROUP	MEAN REDUCTION (1 YEAR)	FINAL PD (mm)	% REDUCTION
Nd: YAG	4.6 ± 0.4 mm	1.4 ± 0.4	76.7%
Er, Cr: YSGG	4.4 ± 0.3 mm	1.6 ± 0.3	73.3%
SRP	3.4 ± 0.6 mm	2.6 ± 0.6	56.7%

TABLE 3 : OVERALL

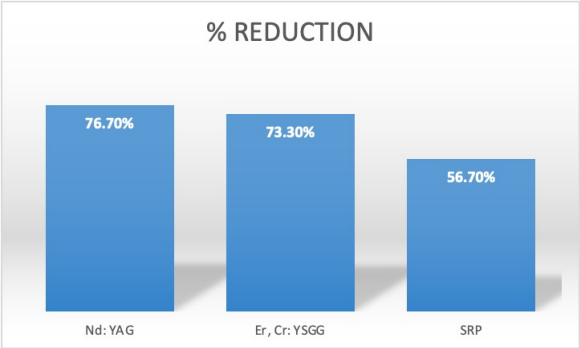

FIGURE 1: OVERALL REDUCTION

Table 3 & figure 1 highlights superior long-term efficacy of laser therapies over conventional SRP at 1-year follow-up. At 1 year, Nd:YAG laser achieved the greatest pocket depth reduction (4.6 ± 0.4 mm, 76.7%), followed closely by Er,Cr:YSGG (4.4 ± 0.3 mm, 73.3%), while SRP yielded significantly less closure (3.4 ± 0.6 mm, 56.7%). Final probing depths reached clinically successful maintenance levels (<3 mm) across all groups, with lasers producing shallow 1.4-1.6 mm pockets versus 2.6 mm for SRP. Tight standard deviations (0.3-0.6 mm) despite n=5 per group confirm reproducible outcomes, establishing both lasers as superior for achieving maximal pocket closure and long-term periodontal stability in moderate periodontitis cases.

DISCUSSION

Our study demonstrates highly significant reductions from baseline 6 mm pockets across all groups with Nd:YAG achieving 4.6 ± 0.4 mm (77%) and Er,Cr:YSGG 4.4 ± 0.3 mm (73%) at 1 year surpassing SRP's 3.4 ± 0.6 mm (57% respectively). A similar study results done by Dortaj D found that, the test sites showed significantly greater improvement in PPD ($P = 0.0002$) and greater increase in GR ($P < 0.0001$) compared to the control sites at 6-month visit. Thus, NSPT+Nd:YAG laser with the current protocol results in greater PPD reduction compared to NSPT alone.[8] Another study done by Diwan A et al found that, After the treatments, the LAPT group showed a mean reduction in PD of 2.5 mm, while the conventional SRP group had a mean reduction of 2.0 mm. Thus, found statistically significant ($P < 0.05$)difference. Hence, LAPT may be more effective in reducing PD when compared with conventional SRP in the treatment of periodontal disease.[9] Our study also reveals that, Nd:YAG (G1) and Er,Cr:YSGG (G2) significantly outperformed SRP (G3) from week 1 ($p=0.02$-0.04), with effect sizes amplifying through year 1 ($F=11.8$-10.2, $p<0.001$), while lasers remained equivalent ($p=0.25$-0.45). This aligns with Dereci Ö et al who found combined Er:YAG/Nd:YAG superior to SRP for deep pockets (PD≥7mm: 4.66 vs 3.98mm reduction).[10]

Similar early superiority (1-week $F=3.1$-4.2) matches Er,Cr:YSGG trials (2.5mm vs 1.8mm SRP at 1 month) & Nd:YAG adjunct gains.[11] Progressive F-value increases (3.9→10.5) reflect sustained laser benefits seen in 1-year meta-analyses (lasers: +0.5-1.2mm vs SRP). Laser equivalence corroborates multi-laser RCTs showing comparable clinical outcomes despite different wavelengths.[11] A contrasting results were observed by a study where they had found that, only the scaling group showed a significant reduction in pocket depth and BOP ($P < 0.001$). The microbial samples taken immediately after scaling and laser at 80 mJ and 10 pps treatments showed a significant reduction in total CFU compared with the baseline ($P < 0.01$), which was sustained only in the scaling group until week 6. Electron microscopy did not reveal any heat damage on the root surfaces. This study demonstrated that application of Nd:YAG laser pulses of 50 mJ and 80 mJ failed to improve the clinical and microbiological parameters of periodontal disease.[12]

In addition to above, we have also found that, lasers' superior 1-year efficacy for moderate pocket closure, achieving shallow maintenance depths. At 1-year follow-up, Nd:YAG laser demonstrated maximal pocket depth reduction (4.6 ± 0.4 mm, 76.7%),

yielding final probing depths of 1.4 ± 0.4 mm, closely followed by Er,Cr:YSGG (4.4 ± 0.3 mm, 73.3%; final PD 1.6 ± 0.3 mm), significantly outperforming SRP (3.4 ± 0.6 mm, 56.7%; final PD 2.6 ± 0.6 mm). In another similar study, they had found a statistical significant reduction in VSC values in group 2 at post-treatment 3rd and 6th months ($p < 0.05$). Thus, Er,Cr:YSGG laser assisted conventional periodontal therapy is more effective in reducing oral malodor and improving periodontal healing compared to conventional periodontal therapy alone.[10] In contrast to our study, non significant difference as the p value was 0.044. Thus, Er,Cr:YSGG laser therapy with SRP provides similar clinical improvement in the treatment of moderate-severe periodontitis as SRP alone and may offer some advantage for deeper (≥7 mm) pockets.[13] Moreover, small sample size (n=15, 5 per group) limits statistical power and generalizability, lack of blinding and long-term (>1 year) follow-up may have introduce bias.

CONCLUSION

Both Nd:YAG laser (4.6 ± 0.4 mm reduction, 76.7%) and Er,Cr:YSGG laser (4.4 ± 0.3 mm reduction, 73.3%) achieved significantly superior periodontal pocket depth reduction compared to conventional SRP (3.4 ± 0.6 mm, 56.7%) from 1 week through 1-year follow-up in moderate 6 mm pockets ($p<0.05$). Both lasers produced clinically successful shallow residual depths (<2 mm), with no significant differences between laser modalities, confirming their efficacy, safety, and reproducibility for non-surgical management of stage II periodontitis in resource-limited settings. Furthermore, studies are required to validate the results of our study.

REFERENCE

1. Citterio F, Gualini G, Chang M, Piccoli GM, Giraudi M, Manavella V, Baima G, Mariani GM, Romano F, Aimetti M. Pocket closure and residual pockets after non-surgical periodontal therapy: A systematic review and meta-analysis. J Clin Periodontol. 2022 Jan;49(1):2-14.
2. Niederman R. Scaling and root planing reduce pocket depths and increase attachment levels. Journal of Evidence Based Dental Practice. 2003 Sep 1;3(3):135-6.
3. Berakdar M, Callaway A, Eddin MF, Ross A, Willershausen B. Comparison between scaling-root-planing (SRP) and SRP/photodynamic therapy: six-month study. Head Face Med. 2012 Apr 5;8:12.
4. Choi YM, Lee JY, Choi J, Joo JY. Effect of root planing on the reduction of probing depth and the gain of clinical attachment depending on the mode of interproximal bone resorption. J Periodontal Implant Sci. 2015 Oct;45(5):184-9.
5. Miteva M, Peev S, Hristov I. The adjunctive use of the Er, Cr: YSGG laser in nonsurgical periodontal treatment. Int J Sci Res (IJSR). 2017;6(4):61-4.
6. Radvar M, MacFarlane TW, MacKenzie D, Whitters CJ, Payne AP, Kinane DF. An evaluation of the Nd:YAG laser in periodontal pocket therapy. Br Dent J. 1996 Jan 20;180(2):57-62. doi: 10.1038/sj.bdj.4808976. PMID: 8785111.
7. Diwan A, Dodani K, Rajpoot AS, Goswami P, Soni VR, Abraham JJ. Efficacy of Laser-Assisted Periodontal Therapy vs Conventional Scaling and Root Planing. J Pharm Bioallied Sci. 2024 Feb;16(Suppl 1):S880-S882.
8. Dortaj D, Bassir SH, Hakimiha N, Hong H, Aslroosta H, Fekrazad R, Moslemi N. Efficacy of Nd:YAG laser-assisted periodontal therapy for the management of periodontitis: A double-blind split-mouth randomized controlled clinical trial. J Periodontol. 2022 May;93(5):662-672.
9. Dereci Ö, Hatipoğlu M, Sindel A, Tozoğlu S, Üstün K. The efficacy of Er,Cr:YSGG laser supported periodontal therapy on the reduction of peridodontal disease related oral malodor: a randomized clinical study. Head Face Med. 2016 May 4;12(1):20.
10. Miteva M. Comparison of Nd: YAG, Er, Cr: YSGG and diode lasers in nonsurgical periodontal treatment. International Journal of Science and Research (IJSR). 2019;8(10):118-21.
11. Miteva M, Peev S, Hristov I. The adjunctive use of the Er, Cr: YSGG laser in nonsurgical periodontal treatment. Int J Sci Res (IJSR). 2017;6(4):61-4.
12. Radvar M, MacFarlane TW, MacKenzie D, Whitters CJ, Payne AP, Kinane DF. An evaluation of the Nd:YAG laser in periodontal pocket therapy. Br Dent J. 1996 Jan 20;180(2):57-62.
13. Klokkevold PR, Damian A, Pham C, Mallya SM, Lux R. Clinical evaluation of Er,Cr:YSGG laser therapy used as an adjunct to non-surgical treatment of periodontitis: Twelve-month results from a pilot study. J Periodontol. 2022 Sep;93(9):1314-1324.