Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 5
Open Access

Comparative evaluation of the Treatment Efficiency of Endo−Perio Lesions Using a Standard Treatment Protocol and Extended by Using a Diode Laser (940 nm)

[1.]Dr. Subasish Behera, [2.]Dr. Soumyaranjan Nanda, [3.]Dr. Shagun Malik, [4.]Dr. Rushit Patel, [5.]Dr. Kodithyala Hareesh Kumar, [6.]Dr. Kavita Chandrasekaran

[1]Associate Professor, Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital(SCB), Manglabag, Cuttack, Odisha.

[2]MDS, Department of Conservative Dentistry and Endodontics, Cuttack, Odisha.

[3]Senior Lecturer, Department of Periodontology, Faculty of Dental Sciences, SGT University, Gurugram, Haryana, India.

[4]Professor and Head, Department of Oral and Maxillofacial Surgery, Karnavati School of Dentistry, Karnavati University, Gujarat.

[5]Assistant Professor, Department of Periodontology, Meghana Institute of Dental Sciences, Warni road, Mallaram, Nizamabad, Telangana.

[6]Resident Dentist, Department of Dentistry, All India Institute of Medical Sciences, Bibinagar (Hyderabad Metropolitan Region), District Yadadri Bhuvanagiri, Telangana -508126

Cite this paper as: Dr. Subasish Behera, Dr. Soumyaranjan Nanda, Dr. Shagun Malik, Dr. Rushit Patel, Dr. Kodithyala Hareesh Kumar,Dr. Kavita Chandrasekaran (2024). Comparative evaluation of the Treatment Efficiency of Endo−Perio Lesions Using a Standard Treatment Protocol and Extended by Using a Diode Laser (940 nm). *Frontiers in Health Informatics*, *13 (5) 436-440*

Abstract

Background

Endo-perio lesions pose a significant challenge in dental practice due to their complex etiology and the intricate relationship between the pulp and periodontal tissues. Conventional treatment protocols often yield inconsistent outcomes. The incorporation of diode lasers, particularly at a wavelength of 940 nm, has shown promise in enhancing treatment outcomes due to their bactericidal, biostimulatory, and decontaminating properties. This study evaluates the treatment efficiency of standard protocols compared to those augmented with a diode laser.

Materials and Methods

This clinical trial included 40 patients diagnosed with endo-perio lesions, divided into two groups of 20 each. Group A received conventional treatment comprising root canal therapy and scaling and root planing, while Group B received the same protocol extended with 940 nm diode laser application. Clinical parameters such as probing pocket depth (PPD), clinical attachment level (CAL), and radiographic bone density were recorded at baseline, 4 weeks, and 8 weeks post-treatment. Statistical analysis was performed using paired t-tests and ANOVA, with significance set at $p< 0.05$.

Results

At 8 weeks, Group B demonstrated significantly better outcomes. Mean PPD reduction was 3.2 ± 0.5 mm in Group B compared to 2.1 ± 0.4 mm in Group A ($p = 0.001$). CAL improvement in Group B was 3.5 ± 0.6 mm versus 2.4 ± 0.5 mm in Group A ($p = 0.002$). Radiographic analysis revealed a 20% increase in bone density in Group B, compared to a 12% increase in Group A.

Conclusion

The adjunctive use of a 940 nm diode laser in the treatment of endo-perio lesions significantly enhances clinical outcomes compared to standard treatment protocols. This approach may represent a superior therapeutic modality in managing these complex conditions.

Keywords

Endo-perio lesions, diode laser, 940 nm, periodontal therapy, root canal therapy, clinical outcomes

Introduction

Endodontic-periodontal (endo-perio) lesions are a common yet complex challenge in dental practice, characterized by the interplay between the pulp and periodontal tissues. The etiology of these lesions is multifactorial, often involving microbial infection, trauma, and systemic conditions, which lead to the destruction of both hard and soft tissues (1,2). Successful management of endo-perio lesions requires addressing both endodontic and periodontal components, as untreated infections in either system can compromise the treatment outcome (3).

Conventional treatment protocols for endo-perio lesions typically include root canal therapy (RCT) and periodontal scaling and root planing (SRP). While effective in many cases, these approaches may not fully eliminate pathogens in deep periodontal pockets or accessory canals (4). Recent advancements in dental technology have explored the potential of adjunctive therapies to enhance treatment outcomes. Among these, diode lasers, particularly those with a wavelength of 940 nm, have gained attention due to their bactericidal properties, ability to reduce inflammation, and capacity to promote tissue healing (5).

Diode lasers operate within the near-infrared spectrum, providing effective decontamination of periodontal pockets and root canals through photothermal effects (6). Studies have reported that diode lasers can significantly reduce microbial loads, stimulate tissue repair, and enhance bone regeneration (7). However, there is limited evidence comparing the efficacy of diode lasers as an adjunct to conventional protocols in the treatment of endo-perio lesions.

This study aims to evaluate the treatment efficiency of a standard protocol for managing endo-perio lesions and compare it with the outcomes of a protocol augmented with a 940 nm diode laser. The findings may provide insights into the potential benefits of incorporating laser therapy into clinical practice for managing these complex lesions.

Materials and Methods

Study Design and Ethical Approval

This randomized clinical trial was conducted on patients diagnosed with endodontic-periodontal (endo-perio) lesions. Ethical clearance was obtained from the institutional ethics committee, and written informed consent was secured from all participants before enrollment.

Participant Selection

A total of 40 participants aged 25–55 years were included in the study based on the following criteria:

- **Inclusion criteria:** Patients with primary endodontic and secondary periodontal involvement, probing pocket depth (PPD) ≥ 5 mm, and radiographic evidence of bone loss.
- **Exclusion criteria:** Patients with systemic conditions affecting periodontal health, those on antibiotics within the past three months, smokers, and pregnant or lactating women.

Grouping and Treatment Protocol

The participants were randomly divided into two groups (n = 20 each):

- **Group A (Control):** Standard treatment protocol involving root canal therapy (RCT) followed by scaling and root planing (SRP).
- **Group B (Test):** Standard treatment protocol as in Group A, supplemented with diode laser application (940 nm).

Clinical Procedures

1. **Root Canal Therapy (RCT):** Performed in both groups using standard protocols. The canals were instrumented with rotary files and irrigated with 2.5% sodium hypochlorite. The canals were then obturated with gutta-percha and a bioceramic sealer.
2. **Scaling and Root Planing (SRP):** Performed under local anesthesia using ultrasonic scalers and hand instruments to remove supra- and subgingival deposits.
3. **Diode Laser Application (Group B):** A 940 nm diode laser (power setting of 1.5 W in continuous wave mode) was applied to the periodontal pockets for decontamination after SRP. The laser fiber tip was moved in sweeping motions within the pockets for 20 seconds per site.

Outcome Assessment

Clinical parameters were recorded at baseline, 4 weeks, and 8 weeks post-treatment:

- **Probing Pocket Depth (PPD):** Measured using a UNC-15 periodontal probe.
- **Clinical Attachment Level (CAL):** Assessed by measuring the distance from the cementoenamel junction to the base of the pocket.
- **Radiographic Bone Density:** Evaluated using digital radiographs analyzed with imaging software to quantify changes in bone density.

Statistical Analysis

Data were analyzed using SPSS software (version 25.0). Paired t-tests were used to compare pre- and post-treatment outcomes within groups, while ANOVA was used to assess differences between groups. A p value of < 0.05 was considered statistically significant.

Results

Baseline Characteristics

The baseline clinical parameters for both groups were comparable, with no statistically significant differences observed. Group A (control group) had a mean probing pocket depth (PPD) of 6.4 ± 0.5 mm, while Group B (laser-assisted group) had a mean PPD of 6.5 ± 0.6 mm ($p = 0.75$). The clinical attachment level (CAL) was 7.0 ± 0.7 mm in Group A and 7.1 ± 0.6 mm in Group B ($p = 0.68$). Radiographic bone density was 45 ± 6% in Group A and 46 ± 5% in Group B ($p = 0.62$).

Post-Treatment Clinical Outcomes

By the end of the 8-week follow-up period, both groups showed significant improvements in clinical parameters, with Group B demonstrating superior results.

- **Probing Pocket Depth Reduction (PPD):** Group A exhibited a reduction of 2.0 ± 0.4 mm, while Group B achieved a reduction of 3.2 ± 0.5 mm ($p = 0.001$).
- **Clinical Attachment Level Gain (CAL):** The CAL improved by 2.3 ± 0.5 mm in Group A compared to 3.6 ± 0.6 mm in Group B ($p = 0.002$).
- **Radiographic Bone Density Improvement:** Group A showed a 12% increase in bone density, whereas Group B demonstrated a 20% increase ($p = 0.001$).

Overall Outcomes

The diode laser-assisted protocol in Group B significantly enhanced clinical outcomes compared to the standard treatment in Group A. The results indicate that the adjunctive use of a 940 nm diode laser leads to better periodontal and radiographic healing.

(*The above findings are summarized in Tables 1 and 2.*)

Table 1: Baseline Characteristics of Study Groups

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Probing Pocket Depth (PPD) (mm)	6.4 ± 0.5	6.5 ± 0.6	0.75
Clinical Attachment Level (CAL) (mm)	7.0 ± 0.7	7.1 ± 0.6	0.68
Radiographic Bone Density (%)	45 ± 6	46 ± 5	0.62

Table 2: Post-Treatment Clinical Outcomes at 8 Weeks

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
PPD Reduction (mm)	2.0 ± 0.4	3.2 ± 0.5	0.001
CAL Gain (mm)	2.3 ± 0.5	3.6 ± 0.6	0.002
Radiographic Bone Density Improvement (%)	12 ± 3	20 ± 4	0.001

Discussion

The management of endodontic-periodontal (endo-perio) lesions remains a significant challenge due to the intricate relationship between the pulp and periodontal tissues. This study evaluated the efficacy of a diode laser-assisted treatment protocol compared to conventional therapy. The results demonstrated that incorporating a 940 nm diode laser significantly improved clinical outcomes, as evidenced by greater reductions in probing pocket depth (PPD), gains in clinical attachment level (CAL), and improvements in radiographic bone density.

The observed improvements in PPD and CAL in the laser-assisted group align with previous studies highlighting the bactericidal and biostimulatory effects of diode lasers in periodontal therapy (1,2). The ability of diode lasers to effectively decontaminate periodontal pockets and reduce microbial loads may explain the superior results compared to conventional scaling and root planing (3,4). Additionally, the photothermal effect of diode lasers enhances soft tissue healing, promoting faster and more effective recovery (5).

Radiographic bone density improvements in the laser-assisted group further support the findings of previous research, which showed that diode lasers stimulate osteoblast activity and promote bone regeneration (6,7). This enhancement may result from the laser's ability to reduce inflammation and improve local blood circulation, creating a favorable environment for bone repair (8).

The findings of this study are consistent with other research indicating that the adjunctive use of lasers enhances periodontal therapy outcomes. For example, studies have reported that diode lasers effectively reduce inflammatory markers such as interleukin-1β and tumor necrosis factor-α, contributing to better periodontal healing (9,10). Moreover, the antimicrobial efficacy of diode lasers has been demonstrated against key pathogens associated with endo-perio lesions, such as *Porphyromonas gingivalis* and *Enterococcus faecalis* (11,12).

Despite the promising results, it is important to acknowledge the limitations of this study. The follow-up period of 8 weeks, while adequate for assessing short-term outcomes, may not reflect long-term stability. Future studies should evaluate the sustainability of these results over extended periods (13). Additionally, while this study focused on the 940 nm diode laser, comparative studies involving other wavelengths or laser types could provide further insights into optimizing treatment protocols (14,15).

Conclusion

In conclusion, this study demonstrates that the adjunctive use of a 940 nm diode laser significantly enhances the efficacy of conventional treatment protocols for managing endo-perio lesions. This approach offers a promising modality for achieving improved clinical outcomes in complex cases. Further research with larger sample sizes and longer follow-up periods is recommended to validate these findings and explore their broader clinical applications.

References

1. Siqueira JF Jr, Rocas IN. Microbiology and treatment of endodontic infections. Compend Contin Educ Dent. 2008;29(10):616-20.
2. Schwarz F, et al. Laser application in periodontal therapy: A review. Clin Oral Investig. 2003;7(1):29-37.
3. Moritz A, et al. The use of diode lasers in dentistry. J Oral Laser Applications. 2001;1(1):7-16.
4. Bagde HS, Alam MK, Almohammed YEM, Almaqawid SMM, Alanazi AWN, Alanazi FTF, Sghaireen MG. The efficacy of platelet-rich plasma as an adjunct to bone grafting in alveolar ridge preservation following tooth extraction. J Pharm Bioallied Sci. 2024 Feb;16(Suppl 1):S564–S566. doi:10.4103/jpbs.jpbs_865_23.
5. Cobb CM. Lasers in periodontics: A review of the literature. J Periodontol. 2006;77(4):545-64.
6. Aoki A, et al. Lasers in non-surgical periodontal therapy. Periodontol 2000. 2004;36:59-97.
7. Goharkhay K, et al. Bactericidal effect of a 940 nm diode laser on periodontal pathogens. Lasers Med Sci. 2009;24(1):59-65.
8. Kimura Y, et al. Effects of laser irradiation on hard tissue repair. J Clin Laser Med Surg. 2000;18(6):267-70.
9. Romanos G, et al. Diode laser adjunctive therapy in the management of peri-implant diseases. Photomed Laser Surg. 2013;31(11):514-22.
10. Kreisler M, et al. Antimicrobial efficacy of a diode laser on anaerobic bacteria in infected root canals. J Endod. 2002;28(9):553-6.
11. Coluzzi DJ. An overview of laser wavelengths used in dentistry. Dent Clin North Am. 2000;44(4):753-65.
12. Gutknecht N, et al. Diode laser radiation and its bactericidal effect in root canal wall dentin. J Clin Laser Med Surg. 2000;18(2):57-60.
13. Eberhard J, et al. Nonsurgical periodontal therapy with adjunctive diode laser treatment: A randomized clinical trial. J Clin Periodontol. 2008;35(8):741-6.
14. Cobb CM, et al. Lasers in periodontal therapy: A literature review. Int J Periodontics Restorative Dent. 2010;30(2):150-62.
15. Kasaj A, et al. Clinical evaluation of an Er:YAG laser combined with scaling and root planing for non-surgical periodontal treatment. J Periodontol. 2008;79(12):2021-8.