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Comparison of the Treatment Efficacy of Endo−Perio Lesions Using a Standard Treatment Protocol and Extended by Using a Diode Laser

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Abstract

Background:
Endo-perio lesions, characterized by the simultaneous presence of endodontic and periodontal diseases, present a complex clinical challenge. The traditional treatment involves a combination of endodontic therapy and periodontal intervention. Recent advancements suggest that adjunctive use of diode lasers may enhance treatment outcomes by reducing microbial load and promoting tissue healing. This study aims to compare the efficacy of a standard treatment protocol with one extended by using a diode laser for managing endo-perio lesions.

Materials and Methods:
A total of 60 patients with diagnosed endo-perio lesions were randomly assigned to two groups. Group A (n=30) received the standard treatment protocol, including root canal therapy and scaling and root planing (SRP). Group B (n=30) received the same standard treatment, augmented with diode laser therapy applied at 810 nm wavelength for decontamination. Clinical parameters, including probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BOP), were recorded at baseline and six months post-treatment. Microbiological analysis was performed to assess bacterial reduction.

Results:
At six months post-treatment, Group B showed a significantly greater reduction in probing depth (3.5 mm) compared to Group A (2.1 mm). Clinical attachment gain was higher in Group B (2.8 mm) compared to Group A (1.9 mm). The bleeding on probing percentage reduced by 60% in Group B, while Group A showed a 45% reduction. Microbiological analysis revealed a more substantial decrease in periodontal pathogens in the laser-treated group.

Conclusion:
The adjunctive use of diode lasers in the treatment of endo-perio lesions significantly enhances clinical outcomes compared to the standard treatment protocol alone. This approach demonstrates improved reductions in probing depth, gains in clinical attachment levels, and decreased bleeding on probing. Diode laser therapy offers a promising adjunctive tool for the management of complex endo-perio lesions.

Keywords:
Endo-perio lesions, diode laser, periodontal therapy, root canal treatment, clinical outcomes, microbial reduction.

Introduction

Endo-perio lesions are complex clinical conditions characterized by the coexistence of periodontal and endodontic diseases within the same tooth. These lesions present a significant challenge in dental practice due to their multifactorial etiology and the intricate anatomical and microbial interplay between the periodontal and endodontic tissues (1). The management of endo-perio lesions typically involves a combination of endodontic and periodontal therapies aimed at eliminating infection and restoring periodontal health (2).

Standard treatment protocols for endo-perio lesions often include root canal therapy to address the pulpal infection and scaling and root planing (SRP) to manage periodontal involvement (3). Despite these interventions, complete resolution of these lesions can be difficult to achieve, and recurrence rates remain a concern (4). Recent advancements in laser technology have introduced diode lasers as potential adjunctive tools in periodontal therapy due to their ability to reduce bacterial load and promote tissue healing through photobiomodulation (5,6).

Diode lasers emit light at wavelengths that penetrate soft tissues, providing a bactericidal effect and enhancing the decontamination of periodontal pockets (7). Studies have demonstrated the efficacy of diode lasers in reducing periodontal pathogens and improving clinical parameters, such as probing depth and clinical attachment levels, in patients with periodontal disease (8). However, the application of diode lasers specifically in the context of endo-perio lesions remains underexplored.

This study aims to compare the efficacy of a standard treatment protocol with one extended by using a diode laser in managing endo-perio lesions. By evaluating clinical outcomes such as probing depth reduction, clinical attachment level gain, and bleeding on probing, this research seeks to provide insights into the potential benefits of integrating diode laser therapy into the treatment regimen for endo-perio lesions.

Materials and Methods

Study Design and Population

This study was designed as a randomized controlled trial to compare the efficacy of a standard treatment protocol versus an extended protocol using a diode laser in managing endo-perio lesions. A total of 60 patients diagnosed with endo-perio lesions were enrolled. Inclusion criteria included patients aged 18-65 years with clinical and radiographic evidence of endo-perio lesions and probing depths ≥5 mm. Exclusion criteria included patients with systemic conditions affecting periodontal health, those on antibiotics or anti-inflammatory drugs within the last three months, and pregnant or lactating women.

Randomization and Group Allocation

Participants were randomly assigned to one of two treatment groups using a computer-generated randomization table. Group A (n=30) received the standard treatment protocol, while Group B (n=30) received the same protocol with adjunctive diode laser therapy.

Treatment Protocols

- **Group A (Standard Treatment):** Treatment consisted of conventional root canal therapy followed by scaling and root planing (SRP). Root canal therapy was performed using the step-back technique with sodium hypochlorite as the irrigant. SRP was conducted using ultrasonic scalers and hand instruments.
- **Group B (Diode Laser Treatment):** In addition to the standard treatment, diode laser therapy was applied to periodontal pockets using a 810 nm diode laser (Picasso Lite, AMD Lasers, Indianapolis, USA). The laser was set at a power output of 1.5 W in continuous wave mode.

The fiber-optic tip was introduced into the pocket parallel to the root surface and moved in a sweeping motion for 30 seconds per tooth.

Clinical Assessments

Clinical parameters were recorded at baseline and six months post-treatment by a calibrated examiner blinded to group allocation. The primary outcome measures included:

- **Probing Depth (PD):** Measured at six sites per tooth using a calibrated periodontal probe (UNC-15, Hu-Friedy, Chicago, USA).
- **Clinical Attachment Level (CAL):** Assessed at the same six sites using the cemento-enamel junction as a reference point.
- **Bleeding on Probing (BOP):** Recorded as present or absent within 15 seconds of probing.

Microbiological Analysis

Subgingival plaque samples were collected from the deepest pocket of each patient at baseline and six months post-treatment. Samples were cultured on selective media to quantify periodontal pathogens, including *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia*.

Statistical Analysis

Data were analyzed using SPSS software (version 26.0, IBM Corp., Armonk, NY, USA). Continuous variables were expressed as means ± standard deviations. Intragroup comparisons were made using paired t-tests, while intergroup comparisons were made using independent t-tests. A p-value of <0.05 was considered statistically significant.

Results

The study included 60 patients, with 30 in each treatment group. The baseline demographic and clinical characteristics were comparable between the groups, ensuring balanced randomization.

Clinical Outcomes

The clinical parameters, including probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BOP), were assessed at baseline and six months post-treatment. The results are summarized in Table 1.

Table 1: Clinical Outcomes at Baseline and Six Months Post-Treatment

Parameter	**Group A (Standard)**	**Group B (Diode Laser)**
Probing Depth (PD) (mm)		
Baseline	6.5 ± 0.8	6.6 ± 0.9
Six Months	4.4 ± 0.7	3.1 ± 0.6
Reduction	2.1 ± 0.6	3.5 ± 0.7
Clinical Attachment Level (CAL) (mm)		
Baseline	7.2 ± 0.9	7.3 ± 0.8
Six Months	5.3 ± 0.8	4.5 ± 0.7
Gain	1.9 ± 0.5	2.8 ± 0.6

Bleeding on Probing (BOP) (%)		
Baseline	85%	87%
Six Months	40%	27%
Reduction	45%	60%

Statistical Analysis

- **Probing Depth (PD):** The reduction in PD was significantly greater in Group B (3.5 ± 0.7 mm) compared to Group A (2.1 ± 0.6 mm) ($p < 0.01$).
- **Clinical Attachment Level (CAL):** The gain in CAL was significantly higher in Group B (2.8 ± 0.6 mm) compared to Group A (1.9 ± 0.5 mm) ($p < 0.01$).
- **Bleeding on Probing (BOP):** Group B showed a more substantial reduction in BOP (60%) compared to Group A (45%) ($p < 0.05$).

Microbiological Analysis

The microbiological analysis revealed a significant reduction in the count of periodontal pathogens in both groups, with Group B showing a more pronounced reduction. The results are presented in Table 2.

Table 2: Reduction in Periodontal Pathogens at Six Months

Pathogen	**Group A (Standard)**	**Group B (Diode Laser)**
Porphyromonas gingivalis	65%	85%
Treponema denticola	60%	82%
Tannerella forsythia	63%	80%

Discussion

The adjunctive use of diode lasers significantly improved clinical outcomes compared to the standard treatment protocol alone. The greater reduction in probing depth and gain in clinical attachment levels in the diode laser group indicates enhanced periodontal healing. The superior microbial reduction further supports the efficacy of diode lasers in decontaminating periodontal pockets.

Discussion

The present study evaluated the efficacy of a standard treatment protocol compared to an extended protocol using a diode laser for managing endo-perio lesions. Our findings indicate that the adjunctive use of diode laser therapy significantly enhances clinical outcomes, demonstrating greater reductions in probing depth (PD) and improvements in clinical attachment levels (CAL) compared to the standard treatment alone.

The results showed a significant reduction in PD and a gain in CAL in both groups, with the diode laser group exhibiting superior outcomes. These findings align with previous studies highlighting the benefits of diode laser therapy in periodontal treatment, including its bactericidal effects and ability to promote tissue healing through photobiomodulation (1,2). The reduction in PD and gain in CAL observed in the diode laser group suggest enhanced periodontal healing, potentially attributable to the laser's ability to penetrate soft tissues and reduce bacterial load (3).

Bleeding on probing (BOP) is a critical indicator of periodontal inflammation. In this study, the diode laser group exhibited a more substantial reduction in BOP compared to the standard treatment group.

This outcome is consistent with other studies reporting decreased bleeding and inflammation following diode laser therapy (4). The laser's ability to modulate inflammatory mediators and improve vascularization likely contributes to the observed reduction in BOP (5).

Microbiological analysis revealed a significant decrease in periodontal pathogens in both groups, with a more pronounced reduction in the diode laser group. This finding underscores the efficacy of diode lasers in bacterial decontamination of periodontal pockets, as supported by previous research demonstrating their antimicrobial properties (6). The significant reduction in key pathogens such as *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia* further validates the adjunctive role of diode lasers in periodontal therapy (7).

Despite the positive outcomes, the study has some limitations. The sample size was relatively small, and the follow-up period was limited to six months. Future studies with larger sample sizes and extended follow-up periods are necessary to confirm the long-term benefits of diode laser therapy in managing endo-perio lesions. Additionally, the study focused on clinical and microbiological parameters, and further research should explore the molecular and histological effects of diode laser treatment.

Conclusion

In conclusion, the adjunctive use of diode lasers in the treatment of endo-perio lesions significantly improves clinical and microbiological outcomes compared to the standard treatment protocol alone. Diode laser therapy offers a promising adjunctive tool for enhancing periodontal healing and reducing microbial load in complex endo-perio lesions.

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