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Clinical efficacy and pain control of diode laser-assisted periodontal flap surgery: A systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 04 October 2023 and was last updated on 04 October 2023.

INTRODUCTION

Review question / Objective P: patients with severe periodontitis who meet the surgical indications for periodontal flap surgery and have at least two quadrants each containing affected teeth with probing depth (PD) >5 mm and bleeding on probing after basic periodontal treatment. I: Semiconductor laser combined with periodontal flap surgery. C: Periodontal flap procedure alone. O: Periodontal parameters: plaque index (PI), gingival index (GI), probing depth (PD) and clinical attachment level (CAL), etc. Pain level: using visual analog scores (VAS). S: randomized controlled trials.

Condition being studied Periodontitis is a chronic inflammatory disease caused by an imbalance between the virulence factors of pathogenic microorganisms and host defense mechanisms, which is characterized by progressive destruction

of periodontal supporting tissues, accompanied by apical migration of epithelial attachments, resorption and destruction of alveolar bone. The main goal of periodontal therapy is not only to stop the process of tissue deterioration, but also to contribute to the regeneration and rejuvenation of tissues lost as a result of the disease. Mechanical debridement is considered an effective method of treating periodontal disease. Limitations in mechanical access to areas of the oral cavity (e.g., depressions, developmental grooves, and bifurcations) often make it difficult to completely eliminate bacterial deposits and associated toxins from the root surfaces of the teeth using non-surgical mechanical means, and therefore surgical interventions are required in these areas.

In recent years, laser periodontal therapy has received much attention as a potential adjunct to conventional mechanical debridement. Different types of lasers, including diode, Nd:YAG, CO₂, and Er (Er:YAG, Er, Cr:YSGG), have been utilized as

adjunctive or alternative tools in periodontal treatment procedures. Compared to conventional surgical techniques, semiconductor lasers (DLs) provide excellent hemostasis, disinfection of the wound or target area, and reduction of post-treatment tissue edema and swelling. Semiconductor lasers are commonly used at a wavelength of 810 nm or 910-980 nm, which primarily targets diseased soft tissues without interacting with dental hard tissues, and has a bactericidal effect on periodontal pathogens that invade the soft tissue walls of periodontal pockets. The current study shows that ablation of inflammatory lesions and epithelial lining of the soft tissue wall in periodontal pockets with laser can retard epithelial cell migration and promote periodontal regeneration. In addition, some of the laser energy scattered and penetrated into the periodontal pockets during irradiation may stimulate cells in the surrounding tissues, leading to a reduction in inflammatory conditions, cell proliferation, improved periodontal tissue attachment, and possibly a reduction in postoperative pain. Although laser therapy is considered to have potential advantages such as bactericidal action, hemostasis, reduced morbidity, and ablation, its routine use in the treatment of periodontal disease is still considered a controversial topic.

METHODS

Participant or population Patients with chronic periodontitis.

Intervention Diode laser combined with periodontal flap flipper.

Comparator Periodontal flap procedure alone.

Study designs to be included RCT.

Eligibility criteria Inclusion criteria: patients with severe periodontitis who meet the surgical indications for periodontal flap flap surgery and have at least two quadrants each containing affected teeth with probing depth (PD) >5 mm and bleeding on probing after basic periodontal treatment. Exclusion criteria: 1. documents in languages other than English and Chinese 2. Duplicate literature 3. the study is unable to provide original data.

Information sources Chinese Academic Journal Full Text Database (CNKI), Chinese Biomedical Literature Database (CBM), Chinese Science and Technology Journal Database (VIP), Wanfang

Database, PubMed, Web of science, Cochrane Library, and Embase.

Main outcome(s) Plaque index, probing depth, loss of attachment, gingival index, Visual analogue scoring.

Quality assessment / Risk of bias analysis Cochrane Handbook for Systematic Reviews of Interventions, version 5.1.0.

Strategy of data synthesis The Q test evaluates the heterogeneity of the included literature. If $P \geq 0.1$ and $I^2 \leq 50\%$, it indicates that the heterogeneity is small, and the fixed effect model is used for analysis; If $P > 50\%$, it indicates the existence of statistical heterogeneity, so the random effect model is used for analysis.

Subgroup analysis Subgroup analyses based on follow-up time, group 1: baseline, group 2: 3 months, group 3: 6 months.

Sensitivity analysis Deletion of any one of the papers and whether the combined data from the rest of the papers deviates significantly from the original results.

Country(ies) involved China.

Keywords periodontitis, Periodontal flap surgery, diode laser.

Contributions of each author

Author 1 - Qiaoyu Hu.

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Author 3 - Qin Liu.