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EFFECTIVENESS OF OZONE THERAPY AND PHOTOBIOMODULATION AS ADJUNCTIVE THERAPY AFTER SCALING AND ROOT PLANING

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Abstract

Introduction: Chronic periodontitis is a multifactorial inflammatory disease characterized by progressive damage to the periodontal tissues such as pocket periodontal and/or gingival recession which can eventually lead to tooth loss. Scaling and root planing (SRP) is the most common non-surgical periodontal treatment. Apart from SRP, various additional therapies have been extensively studied, such as ozone therapy and photobiomodulation.

Objective: The aim of the present systematic review is to compare the efficacy of ozone or photobiomodulation (PBM) therapy in addition to SRP to treat periodontal disease.

Methods: Data were conducted through PubMed and Google scholar databases in English, which were published within the last five years and using the PICOS format.

Results: Based on the results of the analysis, three journal articles were included in the eligibility criteria for this systematic review. The results of the analysis showed that there was a decrease in Pocket Depth from baseline to 3 months follow-up in both groups.

Conclusion: Ozone therapy and photobiomodulation are effective adjunctive therapies to SRP for the treatment of chronic periodontitis. PBM got slightly better results in decreasing Pocket Depth index.

Keywords: Periodontitis, Ozone Therapy, Photobiomodulation, Scaling and Root Planing

Introduction

Chronic periodontitis is a multifactorial inflammatory disease characterized by progressive damage to the periodontal tissues such as pocket periodontal and/or gingival recession which can eventually lead to tooth loss mediated by pathogenic microorganisms.¹⁻⁴

Oral biofilm formation is characterised by the initial adhesion of primary colonisers to the salivary pellicle. This facilitates colonisation by periopathogenic bacterial species including *Treponema denticola*, *Tannerella forsythia*, *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis*. *Porphyromonas gingivalis* is a gram-negative bacterium, which expresses a variety of virulence factors and has long been implicated in periodontitis.^{5,6,7}

While pathogenic microorganisms are the main etiologic factors initiating the disease, it is the host's response to bacterial challenge that accounts for most of periodontal destruction. Modifying factors such as smoking, obesity, diabetes, and immunosuppression can also exacerbate the periodontal disease.⁸⁻¹¹

Treatment of chronic periodontitis is based on the removal of the bacterial biofilm, thus stopping the causal mechanism of periodontal disease. Scaling and Root Planing (SRP) is the gold standard non-surgical therapy, which aims to remove biofilm and calculus from both supragingival and subgingival tooth surfaces (scaling) as well as to smooth and clean the root surfaces (root planing).^{12,13}

However, recolonization from periodontal bacteria is a frequent event following SRP.¹⁴ Accordingly, adjunctive therapeutic approaches have been proposed, such as ozone application and the photobiomodulation therapy. (PBM).^{3,12}

Ozone (O₃) is a triatomic molecule consisting of three oxygen atoms and presents many applications in medicine and dentistry.¹⁵ In particular, the use of ozone is indicated in patients with chronic gingivitis, periodontitis and periodontal abscesses, herpes labialis, etc. since it is able to exert anti-microbial activity, oxidize the microbial toxins implicated in periodontal diseases, and promote healing and tissue regeneration; moreover, ozone gaseous disinfection overcomes the limitations generally related to liquid chlorhexidine rinses.^{12,16}

Another adjuvant therapy in dentistry is photobiomodulation (PBM) also known as Low-Level Laser Therapy (LLLT), has been particularly applied due to reduce gingival inflammation and promote wound healing and analgesic action, which derives from the stimulation of nerve cells, the stabilization of membrane potentials, and the release of neurotransmitters in the inflammatory tissue.¹⁷⁻¹⁹

The aim of the present systematic review is to compare the efficacy of ozone or photobiomodulation (PBM) therapy in addition to SRP to treat periodontal disease.

Materials and Methods

Search Strategy

This article was conducted according to the PRISMA (Preferred Reporting Items for Systemic Review and Meta-Analysis) guidelines. Data were conducted using the PICOS format. The population in this study were patients who were diagnosed with chronic periodontitis. Interventions were SRP treatment with adjunctive ozone therapy and SRP treatment with adjunctive PBM therapy. Comparasion: the clinical parameter before and after SRP treatment with adjunctive ozone therapy compared with adjunctive PBM therapy. Outcomes: degree of *Pocket Depth* (PD) reduction. Study design is RCTs, in the last five years (2018-2023).

Data were conducted through PubMed, Wiley, and MDPI databases in English using the following terms : (“Periodontitis AND Ozone Therapy AND Photobiomodulation”). This systematic review was limited to randomized controlled trials that were monitored at three months after treatment. After determining the literature, data were extracted and some differences would be discuss on discussion.

Study Inclusion and Exclusion Criteria

The inclusion criteria used for this article were full text english and subject of study were human who were diagnosed with chronic periodontitis, had undergone SRP with adjunctive ozone therapy and or with adjunctive PBM therapy, and follow up after three months. While the exlusion criteria used for this systematic

review were any articles study design were systematic review and meta analysis and the studies were in animal.

Outcome Variables

Outcome variables were clinical outcomes taken on the three months after SRP with adjunctive ozone therapy and or with adjunctive PBM therapy, which included degree of *Pocket depth* (PD) reduction.

Data Extraction

The author using specific keywords and the article was selected by screening the title and abstract, then analyzed based on the inclusion criteria that have been determined to set the final list of articles. All selected articles were also screened from the exclusion criteria. Data taken from the article include the author(s), year of publication, number of participants, clinical parameters PD.

Full mouth periodontal probing depth and clinical attachment level (CAL) were measured on six sites (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual) of the teeth with a manual periodontal probe.^{3,11,18}

Quality Evaluation

Selected articles that meet the requirements based on the title and abstract according to the inclusion criteria. Then, screened the full articles from all the collected studies and agreed on the most relevant articles to be included in this study. Furthermore, an independent assessment of all aspects of the study, including the quality of the study and the variables for the data sought.

Result and Discussion

The initial search from two database yielded 506 articles. The titles and abstracts excluded a total of 452 articles with some reasons such as were not relevant, duplicate, could not be opened, and some other articles were literature review or systematic review and meta analysis. Full text found as many as 54 articles which were then screened and found 3 articles that were evaluated and met the inclusion criteria. The flow of article selection can be seen in Figure 1.

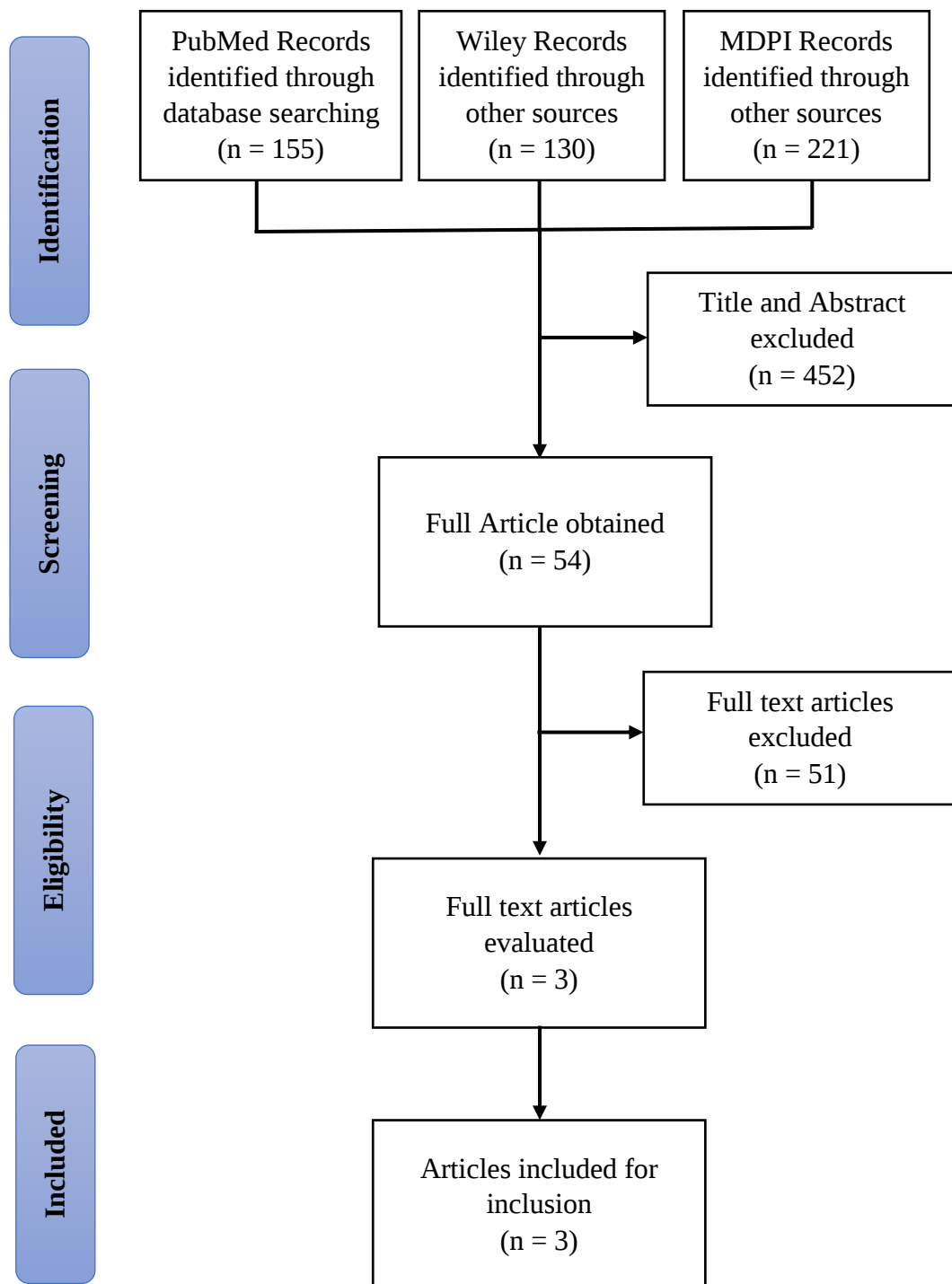


Figure 1. PRISMA Flowchart

Table 1. Description of data from the three included studies reporting clinical parameter of various measurement techniques

Authors	Sample Number	Interventions	Clinical Parameter	Baseline (mean)	Follow Up	
					Three Months (mean)	PD Reduction (mean)
Scribante A, et al ¹¹ (2022)	30 patients	SRP + PBM	PD	5.31 ± 1.02	3.85 ± 0.89*	1.46
		SRP + ozone	PD	5.11 ± 1.07	4.07 ± 0.87*	1.04
Santos NCD, et al ¹⁸ (2019)	19 patients	SRP + PBM	PD	6.6 ± 1.6	4.4 ± 1.2*	2.2
Uraz A, et al ³ (2018)	18 patients	SRP + ozone	PD	5.87 ± 1.13	3.96 ± 0.95*	1.91

*P < 0.05

Table 1 showed that all of the studies were in human, that was to patient with periodontal disease. The studies used were published in 2018, 2019 and 2022. The participants in this study were 67 patients.

Scribante et al¹² reported that there was a significant difference between the two groups, the mean PD at 3 months follow up was significantly lower in the SRP group with adjunctive PBM therapy (3.85 ± 0.89) when compared to SRP with adjunctive ozone therapy (4.07 ± 0.87) with a much higher score of PD reduction (1.46) for the SRP group with adjunctive PBM therapy.

Santos et al¹⁹, in their study showed that there were significant differences at baseline and after SRP with adjunctive PBM therapy. PBM was effective in reducing the mean PD at 3 months follow up (mean score 2.2) and these results were maintained at 6 and 12 months follow up.

Similar study of Abduljabbar et al²⁰ that has been investigated the local effect of PBM on the treatment of periodontal pockets in patients with periodontitis and type 2 diabetes show that all the clinical trials using PBM showed improved results in periodontal parameters at 3 months follow up.

A previous study of Rabiah et al²¹ conducted among betel chewers confirmed the SRP with adjunctive PBM is more efficient than SRP alone in the treatment of periodontitis. Comparasion between the test (SRP with adjunctive PBM therapy) and control groups (SRP only) at 3 and 6 months follow up, reduction of *plaque index* (PI), *bleeding on probing* (BOP), and PD were high in the control compared with the test group. No difference in clinical attachment loss and marginal bone loss was found among patients of both groups at 3 and 6 months.

Meanwhile, Uraz et al³ showed that showed significant results after SRP treatment in addition to ozone therapy as compared to that at baseline, all the parameters were significantly reduced at 3 months after the therapy in both the groups ($P < 0.05$).

In addition, clinical trials have also assessed the efficacy of ozone therapy for the treatment of gingivitis, periodontitis, and peri-implantitis. In particular, in a recent work by Butera et al²², patients suffering from peri-implantitis were recruited

to evaluate the efficacy of a clinical protocol based on the irrigation of pathological sites by means of ozonized water, compared to pure water. Evaluations were conducted at baseline, as well as after one month and two months follow up. The results of the study highlighted a significant reduction in PD, PI, BOP, and *Bleeding Score* (BS) compared to control group.

Moreover, Rapone et al²³ evaluated the adjunctive use of the gaseous ozone therapy for its effect on similar clinical indexes evaluated in the present report, such as BoP and PD; both of these indexes were significantly decreased at 6 months follow up.

With regard to the benefits offered by PBM in the management of periodontitis, PBM could exert secondary infection of the exposed wounds and/or radiation induced local tissue damage.²⁴ Compared to ozone, more approaches are available besides providing gases, such as further ozone water and oil/gel.^{25,26}

Conclusion

Ozone therapy and photobiomodulation are effective adjunctive therapies to SRP for the treatment of chronic periodontitis. PBM got slightly better results in decreasing Pocket Depth index.

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