ORIGINAL ARTICLE

Adjunctive Use of Ozonated Water and Ozonated Olive Oil with Scaling and Root Planing in Chronic Periodontitis: A Comparative Clinical Study

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Abstract

Introduction: In dentistry, gingival and periodontal disorders are a primary source of suffering. All kinds of ozone reduce or treat the majority of the contributory and causative causes. All phases of gingival and periodontal disorders can benefit from ozone, which is well known for its antibacterial and tissue-regenerating qualities. Comparing and assessing the effectiveness of ozonated water (OW) and ozonated olive oil (OOO) as a supplement to scaling and root planing (SRP) in patients with chronic periodontitis is the goal of this study. **Methods:** A total of 30 systemically healthy patients aged 35–55 years with chronic periodontitis were enrolled for this study. After SRP, participants were randomly allocated to Group 1 ($n = 15$, OW irrigation) or Group 2 ($n = 15$, OOO application), with allocation managed by an independent researcher. **Results:** OW showed superior periodontal improvement at 3 months, with greater probing pocket depth (PPD) reduction (5.40 mm vs. 6.57 mm), better CAL gain (5.80 mm vs. 6.40 mm; $P < 0.001$), and improved gingival recession (0.33 mm vs. 0.57 mm; $P = 0.015$) compared to ozonated olive oil. **Conclusion:** This randomized clinical trial demonstrated that both OW and ozonated olive oil, when used as adjuncts to SRP, resulted in significant improvements in PPD and clinical attachment level within their respective groups after 3 months. However, the intergroup comparison revealed a significant difference with OW at 3 months, indicating that OW was effective in enhancing periodontal healing.

Key words: Adjuncts, ozonated olive oil, ozonated water, ozone, scaling and root planning

INTRODUCTION

Progressive clinical attachment loss (CAL), recession (REC), mobility, and eventually tooth loss are the hallmarks of periodontitis, an infectious inflammatory disease.[1] Both non-surgical and surgical techniques are employed to eradicate pathogenic microorganisms; although mechanical debridement is the gold standard, its efficacy can be reduced by a number of factors, including tooth variations, deep periodontal pockets, and the ability of bacteria to invade tissue.[2]

The protective layer in the atmosphere, the multipurpose gas ozone, is a great medication. Periodontal disorders can also be effectively treated with ozone therapy, an allotropic form of oxygen made up of three oxygen atoms. For medicinal purposes, the tri-atomic gas primarily consists of 99–99.5% O_2 and 0.05–0.5% O_3, respectively.[3] The gaseous form of ozone is very unstable in nature. Therefore, the aqueous form, such as suspensions in oil, gel, and liquid, is preferred when using it for the local application.[4]

Ozonated water (OW) is water infused with ozone gas (O_3), known for strong antimicrobial, disinfectant, and anti-inflammatory properties.[5] OW has been shown to have a unique biocompatibility to fibroblasts, cementoblasts, and epithelial cells, indicating that it may be used effectively to treat infectious disorders of the mouth, including peri-implantitis, apical periodontitis, and periodontal disease.[6]

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Pure olive oil that has been ozonized by a continuous flow of an ozone–oxygen combination in a 5:95% ratio until it changes from a greenish liquid state to a whitish gel state is known as ozonated olive oil (OOO).[7] Ozone's antibacterial effect is increased when it reacts with olive oil to form ozonides, aldehydes, peroxides, and hydroxy peroxides activity.[8]

Thus, the aim of this study is to compare and evaluate the effects of OW and OOO as a supplement to non-surgical care of chronic periodontitis.

MATERIALS AND METHODS

A total of 30 systemically healthy patients aged 35–55 years suffering from chronic periodontitis were selected among the patients visiting the Department of Periodontology and Implantology, Sharad Pawar Dental College, Datta Meghe Institute of Higher Education and Research. Patients who were motivated for therapy and regular follow-up, provided informed consent, had at least 10 teeth, were in good physical and systemic health, presented with CAL of ≥1 mm, and had chronic generalized periodontitis with at least 2–3 sites showing periodontal pockets of ≥4 mm were included in the study. Patients who had undergone periodontal therapy in the past 6 months, received antibiotic treatment within the past 3 months, were pregnant or lactating, had known drug allergies, regularly used mouthwash, or were chronic alcoholics were excluded from the study.

Participants received a different treatment as allocated to Groups 1 and 2 after scaling and root planning were completed. For the participant referring to Group 1 (n = 15), OW was irrigated, and for Group 2, OOO was applied. It is a double-blinded study, which used a coin flip approach for randomization to avoid the bias and distribute participants into Groups 1 and 2. A separate researcher who was not involved in the methods created the allocation sequence.

The University of North Carolina-15 (UNC-15) probe, measured probing pocket depth (PPD), CAL, and gingival REC, to evaluate participants' periodontal clinical characteristics. Every patient got lessons on the proper brushing technique as well as a demonstration of good oral hygiene practices.

In the first appointment, each patient received full mouth supragingival scaling. After 1 week, on the second appointment, under local anesthesia of 2% lidocaine with 1:100,000 epinephrine, subgingival scaling and root planing (SRP) was done using Gracey curettes (Hu-Friedy).

Following subgingival SRP, the experimental site was segregated for patients in Group A. A blunt-tipped sterile plastic syringe filled with OW was used to irrigate all sites with a probing depth of ≥4 mm over the course of 5–10 min[9] [Figures 1 and 2].

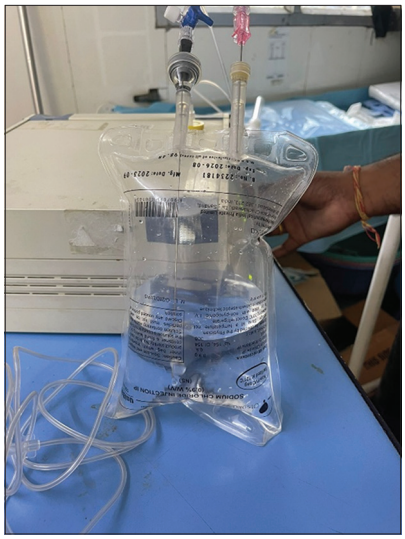

Figure 1: Infusion setup for ozonated water preparation

Figure 2: Application of ozonated water as an adjunctive therapy

Regarding patients in Group B, the experimental site was segregated once subgingival SRP was finished. A blunt-tipped, sterile plastic syringe filled with OOO (DentOzone) [Figures 3 and 4] was used to irrigate all areas with a probing depth of at least 4 mm.

Patients were advised to refrain from using any interdental aids, brushing close to the treated area, and chewing hard or sticky meals for a week. Any negative effects will be noted on recall visits, and any supragingival deposits will be removed.

Recall visits were after 1 month and 3 months. At every recall visit, PPD, CAL, and REC were evaluated.

RESULTS

At baseline, the mean PPD in the OW group was 6.53 ± 1.30 mm with a standard error of 0.34, whereas the OOO

Figure 3: Syringe containing ozonated olive oil for local drug delivery

Figure 4: Application of ozonated olive oil as an adjunctive therapy

group showed a higher mean value of 7.07 ± 1.22 mm with a standard error of 0.32. At the 1-month follow-up, a slight increase was observed in the OW group with a mean PPD of 6.87 ± 0.99 mm (SE: 0.26), while the OOO group recorded a comparable mean of 6.93 ± 1.16 mm (SE: 0.30). By the 3-month follow-up, both groups demonstrated a notable reduction in PPD, with the OW group showing a mean value of 5.40 ± 1.24 mm (SE: 0.32) and the OOO group recording a mean of 5.07 ± 1.39 mm (SE: 0.36). Intergroup comparison revealed no statistically significant difference between the two groups at any time point, with p-values of 0.233 at baseline, 0.806 at 1 month, and 0.512 at 3 months [Figure 5].

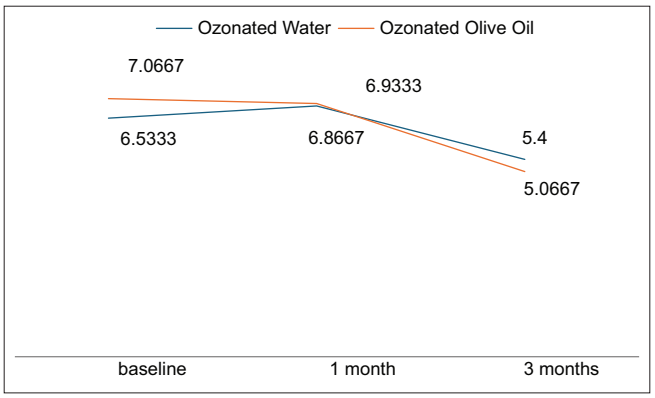

Figure 5: Comparison of mean probing pocket depth between ozonated water and ozonated olive oil at baseline, 1 month, and 3 months

At baseline, the mean clinical attachment level (CAL) in the OW group was 6.80 ± 1.47 mm with a standard error of 0.38, while the OOO group recorded a mean value of 7.20 ± 1.21 mm with a standard error of 0.31. At the 1-month interval, the OW group demonstrated a reduction in CAL to 6.27 ± 1.03 mm (SE: 0.27), whereas the OOO group showed a mean of 6.87 ± 1.19 mm (SE: 0.31). By the 3-month follow-up, a marked improvement was observed in both groups, with the OW group exhibiting a significant reduction to 3.80 ± 0.68 mm (SE: 0.17), while the OOO group recorded 5.40 ± 0.99 mm (SE: 0.25). Intergroup comparison revealed no statistically significant difference at baseline ($P = 0.539$) and at 1 month ($P = 0.187$); however, a highly significant difference was noted at 3 months ($P < 0.001$). Overall, both groups demonstrated improvement in CAL over time, but the OW group exhibited a greater and statistically significant reduction compared to the OOO group at the end of 3 months [Figure 6].

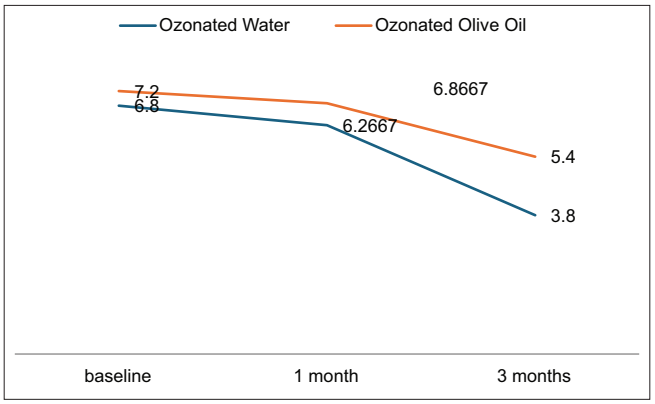

Figure 6: Comparison of mean clinical attachment loss between ozonated water and ozonated olive oil at baseline, 1 month, and 3 months

At baseline, the mean gingival REC in the OW group was 0.27 ± 1.62 mm (SE: 0.42), while the OOO group showed a slightly lower mean value of 0.13 ± 1.68 mm (SE: 0.43). At the 1-month follow-up, both groups demonstrated minor changes, with the OW group showing a mean REC of –0.60 ± 1.24 mm (SE: 0.32) and the OOO group recording –0.07 ± 1.28 mm (SE: 0.33). By the 3-month evaluation, contrasting outcomes were observed between the two groups: The OW group exhibited a substantial reduction in REC to –1.60 ± 1.59 mm (SE: 0.41), whereas the OOO group showed an increase to 0.33 ± 2.16 mm (SE: 0.56). Intergroup comparison revealed no statistically significant differences at baseline ($P = 0.775$) and 1 month ($P = 0.285$), while at

3 months a statistically significant difference was noted ($P = 0.015$). These findings indicate that although both groups showed minor, non-significant changes initially, the OW group demonstrated a significant improvement in gingival REC at 3 months compared to the OOO group [Figure 7].

DISCUSSION

The aim of the present study is to compare the clinical benefit of mechanical therapy along with adjunctive use of OW and OOO as subgingival irrigation in the treatment of chronic periodontitis. SRP is the gold standard for treating periodontitis; however, there are numerous other treatments that have been proposed, such as using ozone.[10]

Ozone, a potent oxidizing agent, has a strong antibacterial effect by quickly releasing freshly created oxygen-free radicals to produce oxygen.[11] Ozone promotes the growth of immunoactive cells and the production of immunoglobulin by concurrently regulating the humoral and cellular immune systems.[12] By regulating interleukin, leukotriene, and prostaglandin levels, it also lessens inflammation and accelerates wound healing. It also reduces inflammation and speeds up wound healing by controlling levels of interleukin, leukotriene, and prostaglandin. Traditional antibiotic therapy changes the subgingival microecological environment by stopping the growth of subgingival bacteria,[13] but it is easy to produce drug-resistant strains.

To treat periodontal disorders and peri-implantitis, ozone has been employed in a variety of formulations, including gas, OW irrigation, ozonated oil application, and ozone-based gel.[14] To investigate its involvement in chronic periodontitis, ozone treatment has been used as an adjuvant therapy in a number of randomized controlled trials.

Rohith *et al.*[15] assessed and supported the adjunctive advantages of irrigation of OW in conjunction with mechanical debridement for the treatment of periodontitis and concluded the beneficiary effect of ozone irrigation.

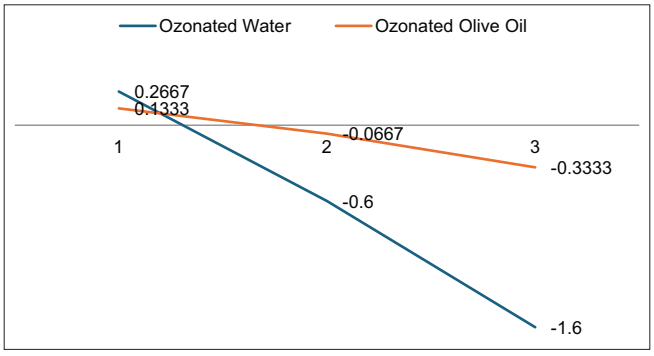

Figure 7: Comparison of mean gingival recession between ozonated water and ozonated olive oil at baseline, 1 month, and 3 months

Ranjith *et al.*[16] reported in a randomized controlled clinical and biochemical study that OW irrigation reduces clinical indices and decreases inflammatory mediators in saliva, providing an added benefit to non-surgical periodontal care.

Grassi *et al.*[17] evaluated the novel activated OOO gel's clinical and microbiological efficacy as a topical adjuvant in the treatment of periodontal pockets and came to the conclusion that its adjunctive use greatly enhanced periodontal outcomes, decreased the pathogenic bacterial load, and showed promise as a safe and efficient supportive treatment for the management of periodontitis.

Mukherjee *et al.*[18] discovered that both OOO and chlorhexidine gel significantly improved periodontal health when compared to plain olive oil, indicating the use of OOO as a local drug delivery agent. The study also looked at the efficacy of subgingival use of plain olive oil, OOO, and chlorhexidine gel as adjuncts to SRP in chronic periodontitis.

Ambrosio *et al.*[19] reported in a systematic review that ozone shows promising therapeutic effects for periodontal and peri-implant diseases; however, SRP remains the gold standard for periodontitis treatment.

This study had limitations that should be considered when interpreting the findings. The relatively small sample size may have reduced the statistical power to detect subtle differences between the groups. In addition, the short duration of follow-up restricted the evaluation of long-term clinical outcomes and the sustainability of treatment effects. Histopathological evaluation was not performed, which limited the ability to correlate clinical improvements with underlying tissue-level changes. Microbiological assessments were also not conducted, preventing confirmation of the antimicrobial effects of OW and OOO on specific periodontal pathogens. Radiographic assessments were not included, which limited the ability to analyze changes in bone levels and overall periodontal architecture over time.

CONCLUSION

As an adjunct to SRP in patients with chronic periodontitis, OW and OOO subgingival irrigation can improve oral hygiene, reduce gingival inflammation, decrease pocket depth, and increase attachment levels, according to the study's limitations. At the end of 3 months, however, OW produced greater outcomes. It is advised that larger sample sizes and longer follow-up times be used in future research to bolster the findings of this investigation.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Permission from the Institutional Ethics Committee was obtained before conducting the study with IEC number: DMIHER (DU)/IEC/2024/254. CTRI no.: CTRI/2024/06/068534.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHORS' CONTRIBUTIONS

As the lead researcher, SVK was in charge of the study's conceptualization, design, data collecting, analysis, and article preparation. PJ oversaw the methodology, directed the study, and made significant edits to the manuscript. SB helped with the collection of data, statistical analysis, and result interpretation. GB helped with the final manuscript's proofreading, data management, and literature review. The final text was reviewed and approved by all authors.

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Not applicable.

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