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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF OZONE THERAPY AS AN ADJUNCT TO SCALING AND ROOT PLANING WITH SCALING AND ROOT PLANING ALONE IN CASES OF CHRONIC PERIODONTITIS- A CLINICAL AND MICROBIOLOGICAL STUDY

Shilpa Chaudhari., Vishakha Patil., Rohini Mali., Amita Mali., Pallavi Patil and Priya Lele

Department of Periodontology BharatiVidyapeeth Deemed University Dental College and Hospital Pune-411042

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ABSTRACT

Background and Objectives: Ozone is well studied antimicrobial and antioxidant agent in cases of caries, hypersensitivity, but studies regarding periodontal disease are very few. Periodontal pathogen which reside in the sub gingival area needs alternative treatment along with conventional treatment to inhibit their growth and prevent further progression of periodontal disease. One possible means is to change the subgingival environment which is shown to be highly anaerobic with a prevailing low oxygen tension. Ozone has a potent antimicrobial power along with its capacity to stimulate circulatory system and modulate the immune response and this makes it a therapeutic agent of choice. This study was therefore planned to evaluate the efficacy of aqueous ozone as an adjunct to Scaling and Root Planing in subjects with Chronic Periodontitis. **Material and Method:** A total of 20 subjects of Chronic Periodontitis were enrolled for the study. 40 Sites with probing depth of 6-7mm from two different quadrants of same arch were selected for the study. Selected sites were randomly divided into 20Control sites with Scaling and Root Planing and 20Experimental sites Scaling and Root Planing with Ozone irrigation. Clinical parameters such as Gingival bleeding Index, probing depth, Relative attachment level were assessed at baseline and 3rd week. Total Microbial count were assessed at baseline and next day. The results were subjected to statistical analysis. **Results:** In the experimental group statistically significant reduction was seen in Gingival bleeding Index, Probing depth and Total microbial count and there was statistically significant gain in Mean Relative attachment level as compared to control group.

Conclusion: Ozone application can be used effectively to treat periodontal disease non-surgically in professional practice.

INTRODUCTION

Periodontitis is a multifactorial disease resulting in destruction of the tissues that support the tooth. It results from extension of the inflammatory process initiated from gingiva to the supporting periodontal tissues. The primary etiological agents however are the pathogenic bacteria which reside in the sub gingival area.

Administration of Systemic antibiotics has been used as an adjunctive to scaling and root planning to take care of pathogenic bacteria residing in inaccessible subgingival areas. As systemic administration may show hypersensitivity reaction, organ toxicity and development of resistant bacteria[1], many chemical plaque inhibitors have been used as an adjunct to mechanical plaque control. Chlorhexidine (CHX), a broad spectrum antiseptic effective against gram positive, gram negative, aerobes and anaerobes has been considered as a gold standard. Again chlorhexidine causes mucosal desquamation, impaired wound healing and impaired fibroblast attachment to the tooth surface, tooth staining and altered taste sensation[2].

To overcome these side effects an alternative approach to suppress subgingival microflora is to inhibit their growth by changing the subgingival environment which is highly anaerobic with a prevailing low oxygen tension. Various agents such as molecular oxygen, hyperbaric oxygenation and hydrogen peroxide have been applied. Recently Ozone treatment is gaining popularity in dentistry due to its potent antimicrobial power against gram positive and gram negative bacteria, viruses and fungi[3]. It also has capacity to stimulate circulatory system thus modulating the immune response. Irrigation system or devices can deliver agents deep into the pockets and may be more effective in halting the progression of periodontal attachment loss[4] thus limiting surgical intervention in the future.

Ozone (O3) in a gaseous or aqueous phase is capable of oxidizing any biological entity. Its oxidative capacity at 100 ppm, 200 ppm and 400 ppm however induces serious toxicity due to lipid peroxidation and ultimately cause DNA damage[5]. A low concentration of ozonated water is sufficient to inactivate bacterial cells (0.12–0.19 mg/L) and their spores (2.29 mg/L). It has been shown that *Streptococcus mutans*, *Lactobacilli casei*and *Actinomycesnaeslundii* suspended in a salt buffer can be completely killed within 60 seconds following exposure to ozone gas[6]. Ozone readily dissolves and forms ozonated water when introduced into water. The powerful disinfecting property of gaseous ozone has been utilized in dentistry to treat primary root caries, occlusal caries, dentine hypersensitivity and cervical sensitivity. It is accepted that its application at doses between 90 µg and 120 µg does not affect the physical properties of enamel[7]. Ozonated water has been used in the sterilization of dentures (10 ppm) and dental unit water-line systems. Plaque microorganisms have been shown to be vulnerable to ozonated water under *in vitro* conditions (4 mg/L for 10 seconds) [8].

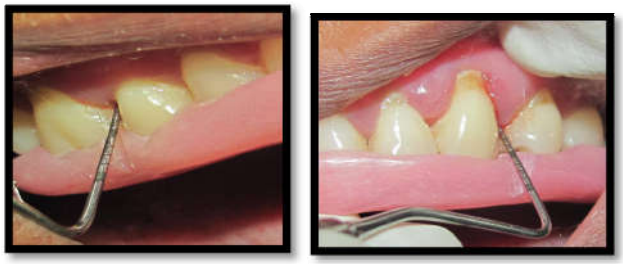
MATERIALS AND METHODS

The study was a randomized, controlled, clinical trial with a split mouth design. A total of 20 patients were selected from Out Patient Department, Department of Periodontology. Ethical clearance was obtained from the Institutional ethics committee. Systemically healthy patients with age of 30 years and above of both the gender diagnosed with Chronic periodontitis from their clinical and radiographic findings were included in the study. Written and verbal consent was obtained from the subjects included in the study. Subjects with age of 30 years and above suffering from chronic periodontitis and having a probing pocket depth of 6-7 mm in two different quadrants of same arch with radiographic evidence of bone loss were included in the study. Subjects with a history of any systemic diseases, history of periodontal treatment in the last six months, pregnant females, smokers, subjects using chemical plaque inhibitors, antimicrobial agents and antioxidant supplements were excluded from the study.

Ozone is a mixture of pure oxygen and pure ozone in the ratio of 0.05-5% of O_3 and 95-99.5% of O_2. Due to the instability of O_3 molecule, it must be prepared immediately before use and cannot be stored over long periods of time. It is prepared by mixing ozone in one liter of distilled water (Figure1).

Figure1 Ozone Preparation

In this study two sites of two different quadrants of same arch were selected in each subject. Sites were divided in to two groups Group I: Scaling and Root Planing (Control group) and Group II: Scaling and Root Planing with Ozone irrigation (Test group). All the clinical parameters i.e. Gingival bleeding Index,[9]Probing depth (Figure2), Relative Attachment Level from base of the pocket to fixed reference point on the stent[10]were recorded at baseline and at 3 weeks. Plaque samples were collected for microbiological study at baseline and immediately next day.



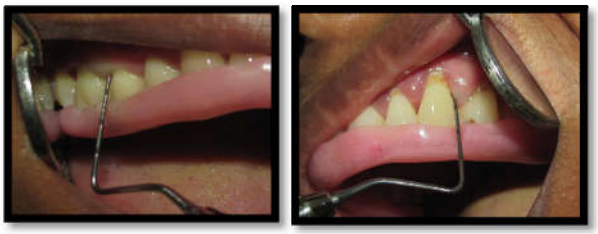
Experimental site **Control site**

Figure 2 Preoperative Probing depth recording

At baseline, scaling and root planning was performed in both the groups. In second group aqueous ozone irrigation was done in the pocket by using blunt needle and syringe
(Figure 3).

Figure 3 Ozone irrigation at Experimental site

Subjects were recalled after 3 weeks to record all the clinical parameters (Figure 4).



Experimental site **Control site**

Figure 4 Postoperative Probing Depth Recording

RESULTS

Statistical analysis was carried out forreadings of Gingival bleeding index, Probing depth, Relative attachment level, and Total Microbial count.

Gingival Bleeding Index

Table 1 Gingival Bleeding Index

	G Group A (n=20) [Control Group]	Group B (n=20) [Experimental Group]	Inter Group (P-value)
Pre-treatment (Baseline)	1.00 ± 0.0	1.00 ± 0.0	
Post-treatment (3 weeks)	0.55 ± 0.51	0.25 ± 0.44	
Intra Group (P- Value)	0.001 (S)	0.001 (S)	
Percentage change	45%	75%	0.056 (NS)

P-value less than 0.05 are considered to be statistically significant.

Control Group: The mean Gingival bleeding index score at baseline was 1.00±0.0 and mean Gingival bleeding index score at 3 weeks post treatment was 0.55±0.51.

Experimental group: The mean Gingival bleeding index score at baseline was 1.00±0.0 and mean Gingival bleeding index score at 3 weeks post treatment was 0.25±0.44.

There was a statistically significant reduction in the Gingival bleeding index from baseline to 3 weeks in both the groups (Table 1).

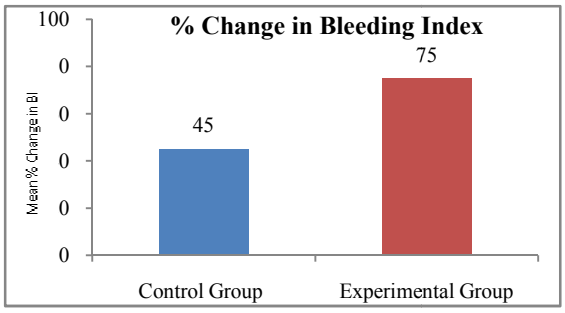


Figure 5 Bar diagram showing Percentage change in Gingival bleeding index between two groups.

On comparison between the control and experimental group, the percentage change in Gingival bleeding index score for Control group was 45% and for Experimental group it was 75% which is statistically non significant. Favourable results by 35% were seen for the experimental group after 3 weeks (Figure 5).

Probing Depth

Table 2 Probing Depth

	Group A (n=20) [Control Group]	Group B (n=20) [Experimental Group]	Inter Group (P-value)
Pre-treatment (Baseline)	6.30 ± 0.47	6.40 ± 0.50	
Post-treatment (3 weeks)	3.60 ± 0.80	3.05 ± 0.51	
Intra Group (P- Value)	0.001 (S)	0.001 (S)	
Percentage change	42.6%	52.3%	0.016 (S)

P-value less than 0.05 is considered to be statistically significant

Control Group: The mean Probing Depth at baseline was 6.30±0.47 and mean Probing Depth at 3 weeks post treatment was 3.60±0.80.

Experimental group: The mean Probing Depth at baseline was 6.40±0.50 and mean Probing Depth at 3 weeks post treatment was 3.05±0.51.

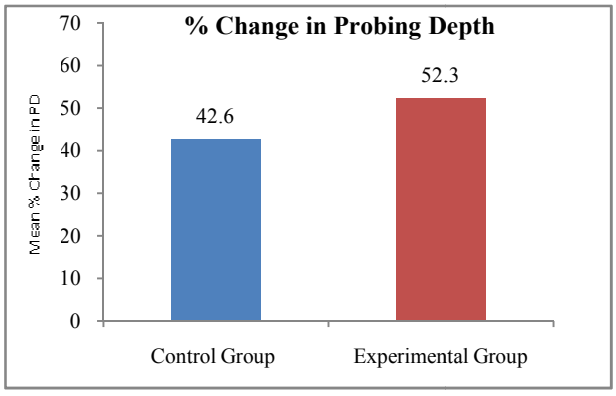


Figure 6 Bar diagram showing Percentage change in Probing Depth between two groups.

There was a statistically significant improvement in the Probing Depth from baseline to 3 weeks in both the groups (Table 2).

On comparison between the control and experimental group, the percentage change in Probing Depth for Control group was 42.6% and for Experimental group was 52.3% which is statistically significant. Favourable results by 9.7% were seen for the experimental group after 3 weeks (Table 4).

Relative Attachment Level

Table 3 Relative Attachment Level

	Group A (n=20) [Control Group]	Group B (n=20) [Experimental Group]	Inter Group (P-value)
Pre-treatment (Baseline)	8.35 ± 0.75	8.65 ± 0.59	
Post-treatment (3 weeks)	7.40 ± 0.59	6.70 ± 1.34	
Intra Group (P- Value)	0.001 (S)	0.001 (S)	
Percentage change	11.1%	22.9%	0.005 (S)

P-value less than 0.05 is considered to be statistically significant

Control Group: The mean Relative Attachment Level at baseline was 8.35±0.75 and mean Relative Attachment Level at 3 weeks post treatment was 7.40±0.59.

Experimental group: The mean Relative Attachment Level at baseline was 8.65±0.59 and mean Relative Attachment Level at 3 weeks post treatment was 6.70±1.34.

There was statistically significant gain in Relative attachment level from baseline to 3 weeks in both the groups (Table 3).

Percentage gain of Relative Attachment

Table 4 Percentage gain of Relative Attachment

	Group A (n=20) [Control Group]	Group B (n=20) [Experimental Group]	Inter Group Comparison (P-value)
Pre-treatment (Baseline)	8.35 ± 0.75	8.65 ± 0.59	
3-Weeks Post-treatment	7.40 ± 0.59	6.70 ± 1.34	
Total Attachment gain (mm)	0.80 ± 0.41	1.90 ± 0.85	0.001 (S)
Intra-Group P value	0.001 (S)	0.001 (S)	--

P-value less than 0.05 is considered to be statistically significant.

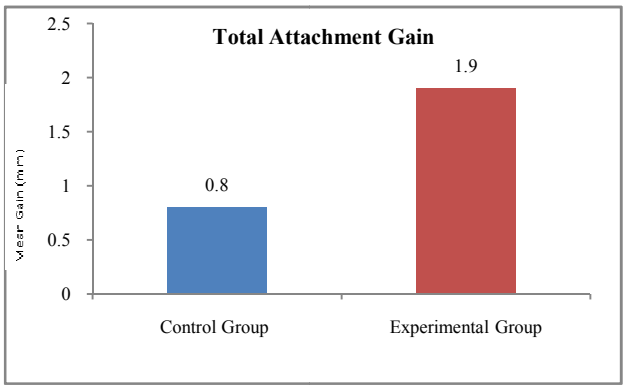


Figure 7 Bar diagram showing Relative Attachment Gain between two groups.

Total attachment gain in control group from baseline to 3 weeks was 0.8mm and total attachment gain in experimental

group from baseline to 3 weeks was 1.9 which is statistically significant.

Total attachment gain was significantly more in Experimental group as compared to control group (Table 4).

On comparison between the Control and Experimental groups, total attachment gain in control group from baseline to 3 weeks was 0.8mm and total attachment gain in experimental group from baseline to 3 weeks was 1.9 which is statistically significant. Total attachment gain was significantly more in Experimental group (Figure 7).

Total microbial count

Table 5 Total microbial count

	Group A (n=5) (Control Group)	Group B (n=5) Experimental Group	Inter Group Comparison (P-value)
Pretreatment (Baseline)	138.2 ± 50.7	201.1 ± 33.0	
Post-treatment (Next day)	120.8 ± 27.8	241.1 ± 118.6	
Intra Group (P- Value)	0.001 (S)	0.001 (S)	
Percentage change	90.1%	88.2%	0.690 (NS)

P-value less than 0.05 is considered to be statistically significant

Control Group: Total microbial count at baseline was 138.2±50.7 and mean Total microbial count post treatment was 120.8±27.8.

Experimental group:Total microbial count at baseline was 201.1±33.0 and mean Total microbial count post treatment was 241.1±118.6.

There was statistically significant reduction in Total microbial count in both the groups (from baseline to next day (Table 5).

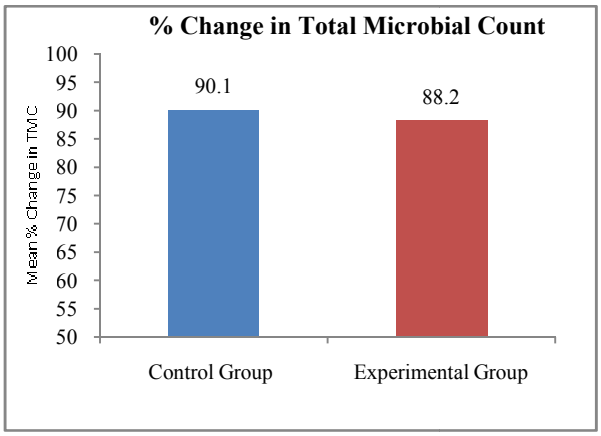


Figure 8 Bar diagram showing Percentage change in Total microbial count between two groups.

On comparison between the Control and Experimental group, the percentage change in Total Microbial Count for Control group was 90.1% and for Experimental group was 88.2%. Even though difference is seen it was statistically non significant and were comparable for both the groups(Figure 8).

DISCUSSION

Periodontal disease is a group of inflammatory disorders, the pathophysiology behind it, is accumulation of microbial plaque and the host response to it[11]. Removal of dental plaque thus forms an important part of controlling disease. Many chemical adjuncts have been tried to improve outcome of mechanical oral hygiene procedures[12]. An alternative approach to conventional treatment in suppression of subgingival microorganisms is to inhibit their growth by changing the subgingival environment which is highly anaerobic[13]. One such approach is use of Ozone. Ozone therapy is gaining popularity because of its different properties like; it is antimicrobial, anti-inflammatory and immunostimulating[14]. It has been observed that no adverse effects like discomfort, burning sensation and dryness/ soreness were reported by the subjects as recorded with the help of the subjective criteria. No evidence of staining of teeth and ulcer formation was observed as recorded with the help of objective criteria as explained in methods and materials.

Our study has shown decrease in clinical parameters score, which are consistent with the earlier studies performed by Ramzyet al[15] in 2005. A split mouth study conducted by Kshitish and Laxman[16] in 2010 showed significant reduction in bleeding index and probing depth by using ozone as compared to chlorhexidine. Dodwad et al[17] in 2011 conducted a comparative study which showed significant reduction in probing depth by using ozone irrigation as compared to chlorhexidine and povidone iodine in cases of chronic periodontitis. These results are similar to our study.

From the overall results it can be concluded that, Statistically significant difference was seen in Gingival bleeding index score, Probing depth and Relative Attachment Level in both the groups from baseline to 3 weeks post treatment. Total Microbial Count showed statistically significant difference in both the groups from baseline to next day. When two groups were compared statistically no significant difference was seen in mean Gingival bleeding index score and Total Microbial Count between the two groups and statistically significant difference was seen in Probing Depth and Relative Attachment Level between the two groups.The Ozone therapy as an adjunct to scaling and root planing is simple and easy procedure. It can reach depth of the pocket and effective against periodontal pathogen. It is biologically acceptable without any side effects.

CONCLUSION

The local ozone application can be used effectively to treat periodontal disease non-surgically in professional practice. It serves as a simple, easy to use, potent, biologically acceptable, antimicrobial agent with no side effects. To elucidate the use of aqueous ozone as an adjunct to scaling and root planing, further longitudinal studies with larger sample size should be carried out. Also different concentrations can be tried out in order to establish a universal therapeutic agent. Also microbiologic evaluation can be done for specific periodontal pathogens.

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