

RESEARCH ARTICLE

Changing paradigm in pocket therapy- ozone vs conventional irrigation

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Abstract

Background: Periodontal disease is a group of inflammatory disorders, the pathophysiology of which is related to tooth accumulated microbial plaque and the host response to those accumulations. The development of periodontal disease has been thought to be associated with several restricted members of oral anaerobic species such as Spirochetes, Porphyromonas etc. Aims & Objectives: The aim of the present study was to compare the effect of oral irrigation with Ozonated water, 0.2% Chlorhexidine and 10% Povidone iodine in patients with chronic periodontitis. Materials and Methods: A randomized clinical trial was performed. A total of 30 patients of both sexes in age group 30-50 yrs suffering from generalized chronic periodontitis were selected for the study. They were divided into three groups (ten patients in each) A, B, C in which they were irrigated with ozonated water, 0.2% Chlorhexidine (CHX) and Povidone iodine respectively. The use of all three types of irrigation was randomized. Results: A higher percentage of Gingival index (72%), Plaque index (57.69%) and Pocket probing depth reduction (39.68%) was observed in four weeks using ozonated water irrigation as compared to Chlorhexidine and Povidone iodine. The percentile reduction of spirochetes (30.50%) using ozonated water was appreciable as compared to Chlorhexidine (t-stat value 0.14) and Povidone iodine (t-stat value 0.16). P value of 0.05 or less was considered statistically significant. Conclusion: Local ozone application can serve as potent atraumatic, antimicrobial agent to treat periodontal disease non surgically both for home care and professional practice. It may also serve as good tool during supportive periodontal therapy.

Key Words: Ozonated water; Chlorhexidine; Povidone iodine; Periodontitis .

Introduction

Periodontal disease is a group of inflammatory disorders, the pathophysiology of which is related to tooth accumulated microbial plaque and the host response to those accumulations (1). These diseases are induced by a variety of organisms that colonize and proliferate supragingivally and subgingivally in susceptible individuals (2). In the formation of dental plaque, oral microorganisms must adhere to the tooth surface and then grow in the prevailing environment. Dental plaque, particularly subgingival plaque, is closely associated with diseased periodontal tissues, so it is generally assumed that plaque microorganisms or their products are responsible for periodontal disease. The development of periodontal disease has been thought to be associated with several restricted members of oral anaerobic species such as black pigmented *Porphyromonas* species and *Aggregatibacter actinomycetem comitans* (*A. actinomycetem comitans*) in the subgingival plaque (3). Spirochetes are a major microbial component of plaque associated with major forms of periodontal disease, including periodontitis that is refractory to nonsurgical treatment (4). They have been implicated as potential etiologic agents of severe periodontal disease in adults. Moore et al (1982) found that certain specific spirochetes were more closely associated with severe periodontitis than they were with healthy sites or gingivitis (5).

A number of chemical adjuncts have been used to improve the outcome of mechanical oral hygiene procedures, one of which is chlorhexidine (CHX), a broad spectrum antiseptic effective against gram

positives, gram negatives, aerobes and anaerobes (6). Povidone iodine also appears to be effective against all microorganisms including bacteria, fungi, protozoa and viruses (7). An alternative approach to conventional treatment in suppression of subgingival bacteria is to inhibit their growth by changing the subgingival environment which has shown to be highly anaerobic with a prevailing low oxygen tension (8). Various agents such as molecular oxygen, hyperbaric oxygenation and hydrogen peroxide have been applied (9). Recently ozone treatment is gaining popularity in dentistry. The potent antimicrobial power of ozone along with its capacity to stimulate circulatory system and modulate the immune response makes it a therapeutic agent of choice (10). Its main use relies on its antimicrobial properties. It has been proved to be effective against gram positive and gram negative bacteria, viruses and fungi (11). Effect on clinical parameters and antimicrobial effect of ozone on pathogens like spirochetes has been attempted for the first time in this preliminary clinical trial.

The aim of the present study was to compare the effect of oral irrigation with Ozonated water, 0.2% Chlorhexidine and 10% Povidone iodine in patients with Chronic periodontitis. The objectives of the study include i) evaluation and comparison of the effects of oral irrigation with ozonated water, 0.2% Chlorhexidine and 10% Povidone iodine on clinical parameters such as Gingival index, Plaque index and Pocket probing depth and also ii) to evaluate the antimicrobial effect of irrigation with ozonated water, 0.2% Chlorhexidine and 10% Povidone iodine on periodontal pathogens such as spirochetes.

Materials & Method

The subjects for the present study were selected from the out-patient Department of Periodontology and Oral Implantology, I.T.S.- Centre for Dental Studies and Research(I.T.S.-C.D.S.R)., Muradnagar, Ghaziabad, U.P. The study was conducted in Department of Periodontics and Department of Oral Pathology, I.T.S.-C.D.S.R. Patients of both sexes within the age limit of 30-50 yrs were included in the study. Provide inclusion exclusion criteria.

A randomized controlled clinical trial was performed. A total of thirty patients suffering from chronic periodontitis were recruited and were allocated randomly into three groups. Group A included patients who were irrigated with ozonated water, Group B in which patients were irrigated with 0.2% Chlorhexidine and Group C included patients who were irrigated with 10% Povidone iodine. Patients with at least one site with pocket probing depth ≥6mm in posterior teeth were selected. Pregnant or lactating women; patients suffering from any known systemic diseases, patients who had received any surgical or nonsurgical therapy 6 months prior to the start of the study, patients who had received any antibiotic therapy, chemotherapeutic mouthrinses and oral irrigation during the past 6 months were excluded from the study. Data collection was performed between January 2011 and March 2011. All participants gave voluntary written informed consent and ethical clearance was obtained from the institution for conducting this study. The study period of 4 weeks was divided into three intervals, i.e. baseline, after 1 week and after 4 weeks. The use of ozonated water, 0.2% Chlorhexidine and 10% Povidone iodine irrigation was randomized. Subgingival pooled plaque samples from one selected site with pocket probing depth ≥6mm were taken at baseline and after 4 weeks with the help of a curette and mounted on a slide with normal saline. These samples

were then stained with fontanas stain for observing spirochetes under oil immersion in light microscope. Scaling and root planing was performed at baseline followed by oral hygiene instructions. At baseline, after 1 week and after 4 weeks, the clinical parameters, viz. Plaque Index (Turesky-Gilmore-Glickman modification of Quigley Hein Plaque Index, 1970) (12), Gingival Index (Loe and Silness 1963) (13) and Pocket Probing depth were recorded. Ozone irrigation- Group A patients were subjected to oral irrigation with ozonated water that was released from an irrigation device, "Kent ozone Dental Jet TY-820"(Kent Ro Systems Ltd., Noida, India) to the selected site. The device released a single pulsating stream of ozonated water from the nozzle with water outflow ≥150ml/min which could be adjusted for different speeds and pressures ranging from 250 to 500 kPa(kilo pascals) with an ozone output of 0.082 mg/h. Chlorhexidine and Povidone iodine irrigation-Group B and Group C patients were subjected to irrigation with 0.2% Chlorhexidine and 10% Povidone iodine with a 2 ml syringe slowly for 1 min.

Results were expressed as mean ± standard deviation and proportions as percentages. Sign test was applied to compare all the parameters recorded in each of the three groups. P value of 0.05 or less was considered statistically significant. One tailed t test was applied for intergroup comparison.

Results

Table-1 shows a higher percentage of reduction in Gingival Index with ozonated water irrigation(72%) as compared to 0.2% Chlorhexidine(60%) and Povidone iodine(52%). Table-2 shows significant reduction in Plaque index with ozonated water irrigation(57.69%) as compared to 0.2% Chlorhexidine(54.17%) and 10% Povidone iodine(52%).

Treatment groups	(Mean ± Standard Deviation)			Difference mean1-mean2	Difference mean1-mean3	Reduction from the Baseline	P v value
	Baseline	One week	Four week				
Ozonated Water group A	2.5 ± 0.53	1.5 ± 0.53	0.7 ± 0.48	1.00	1.8	72.00%	0.0009766
Chlorhexidine group B	2.6 ± 0.52	1.6 ± 0.52	1.1 ± 0.32	1.00	1.5	60.00%	0.0009766
Povidone Iodine Group C	2.5 ± 0.53	1.5 ± 0.53	1.2 ± 0.42	1.00	1.3	52.00%	0.0009766

Table 1: Comparison of mean values of Gingival Index of Different Treatment Groups (At baseline, One Week & Four Week)

Treatment groups	(Mean ± Standard Deviation)			Difference mean1-mean2	Difference mean1-mean3	Reduction from the Baseline	P v value
	Baseline	One week	Four week				
Ozonated Water group A	2.6 ± 0.52	1.6 ± 0.52	1.1 ± 0.32	1.00	1.5	57.69%	0.0009766
Chlorhexidine group B	2.4 ± 0.52	1.4 ± 0.52	1.1 ± 0.32	1.00	1.3	54.17%	0.0009766
Povidone Iodine Group C	2.5 ± 0.53	1.7 ± 0.48	1.2 ± 0.42	0.80	1.3	52.00%	0.0009766

Table 2: Comparison of mean values of Plaque Index of Different Treatment Groups (At baseline, One Week & Four Week)

Treatment groups	(Mean ± Standard Deviation)			Difference mean1-mean2	Difference mean1-mean3	Reduction from the Baseline	P value
	Baseline	One week	Four week				
Ozonated Water group A	6.3 ± 0.48	4.8 ± 0.63	3.8 ± 0.42	1.5	2.5	39.68%	0.0009766
Chlorhexidine group B	6.2 ± 0.42	5.2 ± 0.42	4.6 ± 0.70	1.00	1.6	25.81%	0.0009766
Povidone Iodine Group C	6.2 ± 0.42	5.5 ± 0.53	4.8 ± 0.79	0.70	1.4	22.58%	0.0009766

Table 3: Comparison of mean values of Pocket probing depth of Different Treatment Groups (At baseline, One Week & Four Week)

Treatment groups	(Mean Proportions ± Standard Deviation)		Reduction from the Baseline
	Baseline	One week	
Ozonated Water group A	78.5 ± 15.28	48.0 ± 0.63	30.50
Chlorhexidine group B	79.0 ± 11.01	58.00 ± 13.78	21.00
Povidone Iodine Group C	78.0 ± 11.83	70.00 ± 12.69	8.00

Table 4: Comparison of mean values of Spirochetes count of different treatment groups (At baseline, One Week & Four Week)

Treatment groups	One tailed t-test, with 0.05 level of significance		Critical t	t-Stat
	Degree of Freedom	(Mean Proportions ± Standard Deviation)		
Ozonated Water group A Chlorhexidine group B	10	13.81 ± 647.19	1.81	0.14
		14.84 ± 728.98		
Povidone Iodine Group C Ozonated Water group A	10	13.81 ± 647.19	1.81	0.16
		15.92 ± 830.90		
Chlorhexidine group B	10	14.84 ± 728.98	1.81	0.17
		15.92 ± 830.90		

Table 5: Details of t-test assuming that Ozone is better than 0.2% Chlorhexidine and 10% Povidone iodine when compared collectively on all the above parameters.

Table-3 show significant reduction in Pocket probing depth with ozonated water irrigation (39.68%) as to 0.2% Chlorhexidine(25.81%) and 10% Povidone iodine(22.58%)

Table-4 shows higher percentage of reduction in spirochetes count with ozonated water irrigation (30.50%) as compared to 0.2% Chlorhexidine (21%) and Povidone iodine (8%).

In terms of the mean Bacteria Count showed that there was a significant improvement in pre-treatment and post treatment groups.

It is evident from table -5 that Ozonated water irrigation showed better reduction in all the parameters recorded when compared to Chlorhexidine irrigation and Povidone iodine irrigation.

Discussion

Gingivitis and periodontitis are characterized by a local hypoxia of tissues and also by various microbic flora that may contain over 250 species. The initiation and progression of periodontitis is caused by different bacterial accumulations in the subgingival pockets (19). The principle objective of periodontal therapy is to eliminate the subgingival bacterial presence and, by subsequent supragingival plaque control measures, prevent or minimize recolonization of the

subgingival area by pathogenic microflora(9). Mechanical root debridement to remove dental calculus is important in periodontal therapy but is frequently inadequate in curing severe periodontal infections (14). The mechanical methods of plaque control can also be supplemented by antimicrobial agents (9).

Chlorhexidine has emerged as an important oral antibacterial agent and adjunct to periodontal therapy. It is a broad spectrum antiseptic with pronounced antimicrobial effects on Gram-positive as well as Gram-negative bacteria, some viruses and fungi. Povidone-iodine has also been used as an adjunct in the treatment of chronic periodontitis with promising results. It kills bacteria very rapidly and is effective against periodontal pathogens in-vitro in as little as 15 seconds of contact and in-vivo within 5 minutes of contact. It also fails to allow the development of bacterial resistance and has low systemic toxicity and low financial cost (15). It has been found that gases may be more advantageous for use intraorally than liquids because of their different physical characteristics and diffusion potentials. Direct oxygen and oxygenating agents such as sodium monohydrate, sodium monoxylchlorosense, carbamide peroxide and sodium borate peroxyhydrate were applied to areas of wounded rat oral tissue. All of these showed

complete healing in a shorter time than normally required.(9) The use of ozone is justified as a new option of irrigating agent with antimicrobial action which results from oxidation of microbial cellular components (16). When dissolved in water it becomes highly unstable and hydroxyl radicals are generated. It kills bacteria by two mechanisms, one by direct reactions of molecular ozone and other a free radical mediated reaction (9).

A study conducted by Nagayoshi et al (2004) showed that ozonated water (0.5-4mg/l) was highly effective in killing both gram positive and gram negative oral microorganisms such as *Porphyromonas endodontalis* and *Porphyromonas gingivalis*(3). Ozonated water has also been shown to be effective against *Candida* or *Enterococcus fecalis* and periodontopathic bacteria such as *A. actinomycetemcomitans* and *P.gingivalis* in vitro (9). But no literature exists till date on the in vivo effect of ozonated water on organisms such as spirochetes. The oral spirochetes are often the dominant bacteria observed in subgingival plaque, and yet they are one of the least-studied and understood by the periodontal investigators. They possess proteolytic and keratinolytic enzymes which suppress lymphocyte blastogenesis and inhibit fibroblast and Polymorphonuclear neutrophil leukocyte function (17). Thus this study evaluates and compares the antimicrobial and clinical effects of subgingival irrigation with ozonated water, 0.2% chlorhexidine, 10% povidone iodine in chronic periodontitis patients.

The percentage reduction of gingival index (72%), Plaque index (57.69%), Pocket probing depth (39.68%) was higher in the ozone group as compared to Chlorhexidine and Povidone iodine group. These results are in accordance with the study conducted by Kshitish et al(2010) for 18 days in which a higher percentage of Plaque index (12%), Gingival index (29%) reduction using ozone irrigation as compared to CHX was observed. Ramzy et al (2005) found a significant improvement in Pocket probing depth, Plaque index, Gingival index, and bacterial count to quadrants treated by Scaling and Root planing along with ozone application in patients with aggressive periodontitis.(19) Huth et al (2011) found significant reduction in periodontal pathogens namely *P.gingivalis*, *Parvimonas micra*, *Tannerella forsythia* on irrigation with gaseous/aqueous ozone as compared to 0.2% CHX. None of the agents could substantially reduce *A. actinomycetem comitans* (A.a.) count in biofilm cultures(18).

In the present study, the antimicrobial efficacy of ozone using Fontana's stain demonstrated reduction in spirochetes (30.50%) as compared to Chlorhexidine (21%) and Povidone iodine (8%). Despite the difficulties in the cultivation of spirochetes, there is abundant

literature based upon microscopic examination of plaque samples to implicate spirochetes in periodontal disease. Spirochetes average 40% of the microscopic count in plaque removed from sites classified as adult periodontitis (AP) (range 19 to 57%) and average 50% of the flora in early onset periodontitis (EOP)(20). In certain clinical entities, spirochetes can overgrow in the plaque without being associated with the bone and attachment loss that is characteristic of periodontitis. This has been demonstrated by Loesche et al for acute necrotizing ulcerative gingivitis (ANUG) (21). This situation illustrates the need for identifying species of spirochetes for etiologic relationships to be demonstrated.

In the present study despite the effectiveness of Povidone iodine and substantivity of Chlorhexidine, ozonated water irrigation has shown better results in terms of clinical parameters measured and its antimicrobial action. Further long time studies are required to adequately assess the concentration of ozone that is effective against pathogens like spirochetes. Thus as an alternative management strategy to conventional antiseptics, ozone irrigation can be considered a powerful tool to inactivate microorganisms like spirochetes from microbial plaque.

Conclusion

Local ozone application can serve as potent atraumatic, antimicrobial agent to treat periodontal disease non-surgically both for home care and professional practice. It may also serve as good tool during supportive periodontal therapy. Future of ozone therapy must focus on establishment of safe and well defined parameters in accordance with randomized controlled trials to determine precise indications and guidelines in order to treat various dental pathologies.

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Conflict of Interest:

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