



ROLE OF OZONE THERAPY IN DENTISTRY- A REVIEW

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ABSTRACT

With the advancements in the field of dentistry, new treatment protocols are budding day by day to combat human ailments in a much natural better and simpler way. One such advancement is the application of ozone in dentistry. Ozone (O₃) is a triatomic molecule, consisting of three oxygen atoms, and its application in medicine and dentistry has been indicated for the treatment of 260 different pathologies. Because of its high oxidation potential, it is effective against bacteria, viruses, fungi, and protozoa. It has been shown to stimulate remineralization of recent caries-affected teeth, used as a preventive therapy in caries, root caries, and intracanal irrigants in endodontic treatment. It has been used in treatment of alveolitis, avascular osteonecrosis of the jaw, and herpes virus infection. It also inhibits plaque formation and can be used as an adjuvant in periodontal surgical and maintenance phase. Ozone has also been used in dental unit water line to disinfect water. The ozone therapy has been more beneficial than present conventional therapeutic modalities that follow a minimally invasive and conservative application to dental treatment. Therefore, this review is an attempt to summarize its therapeutic potential in various fields of dentistry and its possible clinical application in future.

INTRODUCTION

The word ozone was first introduced by Schonbein in 1840 [1]. He subjected oxygen to electrical discharges and noted "the odour of electrical matter". Schonbein concluded that odour was due to a gas which he named ozone, from the Greek word Ozein [2,3]. Ozone is a gas composed of three atoms of Oxygen and present naturally in the upper layer of atmosphere in abundance [4]. Ozone therapy is one of the modern non-medication methods of treatment in dentistry. Some factors were responsible for its wide spreading, such as simplicity of performance, good tolerance by patients, absence of side-effects or adverse reactions and high medical-social and economic efficiency. The majority of the contributing factors and causes in the etiology of various dental diseases are reduced or treated with ozone in all its application

forms (gas, water, oil).

BIOLOGICAL ACTIONS OF OZONE

Effect on bacteria, virus, fungus and protozoa

Ozone damages the bacterial cell membranes by ozonolysis and oxidates intra cellular proteins leading to loss of organelle function [5]. Ozone is very effective in antibiotic resistant strains with accelerated efficiency in acidic PH environment [6]. It also makes the infected cell intolerant to peroxides and changes the activity of reverse transcriptase [7] thus hampering viral protein synthesis.

Cellular and Humoral Immune system

It reactivates the immune system through macrophage activation and Cytokine release which in turn boost immune system [8] which makes it useful in patients with low immune status and immunodeficiency.

Anti-inflammatory action

Ozone stimulates release of interleukins,

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leukotrienes and prostoglandins [7] thus reducing inflammation and promoting wound healing.

MODES OF OZONE GENERATION IN DENTISTRY

Ozone generators

There are three different systems for generating ozone gas [9]

Ultraviolet System

Produces low concentrations of ozone, used in esthetics and for air purification.

Cold Plasma System

used in air and water purification.

Corona Discharge System

produces high concentrations of ozone. It is the most common system used in the medical/dental field.

MODES OF OZONE ADMINISTRATION

Ozone is administered on patients for therapeutic purposes in various forms like ozone gas, as an aqueous solution, oil or as ozonated water.

Ozone Gas

Gaseous ozone is most frequently used in restorative dentistry and endodontics. Topical administration of the gaseous form can be via an open system or via a sealing suction system as a prerequisite to avoid inhalation and adverse effects.

Ozone aqueous Solution

Useful for disinfection and sterilization. Displays hemostatic effect in cases of hemorrhage.

Ozone Oil

useful for external application. Ozone is passed through plant extracts to form a thick gel containing ozonides.

Ozonated water

According to German dentist Fritz Kramer [10], ozone, in the form of ozonated water, can be used in the following ways; 1. as a powerful disinfectant, 2. in its ability to control bleeding, 3. in its ability to cleanse wounds in bones and soft tissues, 4. by increasing the local supply of oxygen to the wound area, ozone can improve healing, 5. ozonated water can increase temperature in the area of the wound, and this increase the metabolic processes related to wound healing. Dr. Kramer points out that ozonated water can be used in a number of different ways: 1. as a mouth rinse (especially in cases of gingivitis, periodontitis, thrush or stomatitis); 2. as a spray to cleanse the affected area, and to disinfect oral mucosa, cavities and in general dental surgery; 3. as an ozone/water jet to clean cavities of teeth being capped, receiving root canal therapy,

and in treating painful gingivitis and stomatitis.

APPLICATION OF OZONE IN VARIOUS FIELDS OF DENTISTRY

Bacteria are the cause of many problems in dentistry so a powerful agent is needed for effective elimination of these causative agents. In dentistry, Ozone is used as a chair side disinfectant because of its synergistic part of the treatment, both in eliminating bacteria and oxygenating chair side environment.

Uses in Endodontics and Conservative dentistry: Dental caries

It has been suggested that when ozone gas was applied to carious lesion for 10-20 sec, there was reduction of about 99% of microorganisms. Two different studies done on ozonated water and gaseous ozone to demonstrate the antimicrobial activity of ozone showed that ozone have strong antimicrobial activity against *E. faecalis* and *S. mutans* infections in vitro in bovine dentine as well as in ex vivo conditions and it can be used as an adjuvant in caries therapy [11,12].

Root canals

Ozone oils can be used to sterile the root canal systems and to clear the canals of necrotic debris by virtue of ozone's bactericidal and effervescent properties. Ozone oils are ozonated sunflower oil or olive oil or groundnut oil. This ozone oil irrigation is more quick and efficient in canal sterilization than that conventional irrigation by the sodium hypochlorite and sodium peroxide combination [13, 14]. In discolored non vital teeth, Ozone can be used for bleaching. Once the bleaching agent is placed on the inner aspect of the root canal treated tooth, the crown is irradiated with ozone for minimum of 3-4 mins. This Ozone treatment bleaches the tooth within minutes and provides good esthetic result [15,16].

Uses in Periodontics

Ozonated water is used to irrigate sulci and pockets during scaling and surgical procedure thus reducing preoperative bacterial load [17]. For LASER therapy with the Periolase, ozonated water is to be used during ultrasonic debridement. Routine minor recall treatment cases, such as gingivitis, utilize pretreatment rinsing with ozonated water, irrigation of the periodontium and insufflation of any periodontal pockets [18]. In a study on permeability of oral microorganisms and dental plaque, it was found that both gram +ve and gram -ve such as *Porphyromonas endodontalis* and *Porphyromonas gingivalis* were more sensitive to ozonated water than gram +ve oral *Streptococci* and *Candida albicans* in pure culture. In another study, Dodwad et al. compared the effect of oral irrigation with ozonated water, 0.2% Chlorhexidine and 10% Povidone iodine in patients with chronic periodontitis and it was concluded that local ozone application can serve



as potent atraumatic, antimicrobial agent to treat periodontal disease nonsurgically both for home care and professional practice. It may also serve as good tool during supportive periodontal therapy [19,20].

Uses in Prosthodontics

According to a study, few oral microorganisms and no viable *C. albicans* were detected after exposing the denture to flowing ozonated water (2 or 4 mg/L) for 1 min. Thus, the application of ozonated water is effective in reducing number of *C. albicans* in denture base [21].

Adjunct therapy for tooth extractions, other surgical procedures and bisphosphonate osteonecrosis

In alveolitis, there is accelerated healing by irrigation with ozonated water after removal of the necrotic plug and debris under antibiotic coverage [22].

Uses in Oral medicine

Ozone in healing wounds has been reported to accelerate the healing of soft tissue conditions, i.e. aphthous ulcers, herpes labialis, acute necrotizing ulcerative gingivitis (ANUG) and other gum infections. A case report by Shenberg and Blum [23] demonstrated gaseous and aqueous ozone therapy for treatment of mucositis secondary to chemotherapy/radiotherapy. The treatment protocol involved application of ozone in both aqueous and gaseous forms. Intra-articular administration of ozonated water has been found to be a successful alternative therapy for the management of different joint diseases. A randomized control study was conducted by Daif, [24] involving 60 individuals with bilateral internal derangement of the TMJ and disc displacement with reduction. 87% of the patients who received ozone gas injection into the joint space either completely recovered or improved.

Implant cases

During placement of implants, ozone gas is bubbled into prepared socket and implant is placed. This reduces percentage of infection in implant cases. Ozone therapy can also be used in perimplantitis cases. El Hadary et al. evaluated that short-term administration of cyclosporine A, when administered with topical ozonated oil, may influence bone density and the quality of dental implant osseointegration [25].

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Role in Pedodontics

Most of the child patients have fear and anxiety towards dental treatment. Abu Naba'a *et al.* conducted a split mouth randomized clinical trial. Using the anxiety questionnaire, they found that ozone treatment provoked the least state of anxiety comparing to traditional dentistry [26].

RECENT ADVANCEMENTS

Ozone was found to be effective as an antibacterial agent to treat oral infections caused by *Actinomyces naeslundii*, *Lactobacilli casei* and *Streptococcus mutans*. Exposure of about 60 s exhibited 99.9% killing efficiency, but exposure for such a long period showed degradation of saliva proteins. So exposure of 10 s to 30 s was proved effective to kill significant number of bacteria.

CONCLUSION

Dentistry is changing as we are now using modern science to practice dentistry. The ozone therapy has been more beneficial than present conventional therapeutic modalities. The concept of use of ozone in dentistry is an entirely new arena of therapy. This state of the art technology allows us to take a minimally invasive and conservative approach to dental treatment. Treating patients with ozone therapy reduces the treatment time with a great deal of difference and it eliminates the bacterial count more precisely. The treatment is completely painless and increases the patients' acceptability and compliance with minimal adverse effects. While laboratory studies suggest a promising potential of ozone in dentistry, less number of clinical studies were documented. More number of randomized, controlled trials need to be conducted to determine the precise indications and guidelines to treat various dental pathologies with this promising medical agent. Further research is also needed to standardise indications and treatment procedures of ozone therapy. But, it has to be kept in mind that presently ozone is an adjunct to other conventional treatment modalities and should be used in combination until more research shows benefits in independent usage.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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