



Review Article

OZONE THERAPY IN DENTISTRY- A REVIEW

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ABSTRACT

This review of literature is an attempt to summarize different modalities of ozone application in dentistry. Ozone gas has a high oxidation potential and is effective against bacteria, viruses, fungi, and protozoa. It also has the capacity to stimulate blood circulation, platelets, and immune response. Ozone is used in dentistry in gaseous, ozonated water and as ozonated oils. Ozone was shown to be biocompatible and is used in all aspects of dentistry. It has been shown to stimulate remineralization of recent caries-affected teeth and is 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 (O₃) is a triatomic molecule, consisting of three oxygen atoms, and its application in medicine and dentistry. The ozone therapy has been more beneficial than present conventional therapeutic modalities that follow a minimally invasive and conservative application to dental treatment. The exposition of molecular mechanisms of ozone further benefits practical function in dentistry.

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INTRODUCTION

The word Ozone (O₃) is derived from the Greek word ozein (odorant). Ozone is one of the most powerful antimicrobial agents available for use in medicine and dentistry. In the 1920s Dr Edwin Parr, a Swiss dentist, started to use O₃ as part of his disinfection system. Ozone therapy is a well established alternative and complementary therapy in most of the European countries. (1)

THERAPEUTIC MODALITIES

Therapeutic methods of administration of intraoral Oxygen -Ozone (OO) include: injection of gas, irrigation with ozonated water, insufflation of periodontal pockets with gas, and topical application of ozonated oil. Injection protocols include intraosseous injection of the OO gas mixture, locally into the alveolus, subgingivally, intramuscularly, inferior alveolar nerve area, and into the pterygoid space area. These injection protocols are for treatment of the many types of oral infections. Irrigation administration is also utilized for oral infections including stomatitis, herpetic lesions and periodontal infections (subgingival). Insufflation techniques are generally utilized for decay, periodontal infections and endodontic treatment. A tray technique has been developed for full arch treatment of periodontal disease, caries and biphosphonate osteonecrosis.

Extraoral therapeutic protocols include nasal and ear insufflation, temporomandibular joint injections, trigger point injections and craniofacial lymphatic injections. These modalities are used for various primary and supportive treatment techniques. The potential application of ozone therapy in human body and its biological horizons are listed in Table 1. Antimicrobial effect of ozone is the most studied. Oxygen/ozone therapy in dentistry contains a multiplicity of protocols to deal with dental infection. Three fundamental forms of application to oral tissue are applied- (a) ozonated water, (b) ozonated olive oil, and (c) oxygen/ozone gas. (2)

Table 1: Potential applications of ozone therapy

1.Antimicrobial (bactericidal, viricidal, and fungicidal)	6.Synthesis of immunoglobulin's	11.Bio-energetic and biosynthetic
2.Damage to cytoplasmic membrane	7.Enhance phagocytosis activity	12.Activates protein synthesis
3.Oxidation of intracellular contents	8.Activation of biological antioxidants	13.Enhanced cell metabolism (Ribosome, mitochondria)
4.Activates cellular and humoral immune system	9.Anti-hypoxic and detoxicating	14.Biologically active substances
5.Proliferation of immunocomplement cells	10.Activation of aerobic process (Krebs cycle, glycolysis, oxidation of	15.Synthesis of interleukins, leukotrienes and prostaglandins

Table 2: Dental treatment modalities of ozone therapy

Biofilm purging (Elimination of bacterial pathogens)	Tooth sensitivity	Accelerated healing
Periodontal pocket disinfection and osseous disinfection	Tempromandibular joint treatment	Tissue regeneration
Prevention of dental caries	Gum recession (exposed root surfaces)	Controlling halitosis (Bad breath)
Endodontic treatment	Pain control	Remineralization of tooth surface
Tooth extraction	Infection control	Teeth whitening (Bleaching)

TREATMENT OF DENTAL CARIES AND OPERATIVE DENTISTRY

Various studies have been presented showing that low concentrations of OO gas causes inhibition of pit and fissure caries, root surface caries and interproximal carious lesions. These same studies have also shown that reversal of decay in carious lesions occurs with exposure to OO in as little as ten seconds. The protocols developed by the American College of Integrative Medicine and Dentistry encompass utilization of OO for procedures including pit and fissure sealants, decay removal with subsequent restoration, dentinal hypersensitivity, crown and bridge preparation, and carious exposures. (3) The procedure is to isolate the tooth or preparation and flow the gas into the area the area to be treated slowly for 45- 60 seconds. The use of proper evacuation technique is essential to avoid inhalation of the gas. The oxidant nature of the ozone can cause an irritation to the eyes and the mucosal lining of the respiratory tract. This procedure will kill or significantly inhibit any possible microbial infection at the site with a reduction of postoperative hypersensitivity. (4)

TREATMENT OF ROOT CANALS

Endodontic (root canal) treatment of infected teeth has long been a treatment of choice and the standard of care in dentistry for an infected tooth. Endodontic treatment involves cleaning out the main canal or canals of a tooth with instrumentation, irrigation and chemicals (sodium hypochlorite - bleach). These canal(s) are then filled with a material called gutta percha before the tooth is finally restored with a crown. This procedure is supposed to sterilize the tooth from all the invading bacteria that subsequently caused the tooth and the surrounding bone to become infected. The classical endodontic community feels that this procedure prevents any bacteria from living within the tooth or ever invading the tooth again from the alveolar bone, thus saving the tooth. This has been a contested theory that has been disputed by the allopathic and the integrative dental community. Studies have shown that following endodontic therapy, some bacteria, fungi and viruses remain in the multitude of the very small lateral canals and dentinal tubules that transverse the tooth root and communicate with the periodontal tissue. These studies have shown that the obligate anaerobes (which can include bacteria, virus and fungi) can remain within these canals and are even found all the way to the cemento-enamel junction. The use of ozonated water had the same antimicrobial activity as 2.5 percent sodium hypochlorite without the tissue toxicity. (5) The study also showed that following ozone therapy there was high metabolic activity of the associated fibroblasts indicating an increase in the healing process. Another study found that the use of ozonated oil was actually slightly more effective than calcium hydroxide as an intracanal medicament. The anaerobic bacteria create a positive charge and acidic nature in the infected environment. (6) OO is a gas that carries a negative charge and is attracted to the infected environment resulting in disinfection of the area. Standard of care endodontic procedures are employed during diagnostics and treatment. Then OO Treatment is used for disinfection of the root canals and dentinal tubules. (7)

TREATMENT OF PERIODONTAL DISEASE

Periodontal disease is a multifactorial disease process in the mouth. It has been linked systemically to other diseases such as atherosclerosis, bronchitis, diabetes, preterm and low weight births, pancreatic cancer and others. Traditional treatment has been either conservative treatment by root planing and scaling, surgical intervention with a scalpel or LASER therapy (with the Periolas, an Nd: YAG LASER). (8)

In cases where treatment is by root planing and scaling, the sulci and pockets are initially irrigated with ozonated water by use of a syringe and a canula. This process will reduce the initial pathogenic load on the patient locally and systemically before the root planing and scaling procedure begins. (9) After treatment of a quadrant or half the mouth, each pocket and sulcus is insufflated with OO gas. The gas goes directly into the crevicular fluid and the tissues and sterilizes the area, thus eliminating the pathogenic organisms. For patients undergoing LASER therapy with the Periolas, it is recommended that ozonated water be used during ultrasonic debridement. For certain cases, a silicone tray isolation technique may be utilized. This involves fabrication of appliances made of silicone that fits snugly onto each arch. Each appliance has an inlet and an outlet valve. A low/medium concentration of OO gas flows continuously into the appliance saturating the teeth and periodontium with OO gas. Ozone gas is introduced into the tray through the in port of the tray. The small suction evacuator is attached to the outlet valve allowing the excess gas to be vacuumed away to prevent inhalation of the gas. This treatment requires multiple visits. Routine recall treatment for minor cases, such as gingivitis, utilizes pretreatment rinsing with ozonated water, irrigation of the periodontium and insufflation of any periodontal pockets. (10) In all cases, the patient is given a jar of ozonated olive oil to take home with them and apply topically to the soft tissue. This will insure a continuous dose of OO to the tissue and eliminate the microbes that create the biofilm that causes reinfection of the surrounding tissues.

USES IN PROSTHODONTICS

The effect of ozonated water on oral microorganisms and dental plaque was assessed. Few oral microorganisms and no viable *C. albicans* were detected after exposure to flowing ozonated water (2 or 4 mg/L) for 1 min, suggesting the application of ozonated water might be useful in reducing the number of *C. albicans* on denture bases. (11) One study compared the microbicidal effect between gaseous ozone and ozonated water on dentures and found that direct exposure to gaseous ozone was more effective.

ADJUNCT THERAPY FOR EXTRACTIONS, OTHER SURGICAL PROCEDURES AND BIPHOSPHONATE OSTEONECROSIS

OO is so versatile that it can be used for almost any type of dental procedure. After a tooth is extracted or any basic surgical procedure it is recommended post-surgically to irrigate and insufflate the area. This reduces the positive electric potential of the wound and potential scar with the negatively charged gas or water. Healing of the wound is generally much faster and with less or no complications. (12) Biphosphonate necrosis has been extremely difficult to treat medically and surgically. There has been some success with OO utilizing the foundational protocols along with intraosseous injections and intraoral silicone tray treatment of the osteonecrotic lesion. (13) The patient is always sent home with a jar of ozonated olive oil as a postoperative dressing for the wound.

Table 3: Contraindications of Ozone therapy

1. Pregnancy	2. Autoimmune disorders	3. Hyperthyroidism	4. Anemia	5. Myasthenia
6. Alcohol intoxication		7. CVD	8. myocardial infarction	9. Hemorrhage

CONCLUSION

Ozone is the perfect substance for use in dental procedures. It disinfects the tissues treated and leaves no toxic residues like chlorinated products. It performs this task by oxidizing the cell membranes of pathogenic organisms and killing them. The oxidizing effect of ozone is as follows: one molecule of ozone will kill the same number of bacteria that requires 3,000-10,000 molecules of chlorine for the same effect and ozone kills them 3500 times faster than chlorine.

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