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# Ozonoterapia- An Alternative To Conventional

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### ABSTRACT

The use of ozone in oral health care is flourishing with the evidence of its effectiveness in treating dental caries. As we know its importance in the troposphere is now witnessed in the dental sphere. There is growing evidence that it can be employed as a therapeutic agent in both medicine and dentistry. Its painless, atraumatic, non-invasive nature and absence of discomfort make it an ideal treatment option especially in the case of paediatric patients where patient's acceptance is of utmost importance. So, this article summarizes the therapeutic benefits of ozone in dentistry.

**Keywords:** Ozone, dental applications of ozone, ozone therapy, contraindications of ozone

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## INTRODUCTION

Ozone (O<sub>3</sub>) is a triatomic oxygen molecule with a molecular weight of 47,98 g/mol. It is a highly instable compound, so should be prepared just before use. After preparation within an hour it gets transformed to oxygen. Ozone therapy is one of the contemporary non-medication methods of treatment. It is being used for more than 100 years. Medical reports on the successful application of ozone in the treatment of different diseases and studies of its effects caused a rapidly growing interest in it. Some other factors were responsible for its wide-spreading, such as simplicity of performance, good tolerance by patients, minimal side-effects or adverse reactions and high medical-social and economic efficiency.<sup>2</sup>

Despite its benefits it is still ignored by most medical establishments because of facts that gaseous ozone is quite toxic and has strong oxidative properties. Ozone, which is used for medical purposes, is a gaseous mixture comprised of a major amount of oxygen i.e. 95 to 99.95% and 0.05 to 5% of pure ozone. It exhibits multiple actions on the human body, such as anti-microbial, immune-stimulating, anti-hypoxic, analgesic, detoxicating, bioenergetics and biosynthetic.<sup>3</sup>

## HISTORY

The word ozone comes from a Greek word *ozein* which means odour and was first described by German chemist Christian Friedrich Schonbein in 1840, who is considered as Father of ozone therapy. The first medical application was done by Dr C. Lender to purify blood in test tubes. Dr Edwin Parr used it as a part of disinfection system in 1920. The first dentist to use ozone was Dr Edward Fisch in 1950, on regular basis and reported many cases based on this.<sup>4</sup>

## MODES OF OZONE ADMINISTRATION

Ozone can be delivered in various forms such as topical or locoregional in gaseous or aqueous form or as ozonated oil or sunflower oil. The European Cooperation of Medical Ozone

Societies warns from injecting gaseous ozone intravenously as it can cause air embolism.

## OZONE GENERATION

It's highly impossible to store ozone for longer durations due to its instability. So it must be prepared just before application. To prevent its decomposition into oxygen it can be associated with a vehicle that has more viscous properties to retard its conversion. Different systems for generating ozone gas are: Ultraviolet System produces low concentrations of ozone, used in aesthetics, saunas, and air purification. Cold Plasma System: used to purify air and water, produces high concentrations of ozone. The latter one is the most common system used in the medical/ dental field, easy to handle and controlled ozone production rate are its advantages. Commercially available ozone generator: CurOzone USA Inc. (Ontario, Canada) developed the HealOzone, which is now distributed by KaVo Dental (KaVo, Biberach, Germany), for use in dentistry.<sup>3</sup>

Dr Kramer has pointed out the application of ozonated water:

1. In the form of mouth rinse (especially in cases of Gingivitis, Periodontitis, Thrush or Stomatitis);
2. In the form of to cleanse the affected area and to disinfect oral mucosa, cavities and in general dental surgery;
3. In the form of ozone/water jet to clean cavities of teeth being capped, receiving root canal therapy, and in treating painful gingivitis and stomatitis.<sup>5</sup>

## MECHANISM OF ACTION

Ozone oxidizes bio-molecules, disrupts microbial cell structures and metabolism. Within seconds it can disrupt microbial cell wall, leading to immediate cell lysis.<sup>10</sup> – 20 second application of ozone has been reported to eliminate approximately 99% of the microorganisms found in the dental caries and associated biofilms – and a 40 second treatment time covers all outcomes (Lynch and Baysan, 2001). A low concentration of ozone about 0.1

ppm, is sufficient to inactivate bacterial cells as well as their spores. (Broadwater WT *et al.*, 1973).<sup>3</sup>

## APPLICATION OF OZONE IN DENTISTRY

Ozone presents unique properties and great advantages to clinical practice in dentistry and medicine. It acts as an adjunct to conventional treatment modalities and can be used in a wide range of dental practice.

### Ozone can be used for treatment of following conditions:

- Early carious lesion
- Sterilization of prepared tooth cavities
- Sterilization of root canals
- To enhance the epithelial wound healing
- Decontamination of avulsed teeth
- Desensitization of extremely sensitive teeth
- Bleaching of discoloured root canal treated teeth
- Treatment of periodontal pockets and periimplantitis
- As a denture cleaner and decontamination of used tooth brush.<sup>6</sup>

### Ozone and Dental caries:

Aqueous and gaseous modes of ozone are used for the treatment of dental caries. Though aqueous ozone is less viable to various microorganisms it is found to be less cytotoxic than gaseous form.<sup>7</sup> In the treatment of dental caries it can be applied through a handpiece that has silicon cup so that it provides a snap fit at the application site. It is applied to the carious lesion in a controlled manner, it safely kills the bacteria that cause caries, thus require only a minimum physical intervention and a few seconds. Ozone exhibits its antibacterial effect by oxidizing bacterial cell wall. During cariogenesis, acidogenic bacteria produces pyruvic acid which is considered as strongest naturally occurring acid and ozone can decarboxylate this acid to acetic acid.<sup>8</sup> It is known to remove the smear layer leaving behind exposed dentin on which remineralizing agent can be effectively applied. A number of studies had proved the

effectiveness of ozone in treating pit and fissure caries, incipient caries, root caries and interproximal caries. Ozone therapy is effective against lactobacillus and some streptococcus strains.<sup>9</sup>

### Sterilization of prepared tooth cavity:

Ozone in the gaseous form is used to disinfect the cavities by removing the smear layer. It can be applied before etching and the placement of sealant with no negative impact on sound enamel physical properties. Exposure of ozone gas for a longer duration is known to have a strong bactericidal effect on microorganisms within the dentinal tubules of deep cavities, which result in increasing the clinical success of restorations, with no negative effect on dentin and enamel shear bond strength of the adhesive restoration.<sup>10</sup>

### Sterilization of the root canals:

Ozone oils are used to sterilize the canal systems and to clear off the necrotic debris by ozone's antibacterial properties. Ozone oils are in the form of ozonated sunflower oil, olive oil or groundnut oil. Application of ozone for a period of 10 s was also capable of reducing the number of *Streptococcus mutans* and *Streptococcus sobrinus* in vitro.<sup>12</sup> Cardoso evaluated the efficiency of ozonated water as an irrigating agent during endodontic treatment in an attempt to eliminate *Candida albicans* and *Enterococcus faecalis* and to neutralize lipopolysaccharides inoculated in root canals. Effective results were obtained within 10 minutes of application. No residues were found on the collection of second sample even after a week. Despite this, ozonated water could not neutralize *E. coli* and lipopolysaccharides within the canals and the remaining number of lipopolysaccharides might cause apical periodontitis.<sup>13</sup>

### Ozone in healing wounds:

Ozone is known to accelerate the healing of soft tissue conditions, i.e., herpes labialis, aphthous ulcers, acute necrotizing ulcerative gingivitis (ANUG) and other gum infections. Antiviral action of ozone might be due to damage to the

protein capsule. Virus does not have any enzymatic protection against oxidative conformation so lipid envelop virus like Herpes Virus, Epsilon Bar Virus are sensitive to ozone therapy. Ozone in the form of oil when applied on herpes labialis and mandibular osteomyelitis demonstrates faster healing than conventional treatment.<sup>11</sup>

Filippi observed epithelial wound healing with the use of ozonated water, he found that regular use of ozonated water can accelerate healing of the oral mucosa and this effect was seen in the first two postoperative days. Post-extraction healing time is also reduced by forming a pseudo-membrane over the socket, and this protects from external insults. In case of alveolitis accelerated healing by irrigation with ozonated water was seen after removal of the necrotic pulp & debris with supportive antibiotic coverage.<sup>11</sup> Clavo et al concluded that ozone therapy can produce an improvement in blood flow and oxygenation in some tissues & appears to have a positive effect in the treatment of patients with advanced head & neck tumors.<sup>5</sup>

#### **Decontamination of avulsed teeth:**

Ozonated water is found to be biocompatible with human oral epithelial cells, gingival fibroblast cells, and periodontal cells. Irrigating an avulsed tooth with ozonated water for 2 minutes, cleanses and decontaminates the root surface. It has no negative effect on periodontal cells remaining on the tooth surface before replantation.<sup>14</sup>

#### **Desensitization of extremely sensitive teeth:**

Ozone is also known to terminate root sensitivity. Sixty-second mineral wash over the exposed dentine in a repetitive manner gives quick relief from sensitivity. Ozone works by removing smear layer, opening up the dentinal tubules, broadening their diameter and then the Calcium and Fluoride ions can flow into the tubules easily, deeply and effectively to block the dentinal tubules, so that it prevents exchange of fluid through these tubules. Therefore, ozone can successfully terminate the root sensitivity

problem within a few moments and also lasts longer than those by conventional methods.<sup>5</sup>

#### **Bleaching of discoloured teeth:**

Ozone can be used as a bleaching agent for the discolouration caused by intracanal medicaments like minocycline. Discoloration of the crown can be treated placing the bleaching agent into the inner aspect of the tooth then the crown is exposed to ozone gas for a minimum of 3-4 min. This ozone treatment bleaches the tooth within few a minute.<sup>5</sup>

#### **In periodontics:**

Ozone in periodontics mainly utilizes its antimicrobial action over the gram positive and gram-negative microflora, viruses and fungi. It kills the microorganisms causing periimplantitis. It also shows a positive effect on wound healing by increasing circulation to that area. Nagayoshi et al explored that, almost no microorganisms were detected after being treated with ozonized water (4 mg/l) for 10 seconds.<sup>13</sup>

#### **Ozone as denture and tooth cleanser:**

Microbial plaque piling up over the dentures is mainly of *C. albicans*. The application of ozonated water (2 or 4 mg/L) for 1 min, might be useful in reducing the number of *C. albicans* on denture bases. Even though both gaseous ozone and ozonated water are used for denture cleansing, gaseous ozone was found to be more effective. Ozone application was found to remove the toothbrushes bristles microbiota following conventional brushing.<sup>15</sup>

Cleaning of removable partial denture alloys with ozone is beneficial but it has little impact on the quality of alloy in terms of reflectance, surface roughness, and weight.<sup>6</sup>

#### **CONTRAINDICATIONS OF OZONE THERAPY**

The following are contraindications of ozone therapy: -

- Pregnancy
- Autoimmune disorders
- Hyperthyroidism
- Anemia
- Myasthenia

- Alcohol intoxication
- CVD, myocardial infarction
- Hemorrhage
- Ozone allergy

Inhalation of ozone for a longer duration can have serious effects on the lungs and other organs as well but calibrated doses can be therapeutically used in various conditions without any toxic or side effects. (Bocci V *et al.*, 2009).<sup>16</sup>

Ozone therapy if performed correctly then nothing to worry but the dentist should know how to overcome emergency as a delayed intervention might lead to death. He/she must know all the steps of basic life support (BLS) and must have ambu bag, medical oxygen, an automated defibrillator and ampoules of epinephrine, atropine and corticosteroids at their hospital/clinic set up. (Cummins, 1994)<sup>17</sup>

## CONCLUSION

As that of conventional procedures, ozone therapy also possesses some risks, which can be avoided if the dentist has practical as well as theoretical knowledge. A judicious dose of ozone prevents its risk of hazards. It is more advantageous than present conventional therapeutic modalities that follow a minimally invasive and conservative application to dental treatment. It lessens patient's treatment time and eradicates a large scale of micro-organisms which is of utmost importance especially in the case of treating paediatric patients. The treatment is painless and increases the patient's tolerability and fulfillment with minimal adverse effects. Contraindications of this controversial method should not be forgotten. Further research is needed to regulate indications and treatment procedures of ozone therapy.

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