



## OZONE THERAPY IN DENTISTRY

**Dr. Neha Bhardwaj<sup>1</sup>, Dr. Prabhakar Angadi<sup>2</sup>**

*1. Tutor, Daswani Dental College Kota, Rajasthan*

*2. Reader, Dept of Prosthodontics, SMBT Dental college, Sangamner, Maharashtra*

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Email: [info@jusres.com](mailto:info@jusres.com)

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### ABSTRACT

Ozone which is a component of upper layer of atmosphere is being used in field of medicine and dentistry over decades and it has gone through many advances since then. Therapeutic use of ozone is successful due to its unique antimicrobial, oxidative and non toxic properties. It renders minimally invasive dental procedures including treatment of incipient carious lesions and sterilization of root canal system. This review article summarizes use of ozone for treatment of various diseases.

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### INTRODUCTION

Ozone is a chemical compound consisting of three atoms of oxygen with molecular weight of 47,98g/mol [1]. It is present in upper layer of atmosphere and is highly unstable, giving off nascent oxygen depending on systemic conditions like temperature and pressure [2]. The function of ozone in upper atmosphere is to filter harmful ultraviolet rays from reaching earth's surface. Apart from this, ozone is used in many other fields such as in dentistry and medicine [3]. Ozone is being used successfully in field of medicine for more than a decade due to its properties like simplicity of performance, good tolerance by patients and the absence of side effects. Even though ozone therapy is not accepted by many medical personnel due to its oxidative properties and well known toxic effects on respiratory system [4]. Ozone can enhance the after effects of root canal treatment by utilizing different forms such as ozonated water, ozonated oils directly into infected canals. Direct placement of ozone in infected periodontal pockets is known to seize periodontal disease without any associated side effects.

## **HISTORY**

In 1785 researchers noticed an odor when electric sparks passed in an electrostatic machine. In 1840 Christian Friedrich Schonbein named the substance as ozone, which originated from the Greek word "ozien" –to smell. He is considered as the father of ozone therapy. Due to the known bactericidal and antimicrobial properties of the substance, ozone generator was useful in industrial application and disinfection of water. In 1857 Joachim Hensler, a German physicist and Hans Wolf, German physician developed first Ozone generator for medical use, which was capable of producing a mixture of ozone and oxygen at therapeutically variable dosages [5]. Medically used ozone is a mixture of pure O<sub>2</sub> (0.1% - 0.5%) and O<sub>3</sub> (95%-99%) [6, 7]. In 1870 evidences show Ozone being used therapeutically to purify blood by C Lenderin Germany [8,9]. It was also used in treating gaseous, post traumatic gangrene in German soldiers during 1<sup>st</sup> world war [7]. Before 1983, many Swiss dentists have also been known to use ozone in dentistry [8,9]

## **MECHANISM OF ACTION OF OZONE**

There are several known actions of ozone on human body, such as immunostimulating and analgesic, antimicrobial (bactericidal, viricidal and fungicidal), bioenergetics and biosynthetic (activation of the metabolism of carbohydrates, proteins and lipids) [10]. Ozone damages bacterial cell wall by ozonolysis and oxidation of intracellular protein [11]. It only affects bacterial cell wall and does not show any adverse effects on human body because of their major anti-oxidative ability. Ozone is very effective in destructing the antibiotic resistant strains in an acidic PH [12]. During viral infections ozone causes intolerance of infected cells to peroxides and change of activity of reverse transcriptase, which takes part in viral protein synthesis [13, 14]. As a response to inflammatory process, Ozone stimulates the release of interleukins, leukotrienes and prostaglandins [15], to promote wound healing. Ozone causes secretion of vasodilators, such as Nitrous Oxide, which is responsible for dilation of arterioles, venules and prevents clumping of Red Blood Cells (RBC), thus increasing their surface area for oxygen transportation. It also activates aerobic processes like glycolysis and Krebs cycle at cellular level to stimulate blood circulation [16], hence ozone is also used for treatment of circulatory disorders.

## **APPLICATION OF OZONE IN DENTISTRY**

The use of ozone has been proposed in dentistry because of its antimicrobial and disinfectant properties. It has been used for treatment of incipient carious lesions, sterilization of cavities, root canals, enhancement of epithelial wound healing.

- **Treatment of carious lesions-** Ozone is delivered to the affected area through a special hand piece equipped with a silicon cup, which is kept in contact with the tooth to form a tight seal. Ozone causes oxidation of bacterial cell wall and bacterial by product [17, 18]. Pyruvic acid is a byproduct, which is reduced to acetate and Carbon Dioxide by the action of ozone over the tooth surface. This is a conservative procedure for non cavitated carious lesion. Studies demonstrate that 40 seconds application of ozone significantly reduces *s. mutans*, whereas 60seconds exposure has almost eliminated *s. mutans*, *L.casei* and *A.Naeslundii* [19]. Ozone is also effective against microflora associated with root caries lesions [20]. In endodontics, files lubricated with ozonated oils and use of ozonated water is recommended instead of sodium hypochlorite. A slow insufflation with about 30ml concentrated ozone should be done for 45-50seconds before obtunding the canal. Ozone is also used for bleaching of endodontically treated teeth.
- **Periodontal therapy-** Progression of periodontal disease is caused by plaque biofilm, use of ozonated water was known to be effective in reducing count of both gram +ve and gram -ve bacteria in dental plaque [21]. Ozonated oil is used as a therapeutic agent in treatment of acute necrotizing ulcerative gingivitis
- **Ozone in prosthodontics-** Ozone is used in disinfection of dentures, as denture plaque control is essential to avoid denture stomatitis. When dentures are exposed to ozonated water, antimicrobial activity has been observed against *Candida albicans*[22]. Ozone in gaseous form has proved to be a more potent antimicrobial agent when compared with ozonated water. When applied on the surface of removable partial denture alloys ozone had very little impact on quality of alloy in terms of surface roughness and weight.
- **Ozone in oral surgery-**ozone accelerates the healing process [23]. Patients with chronic osteomyelitis when exposed to ozone, more rapid bone and soft tissue healing were observed with minimum complications. Ozone therapy also found to be effective for treatment of refractory osteomyelitis in addition to the treatment with antibiotics, surgery and hyperbaric oxygen.
- **Ozone in treatment of peri-implantitis-** Studies has proved that ozone is efficient in reducing adherent bacteria on titanium and zirconia without affecting their adhesion and proliferation of osteoblastic cells. It also promotes wound healing due to increase in tissue circulation.

## CONTRAINDICATIONS OF OZONE THERAPY

1. Pregnancy

2. Glucose 6 phosphate dehydrogenase deficiency
3. Hyperthyroidism
4. Severe anemia
5. Severe Myasthenia
6. Acute alcohol intoxication
7. Recent Myocardial Infarction
8. Ozone allergy

## **DISCUSSION**

Minimal invasive dentistry has set a new standard of oral health care. According to new researches and clinical studies ozone therapy is capable of treating the carious lesions at very initial stage. Ozone therapy has been proved to be a new therapeutic modality with great benefits for the patient. The undisputed antimicrobial effect of ozone as compared to other antiseptic agents makes it a therapeutic agent of choice. Several studies demonstrated the oxidative effect of ozone on microorganisms. Ozone is known to causes decomposition of bacterial cell wall and bacterial byproduct [17, 18], it also accelerate healing of wounds [23]. Many evidence based studies have been done to study in vitro biocompatibility of aqueous ozone with oral epithelial cells and periodontal tissues. Even though ozone therapy is not accepted by many medical personnel due to its oxidative properties and well known toxic effects on respiratory system [4].

In spite of the fact, clinical application of ozone is still a matter of controversy. This is supposed to be because of lack of ample in vivo and in vitro randomized controlled trials. Evidence based studies and clinical trials are still required to rationalize the efficacy of ozone. Cochrane databases suggest the lack of consistency between different outcome measures and absence of evidence that application of ozone reverses the decay [24].

## **CONCLUSION**

Modern dentistry subjects to the minimally invasive dental procedures. When compared with conventional treatment procedures ozone therapy is quite promising as it is less invasive, has potent disinfectant property thus reducing bacterial count more specifically and has minimal adverse effects. It allows us to reduce treatment time and patient discomfort, thus increasing patient compliance. Hence it becomes more acceptable to the patient. Contraindications of this controversial method should not be forgotten. In future emphasis should be done on well controlled clinical trials to determine the precise guidelines about the use of therapy.

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