



Role of ozone therapy in Conservative Dentistry and Endodontics

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ABSTRACT-

Ozone also known as trioxigenis the combination of three naturally occurring oxygen atoms. Ozone has been used successfully for the treatment of various diseases for more than a decade. Ozone therapy is an alternative to traditional approaches in dentistry. The main feature suggests that ozone can be used in dentistry as a strong antimicrobial agent. In the present era of increasing antibiotic resistance, ozone therapy is an alternative medical treatment that rationales to increase the amount of oxygen to the body through institution of ozone into the body. In addition, ozone has antimicrobial, immune system regulatory, metabolic rate, and biosynthesis-enhancing effects. Ozone affects cellular and humoral immunity. It has positive effects on oxygen transport in the body; production of adenosine triphosphate (ATP). Advantage of ozone therapy is it is an atraumatic, biologically based treatment. This article reviews role of ozone therapy in conservative Dentistry and Endodontics.

Keywords- Ozone, dentistry, dental caries, root caries, hypersensitivity, infection, nanozone therapy.

I. INTRODUCTION-

Ozone (O₃) is also known as trioxigen or triatomic oxygen, a higher energetic form of atmospheric oxygen (O₂) which consists of 3 atoms of oxygen. It is derived from the Greek word "Ozein" which means odorant.¹ In the stratosphere when an oxygen molecule is stroked by high energy ultraviolet (UV) radiation, it splits into two free oxygen atoms, further these free oxygen atoms collide with oxygen molecules leading to the production of ozone. It is often created by thunder and lightning and is also known for its interaction with industrial pollutants at ground level.

Properties -

Ozone is a blue gas present in abundance in stratosphere with a concentration of 16–20 mg/m. It swiftly gives up nascent oxygen molecule to form oxygen gas, hence considered as an

unstable gas.² Its half-life varies with temperature variation. At 20 °C it has a half-life of 40 min at 0°C about 140 min.³ Due to this instability, it has the highest oxidation potential, approximately 150% greater than that of chlorine when used as an antimicrobial agent. This strong oxidant property has led to use of ozone in medical and dental fields.

Production of ozone –

For medical use highly specific gazettes known as Ozone Generators are used for production of ozone. Medical grade oxygen is made to flow through high voltage tubes with outputs ranging from 4000 V to 14000 V. The Ozone Generators work on one of the three principles: Ultra-violet light lamp, Corona discharge or Cold plasma.^{12–14} In dentistry, there are two widely used ozone units: the heal ozone¹⁵ and ozotop.⁴

Goals of ozone therapy-

- (i) Inactivation and elimination of pathogens,
- (ii) Stimulation of immune system and improved circulation,
- (iii) Reduction of inflammation and pain,
- (iv) Stimulation of humoral anti-oxidant system,
- (v) Restoration of proper oxygen metabolism,
- (vi) Prevention of shock and stroke damage,
- (vii) Induction of eco-friendly environment,
- (viii) Improvement in brain function and memory.⁵

Routes of ozone administration

(i) Gaseous form - Gaseous ozone could be administered topically either by an open system or by a sealing suction system to avoid inhalation and adverse effects. Most frequently used in restorative dentistry and endodontics. It is a non-invasive therapy for treatment of dental caries and may be used as a disinfectant before the placement of a direct restoration and also as therapy for hypomineralized teeth.⁶

(ii) Ozone aqueous solution- It has been shown to be efficacious against Gram-positive and Gram-negative oral microorganisms as well as



bacteria in plaque biofilm. In comparison to other chemical cleaners, it appears to be less expensive.⁷ If ozone gas is inhaled into the respiratory tract it has toxic effects, hence to control oral infections and various pathogensozonated water may be useful. Commercially available as ultra-pure, tripple ozone treatment system.^{8,9}

(iii) Ozonized oil - It is competitive antimicrobial agent due to wide accessibility of sunflower oil. It is found efficacious against Streptococci, Enterococci, Staphylococci, Pseudomonas, Escherichia coli and especially Mycobacteria and is used for the cure of fungal infections.¹⁰ Commercially available as Oleozone, Bioperoxoil.

Applications –

(i) Management of pit and fissure caries -

Deep pits and fissures are difficult to clean and hence are highly likely to cause food lodgement resulting in bacterial growth. Ozone application in such cases has been found to be highly effective. Cleansing the fissures prior to ozone treatment is recommended. This permits the ozone to readily access the caries. After the ozone treatment, application of remineralizing agent and sealing of the clean fissures is encouraged.¹¹ Ozone removes the smear layer leaving behind the exposed dentin that is occluded by the remineralizing agent applied. Huth et al. concluded that ozone application significantly improved non-cavitated initial fissure caries in patients at high caries risk over a 3- month period.¹²

(ii) Management of root caries –

Marked reversal and arrest of shallow non-cavitated root caries lesions have been reported following the use of ozone as part of a preventive care.¹³ The clinical results are enhanced when this process is applied in conjunction to the reduced frequency of consumption of fermentable carbohydrates, increased use of fluoride- containing products and improved oral hygiene. Arrest in the progression of noncavitory root caries, without the need for its removal has been reported following regular application of ozone for 40 s, and the use of remineralizing products.¹⁴ Ozone is the most effective in cases of shallow lesions since it shows enhanced ability to penetrate lesions which are about 1mm deep at the maximum. In case of deeper lesions outer caries must first be removed, leaving about 1 mm of caries over the cavity floor. Then the ozone treatment followed by routine restoration is indicated. Ozone should be considered an adjunct to existing treatment and preventive methods.

(iii) Role in Restorative Dentistry –

Evidence from in vitro studies indicate that the ozone can be used as a prophylactic antimicrobial agent prior to etching and placement of restorations to prevent secondary caries.

There was no alteration observed on the physical properties of enamel, dentin including knoop surface microhardness or contact angle and adhesive restorative materials.¹⁵ When applied for prolonged duration; ozone gas has a strong bactericidal effect on microorganisms within the dentinal tubules of deep cavities, consequently improving the clinical success of restorations.¹⁶ Crown discoloration of non-vital teeth is treated after placing bleaching paste in the pulp chamber followed by ozone exposure for 3–4 min by the virtue of its oxidation property.¹⁷

(iv) Hypersensitive teeth –

Loss of tooth structure occurring due to multiple factors like attrition, abrasion, erosion, trauma from occlusion may cause wearing off of enamel and dentin thereby causing hypersensitivity. Ozone application has been found to effectively reduce sensitivity of not only exposed enamel and dentin but also in cases of root sensitivity. 40–60 s application of ozone is found to instantly reduce pain in these sensitive teeth. Ozone initiates removal of the smear layer, opens the dentinal tubules and widens them. On applying remineralizing agent; calcium & fluoride ions enter the dentinal tubules easily, readily and completely, preventing the fluid exchange from these tubules. Hence, termination of sensitivity occurs following ozone application within seconds and also lasts longer than those by conventional methods.¹⁸

(v) Role in Endodontics –

Ozone has immense potential to be used as an antimicrobial in endodontics.¹⁹ Ozone is effective when it is prescribed in adequate concentration, time and delivered correctly into root canals after the traditional cleaning, shaping and irrigation has been completed. The potential use of ozone gas, ozonated water and ozonized oil in endodontic therapy has been repeatedly reported in the literature.^{20,21} Intra canal gas circulation of ozone at a flow rate of 0.5–1 l/min with net volume of 5 gm/ml for 2–3 min showed encouraging results against pathogenic microbes in the root canal. Ozonated water can be used as an intracanal irrigant and in infected necrotic canals, ozonized oils can be used as an intra-canal dressing reducing the marked anaerobic odor emanating from infected teeth. When used as an irrigant, ozone encourages tissue regeneration and bone healing. Also, when a root canal was disinfected by ozone water with sonification, the antimicrobial efficacy was comparable to 2.5% NaOCl.¹¹ Hence in periapical



infections, ozone therapy can increase the scope of successful nonsurgical management.

(vi) Ozone and dental unit water lines -

Dental unit water line (DUWL) contamination has become a concern. Opportunistic pathogens were cultured from the mains water. Montebugnoli et al concluded that dental manufacturers should be invited to design dental units that incorporate automated devices to disinfect DUWLs.²² In model dental unit water lines, ozone achieved a 57% reduction in biofilm and a 65% reduction in viable bacteria in spite of being used in a very low dose and with a short time of application.²³

Nanozone therapy -

It is a nano-technology based ozone therapy. Nanotechnology is an emerging field of applied science and technology that has tremendous potential to bring about significant health benefits to the society. It opens up new avenues for vast, abundant research. It is the science that deals with manipulation of matter at the atomic or molecular level. Nanozonotherapy provides strongly oxidizing ozone. When given in adequate doses allows removal of 99.9% of bacteria which are responsible for the development of dental caries.²⁴

Ozone toxicity-

When administered 0.05 ppm of ozone for 8 h it is non-toxic. A maximum concentration of ozone in oral cavity amounts to 0.01 ppm, during ozone therapy. Certain side-effects are cough, nausea, vomiting, headache, epiphora, rhinitis, upper respiratory irritation, shortness of breath, and heart-related problems.²⁵

Ozone intoxication-

- (i) Vitamin E
- (ii) Ascorbic acid
- (iii) N Acetylcysteine
- (iv) Inhale humid oxygen
- (v) Patient must be placed in supine position²⁶

Contraindications of ozone therapy-

- (i) Pregnancy
- (ii) Hyperthyroidism
- (iii) Glucose-6-phosphate-dehydrogenase deficiency
- (iv) Severe anemia
- (v) Severe myasthenia
- (vi) Active haemorrhage²⁷

II. CONCLUSION –

Ozone therapy has multiple applications in almost every speciality of dentistry. It is atraumatic, painless, non-invasive in nature with

relative absence of discomfort. It is quite inexpensive and conservative treatment modality with least adverse effects. These unique features increase patient's acceptability and compliance thus making it an ideal treatment choice for dental patients.

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