OZONE THERAPY IN DENTISTRY

General

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Abstract

Ozone due to its unique properties like analgesic, antihypoxic, detoxicating, immunostimulant, antimicrobial, biosynthetic and bioenergetic properties is used to treat various diseases by activation of the metabolism of carbohydrates, protein and lipids. Ozone is the component of upper layer of atmosphere and is used in dentistry to treat minimally invasive dental procedures, treatment of incipient carious lesions, gingival and periodontal diseases. It is also found to be effective in curbing the resistant microbial root canal flora. This review article is an attempt to summarize the various applications of ozone therapy in dentistry.

Key Words: Ozone, caries, periodontal disease, antimicrobial, antihypoxic, biosynthetic, immunostimulating

INTRODUCTION

The word ozone originates from the Greek word ozein, which means odor. It was first used in 1840 by German chemist Christian Friedrich Schonbein who is considered as the “father of ozone therapy”.[1] Ozone is earth’s natural way of self-cleansing as it combines with the pollutants and cleanses the air, thus protecting the living organisms from the ultraviolet rays.[2] In the recent past, medical grade ozone has been used as one of the non-medication methods of treatment and gradually during the course of time, due to its antimicrobial properties, ozone was used in dentistry.[3] Thus, ozone therapy can be defined as a versatile bio-oxidative therapy in which oxygen is administered via gas or dissolved in water or oil base to obtain therapeutic benefits.[4]

OZONE PRODUCTION

Ozone consists of three oxygen atoms and forms a tri-atomic molecule, wherein the oxygen bonds are bound together at an obtuse angle of 116 degrees. It has an internal steric hindrance as a result of which each oxygen atom forms a single bond with another thus producing a negative charge throughout the ozone molecule.[4] This oxygen molecule in air combines under the influence of factors such as ultraviolet radiation from sun and electric discharges from lightening leading to production of internal physical stress thus resulting in production of ozone.[3,4]

The ozone gas is generated as four different systems: Ultra-violet light lamp, Corona discharge system, Cold plasma system and by producing a strong electromagnetic field.[5] For medical and dental use, oxygen is made to flow through high voltage tubes with outputs ranging from 4000V to 14000V.[6] The two widely used ozone units in dentistry are the heal ozone[7] and ozotop.[8] The three basic forms of application to oral tissues include the ozonated water in root canal therapy, ozonated olive oil after periodontal surgeries, treatment of dry sockets, denture sore mouth, herpes labials, oral ulcers and ozonated gas to treat dental caries and apthous ulcer.[9]

MECHANISM OF ACTION

The unique properties of ozone can be attributed to its antimicrobial, immunostimulant, analgesic, detoxicating, anti-hypnotic, bio energetic and biosynthetic actions.[4] It inactivates the bacteria by oxidation of lipoproteins and phospholipids thus disrupting the integrity of bacterial cell envelope including their spores, and also inhibits the cell growth of fungi and viruses. Ozone activates the Krebs cycle and stimulates the production of ATP, stimulates 2,3-diphospho-glycerate and thus increases the amount of oxygen release to the tissues.[10]

INDICATIONS

Ozone therapy in dentistry is indicated in the prevention and remineralization of dental caries, endodontic treatment, dentinal hypersensitivity, prophylaxis, bleaching of discolored teeth, soft tissue pathoses and treatment of dry socket.[9]

CONTRAINDICATIONS

Glucose-6-phosphate-dehydrogenase deficiency, Anemia, Pregnancy, Hemorrhage, acute alcohol intoxication and ozone allergy.[11]

ADVANTAGES & DISADVANTAGES

Ozone therapy is non-invasive, by the means of its friendly ecologic environment and an oxidizing effect it improves the metabolism of infected tissues. Since maintaining the tightness between the cap and ozoned tooth becomes difficult, more time of greater than 10 minutes may be needed for proper cap preparation for its administration.[12]

DENTAL APPLICATIONS

1. CARIES: Due to its high ability of oxidation and destruction of bacterial membranes, a 20 second application of ozone in gaseous form leads to destruction of 99% microorganisms in the carious lesions.[13] Studies have concluded that 40 second application of ozone in the gaseous form on non-cavitated fissure caries and root caries in permanent teeth reduced the progression of caries.[14] However, a study by Baysan and Beighton (2007) failed to notice a significant reduction in the number of viable bacteria in the cavitated occlusal lesions.[15] Thus, ozone can be used in fissured occlusal caries, pit and fissure caries and root caries.[22]
2. ENDODONTICS: It has been reported that ozonated water and gaseous ozone in infected human dental root canals however did not neutralize endotoxin, but was shown to be effective against candida albicans and enterococcus faecalis in the root canal system.[16,17]
3. ORAL MEDICINE: Ozonated water or oil can improve oxygenation in the tissues, increase the blood flow and can thus be used to treat the soft tissue lesions like Herpes, apthous ulcers, angular chelitis and candidiasis.[11,23]
4. ORAL SURGERY: Studies have also found that ozonized water applied on a regular basis can accelerate the healing rate in oral mucosa and can be useful in patients with chronic mandibular osteomyelitis and osteonecrosis of jaw in patients with multiple myeloma.[16,24]
5. PERIODONTICS: Studies have shown that the aqueous form of ozone showed less cytotoxicity than gaseous form or established antimicrobials, however 0.5-4mg/l of ozonated water was highly effective against killing of P.gingivalis, T. forsythia and P. micra.[14] Nagayoshi et al (2004)25 treated the dental plaque

8. ORTHODONTICS: Ozonized olive oil gel has shown to be effective in reducing enamel demineralization around orthodontic bracket during orthodontic treatment.20 A study by Cehreli SV (2010)21 concluded that shear bond strength values of ozone treated specimens were higher.
9. PEDODONTICS: The application of ozone therapy in pediatric dentistry can be attributed to the fact that it is very quick, effective, easy and painless thus improving the patient compliance. Dahnhardt et al (2006)27 used ozone therapy in treating caries in anxious children and he noticed that there was 93% total reduction of dental anxiety in pediatric patients with dental trauma.[27]

OZONE TOXICITY

Due to the high oxidative power of ozone, known side effects like epiphora, upper respiratory irritation, cough, headache, rhinitis, breathlessness, vomiting, blood vessel swelling and stroke can be encountered. However the patient can be placed in the supine position and treated with vitamin E and n-acetylcysteine.[11,19]

CONCLUSION

Ozone therapy being painless, atraumatic, non-invasive and less discomfort is the treatment of choice for most of the patients and due to its unique properties as discussed, ozone has a wide range of application in almost every field of dentistry.

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