

Review Article

OZONE THERAPY AS AN ADJUNCT THERAPY IN DENTISTRY: A REVIEW

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Abstract:

The oral cavity gives the impression of being an open ecosystem, with a dynamic equilibrium between the entry of microbes, colonisation methods, and host defences designed to remove them: the oral mucosa, the gingiva, the gingival crevices, the gingival crevices, the ging Bacteria need to attach themselves to either hard tooth surfaces or epithelial surfaces in order to prevent eradication. Oral caries, periodontal disease, and peri-implantitis are among of the most frequent oral diseases, and the production and growth of oral biofilms, as well as the inside selection of certain microbes, have all been found to be connected with these conditions. The eradication of the biofilm by mechanical means and the use of antibiotic disinfectants or other types of antibiotics as an adjuvant treatment have been the traditional approaches to periodontal care. Ozone, which has the chemical formula O₃, is a triatomic molecule that is composed of three atoms of oxygen. The use of ozone in dentistry and medicine has been advised for the treatment of 260 various diseases and conditions. The ozone therapy has proven to be more helpful than the currently available conventional therapeutic modalities. These modalities typically involve a conservative and minimally intrusive approach to dental care. The demonstration of the molecular processes behind ozone's practical functions is of great help to the field of dentistry.

KEY WORDS- Ozone therapy, Dentistry, Adjunct therapy, effects.

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1. Introduction

Ozone (O₃) may be a gas with a characteristic, penetrating odour that's gift in little amounts in part air. part air is formed of N (71%), O (28%) and different gasses (1%) together with gas that is altered by processes associated with altitude, temperature and pollution. in step with its application, the gas concentration might vary between one and one hundred µg/ml (0.05-5%). The gas expert determines the entire dose in step with the medical/dental indication and also the patient's condition. Medical gas is formed once medical grade O is electrically activated (using Associate in Nursing gas Generator) to create gas. it's a mix of the purest O and purest gas. gas is Associate in Nursing unstable gas and it quickly provides up aborning O molecule to create O gas. the discharge of aborning O has helpful effects. It has been employed in medical field thanks to its extraordinarily sturdy chemical agent property that oxidises nearly all surfaces to the best oxidization stage.¹

HISTORY

The German chemist Christian Friedrich Schönbein (1840), of the University of metropolis in Suisse is thought to be the daddy of gas medical aid. once he passed Associate in Nursing discharge through water, a wierd smelling gas was made, that he referred to as gas, derived from the Greek word ozein which suggests odour. starting of dental-application analysis with the approval of Associate in Nursing Institutional Review Board for Human analysis from Capital University of Integrative drugs in Washington, D.C., started in 2001. the primary formal lecture on oxygen/ozone medical aid was given in 2001 at Capital University. Later on, intensive analysis continued with the publication of Dr. mythical being Rilling's and Dr. Renate Viebahn's text, "The Use of gas in drugs." This text was a typical till 2002, when Dr. VelioBocci revealed "Oxygen/Ozone medical aid – A critique." This was followed by initial dental-applications clinical seminar in urban center in 2003. In 2004, academician Edward kill of capital, UK, contributed to and emended the book "Ozone: The Revolution in medical specialty." varied researchers since that point have worked to elucidate the character and actions of gas. Mariniak Associate in Nursing Delarive showed that it's an allotropical style of O, and Mulliken and Dewar processed its molecular structure.

BIOLOGICAL ACTIONS²

There area unit many acknowledged actions of gas on frame, like immune stimulating and analgesic, anti hypoxic and detoxicating, antimicrobial, bioenergetic and synthesis (activation of the metabolism of carbohydrates, proteins, lipids) etc.

1. IMMUNOSTIMULATING ACTIVITY:

Ozone influences cellular and body substance system by stimulating proliferation of immunocompetent cells and synthesis of immunoglobulins. It additionally activates operate of macrophages and will increase sensitivity of micro-organisms to bodily function. When administered at low concentrations, the organisms own resistance is mobilized, i.e. gas (re)activates the system. As a response to the current activation through gas, the body's immune cells turn out special messengers referred to as cytokines. These molecules successively activate different immune cells, setting off a cascade of positive modification throughout the system, that is excited to resist diseases. gas causes the synthesis of biologically active substances like interleukins, leukotrienes and prostaglandins that is helpful in reducing inflammation and wound healing.

Ozone brings concerning the increase of pO₂ in tissues and improves transportation of O in blood, which ends up in modification of cellular metabolism – activation of aerobic processes and use of energetic resources. It additionally prevents formation of erythrocytes aggregates and will increase their contact surface for O transportation and to stimulate the circulation is employed within the treatment of circulatory disorders.

Ozone causes secretion of vasodilators like NO, that is to blame for dilatation of arterioles and venules that helps in tissue regeneration. It activates mechanisms of supermolecule synthesis, will increase quantity of ribosomes and mitochondria in cells. These changes on the cellular level make a case for elevation of practical activity and regeneration potential of tissues and organs.

2. ANTIMICROBIAL ACTIVITY:

The gas has an action on cells by damaging its cytoplasmatic membrane thanks to ozonolysis of twin bonds and additionally ozone-induced modification of intracellular contents (oxidation of proteins loss of cell organ function) attributable to secondary oxidants effects. This action is non-specific and selective to microorganism cells; it doesn't injury frame cells attributable to their major antioxidative ability.

Gas is incredibly economical in antibiotics resistant strains. Its antimicrobial activity will increase in liquid atmosphere of the acidic hydrogen ion concentration. In infectious agent infections the gas action lies within the intolerance of infected cells to peroxides and alter of activity of polymerase, that takes half in synthesis of infectious agent proteins. A high concentration of gas kills bacterium terribly quickly and is thousand-fold a lot of powerful than different microorganism killing agents. the typical concentration of gas employed in treatments is twenty-five µgm of gas per cubic centimetre of oxygen/ozone gas mixture. Evidence-based analysis has shown that at this concentration, gas effectively kills bacterium, fungi, viruses and parasites. As Associate in Nursing antimicrobial agent, it's a strong oxidiser at a dramatically lower concentration than gas with none of the hepatotoxic facet effects.

One molecule of gas is adequate to between 3000 to 10,000 molecules of gas and it kills unhealthful organisms three,500 times quicker. Studies have disclosed that it solely takes ten sec to kill ninety-nine you look after bacterium, fungi and viruses. It will oxidize several organic compounds and it's a strong antimicrobic. a number of the opposite effects area unit circulatory sweetening, disruption of growth metabolism and stimulation of O metabolism.

3. Bacteria

Ozone acts on microorganism cell membranes, by oxidization of their macromolecule and compound protein parts. there's proof for interaction with proteins similarly. Ozone seems to render the spores defective in germination, perhaps because of injury to the spore's inner membrane.

4. Virus

All viruses area unit at risk of ozone; nonetheless disagree widely in their status. Lipid- enclosed viruses area unit particularly sensitive to gas. Analysis of infectious agent components showed injury to peptide chains and envelope proteins impairing viral attachment capability, and breakage of infectious agent ribonucleic acid.

5. Fungal and protozoa

Ozone inhibits cell growth at all stages.

6. Dental Plaque

Ozonated water inhibited the accumulation of experimental bacterial plaque invitro. Ozonated water had sturdy antiseptic activity against bacterium in plaque biofilm. It was found that ozonated water (0.5–4 mg/L) was extremely effective in killing of each gram-positive and gram-negative microorganisms.

gram-negative bacterium, such as *Porphyromonas gingivalis*, *Porphyromonas endodontalis* were a lot of sensitive to ozonated water than gram-positive oral streptococci and candida.

7. Intracanal Medication

Effects of intracanal medication exploitation ozonated oil compared to a slaked lime paste related to camphorated paramonochlorophenol and alcohol (HPG) for the endodontic treatment of teeth with periapical lesions. The picture taking, histo-pathological, and histo bacteriological analysis showed no vital variations between peri- radicular tissue responses to each medication.³ In vitro studies showed that gas was effective over most of the bacterium found in cases of pulp sphacelus. Small, non-cavitated lesions showed a bigger reduction in number of microorganisms once the applying of gas than did larger lesions, and lesions nearer to the animal tissue margin also showed less reduction within the variety of microorganisms. This suggests that the reversal of unhealthy lesions depend on the scale and localization. Non cavitated lesions were more probably to reverse than cavitated lesions.⁴

The longer the contact time, the higher the microbiological kill rate. it had been showed that by increasing the contact time from ten to twenty s, the microorganism kill rate changed from gas being a disinfectant to feat sterilizingeffect.⁵

Detection of altered secretion proteins indicates that spittle parts represent extra targets for gas. In one study on primary root decay lesion (PRCL) found that ozone application for either for ten or 20s dramatically reduced most of the microorganisms in PRCLs with none facet effects recorded at recall intervals between three and five months.

8. Dental unit water line (DUWL) ⁶

Dental unit waterline (DUWL) contamination has become a priority. Water becomes stagnant once the units don't seem to be in use. Detachment of microorganisms, splatter, and aerosols from dental procedures might infect health care personnel. Another study prompt that DUWL biocides might adversely have an effect on adhesion of rosin to enamel. Ozone has been used for purification of water thanks to its potency and lack of facet effects. Kohno et al published their results that indicated acidic electrolyzed water can be applied as Associate in Nursing acceptable live against bacterial contamination of the DUWL.

9. CELLULAR ACTIVITY:

a. Effect on blood cells

Ozone reduces or eliminates clumping of red bloodcells and its flexibility is renovated, in conjunction with oxygencarrying ability. There is a stimulation of the productionof peroxidase, catalase, and superoxidedismutase that act as atom scavengers.

b. Effect on leukocytes ⁷

Ozone behaves as a weak protein such as tumor necrosis factor, interleukin-2, interleukin-6, interleukin-8, reworking growth factor- β inducer. Ozone reacts with the unsaturated fatty acids of the macromolecule layer in cellular membranes, forming element peroxides (H₂O₂), one among the foremost significant cytokine inducers.

c. Platelets

H₂O₂ generated by blood ozonation activate phospholipase C, phospholipase A₂, cyclo-oxygenases and lipo-oxygenases, and thromboxane synthetase, permitting a step increase of intracellular Ca²⁺, unharness of autacid E₂ and thromboxane A₂ with irreversible platelet aggregation.

d. Miscellaneous

Herpes lesions are studied with topical gas administration. Ozonated oil applied on oral herpes and jaw osteitis incontrovertible quicker healing times than typical protocols.⁸ Ozone in these cases, neutralizes herpes virions by objection, thus inhibiting antiseptic supra infections, and stimulating the healing of tissues through circulatory prompting. gas has been well-tried to be one among the foremost powerful oxidants we will use in medical specialty. Ozone is thought to encourage wound healing similarly as management infection. it had been shown that daily treatment with ozonized water accelerates the physiological healing rate. gas was used within the treatment of avascular osteonecrosis of the jaw (ONJ). There was complete healing of the lesions with the disappearance of symptoms.

Modes of gas administration

The European Cooperation of Medical gas Societies warns from direct endovenous injections of ozone/oxygen gas that ought to not be practiced thanks to the doable risk of air embolism.

Ozone gas application ⁹

a. Ozone generating instrumentality converts O to gas. The gas is thenceforth junction rectifier to a hand piece fitted with a polymer cup. otherwise formed polymer cups area unit on the market that correspond to the shape of assorted teeth and their surfaces. This ensures shut contact between the polymer cup and also the unhealthy space of the tooth in order that the gas doesn't escape. The gas is junction rectifier through the polymer cup over the tooth for a minimum of ten seconds. The gas within the polymer cup is collected once more and reconverted to O by the equipment.

b. Ozone solution

The following properties of gas area unit employed in this case:

- Disinfectant and sterilizing effect;
- Hemostatic result particularly in cases of hemorrhages;
- Accelerated wound healing, improved O offer and support of metabolic processes

c. Ozone oil

Ozonated oils area unit pure plant extracts, through that pure O and gas area unit passed. The plant extracts endure a chemical change to create a thick, viscous oil, or in some cases, a rock oil jelly-like product. the ultimate products contain ozonides. This methodology of external application is harmless.

d. Topical gas medical aid

There is perpetually an opportunity of development of resistance against antibiotic. Pathogens on the opposite hand, cannot overcome aerobic challenges of gas.

In addition, there's proof that gas directly inactivates microorganism toxins, whereas antibiotics don't. Indeed, toxins area unit major contributors to microorganism tissue destruction.

e. Goals of gas therapy¹⁰

The goals of oxygen/ozone medical aid are:

- Elimination of pathogens.
- Restoration of correct Oxygen metabolism.
- Induction of a friendly ecologic atmosphere.

f.

- Increased circulation.
- Immune activation.
- Simulation of the body substance anti-oxidant system.

Ozone toxicity ¹¹

Overwhelming proof shows that the bronchial–pulmonary system is incredibly sensitive to gas and this gas should never be inhaled. The tract lining fluid is recognized by a awfully skinny, watery film containing a minimal quantity of antioxidants that creates tissue layer cells extremely prone to oxidization. embolism additionally occurred throughout direct endovenous administration of O₂ and O₃ of Ozone medical aid. Known facet effects are epiphora and higher metastasis irritation, rhinitis, cough, headache, occasional nausea, and ejection.

CONCLUSION

Ozone is used in almost all aspects of dentistry. There are good evidences of ozone biocompatibility, and effectiveness in removing the microorganisms from dental unit water lines, the oral cavity, and dentures. Advantage of ozone therapy is it is an atraumatic, biologically based treatment. It is toxic when inhaled, and in intravenous administration. It used in dentistry in three forms, gas, oil, and with water. Used as a preventive agent in pit and fissure caries and as a therapeutic agent in primary root caries. Used as an irrigating agent in endodontic, an adjuvant in periodontal surgical and maintenance phase. It must be clear that if we want to use ozone, we must avoid its toxicity by using a precise ozone generator, by collecting a precise gas volume with a defined ozone concentration.

Future of ozone therapy must focus on the establishment of safe and well-defined parameters in accordance to determine the precise indications and guidelines in order to treat various dental pathologies with this promising medical agent.

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