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Dental applications of ozone therapy: A review of literature

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Abstract Ozone has been used successfully for the treatment of various diseases for more than a decade. Its unique properties include immunostimulant, analgesic, antihypnotic, detoxicating, antimicrobial, bioenergetic and biosynthetic actions. Its atraumatic, painless, non invasive nature, and relative absence of discomfort and side effects increase the patient's acceptability and compliance thus making it an ideal treatment choice specially for pediatric patients. This review is an attempt to highlight various treatment modalities of ozone therapy and its possible clinical applications in future.

Contents

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1. Introduction

Ozone (O_3) is a natural gaseous molecule made up of three oxygen atoms. The word ozone originates from the Greek word ozein, which means odor and was first used in 1840 by German chemist Christian Friedrich Schonbein "The father of ozone therapy."[1] The stratosphere layer of the atmosphere contains abundance of ozone[2] and it protects the living organisms from the ultraviolet rays. Ozone is heavier than air and hence it falls downward to earth from such high altitudes.[3] It cleanses the air and combines with any pollutant that it comes in contact. This is earth's natural way of self-cleansing.[4]

Since more than 100 years medical grade ozone has been used as one of the non-medication methods of treatment. The first dentist to use ozone therapy in his practice was E. A. Fisch in the 1930's, to aid in disinfection and wound healing during dental surgeries.[5] The main use of ozone in dentistry relays on its antimicrobial properties.[6]

Ozone therapy can be defined as a versatile bio-oxidative therapy in which oxygen/ozone is administered via gas or dissolved in water or oil base to obtain therapeutic benefits.[7]

2. Structure

Three oxygen atoms constitute to form a tri-atomic molecule of ozone. Equal oxygen – oxygen bonds bound them together at an obtuse angle of 116 °C. The structure of ozone has an internal steric hindrance that prevents it from forming a triangular structure.[8] As a result of this, instead of forming the expected double bonds each oxygen atom forms a single bond with the another oxygen atom resulting in a negative charge throughout the ozone molecule.[2]

3. Properties

Ozone exists as colorless gas, with a pungent odor at room temperature, detectable even at concentrations as low as 0.02–0.05 ppm.[9] Its half life varies with temperature variation. At 20 °C it has a half-life of 40 min at 0 °C about 140 min.[10]

4. Ozone production

Oxygen molecules in the air combines under the influence of factors such as ultraviolet radiation (from the sun) and electrical discharges (lightning). Intense physical stress on water (such as in areas of waterfalls and ocean waves crashing onto rocks) also results in production of ozone in nature.[11] 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 ozone[15] and ozotop.[11]

5. Mechanism of action

Ozone therapy has a wide range of applications in treating various diseases owing to its unique properties including antimicrobial, immunostimulant, analgesic, antihypnotic, detoxicating, bioenergetic and biosynthetic actions.

5.1. Anti-microbial effect

Ozone causes inactivation of bacteria, viruses, fungi, yeast and protozoa. It disrupts the integrity of the bacterial cell envelope by oxidation of phospholipids and lipoproteins. Ozone at low concentration of 0.1 ppm, is sufficient to inactivate bacterial cells including their spores.[16] In fungi, O_3 inhibits cell growth at certain stages, budding cells being the most sensitive.[17] With viruses, the O_3 damages the viral capsid and upsets the reproductive cycle by disrupting the virus-to-cell contact with peroxidation.[18]

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