

Applications of Ozone in Dental Arena: A Revolution

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ABSTRACT

Patently the oral cavity acts as a sweeping environment, with a vibrant sense of balance between the bacteria trying to inhabit and invade the oral cavity and defensive nature of oral cavity to protect against the micro-organisms. The bacteria has the core property to adhere to the soft and hard surfaces of the oral cavity and to disrupt the structural net of the micro-organisms, the use of straightforward procedures like the local application of disinfectants along with scaling and root planning have been employed. Ozone is a molecule entailing 3 oxygen atoms and currently it has proved useful for over successful treatment of over 300 pathologies. Additionally, in most of the cases, ozone has substantiated to be an enhanced option as equated to the conventional methods. The article focuses on wide-ranging applications of ozone in the field of dentistry.

KEYWORDS: Ozone; dental; applications

INTRODUCTION

Ozone is a colorless gaseous state of oxygen and is extant majorly in the stratosphere. It holds a high ground in the stratosphere because of its capability to filter UV rays, which is vital for the preservation of natural equilibrium in the environment. It is a chemical element comprising of 3 oxygen atoms which is an advanced active form as compared to the normal oxygen in the atmosphere. One of the major ability of ozone is the efficacy in killing the micro-organisms which is evident by its widespread use in the water purification systems. The mechanism of action reveals its ability to toil on the cell membranes by triggering the oxidation process of the lipid component as well as the protein component.¹ It grounds impairment to the inner membrane of the bacterial spore and thereby hampering the germination process.

HISTORY

The term ozone descends its foundation from a Greek terminology "Ozein". The gas first came into notice in the year of 1839 when Mr.Schonbein observed it during the process of electrolysis of water.² It was utilized for the very first time by a doctor named C.Lender for the purpose of blood purification. In Germany, when the world was at the peak of World War I, ozone was being used to treat injuries, diabetic foot and advanced cases of gangrene. In the late years of 1920, a dentist in Switzerland named Dr.Edwin Parr, a Swiss dentist, initiated the usage of ozone as a fragment of his disinfection structure.³ The list of diseases being successfully treated by ozone by the year of 1929 amounted to about 120. It was later in the early 1930s

when a German dentist named EA Fisch initiated the application of ozone in dentistry on a regular basis and did intensive research and study on the subject.

APPLICATIONS IN DENTISTRY

- Ozone and dental caries: Ozone has been revealed to be a dominant and unswerving anti-microbial agent against microorganisms.⁴ Ozone has a ruthlessly upsetting consequence on bacterial groups that to caries, causing an eradication of those bacteria. Ozone has a strong decarboxylation effect on the pyruvic acid⁵ which leads to a strong decline in caries progression ultimately leading to a complete halt. Studies have shown that non-cavitated lesions were easier to treat with ozone as compared to cavitated lesions.⁶ A study was done by Holmes and his associates to check the efficacy of ozone on the dental caries in older age groups.⁷ One of the major revelation of the ozone treatment came in the light with the speed at which it can heal. The associates claim that the lesion can be reversed in 40 seconds. The studies showed that within a phase of 1.5 years, a 100% success is achieved with complete state of mineralization.
- Ozone and Dentin Hypersensitivity: A stimulation of hypersensitivity in the dentinal tubules has been known to lead to little, sharp agonizing pain ascending classically due to thermal, chemical or any other known stimuli. Studies conducted and trials performed have recognized the importance of ozone in the gaseous state to decline the intensity of pain instantaneously after application. The reduced sensitivity of the dentin achieved by ozone persists for

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a lengthier duration.⁸ Customarily, the presence of smear layer especially on the roots which are exposed works as a strong roadblock for the calcium and fluoride ions to enter. The major function of ozone is to detach and eradicate the smear layer and expose the tubules, thereby allowing the Ca and F ions to stream into the tubules effortlessly. This results into a complete plugging of the tubules, averting the liquid exchange.

- **Ozone and Root Canal:** Ozone is one of the most potent anti-microbial agents available in the field of medicine.⁹ However the antimicrobial effect would be efficacious if it is used in appropriate concentration. Furthermore, in the case of a root canal, a proper method of delivery is critical to ensure suitable cleaning and irrigation. A study was conducted by Halbauer and his associates on 37 root canals for checking the efficacy of anti-microbial action of ozone in the root canal. On scrutinising independently, a momentous decline was found for *S.mitis* and *P.acnes* ($p < 0.05$).¹⁰ The outcomes of this study confirms the efficiency of ozone on the bacterial count drop in the root canal.
- **Ozone and Plaque:** Plaque has been documented to cause carious tooth lesions as well as pathologies associated with the periodontium. Ozone with its potent anti-microbial activity helps to reduce the bacterial content of the plaque. Indirectly, ozone can help to reduce the chance of dental caries or periodontal pathologies. However, studies have shown that ozone is not completely successful in reducing the cariogenic microorganisms present in the plaque biofilm.¹¹ The ozone for the disruption of the gram positive and gram negative bacteria is administered in the form of ozonated water. A trial performed by Huth and his associates proved that the aqueous form is a much more potent anti-septic agent with relatively diminished cytotoxicity as compared to the gaseous ozone. Hence it is biocompatible in most ways when applied in the oral cavity.¹²
- **Ozone and Bone Metabolism:** The application of Ozone has an affirmative impact on bone metabolism, thereby proving to be the augmentation to the reparative course.¹³ Agapov VS and his associates reported that the subjects suffering from osteomyelitis were administered with the ozone which showed a tremendous speed in recovery with the complete regaining of the immunity.¹⁴ Ozone applications are beneficial in all cases of osteomyelitis be it acute, chronic or refractory osteomyelitis. It also aids in healing if the patient is on medications like the bisphosphonates. Studies over a period of time have shown to reduce the incidences of osteoradionecrosis and other complication with the help of ozone therapy.
- **Ozone and wound healing:** Ozonated water has been implicated to hike the rate of wound healing in the oral cavity. The superior most effect is usually observed in the first 48 hours after the surgical treatment. When the results are contrasted with the

treatment without ozone, the everyday action with ozonated water hastened the healing rate. The biggest benefit with the accelerated healing is that it decreases the need for the additional systemic medication. Since ozone has good healing potential, its application immediately after the extraction of the tooth has shown to decrease the chances of the post-extraction complications.

- **Ozone and denture cleaning:** The usual microorganism that deposits and accumulates under the dentures is the candida group. It is essential to keep the denture clean of any such group microorganisms to prevent denture stomatitis and under complications. The use of the ozonated water may help reduce the concentration of the candida group. It is also effective against other bacterial groups, especially against the methicillin-resistant *Staphylococcus* group. Moreover, application of ozone on the dentures would not cause any bearing on the quality of the denture material nor be accountable for any external roughness.
- **Ozone and Bleaching Effect:** Some evidence of tooth whitening has been observed with the use of ozone gas owing to the strong oxidizing properties it has. A study done by Vagharedin Akhavan Zanjani in 2015 demonstrated the effective of bleaching on the tooth with the use of ozone.¹⁵ Similarly, a study in 2003 by Holomes has proved that the anti-oxidant property of the ozone indeed has a rich bleaching effect on the human dentition.

APPLICATION MODALITIES

The variegated modalities for application of ozone in dental involve the use of ozone gas, ozonated water, and ozonized oil.

- **Ozone gas:** A device is prepared which is customized for each subject for delivery about 2mm beyond the gingiva. The device has two openings, one for inlet and the out one for the outlet. The ports are then attached to the electronic device and this technique will treat all the affected area.
- **Ozonated water:** Ozonated water is utilized to irrigate the oral cavity or root canals and is effective due to its anti-microbial effect.
- **Ozonated olive oil:** Any tipped device can be used to administer olive oil in the ozonated form. It has appropriate concentration until a week after which it needs a continual application in the clinic.

CONCLUSION

Evidently ozone encompasses oxygen which is the most basic essential necessity in the life cycle of the homo-sapiens and rest of the species. Ozone is one of the top most indispensable elements for maintaining the ecosystem of the biosphere. In comparison with the conventional medicinal options which comprises of antibiotics, ozone cure is fairly cost-effective. Dentistry is varying with induction of modern science to practice dentistry. Moreover, managing the medical treatment of

subjects with ozone therapy causes a drastic decline in the time required for treatment and postop visits. Apart from being painless, it causes minimal patient discomfort. Considering the benefits of the ozone therapy, it is imperative that further research is conducted to standardize the procedures of ozone therapy.

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