OZONE IN PEDIATRIC DENTISTRY- A REVIEW

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Abstract

The therapeutic use of ozone has been suggested for a long time in general dentistry and paediatric dentistry for its antimicrobial, virucidal, disinfectant, and biocompatible properties. Ozone has also anti-inflammatory, analgesic, and immunostimulant properties, and it promotes tissue regeneration. Dental treatment in children is often complex and ozone could support the clinician to enhance the approach and prognosis with young patients, non-cooperant children, or special needs patients. The efficiency of ozone will certainly increase if studies continue to show positive outcomes in a growing number of dental paediatric conditions. This review explores the recent literature of ozone therapy in paediatric dentistry and suggests fields of application for future randomized controlled trials (RCTs).

Keywords: ozone; minimal invasive therapy; paediatric dentistry.

INTRODUCTION

Ozone (O3) 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 ozone2 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

Applications

Antimicrobial effect of ozone is the most studied. Oxygen/ ozone therapy in dentistry contains a multiplicity of protocols to deal with dental infection. Three fundamental forms of application to oral tissue are applied — (1) ozonated water, (2) ozonated olive oil, and (3) oxygen/ ozone gas. Ozonated water and olive oil have the capacity to entrap and then release oxygen/ozone, an ideal delivery system. These forms of application are used singly or in combination to treat dental disease. Ozone application has various beneficial effects on the oral tissues including remission of various mucosal alterations, enhanced wound healing and increased turnover rate of oral cells. (Table 1)

Table 1- Potential applications of ozone therapy

Antimicrobial (bactericidal, viricidal, and fungicidal)	• Damage to cytoplasmic membrane • Oxidation of intracellular contents • Specific to microbial cell • Effective in antibiotic resistive strain
Immuno-stimulating	• Activates cellular and humoral immune system • Proliferation of immune-complement cells • Synthesis of immunoglobulin's • Enhance phagocytosis activity • Activation of biological antioxidants
Analgesic	• Anti-hypoxic and detoxicating • Activation of aerobic process (Krebs cycle, glycolysis, oxidation of fatty acids)
Bio-energetic and biosynthetic	• Activates protein synthesis • Enhanced cell metabolism (Ribosome, mitochondria)
Biologically active substances	• Synthesis of interleukins, leukotrienes and prostaglandins • Synthesis of immunoglobulin's

Prevention and management of dental caries

In case of dental caries, Deep pits and fissures are difficult to clean and hence are highly likely to cause food lodgement resulting in bacterial growth.8 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.9 Ozone removes the smear layer leaving behind the exposed dentin that is occluded by the remineralizing agent applied. The application of Ozone therapy in the management of dental caries is widely studied. Most of the child patients have fear and anxiety towards dental treatment. Dahnhart JE et al evaluated the anxiety level of children (and their parents) treated with ozone and found that all children & parents reported significant anxiety prior to ozone treatment. However, following the treatment, the children reported they would be pleased to return for future treatments. Also, 80% of the parents said they would be willing to pay more for this therapy compared with traditional drilling and filling.10 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.11

Management of Periodontal diseases: Studies found that ozonated water strongly inhibited the formation of dental plaque and was highly effective in killing of both gram positive and gram negative microorganisms.12 Ozonated water can be used in the ultrasonic water reservoir, also as a pretreatment rinse before scaling, root planning and the sulci, pockets are irrigated using syringe and canula in non-surgical pocket curettage. This process will reduce the initial pathogenic load on the patient locally and systemically. After treatment, each pocket & sulcus is insufflated with ozone gas which directly goes into tissues, sterilizing the area. The patients are also given ozonated oil to apply topically to the soft tissue. Huth et al11 in their study reported that the aqueous form of ozone, as a potential antiseptic agent, showed less cytotoxicity than gaseous ozone or established antimicrobials under most conditions.

Root canal therapy in deciduous teeth : Nagayoshi and colleagues 13 found nearly the same antimicrobial activity (against E. faecalis and Streptococcus mutans) and a lower level of cytotoxicity of ozonated water as compared with 2.5% NaOCl. They stated, "Ozone is known to act as a strong antimicrobial agent against bacteria, fungi, and viruses. Ozonized oils can also be used as a temporary root canal dressing in infected necrotic cases. In peri-apical lesions, ozone gas infiltration contributes in the nonsurgical management of these lesions. Siqueira and colleagues14 evaluated the antibacterial activity of the ozonated oil and calcium hydroxide pastes against bacterial species commonly associated with the etiology of periradicular diseases. Of the tested medicaments, ozonated oil was the most effective against the evaluated bacterial species.

Bleaching of discolored teeth: Ozone is used to lighten the discoloration in root canal treated teeth. Crown discoloration is a major aesthetic problem, especially in anterior teeth. Conventional walking bleaching requires much more time and results are

not often satisfactory. Also, capping the tooth with ceramic crown is not always a good idea. Ozone can also, be successfully used for lightening the yellowish tinge of tetracycline-stained rat incisors, as reported by Tessier J and collegues in their experimental study.15

Wound healing: Ozone reduces the post-extraction healing time by forming a pseudo-membrane over the socket, so protecting it from any physical and mechanical insults. Ozone therapy was found to be beneficial for the treatment of the refractory osteomyelitis in the head and neck in addition to treatment with antibiotics, surgery and hyperbaric oxygen. In alveolitis, there is accelerated healing by irrigation with ozonated water after removal of the necrotic pulp & debris under antibiotic coverage.16

Decontamination of toothbrush: Ozone application was found to remove the toothbrushes bristles microbiota following conventional brushing.

Dental unit water lines disinfection: Ozone can be used for Dental unit water lines purification and to minimize cross infection due to its antimicrobial efficiency and lack of side effects. In dental unit water lines, ozone achieved a 57 percent reduction in biofilm and a 65 percent reduction in viable bacteria in spite of a very low dosage and short time of application.17

DISCUSSION

In contrast with traditional medicine modalities such as antibiotics and disinfectants, ozone therapy is quite economical; it will markedly reduce both medical cost and invalidity. Dentistry is varying with induction of modern science to practice dentistry. The ozone therapy has been more beneficial than present conventional therapeutic modalities that follow a minimally invasive and conservative application to dental treatment. The exposition of molecular mechanisms of ozone further benefits practical function in dentistry. Treating patients with ozone therapy lessens the treatment time with an immense deal of variation and it eradicates the bacterial count more specifically. The treatment is painless and increases the patients' tolerability and fulfilment with minimal adverse effects. Contraindications of this controversial method should not be forgotten. Ozone should be considered an adjunct to existing treatment and preventive methods rather than an isolated treatment modality. The vast majority of the dentists that are using ozone therapy treatments today use the treatment in conjunction with plaque and diet control, chemotherapeutic approaches such as fluoride or chlorhexidine, sealants, and stepwise excavation. It is thus clear that clinical dentistry has adopted ozone to be used in conjunction with other clinical approaches, not as an alternative.12 The new Caries Elimination System, based on ozone gas, is delivered through a hose and hand 3 piece into a polymer cup that is placed around the tooth surface to be treated. The ozone penetrates through the decayed tissue, eliminating any bacteria, fungi and viral contamination. It also denatures the acid metabolites of the bacteria.

CONCLUSION

Ozone therapy has a wide range of applications in almost every field of dentistry. Its unique properties include immunostimulant, analgesic, antihypnotic, detoxicating, antimicrobial, bioenergetic and biosynthetic actions. Its atraumatic, painless, non invasive nature and relative absence of discomfort increase patient’s acceptability and compliance thus making it an ideal treatment choice specially for pediatric patients.

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