

## Review Article

### Application of Ozone Therapy in Dentistry– A Review

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#### ABSTRACT:

There is growing interest in the use of ozone in dentistry. Anecdotally, many clinicians believe that the superiority of ozone therapy over conventional dental treatment has not yet been proven. At this time, dental applications of ozone are not included in the clinical guidelines or standards of care documents published by the various dentists associations and academies throughout the world. Ozone is used in dentistry in gaseous, ozonated water and as ozonated oils. Ozone was shown to be biocompatible and is used in all aspects of dentistry. It has been shown to stimulate remineralization of recent caries-affected teeth and is used as a preventive therapy in caries, root caries, and intracanal irrigants in endodontic treatment.

Key words: Ozone therapy, Ozonated water, Ozonated oils, Root caries.

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#### INTRODUCTION

The word ozone was first introduced by Schonbein in 1840.(1) He subjected oxygen to electrical discharges and noted “the odour of electrical matter”. Schonbein concluded that odour was due to a gas which he named ozone, from the Greek Ozein.(2,3) Ozone is a gas composed of three atoms of Oxygen and present naturally in the upper layer of atmosphere in abundance.(4) It absorbs the harmful ultra-violet rays present in the light spectrum from the sun and protects the living creatures from the ultra-violet rays. It has got a high oxidation potential which is 1.5 times greater than chloride when used as an antimicrobial agent. It also stimulates blood circulation and the immune response.(4) Ozone therapy is one of the modern non-medication methods of

treatment. It is being used for more than 100 years. Medical reports on successful application of ozone in therapy of different diseases and studies of its effects caused a rapid growing interest in it. Some other factors were responsible for its wide spreading, such as simplicity of performance, good tolerance by patients, absence of side-effects or adverse reactions and high medical-social and economic efficiency. Even though ozone therapy is still being ignored by most of medical establishment because of facts that gaseous ozone is quite toxic and has strong oxidative properties.[10]

#### HISTORY

Ozone therapy has been in use since the 1800s and in 1896 the genius Nikola Tesla patented the first ozone generator in the US,

later forming the 'Tesla Ozone Company'. After that the Institute for Oxygen Therapy-Healing was formed in Berlin and the man credited with founding naturopathy, Dr. Benedict Lust, began practicing in New York, and wrote many articles on ozone. This form of treatment is highly popular in Germany and in 1959; an ozone machine called "Ozonosan" was patented by Dr. Joachim Hansler which formed the basis of the expansion in German ozone therapy.(5-9)

### **MECHANISMS OF THERAPEUTIC ACTIONS OF OZONE**

There are several known actions of ozone on human body, such as anti-microbial, immunostimulating, antihypoxic, analgesic, detoxicating, bioenergetic and biosynthetic (activation of the metabolism of carbohydrates, proteins & lipids) etc. Table 1 summarizes various medical indications of ozone therapy along with mechanism of actions of each use. 1. Anti-microbial action - The anti-microbial effect of ozone as a result of its action on cells by damaging its cytoplasmic membrane due to ozonolysis of dual bonds and also ozone-induced modification of intracellular contents because of secondary oxidants effects. This action is non-specific and selective to microbial cells; it does not damage human body cells because of their major antioxidative ability. Ozone is very efficient in antibiotics resistant strains. Its anti-microbial activity increases in liquid environment of the acidic pH. In viral infections the ozone action lies in the intolerance of infected cells to peroxides and change of activity of reverse transcriptase, which takes part in synthesis of viral proteins. Immunostimulating action - Ozone influences cellular and humoral immune system. It stimulates proliferation of immunocompetent cells and synthesis of immunoglobulins. It also activates function of macrophages and increases sensitivity of micro-organisms to phagocytosis. When administered at low concentrations, the organisms own resistance is mobilized, i.e.

ozone (re) activates the immune system. As a response to this activation through ozone, the body's immune cells produce special messengers called cytokines. These molecules in turn activate other immune cells, setting off a cascade of positive change throughout the immune system, which is stimulated to resist diseases. This means that the application of medical ozone is extremely useful for immune activation in patients with a low immune status and/or immune deficit. Ozone causes the synthesis of biologically active substances such as interleukins, leukotrienes and prostaglandins which is beneficial in reducing inflammation and wound healing. Antihypoxic action - Ozone brings about the rise of pO<sub>2</sub> in tissues and improves transportation of oxygen in blood, which results in change of cellular metabolism reactivation of aerobic processes (glycolysis, Krebs cycle, b-oxidation of fatty acids) and use of energetic resources. It also prevents formation of erythrocytes.

### **APPLICATION OF OZONE IN DENTISTRY**

The use of ozone has been proposed in dentistry because of its antimicrobial, disinfectant, biocompatibility and healing properties. Ozone has been applied for treatment of early carious lesions, sterilization of cavities, root canals, periodontal pockets, enhancing epithelial wound healing such as ulcerations and therapeutic lesions, Bleaching of discoloured root canal treated teeth, Desensitization of extremely sensitive teeth, treatment of peri-implantitis, and as a rinse for the avulsed teeth or as a denture cleaner and decontamination of used tooth brush. Ozone in Prevention of Dental caries: Ozone can be used to kill bacteria present in carious lesion, painlessly and even without anaesthetic. Ozone is applied to the carious lesion in a controlled manner, safely killing bacteria that have caused caries, thus requiring minimal of physical intervention and just a few seconds. In cases of incipient caries, ozone can kill bacteria in the

demineralized part and this demineralised tooth structure then, can be remineralized using a special remineralization kit, containing Calcium, Fluorine, Phosphorus and Sodium, all in their ionic forms.(13-17) Ozone in Endodontic treatment. Ozone oils can be used to sterile the root canal systems and to clear the canals of necrotic debris by virtue of ozone's bactericidal and effervescent properties. Ozone oils are ozonated sunflower oil or olive oil or groundnut oil. This ozone oil irrigation is more quick and efficient in canal sterilization than that conventional irrigation by the sodium hypochlorite and sodium peroxide combination.(18-20) Ozone in Healing wounds one has been reported to accelerate the healing of soft tissue conditions, i.e. aphthous ulcers, herpes labialis, Acute necrotizing ulcerative gingivitis (ANUG) and other gum infections. It also 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.(21) Ozone in Bleaching 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.(22) Also, capping the tooth with ceramic crown is not always a good idea. But, now, ozone has the answer to all these questions. Ozone can be successfully used for lightening the yellowish tinge of tetracycline-stained rat incisors. Ozone in desensitization of sensitive root necks, Quick and prompt relief from root sensitivity has been documented after ozone spray for 60 seconds followed by mineral wash onto the exposed dentine in a

repetitive manner. This desensitization of dentine lasts for longer period of time. Smear layer present over the exposed root surface prevents the penetration of ionic Calcium and Fluorine deep into the dentinal tubules. Ozone removes this smear layer, opens up the dentinal tubules, broadens their diameter and then Calcium and Fluoride ions flow into the tubules easily, deeply and effectively to plug the dentinal tubules, preventing the fluid exchange through these tubules. Thus, ozone can effectively terminate the root sensitivity problem within seconds and also results last longer than those by conventional methods.

### OZONE TOXICITY

Overwhelming evidence shows that the bronchial-pulmonary system is very sensitive to ozone and this gas should never be inhaled.[11] The respiratory tract lining fluid is constituted by a very thin, watery film containing a minimal amount of antioxidants that makes mucosal cells extremely vulnerable to oxidation. Pulmonary embolism, which occurred during direct intravenous administration of O<sub>2</sub>/O<sub>3</sub>, an application prohibited by the European Society of Ozonotherapy since 1983.[12] Known side effects are epiphora and upper respiratory irritation, rhinitis, cough, headache, occasional nausea, and vomiting.

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