

# Ozone: A new face of dentistry

R Garg, S Tandon

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## Abstract

Most of people possess a fear towards dentistry. On account of this fear, they avoid the dental treatment. Infact, people fear injections and drills that are used in dental clinics. But, in recent time, dentistry has been experiencing a period of dynamic changes and growth, perhaps like no other time before. The use of ozone in dental treatment is the result of this dynamics and growth. Incorporation of ozone in dental clinic set-ups would eradicate the feeling of pain during dental treatment and also cut off the treatment time, significantly. Ozone has been shown to stimulate remineralization of recent caries-affected teeth after a period of about six to eight weeks. Scientific support, as suggested by demonstrated studies, for ozone therapy presents a potential for an atraumatic, biologically-based treatment for conditions encountered in dental practice.

## INTRODUCTION

Until now, dentists have been convinced that caries can only be eliminated by the removal of the carious part of the tooth followed by replacement of that deceased substance with a suitable restorative material. Also, surgical treatment for caries involved usually the removal of healthy tooth substance, with occasionally ensuing pulpitic disorders. And, very oftenly, sooner or later, secondary caries appeared and filling needed replacing. But, all that has changed now. The treatment and prevention of tooth decay, it only takes seconds, has minimal physical intervention and is completely pain-free. This has become possible only because now, dentists have in their armamentarium, ozone. Ozone is a gas composed of three atoms of oxygen and is the most powerful oxidant. It is one of the most important gases in the stratosphere due its ability to filter UV rays which is critical for the maintenance of biological balance in the biosphere. It has been used in human medicine since the beginning of twentieth century. Today, ozone is used not only to disinfect wounds and improve blood circulation, but also as a treatment for carcinomas, leukemia, rheumatism and multiple sclerosis.

In dentistry, now a days, ozone has got its own role. It is used in a safe and controlled manner to remove caries painlessly followed by remineralization of that demineralized tooth structure.<sup>1</sup> This is very much true for the cases of incipient caries. But, still for the cases of open cavitations, scientists will have to go a long way. But definitely one day, ozone would be the single only answer to all types of caries.

## WHAT IS OZONE?

Ozone is a gas composed of three atoms of Oxygen and present naturally in the upper layer of atmosphere in abundance. It has got the capacity to absorb the harmful ultra-violet rays present in the light spectrum from the Sun. Thus, ozone filters the light spectrum high up in the atmosphere and protects the living creatures from the ultra-violet rays.

Ozone is an unstable gas and it quickly gives up nascent Oxygen molecule to form Oxygen gas. Due to the property of releasing nascent Oxygen, it has been used in human medicine since long back to kill bacteria, fungi, to inactivate viruses and to control hemorrhages. Medical grade ozone is made from pure medical oxygen because oxygen concentration in the atmospheric air is variable. Atmospheric air is made up of nitrogen (71%), oxygen (28%), and other gasses (1%) including ozone which is altered by processes related to altitude, temperature, and air pollution.

There are three different systems for generating ozone gas<sub>2</sub>:

- Ultraviolet System: produces low concentrations of ozone, used in esthetics, saunas, and for air purification.
- Cold Plasma System: used in air and water purification.
- Corona Discharge System: produces high concentrations of ozone. It is the most common system used in the medical/ dental field. It is easy to handle and it has a controlled ozone production rate.

## **BRIEF HISTORY**

Christian Friedrich Schönbein, a German chemist is considered to be the father of ozone therapy (1840). When he passed an electrical discharge through water, a strange smell was produced, which he called ozon, from the Greek word ozein (odor). Edward Fisch was the first dentist to use ozone in 1950. He used ozone to treat Austrian surgeon Ernst Payr who then became an ozone enthusiast and began a line of research dedicated to its use in healthcare. At the time, ozone therapy was difficult and limited due to the lack of ozone-resistant materials, such as Nylon, Dacron, and Teflon, until 1950 when ozone-resistant materials were manufactured. At that time Joachim Hänsler, a German physicist and physician, joined another German physician, Hans Wolff, to develop the first ozone generator for medical use. Their design continues to be the basis for modern equipment.

Medical grade ozone is a mixture of pure oxygen and pure ozone in the ratio of 0.05% to 5% of O<sub>3</sub> and 95% to 99.95% of O<sub>2</sub>. Due to the instability of the O<sub>3</sub> molecule, medical grade ozone must be prepared immediately before use. Within less than an hour after preparation only half of the mixture is still ozone while the other half is transformed into oxygen. As a result, it is impossible to store ozone over long periods of time. In order to control the decomposition of O<sub>3</sub> into oxygen it can be associated with a vehicle with aqueous properties to promote the conversion more quickly or with a vehicle with more viscous properties to retard the conversion.

## **DENTAL OZONE GENERATORS**

Recent studies have proven the effectiveness of applying ozone in both the medical and dental fields and its indications for use in a wide range of specialties.<sup>3</sup> Application of ozone gas has been advocated in dentistry for sterilization of cavities,<sup>4,56</sup> root canals,<sup>7,8</sup> periodontal pockets,<sup>9</sup> and herpetic lesions.<sup>10</sup> CurOzone USA Inc. (Ontario, Canada) developed the HealOzone, which is now distributed by KaVo Dental (KaVo, Biberach, Germany), for use in dentistry.

Millar and Hodson<sup>11</sup> compared the safety of two ozone generating systems. These are the Ozicure device (which is no longer available and is not licensed for use in Europe) and HealOzone developed by CurOzone USA Inc., now distributed by KaVo Dental, Biberach, Germany, for use in dentistry. The two were compared based on the amount of ozone that escaped during gas application. The investigators

found the Ozi-cure device, when used without adequate suction, allowed ozone to reach concentrations above the permitted levels and, therefore, should not be used. The HealOzone generator was found to be safe to use following the manufacturer's recommendations. After the treatment, a special filter in the generator turns the residual ozone back into oxygen.<sup>12</sup>

## **INDICATIONS OF OZONE IN DENTAL PROBLEMS**

Very recently, in dentistry, ozone has got its role in various dental treatment modalities. Interest in ozone use in dentistry is due to the infectious diseases associated with the oral cavity. Ozone therapy presents great advantages when used as a support for conventional treatments, for example, to dental caries, periodontal procedures, and endodontic treatment.<sup>13</sup>

- Prophylaxis and prevention of caries
- Remineralization of pit and fissure caries
- Remineralization of root and smooth surface caries
- Restoration of open cavitations along with conventional conservative measures
- Bleaching of discoloured root canal treated teeth
- Endodontic treatment
- Desensitization of extremely sensitive tooth necks
- Soft tissue pathoses

## **CARIES PREVENTION AND REMINERALIZATION**

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 demineralized tooth structure then, can be remineralized using a special remineralization kit, containing Calcium, Fluorine, Phosphorus and Sodium, all in their ionic forms.<sup>114</sup>

## **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 oftenly satisfactory. Also, capping the tooth with ceramic crown is not always a good idea. But, now, ozone has the answer to all these questions.

After removing the root canal filler material from the pulp chamber, the canal is sealed tight at the level of cemento-enamel junction. Then, the chamber is cleansed with sodium peroxide solution to remove any debris, cement particles and the smear layer, leaving the dentinal tubules opened-up. Now, a bleaching paste or a cotton pellet moistened in bleaching solution is packed in the chamber and the orifice is sealed with the Glass-ionomer cement. After placing the bleaching agent in to the inner of the tooth, the crown is irradiated with ozone for minimum of 3-4 minutes. This ozone treatment bleaches the tooth within minutes and gives the patient a happy and healthier-looking smile.

### **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.

### **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 expose 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.

### **SOFT TISSUE PATHOSES**

Ozone has been reported to accelerate the healing of soft tissue conditions, i.e. aphthous ulcers, herpes labialis, 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 CONTRAINDICATIONS**

The following are contraindications for use of ozone therapy:<sup>13</sup>

- Pregnancy
- Glucose-6-phosphate-dehydrogenase deficiency (favism)
- Hyperthyroidism
- Severe anaemia
- Severe myasthenia
- Active hemorrhage

### **CONCLUSION**

Most people suffer anxieties about being treated for tooth decay or more precisely; they fear the injections and drills. But, now, with ozone treatment, this is all the thing of past. Studies have shown that 99 percent of all the bacteria causing tooth decay have been eliminated after 10 seconds of ozone exposure and even 99.9 percent bacteria after 20 seconds exposure. Thus, treating patients with ozone cuts off the treatment time with a great deal of difference, it eliminates the bacterial count more precisely and moreover, it is completely painless, so increasing the patients' acceptability and compliance.<sup>11,15,16</sup> Ozone can now be incorporated in various other treatment modalities also, like bleaching of discoloured teeth, root canal treatment, desensitization and treatment of some soft tissue infections. Ozone, definitely, seems to be a promising treatment modality for various dental problems, in future.

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**Author Information**

**Rajeev Kumar Garg**

Dental surgeon, Dental surgery clinic

**Sandeep Tandon**

Professor & Head, Dept. of Paedodontics, Govt. Dental College & Hospital