Integrating oxygen/ozone therapy into your practice

The two primary nutrients in life are oxygen and water. Now dentists can use them to their advantage to treat oral infections.

by Philip Mollica , DMD, and Robert Harris, DMD

One of the first questions we ask our students who train in "Oxygen/Ozone Therapy in Dentistry," is "What are the two primary nutrients of life? We receive many answers, such as protein, carbohydrates, vitamin C, essential fatty acids ... and the list goes on and on. Most of our students tend to look for the more complex answers to our biologic questions!

The answer to this question is simple — *oxygen* and *water*. Without these two primary nutrients, there can be no life as we know it. With this in mind, we can take these two elements and use them to our advantage in maintaining our overall health and well-being. Thus, hydration therapy and oxygen/ozone therapy are born. Our focus in this article will be on the concepts and implementation of oxygen/ozone therapy in dentistry.

Integrating oxygen/ozone therapy into a dental practice is truly a paradigm shift. You now have the capability for effective, safe, nontoxic therapies that address the multifactoral infective states within the oral cavity.

During the last seven years, we have developed a number of therapeutic protocols to address common dental infections associated with periodontal disease, root canal therapy, and caries. But before we delve any further into these treatments, let's review oxygen/ozone therapy, its history, and its development in the medical and dental community.

Oxygen/ozone therapy has a long history of research and clinical application with humans. The German chem-

ist, C.D. Schonbein, first discovered ozone in 1840. The first medical application was in 1870 when Dr. C. Lender purified blood in test tubes. Medical applications became widespread throughout Europe and America. As of 1929, more than 114 diseases were listed for treatment with oxygen/ozone therapy. Interestingly enough, in 1930, a German dentist, Dr. E.A. Fisch, used ozone on a regular basis in his dental practice in Zurich, Switzerland, and published numerous papers on the subject. Dr. Fisch influenced the work of Dr. Erwin Payr, a renowned surgeon. Dr. Payr's work set the stage for mainstream use of oxygen/ozone therapy in medicine.

Extensive research continued with the publication of Dr. Siegfried Rilling's and Dr. Renate Viebahn's text, "*The Use of Ozone in Medicine.*" This text was a standard until 2002, when Dr. Velio Bocci published "*Oxygen/Ozone Therapy — A Critical Review.*" After more than 130 years of use, oxygen/ozone therapy is currently the standard of care in over 20 countries throughout the world.

In the United States, oxygen/ozone therapy is fully recognized by the medical community in 14 states. Recognition is pending in three states. Oxygen/ozone therapy was in use in the United States in 1885 when Dr. Charles Kenworthy, a Florida physician, published his experiences with ozone in the *Florida Medical Association Journal*.

Ozone use predates the 1906 Pure Food and Drug Act, its subsequent revisions, and the FDA. As a result, ozone's medical/dental use is grandfathered in the United States and is perfectly legal to use. We were introduced to oxygen/ozone therapy in 1998. We began dental-application research with the approval of an Institutional Review Board for Human Research from Capital University of Integrative Medicine in Washington, D.C., in 2001. Our first formal lecture on oxygen/ozone therapy was given in 2001 at Capital University. This was followed by our first dental-applications clinical seminar in Louisville, Ky., in 2003. In 2004, Professor Edward Lynch of Belfast, United Kingdom, contributed to and edited the book "*Ozone: The Revolution in Dentistry.*"

Ozone — what is it and what does it do?

What is ozone? Ozone is a chemical compound consisting of three atoms of oxygen. It is the elemental form of oxygen that occurs naturally as a result of ultraviolet energy or lightning, causing a temporary recombination of oxygen atoms into groups of three. In the clinical setting, an oxygen/ozone generator simulates lightning via an electrical discharge field. Ozone protects living organisms by surrounding the earth at altitudes of 50,000 to 100,000 feet. The ozone layer absorbs the sun's harmful ultraviolet rays, thus allowing for survival of plant and animal life.

Ozone forms near ground level as a result of the reaction of ultraviolet light with hydrocarbons, nitrogen oxide, and sulfur compounds to produce photochemical smog. Ozone is not the cause of smog, but it is a by-product. Since ozone is a powerful oxidizer, it actually helps clean the atmosphere of these dangerous compounds. Ozone is used as a measuring device for smog levels — to reiterate, it is not smog, but nature's way of cleaning up the smog.

> Why not treat infections with a naturally occurring substance that is truly broad-spectrum with no toxicity or side effects? That substance is oxygen and its energized form, ozone.

The properties of ozone are the foundation of what makes it work so well in dentistry. Ozone is a powerful oxidizer — it effectively kills bacteria, fungi, viruses, and parasites at a dramatically lower concentration than chlorine, with none of the toxic side effects. One molecule of ozone is equal to between 3,000 to 10,000 molecules of chlorine and it kills pathogenic organisms 3,500 times faster! In a medical/dental ozone generator, the medical grade O_2 is converted to O_3 in special tubes via a corona discharge reaction (similar to lightning). This type of generator is able to control the concentration of ozone critical to delivering the correct dose in micrograms/milliliters (mcg/ml). Concentration is determined by exposure and contact time of the medical-grade oxygen to the 5 to 13 millivolts [Bocci] sealed-corona discharge tubes.

Because of ozone's physical properties in the dental model, the ratio of ozone to oxygen is extremely low. The typical average concentration of ozone used in treatments is 25 micrograms of ozone per milliliter of oxygen/ozone gas mixture. That translates into 0.25 parts of ozone to 99.75 parts of oxygen. Evidence-based research has shown at this concentration, ozone effectively kills bacteria, fungi, viruses, and parasites.

A continual battle with oral infections

Dentistry is in a continual battle with infection, soft tissue, and/or hard tissue. These infections come from bacteria, fungi, viruses, and parasites. An infection can be of a single organism or a combination of all the above. In the developmental stages of oxygen/ozone therapy in dentistry, we philosophically took into consideration the "oral-systemic link." Keep in mind the far-reaching implications associated with acute or long-standing chronic

infections typically seen with periodontal disease and some teeth that have had root canals. The systemic effects of oral infections on the other areas of the body have been well documented in both medical and dental literature.

Attempts to eliminate oral infections have been minimally successful due to the interrelated nature of the multiple causative factors. These factors include microorganisms, diet, saliva, and immune responses. Treatments such as prophylaxis, rinses, fluoride, sealants, restorations, surgical procedures, diet, and lifestyle modification have altered risk factors. The result is the host adapts to the acute infection and the infection then converts to a subclinical chronic infection. These pathogenic organisms — being opportunistic — eventually clinically "reinfect" the afflicted tissue.

Instead of treating the whole body with antibiotic, viral, fungal, or parasitic agents, why not treat the infection with a naturally occurring substance that is truly broad-spectrum with no toxicity or side effects? That substance is oxygen and its energized form, ozone.

The commonality of all the pathogenic organisms is the weak antioxidant/enzyme systems in the cell membranes of these organisms. The ozone will punch a hole in the membrane of the organism, thus resulting in the organism's death. Now the contents of the pathogen are exposed to the internal environment that allows the immunologic system to start its physiologic cascade.

One of the most amazing biochemical and physiological studies conducted at Scripps Institute recently showed how antibodies actually produce ozone to kill invading microorganisms. Now antibodies, in addition to identification of pathogens, also kill them with ozone. So in reality, we are now doing nature's work within our dental standard of care.

Setting standard-of-care and therapeutic goals based on sound evidence-based science is critical. Therapeutic goals are *inclusive* and not exclusive of standard of care. In oxygen/ozone therapy in dentistry, our goals are:

1. ***Elimination of pathogens***
2. ***Restoration of proper oxygen metabolism***
3. ***Induction of a friendly ecologic environment***
4. ***Increased circulation***
5. ***Immune activation***
6. ***Simulation of the humoral anti-oxidant system***

Oxygen/ozone therapy in dentistry contains a multiplicity of protocols to deal with dental infection. Three basic 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.

Periodontal disease is defined by the American Academy of Periodontology as "chronic bacterial infection that affects the gum and bone supporting the teeth." But we now know that this "infection" can also be viral, fungal, and parasitic. When treating periodontal disease, standard of care is a *must*. All standard diagnostics are utilized, including radiographs, pocket-probing, and clinical exam.

Therapy Training levels

Oxygen/ozone therapy in dentistry training is currently taught at two levels.

The Level One curriculum consists of biochemistry, physiology, human anatomy, safety, efficacy, and research methods, leading to evidence-based dental application. The emphasis is on always staying within the standard of care, but utilizing oxygen/ozone to enhance the outcome of care.

Level Two covers advanced studies offered to students after six-to-12 months of oxygen/ozone-enhanced practice. The curriculum includes protocol update, critical review of complex cases, and also folds in concepts of advanced supportive therapies.

How treatment works

As an example, let's say a patient has generalized Type III moderate periodontitis. Using the standard protocol for oxygen/ozone therapy, the patient is placed on a four-week protocol, with follow-up after one month, and then scheduled for three-month recalls. Each week corresponds to a quadrant of dentition for anesthesia, root-planing, scaling, and curettage. Starting with the first visit — while anesthesia is established — the sulcus/pockets are irrigated using a canula with a syringe of ozonated water. This process reduces and eliminates the pathogenic load within the pockets and sulcus areas. Now mechanical removal of debris can be more safely performed, lessening the infection burdening the entire body. After the quadrant is completed, re-irrigation is performed for the entire pocket/sulcus of all quadrants.

The next procedure is what we call the "rocket fuel." Each pocket/sulcus is insufflated with a mixture of oxygen/ozone gas. Due to the physics of a gas entering into a liquid, the crevicular fluids and the epithelial tissues lining the sulcus absorb the oxygen/ozone mixture, ensuring complete anaerobic pathogen load elimination. In addition, the tissue responds with increased perfusion and immunologic activity, allowing for enhanced healing. The patient is given standard home-care instruction with one added item — ozonated olive oil.

After the patient performs all home-care hygiene, he or she applies the oil to the soft tissue. Once the oil melts, it again releases oxygen and ozone supporting the current therapy. If the dentist has any stubborn areas, the oxygen/ozone can be injected directly into the area, and the gas goes immediately into solution. This resolves the local issue.

The methods applied are safe and efficacious with no toxicity or side effects. Usually, by the third visit, the infection is resolved and the dentist is performing mechanical debris removal and continuing-supportive therapy. If we had to use pharmaceuticals to resolve a multi-type pathogenic microbe infection, it would have to include many different agents with their known side effects.

The big problem with root canals

So what is the problem with root canals? The problem is that some are in a chronic state of infection. Dentists get excited when we find an extra canal or a lateral canal and, by some miracle, fill it. The reality is that a tooth is made up of millions of little lateral canals or tubules. These tubules are colonized by microbes from the infected main canals. Studies have shown that bacteria from infected teeth have been found all the way to the cemental junction. The vast majority of the microbes found in tubules are obligate anaerobes, such as viruses, bacterial, and fungi.

Many forms of therapy have been developed and used to solve this problem with varying degrees of success. A study published in 2004 in the *Journal of Endodontics* showed that the use of ozonated water had the same antimicrobial activity as 2.5 percent sodium hypochlorite with none of the toxicity. The same study also showed metabolic activity in the associated fibroblasts was high with exposure to ozonated water, indicative of a healing process occurring. Another interesting fact is that anaerobic-type microbes produce a positive-charged infection environment. Since oxygen is the only gas that can carry an electrical charge, this opposite charge phenomena attracts ozone to the area and the pathogens are killed. Standard-of-care diagnostics and canal preparation remain the same. Taking into consideration the routes of oxygen/ozone application, root canal therapy goes through a paradigm change. The additions to treatment are as follows:

- ***Files are coated with ozonated olive oil for lubrication and disinfection.***
- ***The canals are prepared, irrigated with ozonated water, and dried.***
- ***The final step before filling each canal is slow insufflation with oxygen/ozone gas. The insufflation process allows the molecular oxygen/ozone to travel into the canals, lateral canals, and tubules. The molecular oxygen/ozone can travel through the tubules and kill the positively charged microbes and perform a true sterilization.***

Our research team monitors the toxic assay of the treated dentition using toxic oral pathology assay (TOPAS). The results have been less postoperative complaints from patients, fewer re-treats, and monitored assay showing no reinfection of the dentition — safe, effective ... and quiet Saturday nights! In September 2005, at the IAOMT meeting in Las Vegas, Dr. Boyd Haley stated, "The use of ozone in dentistry to create an infection-free root canal tooth will create a paradigm shift in the practice of dentistry."

Treating caries

Let's examine caries and its treatment with oxygen/ozone therapy. A series of more than 30 studies were presented by Dr. Edward Lynch and collaborators. The studies showed that oxygen/ozone therapy has an inhibiting effect in the development of pit and fissure caries, root caries, and interproximal carious lesions. Studies also have shown reversal of caries in lesions with exposure to oxygen/ozone in as little as 10 seconds.

Our protocols encompass utilization of oxygen/ozone for pit and fissure sealants, caries removal, cavity preps, dentinal hypersensitivity, crown and bridge preparations, and carious exposures, to name a few. For example, with a Class II lesion, perform a standard-of-care preparation, then place the matrix band in position for restoration placement. Just before restoration placement, cover the prepared area with oxygen/ozone gas with proper evacuation for 20 to 30 seconds. Then place your restoration. This simple process will dramatically reduce postoperative sensitivity, kill any possible microbe at the site, and eliminate the possibility of leaving infected dentin.

The uses of oxygen/ozone therapy in dentistry sound too good to be true. We have trained more than 120 dentists to perform oxygen/ozone therapy. They use the same protocols and same instrumentation while providing excellent interrelator reliability for the procedures performed. The replication of treatment results are essential for scientific evidence-based dentistry outcome studies. **DE**

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