

Integration into General Dental Practice. Successful treatment of Caries using the HealOzone. Part I

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Abstract

This paper examines how the traditional concepts of dental care must change in the light of recent published evidenced based research into new methods for caries detection and treatment. The historical background to ozone is discussed and shows how this gas has a profound influence on the ecology of micro-organisms within active carious lesions.

The costs of traditional "amputation" therapy are compared to ozone treatment. The aim of Ozone treatment using the HealOzone system (KaVo) is to conserve tooth tissue to allow carious lesions to heal naturally by remineralisation and to regain structural strength of the tooth. The cost analysis is discussed in the wider implication of potential savings were this technology to be used throughout the world.

Successful use of Ozone to manage caries

According to "The Niche Environment Theory", a "bacterial niche" is established within a carious lesion. Bacteria are far from the 'simple bugs' as they are often referred to. They have survived for millions of years, whereas humans have a minute time frame of existence in comparison. The dental profession should not be surprised to learn that bacteria set up complex interactions with other bugs, 'talk' to neighbouring colonies when times are good, and call for help from others when their host attempts to change their environment. Protein coatings, plaque and debris are known to protect these colonies by reducing the effect of pharmaceutical agents designed to eliminate these bacterial colonies.

The concept of dental caries has changed in the last decade. Investigations into the deepest molecular processes have disclosed the exquisite dynamic, cyclical, mechanisms of physiological demineralisation and remineralisation that takes place daily in oral hard tissues. The dental profession shares today a completely new vision of an old pathology. Decay starts as a metabolic imbalance, shifted towards acidity and demineralisation through numerous daily cycles of demineralisation and remineralisation. Dental plaque biofilm is the medium in which this process develops. In such an environment acidophilic and acidogenic bacteria develop this 'ecological niche'. It is important to accurately detect and diagnose caries¹⁻⁹. At an early stage in the development of a carious lesion, when enamel and dentine are demineralised and dentine has not been denatured by proteolysis, these dynamics can be reversed, and remineralisation occurs. When the bacterial ecological niche is eliminated remineralisation occurs and predominates.

Progression of the carious lesion occurs when conditions are suitable for acidogenic microorganisms to release acid as a metabolic by-product. The acid produced may lead to a breakdown of mineralized tooth structure. At times, an equilibrium situation may occur when the rate of remineralisation equals the rate of de-mineralisation. Ozone has the effect, through its powerful oxidizing properties, of not only removing the protein protection and being bactericidal, but also oxidising the biomolecules that allow the niche to

survive and expand. This has a severely disruptive effect on the microbial population in the carious lesion and obliterates the cariogenic bacteria and their ecological niche, thereby swinging the equilibrium in favour of re-mineralisation. No more acid can be produced within the lesion when the acid-producing microflora are eliminated. For example, the acid pyruvic acid, one of the strongest naturally occurring acids manufactured by bacteria, and implicated in the maintenance of the resting Ph and progression of caries, is oxidised by ozone to acetate and carbon dioxide⁹. Acetate is less acidic than pyruvic acid, and this de-carboxylation reaction leads to mineral uptake due to the less acidic conditions in a carious lesion. The lesion will become populated with normal mouth commensals which do not produce significant acid, leading to a predominance of remineralisation, after ozone therapy. Ozone is safe when used in the Heal Ozone unit and has been shown clinically to be effective in the management of root caries lesions,¹⁰⁻¹⁵. These lesions often present in the elderly who may have associated medical problems, which complicate their dental management. Using ozone therapy, such lesions are easily treated. The portability of the HealOzone unit facilitates its use in the domiciliary setting and treatment is also simplified because the clinician does not need to carry a range of restorative materials on such visits. Dentists using the HealOzone unit for caries management, encourage their patients to regularly use a fluoride-containing mouthwash, that will enhance the efficacy of ozone by promoting remineralisation and to reduce the frequency of consumption of fermentable carbohydrates.

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Using ozone treatment as their primary approach to the treatment of many incidences of dental caries completely removes any potential stressors. There is no local anaesthesia to give, no use of the drill and no packing of restorative material. The time spent on providing the actual treatment is also minimal in the extreme. GDP's can therefore provide the most modern and most natural treatment available to patients without fear that they cause any physical or mental trauma - all the potential sources of stress for the surgeon in restorative treatment of the carious lesion are removed and yet providing the very best in dental care.

All these factors also apply to the final restoration of the ozone treated tooth. Where the remineralised lesion is not visible it can be left without further intervention. The reasons to place a final restoration are sometimes:

- 1 To prevent food packing and food trapping which may lead to caries in adjacent teeth, or localized periodontal disease (if interproximal) or may simply cause concern to the patient if on the occlusal surface)?
- 2 Cosmetic reasons (remineralised tooth tissue may darken considerably). This can obviously lead to cosmetic concerns, especially in the anterior region and hence placement of a restorative material may be required purely for appearance.

Following on from the core philosophy of ozone treatment and of minimally invasive dentistry, restorative care is generally with a bonded composite resin restoration. Restoring, using 15 seconds etching (enamel) and a maximum of 15 seconds etching of dentine, followed with a dentine bonding agent and finally composite resin, is again a totally atraumatic and simple procedure for the patient and surgeon alike. Any regions of remineralisation that have darkened during the course of treatment can be simply and effectively masked. The authors have found in many cases that previously active root caries lesions are easily masked using one of the flowable composite materials. These are extremely simple and rewarding materials to use and, if placed correctly require no polishing, simplifying the treatment process even more. Lynch recommends you read Reality (see www.realityesthetics.com) for a general overview on adhesive techniques.

Reversal of caries in deciduous teeth

Dental treatment of young people can have long lasting associated effects. If dental care is painful and unpleasant, as these patients grow into adults, they will tend to only attend when in pain. As all dentists know, at this stage, restorative care tends to be more difficult and more extensive. The use of ozone¹⁶ and mineral releasing glass ionomers can play a significant role in the dental

management of these patients. As confidence in the treatment by the patient and parents or guardians is gained, so the compliance with important oral hygiene message will be increased.

Where caries is found, it is simple to treat and the application of, for example, FujiVII (GC Japan) will supply long-term fluoride and mineral release, as well as preventing ingress of food debris and re-establishment of the acid-niche environment. Treatment is simple, fast (the average ozone time for practitioners using the HealOzone is 30 seconds) and involves little preparatory work. The soft caries is first cleaned away, until a leathery base is reached. This can be done with hand instruments. Ozone is applied, the lesion wetted with the CurOzone (CurOzone USA) remineralising wash and then a glass ionomer can be applied. This modified ART technique has been reported by Holmes with excellent success when combined with Ozone (2004).

Allied to this ozone has been used in the treatment of deciduous molar teeth with hopeless prognoses as a result of caries. In some parts of the UK and USA it is upsetting to find so many children at 3 and 4 years of age with gross decay. For these patients the usual outcome is a general anaesthetic and extraction. These lesions are treated with ozone and have found that the majority of children are co-operative and actually enjoy the experience. What has been found of great interest is that the toothache in young children has been reduced and even abolished after ozone treatment, with much relief for the parents. Ozone treatment seems to be an excellent palliative treatment for such youngsters.

Reversal of caries in permanent teeth

Ozone^{17,18} is used instead of fissure sealants during the eruption of the permanent dentition and as prophylaxis in populations at risk of rampant carious lesions. It is possible that the current fissure sealant technique needs to be re-examined. Current protocols for fissure sealants include the use of a bristle brush and pumice to clean the occlusal surfaces of teeth prior to sealing. However, it is known that food debris and bacteria will remain impacted in the depth of the fissures where hidden caries can be present. Any micro-leakage could allow the acid-niche to resume its activity, and over a period of time, the surface may collapse into a large carious cavity.

Alternative preparation systems, such as the KaVo ProphyFlex or similar, or air abrasion could be used. Bristle brushes used to manufacture the bristle brushes are often larger than the fissures being cleaned. However, air abrasion powder (average particle size 27microns) will flush out the debris, prepare the fissure for acid etching, and produce a more reliable sealing along the fissure edges.



Clinical view of two composite restorations. Please note the insufficient marginal adaptation, marginal fracture, discoloration, delamination and partial new decay.



The completed restoration on the second premolar.



After removal of the defective restorations. The pulp wall of the second premolar shows the result of leakage and caries. A great benefit for the maintenance of pulpal health is obtained by using Ozone from the Head Ozone at this stage of treatment.



Both premolars restored with direct composite restoration in a layering technique.



Proximal view of the second premolar to demonstrate the applied layer of resin modified GIC to the pulp floor.



The restored occlusal morphology compliments the healthy appearance of the teeth and the use of the Heal Ozone on the prepared cavities should improve the chances of long term success and eliminate the chance of any post operative sensitivity.

Successful treatment of primary pit and fissure carious lesions (PFCLs) using Ozone

Early diagnosis of primary pits and fissure caries is of great importance in children and adults because of the rise of a new type of carious lesion which is difficult to diagnose with traditional methods such as oral radiographs. Low sensitivity to visual, probing and bitewing examination leads to a significant number of teeth with dentinal hidden pit and fissure caries being undetected. Lesions have a natural history of deepening into dentine leaving a macroscopically undamaged enamel surface. Minimal early mineral loss prevents x-rays to show evidence of decay, and no macroscopic cavitation is evident. Systems using indirect light fluorescence have been demonstrated effective in the clinical diagnosis of decay in permanent and in deciduous dentition.

In superficial root caries or early pit and fissure carious lesions, ozone alone may be sufficient to treat these lesions^{12,14,15,17,18}. However, in situations where severe breakdown of tooth structure has occurred, ozone may be used initially to promote re-mineralisation and when this has occurred the cavity may be sealed with a suitable restorative material.

Treatment of the larger carious lesion with ozone

The larger lesions need special care. It must be stressed that larger lesions are not those to be treated with ozone alone; most will require a combined approach of traditional therapy, as well as ozone. As before, the aim is to allow natural remineralisation to take place on a predictable basis, without the wholesale destruction of tooth tissue. Where the lesion extends deep into the dentine, the action of ozone will take a longer time period of treatment, or may require several treatment periods over time. The basic protocol is the same; the soft caries is removed along with any enamel which is unsupported in an occlusal contact area. Ozone is applied for 40 seconds or longer. Some practitioners have used 2 to 3 minutes Ozone application times for large deep lesions that extend on x-ray almost to the pulp chamber. Then, the remineralising wash is applied.

There are two options of choice at this stage of treatment that HealOzone practitioners are using

a. The lesion is left as "self cleansing", and the patient is instructed with modified oral hygiene instructions. After routine brushing and rinsing, they are asked to place a small amount of the paste directly into the cavity. Then they spray two puffs of the remineralising solution directly into their mouths. This is repeated at least three times each day. In between this brushing protocol, these patients are also topping up their oral bio-available mineral concentrations by an additional two puffs, one in the morning, and another in the afternoon. This concerted loading of the patient's saliva mineral content has led to reports from these practitioners of complete hardening and reversal of the carious lesions within 6 weeks.

b. The lesion is restored using a mineral-releasing glass ionomer, such as FujiVII¹⁹. This will allow remineralisation to occur, without the possibility of ingress of food debris and re-colonisation of the cavity. Where this has been carried out, for example in the Class II type lesions extending into the approximal contact areas, practitioners are reporting complete remineralisation after 3-4 months.

It must be stressed that all these practitioners commented that it is vital to control both their own, and their patients expectations. If the pulpal tissue has already become necrotic, no amount of ozone will bring it back to life. Either root canal therapy or tooth removal is the only two viable options at this stage. However, the good news at this point, is that ozone can be used both in root canal treatment, and to manage potential pain post-removal by eliminating opportunistic infections in the socket and exposed soft tissue before healing has taken place. Ozone may also hasten the healing potential, and reduce the time taken to heal.

HealOzone toothpaste, spray and mouthrinse

In studies where the HealOzone toothpaste, spray and mouthrinse have been used by Patients, combined with the use of Ozone from the HealOzone unit, almost 100% of all carious lesions treated reversed. The HealOzone toothpaste, spray and mouthrinse contain a special formula, which dramatically enhances remineralisation of teeth. These products contain numerous active ingredients including optimum fluoride, calcium, phosphate, zinc, xylitol, and other antimicrobial agents. Therefore, it is recommended that Patients should use these products directly after HealOzone treatment.

Conclusion

In conclusion, ozone therapy provides a treatment modality with considerable benefits for dental patients of all ages^{14,20}. It is applicable to a wide range of conditions of the intra-oral hard and soft tissues. The treatment of carious lesions is effective and made much more acceptable for the patient. This makes it especially relevant to the younger patient, who may find conventional treatment unacceptable and also for the elderly, who may have medical problems, which may complicate conventional dental treatment. The treatment is simple, completely safe to provide and often renders the need to introduce additional restorative materials unnecessary. More than one million Patients have already been treated in the UK alone using the HealOzone system and not a single side effect has ever been recorded.

Patients are delighted and it can create a 'buzz' in the local community. Any innovation that can help halt dental disease and the fear of the dentist has to be welcomed. The HealOzone Users experiences have shown that the ozone concept enhances the GDP's ability to communicate with patients who rapidly warm to the idea. It seems to stimulate their interest and the therapy has the potential to be a financial asset.

Consider the proposed treatment with ozone respects the criteria of precision, responsibility, realism, ecology and measurability. The precision of treatment consists in the high oxidative action on substrates and bacteria; realism of treatment is supported by the very rapid kinetics of ozone oxidative reactions, and by the long lasting effects of remineralisation; responsibility of treatment is well identified and involves the entire oral environmental system, whilst operational responsibility relies on the dentist, and the patient's compliance. Compliance is limited to those specific cases in which a fluoride therapy is preferable after ozone treatment.

Further clinical and technical studies on non invasive ozone treatment in oral and dental pathologies are necessary to fill the gap between the naturalistic observations and the comprehension of these complex mechanisms and pathways. Now perhaps the dental community can share the awareness that ozone heralds new preventive and therapeutic possibilities never before achieved and allows a new vision, which complies with needs and demands of the public for non invasive and effective preventive dental care.

From a dental public health point of view, with dental caries being such a problem in large areas of the country and with such a shortage of clinicians here in some parts of the UK and Europe, the ozone therapy has potentially a major part to play in the prevention and treatment of dental caries. The HealOzone machine and the DIAGNOdent (used for laser detection of caries) are totally portable and units are being used with great effect in dental practices and community clinics. It takes such little time to treat several teeth that it is possible to help many more patients compared with conventional treatment. Being so simple to use, dental hygienists and therapists are ideally suited to providing the treatment for all categories of patient.

Ozone certainly has a major role to play in a preventative-orientated dental practice and every evidenced based, double blind clinical trial which have been completed to date have proven that the HealOzone should be used to treat caries in our Patients . The HealOzone system has proven itself in Dental practices throughout the World since 2001 to improve the oral health of millions of Patients.

Recommended Reading

Ozone, The Revolution in Dentistry, Quintessence Book, 2004. Editor Edward Lynch, ISBN 1-85097-088-2 (See www.pearly-whites.tv to purchase this book)

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