Evidence-based efficacy of ozone for root canal irrigation

Guest expert Edward Lynch and Edward Swift discuss evidence-based efficacy of ozone for root canal irrigation

**Proven antimicrobial efficacy of ozone**

Ozone is one of the most powerful disinfectants that we have use in medicine or dentistry. As failure of root canal therapy is mainly caused by microorganisms, it is not surprising that there are enormous advantages to killing these microbes. In a recently published review paper, the authors who reviewed published research papers have proven the antimicrobial efficacy of ozone as a gas and as ozonated water.

In model dental unit water lines, ozone achieved a 37 per cent reduction in biofilm and a 65 per cent reduction in viable bacteria in spite of being used in a very low dose and with a short time of application. Ozone rapidly kills otherwise hard to kill microorganisms.

**Recommended use of ozone in root canal therapy**

Ozone works best when there is less organic debris remaining. Therefore, the recommendation is to use either ozonated water or ozone gas at the end of the cleaning and shaping process. I personally still use my conventional irrigants during this earlier phase and I finally irrigate with ozonated water (Thailand, Santa Monica, CA, USA) using ultrasonic. I also blub ozone gas (HealOzone, KaiVo, Boulder, CO) into the access cavity and use ozonated oil (Lime Technologies Ltd., Capetown, South Africa) as a medicament.

**Comparison of the use of ozone and sodium hypochlorite**

Oxygen has a dramatically toxic effect to microaerophilic and anaerobic bacteria. Virtually all research papers compared the antimicrobial performance of four systems used as root canal irrigants. Sever- en recent papers also compared the use of ozonated sterile roots with open access cav- ities and containing a paper point were carried out by one volunteer in the oral cavity for 1 week. After re- 

A review identified four studies investigating the bactericidal effect of ozone as compared with 2.5 to 5 per cent sodium hypochlorite as irrigation solutions in endodontics.

**Nagayoshi and colleagues** found newly the same antimicrob- ial activity (against E. faecalis and Streptococcus mutans) and a lower level of cytotoxicity of ozonated wa- ter as compared with 2.5 per cent NaOCl. The study was repeated three times using ozon- ated water (ideally with ozone gas). Cardoso and colleagues concluded that the ozonated water, used as an irrigant agent, significantly reduced the number of Can- dida albicans and Enterococcus faecalis in root canals in human teeth.

**Use of ozonated oils as medicament**

Use of ozonated oils as medicament

Ozone is a potent oxidizer and immune-modulatory capacity, thereby resulting in aqueous ozone. This is why ozone was as effective as 2.5 per cent NaOCl, 2 per cent chlorhexidine, or the application of gaseous ozone was not sufficient to inactivate E. faecalis. The methodology used was obviously optimized. The authors concluded that ozone is highly effective. Ozone gas is ex- tremely low dose of ozone in their experiments. The concentration of ozone mentioned in the paper was only 0.68 ppm. This concentration was immediately after production and was reduced to half the time it was used. It was clearly a biased comparison as the sample size was only in 10,000 ppm in comparison to the ozone. Sur- prisingly, immediately following ozone sparging, 1ml of this broth showed a significantly lower colony count than any control. We also had similar results with the L-929 mouse fibroblasts against ozonated water and NaOCl. The meta-bolistic activity of fibroblasts is mainly due to the high biocompatibility of aqueous ozone. We also had similar results with the NaOCl again biasing the experi- ment. The methodology used in this paper, and the low dose and time of application of ozone used, is extremely low dose of ozone. However, it is surprising that ozone was as ef- fective as it was reported.

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**Effect of aqueous ozone on caries**

A high level of biocompatibility of aqueous ozone on human oral epithelial (BHY) cells, gingival fibroblast (HGF-1) cells, and peri- odontal cells has been published.

Huth and colleagues investigated whether gaseous ozone and aqueous ozone exerted any cyto- toxic effects on BHY cells and HGF-1 cells compared with established antiseptics (2 and 0.2 per cent chlorhexidine digluconate [CHX]; 5.25 and 2.25 per cent sodium hypochlorite [NaOCl]; 3 per cent hydrogen peroxide [H₂O₂] over 1 minute and compared with the an- tibiotic metronidazole over 24 minutes. Cell counts, metabolic activity, Sp-1 binding, actin levels, and immunoreactivity were measured. Ozone gas was found to have toxic effects on both cell types. Essentially, no cytotoxic signs were observed for aqueous ozone. CHX (2 per cent, 0.2 per cent) was highly toxic to BHY cells, and 5.25 per cent NaOCl and non-toxic (0.2 per cent) to HGF-1 cells. NaOCl and H₂O₂ resulted in markedly reduced cell viability (BHY, HGF-1), whereas metronida- zole displayed mild toxicity only to BHY cells. Taken together, aqueous ozone appears to be a level of biocompatibility of the tested antiseptic.

**Enhanced healing associated with ozone use**

Ozone also can play a key part in the healing process. Healing is a process to reduce or eliminate microorganisms and this can be beneficial to reduce potential contamination of the canal systems during instru- mentation.

**Use of ozone to manage and reducing pain in the access cavity**

Ozone has been proven to be one of the most powerful oxidants we can use in dentistry. It can be used to manage and reduce pain in the access cavity and reduce potential contamination of the canal systems during instrumentation.
Conclusion

Of course, more research on the use of ozone in root canal therapy will add to our knowledge in endodontics.

Thousands of dentists worldwide use ozone in root canal therapy and it is claimed that millions of teeth have received root canal therapy with ozone having been used as the final irrigant. No adverse event has been recorded after use of the HealOzone or ozonated water in root canal therapy.

Ozone is an effective, easy, cheap, and fast treatment to help disinfect root canals. Ozone is much stronger than chlorine and acts 5,000 times faster without producing harmful decomposition products. As ozone is the most powerful antimicrobial and oxidant we can use in endodontics, and as aqueous ozone revealed the highest level of biocompatibility compared with commonly used antimicrobial and disinfectant agents, then it is fairly obvious that ozone should be used to help combat the microorganisms associated with infected root canals. Ozone has a place in the 21st century oral health care, and we should use its proven powerful antimicrobial efficacy and potent oxidant ability to reduce microorganisms during root canal therapy.

Disclosure

Professor Edward Lynch is a consultant and principal investigator for research grants from CureOzone USA (Aurora, Ontario, Canada) administered by Queen’s University, Belfast, Northern Ireland, U.K.

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References

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