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

Question: As a follow-up to the recently published information on ozone as a means of caries treat- ment, can you provide some infor- mation on the use of ozone in root canal therapy?

Answer: Ozone has been pro- posed as a dental antiseptic agent based on its known antioxi- dant effects in both gaseous and aqueous forms. Ozone is effective when used in the oral cavity for 1 week. After re- moval, the samples were taken for microbiologic analysis. The root canals were then disinfected with the EndoTronic System (Ly- sis S.r.l., Nova Milanese [MI], Italy), MTAD (Dentsply Tulsa Dental, Tulsa, OK, USA), sodium hypochlorite (NaOCl), or HealO- zone, and thereafter, the samples were reported several bacteria-free. The analyses were the roots then sealed and incubated for a further 24 hours, which further growth was again determined. After dis- fecting, there was a significant de- crease in the absolute bacterial count between each dissection method and the positive control group. There was no statistically significant difference between the 5 per cent NaOCl, MTAD, and HealOzone. Bacterial regrowth after 1 week of disinfection was detected in all specimens of the control group, whereas the test groups showed several bacteria-free specimens. The authors con- cluded that ozone has great poten- tial in endodontic disinfection. Ozone and that MTAD and HealOzone seem to be as effective as 5 per cent NaOCl in reducing mixed bacterial biofilm in the root canal system.20

I would speculate that the an- timicrobial effect of the ozone would have been even greater if it had been applied longer. I personally feel that conven- tional irrigation (including NaOCl) should be used during cleaning and shaping, and ozonated water (ideally with ozone gas) should be used as the final irrig- ant with ultrasonication.

Cardoso and colleagues21 con- cluded that the ozonated water, used as an irrigant agent, signifi- cantly reduced the number of En- terococcus faecalis and Streptococcus mutans and a lower level of cytotoxicity of ozonated wa- ter as compared with 2.5 per cent NaOCl. The ozone is known to act as a strong antmicrobial agent against bacteria, fungi, and viruses. In a recent study, the authors examined the effect of ozonated water against Enterococcus faecalis and Streptococcus mutans that ozonated water had no significant effect on the viability of bone in dentin. After irri- gation with ozonated water, the tooth structure was able to resist the biofilms. Indicating that Ozonated water seems to be a promising disinfectant agent, and a 50 per cent reduction in viable bacteria in spite of being used in a very low dose and a short time of application.22 Ozone rapidly kills otherwise hard to kill microorganisms.

Proven antimicrobial efficacy of ozone

Ozone is one of the most power- ful antiseptics available for use in medicine or dentistry. As failure of root canal therapy is mainly caused by microorganisms, there is not surprising that there are enormous advantages to killing these pathogens. Ozone has been reviewed research papers have proven the antimicrobial effectiveness of ozone as a gas and as ozonated water.23–25 In model dental unit water lines, ozone achieved a 57 per cent reduction in viable bacteria in spite of being used in a very low dose and a short time of application.26–28 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 fi- nally irrigate with ozonated water (Thiopanox, Santa Monica, CA, USA) using ultrasounds. I also ul- tihave ozonated water (KaVo, Biberach, Germany) into this or- gic medicament.

Comparison of the use of ozone and sodium hypochlo- ride

Oxygen has a dramatically toxic effect to microaerophilic and anaerobic bacteria. Vertley and collea- gues29 compared the antimicro- bial performance of four systems used as root canal irrigants. Sev- eral systems were tested in sterile roots with open access cavi- ties and containing a paper point were used by one volunteer in the oral cavity for 1 week. After re-

20. Huth and colleagues32 reported that the ozonated oil was used as the intra- canal medicament.27 After 6 months, the animals were sacri- ficed and the specimens were processed for histologic and histo- bacteriologic analyses. The root canals treated in a single visit showed a success rate of 46 per cent. When a calcium hydroxide/ CMCP-based interappointment in- tracanal medication was used, 74 per cent of the specimens were catego- rized as successful. In cases where ozonated oil was used as the intra- canal medicament, the success rate was 77 per cent.

Siqueira and colleagues30 eval- uated the antibacterial activity of the ozonated oil and calcium hy- droxide paste against bacteria species commonly associated with the etiology of periodontal dis- eases. Conclusively, the ozonated oil was the most effective against the evaluated bacterial species.

Biocompatibility of ozone in root canals

A high level of biocompatibility of aqueous ozone on human oral epithelial (BKG) cells, gingival fi- broblast (HGF-1) cells, and peri- odontal cells has been pub- lished.22–24

Huth and colleagues33–34 investi- gated whether gaseous ozone and aqueous ozone exerted any cyto- toxic effects on BKG 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]; 5 per cent hydrogen peroxide [H_2O_2] over 1 minute and compared with the an- ti-inflammatory effect. Ozone gas was found to have toxic effects on both cell types. Essentially, no cytotoxic signs were observed for aqueous ozone. CHX (2 percent, 0.2 per cent) was highly toxic to BKG cells, and NaOCl (2 and 0.2 per cent) and monochlorophenol (CMCP) as an intracanal medicament.35

Enhanced healing associated with ozone use

Ozone also plays a key part in the healing process, 36–38,39,40 which also helps to speed up the healing process. However, the use of ozone gas for healing purposes is still in its early stages. Further studies are needed to fully understand the mechanisms of action of ozone gas in healing processes.
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 a result, ozone revealed the highest biocompatibility compared with commonly used antibiotics, 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 it to prove its 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 CurOzone USA (Aurora, Ontario, Canada) administered by Queens University, Belfast, Northern Ireland, U.K.

Article first published in the Journal of Esthetic and Restorative Dentistry. To subscribe, visit www.estheticacademy.com/je rd.html

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