Antimicrobial Efficacy of Ozone on *Enterococcus faecalis*

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Introduction

The *raison d'être* for performing root canal therapy (which very often can be complicated, time-consuming and skill-demanding) is to bring about the healing of apical periodontitis[1], a pulpally-derived periapical bone lesion. S Kakehashi *et al.*(1965)[2], and G Sundqvis (1976)[3] conclusively showed that INTRACANAL microorganisms were the aetiological agents causing apical periodontitis. While most of the microorganisms could be killed by the universally accepted NaOCl solutions even in dilute concentrations provided the volume used is copious, *Enterococcus faecalis* has been found[4] to be very resistant within the anaerobic eco-environment of the human root canal system. Ozone is a powerful oxidant and potent microbicide and has been shown to be effective in the treatment of Primary Root Caries[5] and Primary Occlusal Pit and Fissure Caries[6]. In this *in vitro* study Ozone, generated by the desktop HealOzone Unit (Fig 1), was used to kill this 'endodontic villain' and the results were encouraging.

Aim

The Aim of this Study was to Assess the Antimicrobial Efficacy of Ozone on *Enterococcus faecalis*.

Materials and Methods

Enterococcus faecalis was cultured overnight on blood agar plates. A suspension of the micro-organisms was made up to an approximate concentration of 10^8/ml using McFarland Standards in Phosphate Buffered Saline (PBS). Serial dilutions to 10^7, 10^6 and 10^5/ml were made. From these 50 µl of each concentrate was pipetted into each well of a microtitre plate.

Materials and Methods (continued)

Each well of concentrate was treated in turn with Ozone from the HealOzone Unit at different exposure times of 10s, 20s, 30s and 60s. Samples were taken from the well, spiral-plated, incubated at 35°C for 5 days and enumeration of the colony forming units (c.f.u.) performed.

Results

Exp Time ▶ / Conc.(c.f.u./ml) ▼	*60 seconds*	*30 seconds*	*20 seconds*	*10 seconds*	In PBS-No Treatment
10^8	2×10^3	4.0×10^5	2.0×10^7	5.5×10^7	6.0×10^8
10^7	0	0	3.4×10^5	4.4×10^5	5.6×10^7
10^6	0	0	0	0	6.5×10^6
10^5	0	0	0	0	5.2×10^5

Fig 1: HealOzone Unit
(CurOzone USA and KaVo, Germany)
Delivery Capability: 2100ppm conc.
615ml/hour flow rate

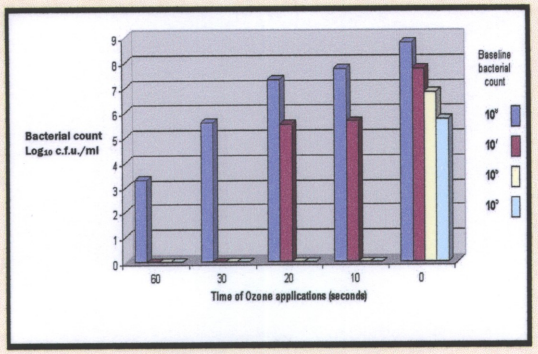

Fig. 2. c.f.u. Remaining After Different Exposure Times (in seconds) to Ozone

Discussion

One cannot directly extrapolate to the human situation from the results of this experiment and recommend ozone as an endo irrigant without repeat experiments *in vivo*. In the oral cavity (a)*Candida albicans* is another known candidate among the causative agents for failed endodontic treatment[4], (b) microbial interactions (positive i.e. synergistic or negative) influencing the ecology of the endodontic flora[4] and (c) the intra-canal environment itself may alter the bactericidal property of any disinfectant used. Ozone, as an endodontic disinfectant, has great potential in solving the above-mentioned (a),(b),(c). The HealOzone unit is user-friendly in producing ozone, which when used in the gaseous state in the root canals, could affect deeper penetration into the dentinal tubules. This will be investigated in future *in vivo* experiments.

Conclusions

Ozone kills all *Enterococcous faecalis* when its concentration in suspension is 10^6/ml and lower, even at exposure times of only 10 seconds.

References

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