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Evaluation of Nd:YAG and Er:YAG irradiation and antibacterial photodynamic therapy on *Enterococcus faecalis* biofilms

Aim To compare the antimicrobial efficacy of two high power lasers (Nd:YAG and Er:YAG) and two commercial antimicrobial photodynamic therapy (aPDT) systems with the traditional root canal irrigant on *Enterococcus faecalis* biofilms grown on dentine disks *in vitro*.

Methodology Twenty four hour *E. faecalis* biofilms were grown on dentine disks in a microtiter plate and subjected to the following treatment or control groups: aPDT using the Denfotex system, aPDT using the Helbo system, Er:YAG laser irradiation (2940 nm, 50 mJ and 100 mJ, 15 Hz, 40 s), Nd:YAG laser irradiation (1064 nm, 2W, 15 Hz, 40 s) and immersion in sodium hypochlorite (NaOCl) 0.5% for 1, 5, 10 and 30 min. Surviving bacteria were harvested and the number of CFU per disk was determined by plate count.

Results Significant differences ($P < 0.03$) in viable counts compared to untreated controls were observed for: aPDT (Helbo) (2 log₁₀ reduction), Er:YAG irradiation using 100 mJ pulses (5 log₁₀ reduction) and all NaOCl treatments (>6 log₁₀ reduction). NaOCl 0.5% for 30 min effectively eliminated all bacteria. aPDT (Denfotex), Er:YAG irradiation using 50 mJ pulses and Nd:YAG treatment caused a reduction in the viable counts of <1 log₁₀ but these results were not significantly different from the untreated controls ($P > 0.05$).

Conclusions NaOCl and Er:YAG irradiation were highly effective in eliminating *E. faecalis* grown as a biofilm. aPDT eliminated *E. faecalis* biofilm to some extent, with a difference between both systems. Nd:YAG irradiation was the least effective against *E. faecalis* biofilm in this study.