

## Effect of photo-activated disinfection on endodontic pathogens *ex vivo*

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### Abstract

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**Aim** To test the hypothesis that photo-activated disinfection (PAD) has a bactericidal effect on pathogens inoculated in root canals, with emphasis on biofilm formation/destruction.

**Methodology** Root canals of extracted teeth ( $n = 38$ ) were prepared (size 30, 0.10 taper), autoclaved, divided into three groups and two negative controls inoculated (*Streptococcus anginosus*, *Enterococcus faecalis* or *Fusobacterium nucleatum*) and treated (PAD, laser, dye or positive control) according to a cross-sectional design. Resultant colony-forming unit counts were associated with observations of cell structural changes using environmental scanning electron microscopy (ESEM) on inoculated dentinal surfaces ( $n = 22$ , two controls) before (1, 2 and 6 days of incubation) and after treatment with PAD.

**Results** Treatment of root canals with PAD (15 J) caused a significant reduction of the bacterial load, resulting in a 93.8% kill of *S. anginosus* ( $P < 0.0001$ ), a 88.4% kill of *E. faecalis* ( $P < 0.05$ ) and a 98.5% kill of *F. nucleatum* ( $P < 0.0001$ ), but no sterilization. Laser alone had no significant effect on the load nor did the dye without laser. The ESEM experiment showed that individual cells or monolayers were easily eliminated with PAD. But when biofilms were present (2 and 6 days for *E. faecalis*, 6 days for *S. anginosus*), bacterial eradication was substantially reduced in deep layers.

**Conclusions** Photo-activated disinfection is not an alternative but a possible supplement to the existing protocols for root canal disinfection as the interaction between light (diode laser) and associated dye (TBO) provides a broad-spectrum effect. Some endodontic pathogens that grow as single-species biofilms, however, are difficult to eradicate.

**Keywords:** bacterial morphology, culturing, environmental scanning electron microscopy, laser, root canal infection.

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