

Antimicrobial Photodynamic Therapy Combined With Conventional Endodontic Treatment to Eliminate Root Canal Biofilm Infection

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Background and Objective: To compare the effectiveness of antimicrobial photodynamic therapy (PDT), standard endodontic treatment and the combined treatment to eliminate bacterial biofilms present in infected root canals.

Study Design/Materials and Methods: Ten single-rooted freshly extracted human teeth were inoculated with stable bioluminescent Gram-negative bacteria, *Proteus mirabilis* and *Pseudomonas aeruginosa* to form 3-day biofilms in prepared root canals. Bioluminescence imaging was used to serially quantify bacterial burdens. PDT employed a conjugate between polyethylenimine and chlorin(e6) as the photosensitizer (PS) and 660-nm diode laser light delivered into the root canal via a 200- μ fiber, and this was compared and combined with standard endodontic treatment using mechanical debridement and antiseptic irrigation.

Results: Endodontic therapy alone reduced bacterial bioluminescence by 90% while PDT alone reduced bioluminescence by 95%. The combination reduced bioluminescence by > 98%, and importantly the bacterial regrowth observed 24 hours after treatment was much less for the combination ($P < 0.0005$) than for either single treatment.

Conclusions: Bioluminescence imaging is an efficient way to monitor endodontic therapy. Antimicrobial PDT may have a role to play in optimized endodontic therapy. *Lasers Surg. Med.* 39:59–66, 2007. © 2006 Wiley-Liss, Inc.

Key words: endodontic therapy; root canal infection; photodynamic therapy; polyethyleneimine chlorin(e6) conjugate; bioluminescence imaging; biofilm