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Photodynamic Inactivation of *Enterococcus faecalis* in Dental Root Canals In Vitro

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Background and Objectives: We previously reported the use of a flexible fiber optic that uniformly distributed light in the root canal space for targeting bacteria after their sensitization with methylene blue (MB). In the present study, we investigated the photodynamic effects of MB on *Enterococcus faecalis* species in experimentally infected root canals of extracted teeth after their sensitization with a concentration of MB that exhibits reduced dark toxicity.

Study Design/Materials and Methods: In a model of root canal infection, 64 root canal specimens were prepared from extracted, single-rooted teeth and inoculated with *E. faecalis* (ATCC 29212). Three days later root canal infection was confirmed by scanning electron microscopy. The root canal systems were then incubated with 6.25 μg/ml MB for 5 minutes followed by exposure to light at 665 nm (60 J/cm^2) that was delivered from a diode laser via a fiber optic with a diameter of 500 μm. Following photodynamic therapy (PDT) the canal content was sampled by flushing the root canals, serially diluted and cultured on blood agar. Survival fractions were calculated by counting colony-forming units. High-performance liquid chromatography (HPLC) was employed to determine the porphyrins content of *E. faecalis*.

Results: Scanning electron microscopy confirmed the presence of bacteria in the root canal system. PDT achieved 77.5% reduction of *E. faecalis* viability. MB alone and light alone reduced bacterial viability by 19.5% and 40.5%, respectively. HPLC did not reveal any porphyrin patterns expressed by *E. faecalis*.

Conclusion: The results of this study support the need to determine the optimum MB concentration and light parameters to maximize bacterial killing in root canals. Lasers Surg. Med. 39:782–787, 2007.

Key words: methylene blue; scanning electron microscopy; diode laser