

### An in-vitro antimicrobial effect of 405 nm laser diode combined with chlorophylls of Alfalfa (*Medicago sativa* L.) on *Enterococcus faecalis*

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#### ABSTRACT

**Background:** *Enterococcus faecalis* (*E. faecalis*) is a bacterium commonly detected in the root canals of teeth with post-treatment apical periodontitis or advanced marginal periodontitis. It has the ability to live in an extreme environment and survive as an organism with its virulence factor possibly contributing to the pathogenesis of post-treatment apical and marginal periodontitis. Photodynamic therapy (PDT) is an urgently required alternative method of improving therapy effectiveness. Photodynamic therapy combined with conventional endodontic treatment decreases the number of antibiotic-resistant bacteria and biofilms. Chlorophyll is one of the photosensitizers added to enhance the absorption of light in photodynamic therapy. **Purpose:** The purpose of this study was to determine the antimicrobial effect of the combination of photodynamic laser therapy and Alfalfa chlorophyll in *E. faecalis*. **Methods:** In vitro study using *E. faecalis* distributed between negative control (C-) and positive control (C+), treatment groups using various energy doses of a 405 nm diode laser (2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20 J/cm<sup>2</sup>) with (G1) and without alfalfa chlorophyll as organic photosensitizer (G2). The suspension was inoculated on Tryptocase Soy Agar (TSA) and incubated at 37° C for 24 hours. The number of colony-forming units per milliliter (CFU/ml) was determined. The results were analyzed by ANOVA with p value < 0.05. **Results:** A 405 nm irradiating laser with or without a photosensitizer can decrease *E. faecalis* viability percentage through the administering of various energy doses. The highest decrease (42%) was obtained in the group without a photosensitizer using 20 J/cm<sup>2</sup>, while 10 J/cm<sup>2</sup> in the group with a photosensitizer proved the most effective dose (25%). **Conclusion:** The results of this study showed a decrease in the viability of *E. faecalis* exposed to a 405 nm (40 mW) laser. An irradiating process using a 405 nm laser without a photosensitizer (Alfalfa chlorophyll) resulted in the highest percentage decrease (42%) in *E. faecalis* bacterial viability.

**Keywords:** antimicrobial Photodynamic therapy; *Enterococcus faecalis*; diode laser 405 nm; Alfalfa chlorophyll

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#### INTRODUCTION

*Enterococcus faecalis* (*E. faecalis*), a Gram-positive bacterium commonly found in the root canal, is ovoid in shape with a diameter of between 0.5 and 1 µm. This bacterium is a facultative anaerobe and possesses the ability to survive in an extreme environment such as in a highly alkaline pH and high salt concentrated condition.<sup>1</sup>

*E. faecalis* is resistant to calcium hydroxide and antibiotics.<sup>2</sup> Tetracycline produce a poor antimicrobial effect on periodontal *E. faecalis*, with more than 50% of the *E. faecalis* periodontal isolates showing resistance. Furthermore, *E. faecalis* isolates from root canals demonstrate a high prevalence of the genetic determinant of tetracycline resistance (*tetM*). Recent studies have indicated that *tetM* genes were detected in approximately 50% of isolates from the root canal.<sup>1</sup>