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College of Dentistry**



**Antibacterial Effectiveness of Silver Nanoparticles,  
Sodium Hypochlorite and Chlorhexidine Irrigants  
against *Enterococcus faecalis* in Root Canal of  
Permanent Teeth  
(A Comparative Study)**

A Thesis

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## Abstract

**Background:** The role of microorganisms and their by-products in the initiation, propagation, and persistence of pulpal and periapical disease had been confirmed by many investigators. Elimination of bacteria from infected root canal system to achieve favorable healing environment is a major goal of root canal treatment. This involves several steps including: instrumentation, irrigation and application of intracanal medicaments. Irrigation is an important procedure during root canal treatment as it can clean the areas of the root canal system that cannot be touched by instrument. *Enterococcus Faecalis* has a major role in the failure of root canal treatment. Their ability to withstand the harsh environmental changes, due to their high alkaline tolerance and tubular invasion ability, protect them from root canal irrigant and medicament that made them a treatment-resistant microorganism.

**Aim of the study:** The present study aimed to evaluate and compare the antibacterial activity of silver nanoparticles, sodium hypochlorite and chlorhexidin against *E.faecalis* as an irrigants in permanent teeth.

**Materials and Methods:** Root canals of 55 single-rooted human permanent teeth were cleaned, shaped and sterilized. Isolation of *Enterococcus faecalis* was done from root canal samples that were collected from patients with necrotic pulp. After obtaining pure culture of *E.faecalis*, All the teeth samples were inoculated with *Enterococcus faecalis* and incubated at 37°C for 2 weeks. Silver nanoparticles were obtained from the biosynthesis (probiotic) of the bacillus mixture. The teeth were divided into four groups, 15 for each of 2.5 sodium hypochlorite, 2% chlorhexidine and 100 ppm silver nanoparticles, while the forth group was for normal saline ( $n = 10$ ) as a control group. Paper points were used to obtain pre- and post-irrigation samples so that the

colony-forming units were counted. Data were analyzed using SPSS and tested by Shapiro-Wilk test, One-Way ANOVA and Games-Howell test where the level of significance was set at 0.05.

**Results:** All the tested irrigants showed superior effectiveness compared to the normal saline ( $P < 0.05$ ). Overall, 2.5% sodium hypochlorite presented the most effectiveness against *E. faecalis* biofilm, followed by 100ppm silver nanoparticles, then the 2% chlorhexidine by mean percentage of antibacterial effectiveness of 99.87%, 99.51% and 98.66% respectively with no significant difference between them.

**Conclusions:** All of the 2.5% sodium hypochlorite, 100 ppm of Silver nanoparticles and 2% chlorhexidine solution were effective against *E. faecalis* in the root canal of permanent teeth. Silver nanoparticles was an effective irrigant solution and could be used as an alternative rinsing agent for sodium hypochlorite.