Experimental Research

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Dentistry Section

Antimicrobial Efficacy of Various Concentrations of Chlorhexidine Against *Enterococcus Faecalis* Bacteria

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ABSTRACT

Introduction: *Enterococcus faecalis* bacteria is well-known for causing a persistent root canal infection, nevertheless its phenotypic characteristics are not widely known.

Aim: To evaluate the antimicrobial efficacy of various concentrations of chlorhexidine against *E. faecalis* bacteria in the endodontically treated root canals.

Materials and Methods: The present *in-vitro* study was done using *E. faecalis* isolates from 30 endodotic patients. Samples were taken from patients at the start of the endodontic treatment (pre-treatment) and with repeated treatment (post-treatment) after satisfying the inclusion criteria. *E. faecalis* samples were isolated from patient's teeth which were then cultured followed by exposure to different concentrations of chlorhexidine of 0.1%, 0.2% and 2% with an incubation period of half hour, one hour and three hours respectively. Viability of *E. faecalis* samples were calculated with MTT assay using a standardised formula.

Results: As the chlorhexidine concentration increased, the viability of *E. faecalis* isolates is reduced, although statistically it is not significant. With increase in incubation time from half hour to one hour, Chlorhexidine (CHX) effectiveness increased, although this trend was decreased after three hours of incubation time.

Conclusion: Chlorhexidine 0.1% resulted in the largest decrease in *E. faecalis* viability and an incubation time of 30 minutes was effective to significantly reduce the viability of *E. faecalis*.

Keywords: Biomechanical preparation, Persistent infections, Post-treatment endodontic disease, Root canal irrigants

INTRODUCTION

Post-Treatment Endodontic Disease (PTED) is a persistent infection of the pulp and periapical tissue that occurs after the root canal has been treated and obturated. Epidemiological research showed that the occurrence of PTED is high [1]. The main cause of PTED is microorganisms that are able to survive against the root canal treatment along with the antimicrobials used. The most common microorganism found in the case of persistent infections is *Enterococcus faecalis* [2]. The amount of *E. faecalis* found in persistent infections was reported to be nine times more than the amount of *E. faecalis* found in the cases of primary endodontic infection [3]. To date, no adequate information is provided to explain how these bacteria are able to survive [4].

Enterococci have emerged as an important cause of nosocomial infection [5]. Various studies have proved the association of *E. faecalis* with different periradicular diseases [4-8].

Endodontic treatment aims to eliminate any microorganisms along with their metabolism products; this also includes *E. faecalis* bacteria. The use of irrigation solutions and medicaments in the root canal are done in order to help eliminate any microorganisms that cannot be removed through mechanical preparation. The commonly used irrigation material is sodium hypochlorite (NaOCl) with a concentration between 0.5-5.25%. This solution can penetrate into the dentinal tubules properly and able to dissolve any organic substances. However, as an irrigation material, it has a pungent smell, unable to dissolve inorganic substances, and toxic; higher concentration may provide a stronger antibacterial effect, but so does its toxicity [9]. The effective concentration of NaOCl reported against *E. faecalis* is 5%. Chlorhexidine is an alternative irrigation material to NaOCl because it is relatively non-toxic and has a broad-spectrum antimicrobial properties, along with its relatively low side effects [10].

Chlorhexidine can be found in the form of a gel or liquid. Several concentrations of CHX normally used today are 0.1%, 0.2%, and 2%. Chlorhexidine with a concentration of 2% can be used as an alternative irrigation material; it is considered that a 2% CHX has the same ability as a 5.25% NaOCl solution without any irritation side effect. Chlorhexidine has a bacteriostatic property at a concentration of 0.2% and bactericidal properties at a concentration of 2%, it will be then absorbed into the dental tissues and mucous membranes and released gradually at a therapeutic level. In an *in-vitro* research, it was revealed that the time needed by CHX 1% and 2% to eliminate all microorganisms was the same as the time needed by NaOCl 5.25% [10].

The aim of this research was to evaluate the antimicrobial efficacy of various concentrations of CHX against *E. faecalis* bacteria in the endodontically treated root canals.

MATERIALS AND METHODS

The present *in-vitro* study was done using *E. faecalis* isolates from endodontic patients, in Department of Conservative Dentistry in collaboration with Department of Oral Biology in University of Indonesia, Jakarta from January 2013 to September 2013. The study was done after taking the Institutional Ethical committee clearance (94/Ethical Clearance/FKGUI/I/2012). The number of subjects in this study were 30 patients (7 subjects with persistent cases, 17 subjects with pulp necrosis cases, and 6 subjects with abscess cases).

Informed consent was obtained from all the participants involved in the study.

The inclusion criteria for the subjects applied in this research are:

i. Male and female subjects aged 15-55 years with a diagnosis of infection in endodontically treated tooth/reinfection of root canal (persistent case).
ii. Cases of primary endodontic infection including pulp necrosis, or periapical abscess.
iii. All permanent molar teeth should have erupted completely; and with good general condition (healthy physical condition without any systemic abnormalities).