

## Rapid Decontamination of Gutta Percha Cones Using Different Chemical Agents

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### الخلاصة

**الهدف:** أن الهدف من الدراسة هو مقارنة تأثير أربعة سوائل على قابليتها السريعة لإزالة الجراثيم من مخروطات كونايركا. **المواد وطرق البحث:** تم استخدام 320 مخروطات كونايركا في هذه التجربة حيث وضعت في محلول جرثومي لكل من المكورات العنقودية، الاشريشيا القولونية، عصيات ستلس، و البيضات البيضاء بعدها تم غمرها في سوائل معقمة (6% بيروكسيد الهيدروجين، 2% كلورهكسدين، 1% هايوكوريت الصوديوم و 70% كحول أثيلي) للمدد 1، 5، 10 و 15 دقيقة. بعدها تم نقل المخروطات إلى أنابيب مختبرية حاوية على 4 مل من مرق القلب والدماغ وزرعها على الأوساط الزرعية المنتخبة. وبعد الحضان لمدة 24 ساعة بدرجة 37°م تم حساب أعداد المستعمرات الجرثومية. **النتائج:** أوضحت النتائج أن بيروكسيد الهيدروجين كان فعالا في دقيقة واحدة بينما كان كلورهكسدين، هايوكوريت الصوديوم فعالا بعد 10 دقائق وأخيرا الكحول أثيلي بعد 5 دقائق لغرض إزالة التلوث من مخروطات كونايركا. **الاستنتاجات:** أوضحت الدراسة أن بيروكسيد الهيدروجين أكثر فعالية في إزالة التلوث من مخروطات كونايركا.

### ABSTRACT

**Aim:** To compare the effectiveness of four different disinfectant solutions in rapid decontamination of gutta percha cones. **Materials and Methods:** In this experimental study, 320 gutta percha cones were placed in bacterial suspensions of *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, and *Candida albicans* for 30 minutes, and then immersed in disinfectant solutions (6% hydrogen peroxide, 2% chlorhexidine, 1% sodium hypochlorite, and 70% ethyl alcohol) for 1, 5, 10, and 15 minutes. After that, the cones were aseptically transferred to the test tubes containing 4 ml brain heart infusion broth, and then cultured on selected agar media and number of colonies was estimated after 24 hours incubation at 37 °C. **Results:** Hydrogen peroxide was effective in 1 minute, while chlorhexidine and sodium hypochlorite after 10 minutes, and ethyl alcohol in 5 minutes for decontamination of gutta percha cones. **Conclusion:** Hydrogen peroxide was the most effective agents in decontamination of gutta perch cones.

**Key Word:** Decontamination, Gutta Percha, Chemical Agents.

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### INTRODUCTION

One of the primary objectives of root canal therapy is to eliminate or reduce microorganisms in the root canal. Decreasing the number of microorganisms without injuring adjacent vital tissues enhances endodontic success<sup>(1)</sup>. During endodontic therapy, an aseptic sequence is one of the professional main concerns and must not be broken<sup>(2,3)</sup>.

Care must be taken during root canal therapy to prevent contamination of filling

materials and avoid root canal contamination. Gutta percha cones are now widely used to fill root canals. However they are not resistant to conventional sterilization processes in moist or dry heat. To keep the aseptic chain, gutta percha cones require rapid chair side decontamination before use<sup>(4)</sup>.

Literatures revealed several methods for rapid decontamination of gutta percha cones in dentistry. Among others, these include the following chemical agents:

polyvinylpyrrolidone iodine, glutaraldehyde, sodium hypochlorite, hydrogen peroxide, chlorhexidine, quaternary of ammonium, alcohol iodine, and ethyl alcohol. There is no agreement among national or foreign specialists for the best method<sup>(5-8)</sup>.

The aim of this study was to evaluate the antimicrobial effect of different chemical agents used for decontamination of gutta percha cones contaminated with different microorganisms. The chemical agents used were 6% hydrogen peroxide, 2% chlorhexidine, 1% sodium hypochlorite, and 70% ethyl alcohol.

### MATERIALS AND METHODS

In this experimental study, Gutta perch cones (ALPHA- DENT, INC, USA) size 80 was decontaminated by immersion in 6% sodium hypochlorite for 30 minute. The cones were individually and aseptically rinsed with sterile distilled water, and allowed to dry in Petri dishes containing sterile filter paper pads.

The disinfectant solutions used were 6% hydrogen peroxide, 2% chlorhexidine (Hibitane, 5% (w/v), Zeneca Limited U.K), 1% sodium hypochlorite (FAS a commercial household bleach, 6.25% (w/v), Iraq), and 70% ethyl alcohol (Wadi Al-Rafidain Factory, Iraq).

Pure cultures of *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, and *Candida albicans* were obtained from Microbiology unit in the Department of Dental Basic Sciences. A bacterial suspension of 24 hours in brain heart infusion broth was used to contaminate of gutta percha cones by immersing them in 4 ml of selected bacterial suspension for 30 minutes. The cones were transferred to sterile filter paper pads in Petri dish, and allowed to air dry for 5-10 minutes at room temperature under aseptic conditions. A series of 320 contaminated gutta percha cones was used. Five cones transferred individually to sterile tubes containing 10 ml of the chemical agent to be tested and kept for 1, 5, 10, and 15 minutes. Each cones was transferred to 4 ml of brain heart infusion broth (Oxiod LTD, Basingstoke, Hants/ England). Gutta percha cones that decontaminated from *Staphylococcus aureus* and *Bacillus subtilis* were inoculated

on brain heart infusion agar, those from *Candida albicans* on sabouraud agar (Oxiod LTD, Basingstoke, Hants/ England), and those from *Escherichia coli* on MacConky agar (Oxiod LTD, Basingstoke, Hants/ England), and incubated (Fisher Scientific/ Russia) for 24 hours at 37 °C and the number of colonies were estimated. Bacterial growth in inoculated plates indicated failure of decontamination and absence of growth indicated the efficiency of antimicrobial activity of the tested agents. For control of the experiments, 5 decontaminated cones (negative control), 5 contaminated cones (positive control) were individually cultivated in brain heart infusion broth, and another 5 contaminated cones immersed in distilled water for 1, 5, 10, and 15 minutes were also cultured (washing control), all control group inoculated in selected agar media and incubated for 24 hours at 37 °C<sup>(4,5,6)</sup>.

### RESULTS

In this study, 6% hydrogen peroxide was the most effective agent because all gutta perch contaminated cones were decontaminated in 1 minute (Figure 1). Contaminated cones treated with 2% chlorhexidine showed decontamination effect on *Staphylococcus aureus* after 10 minutes and from *Candida albicans* after 5 minutes, while decontamination effect on *Escherichia coli* and *Bacillus subtilis* occurred in 1 minute (Figure 2).

Using ethyl alcohol at 70% showed that decontamination of cones from *Staphylococcus aureus*, *Bacillus subtilis*, and *Candida albicans* was achieved in 1 minute and from *Escherichia coli* after 5 minutes (Figure 3).

Finally, 1% sodium hypochlorite decontaminated the cones from *Staphylococcus aureus*, *Bacillus subtilis*, and *Escherichia coli* within 1 minute, but contaminated cones become sterilized from *Candida albicans* after 10 minutes as shown in Figure 4.

For control groups, negative control did not show bacterial growth, while positive control did, and washing control also revealed bacterial growth at all time intervals for all microorganisms.

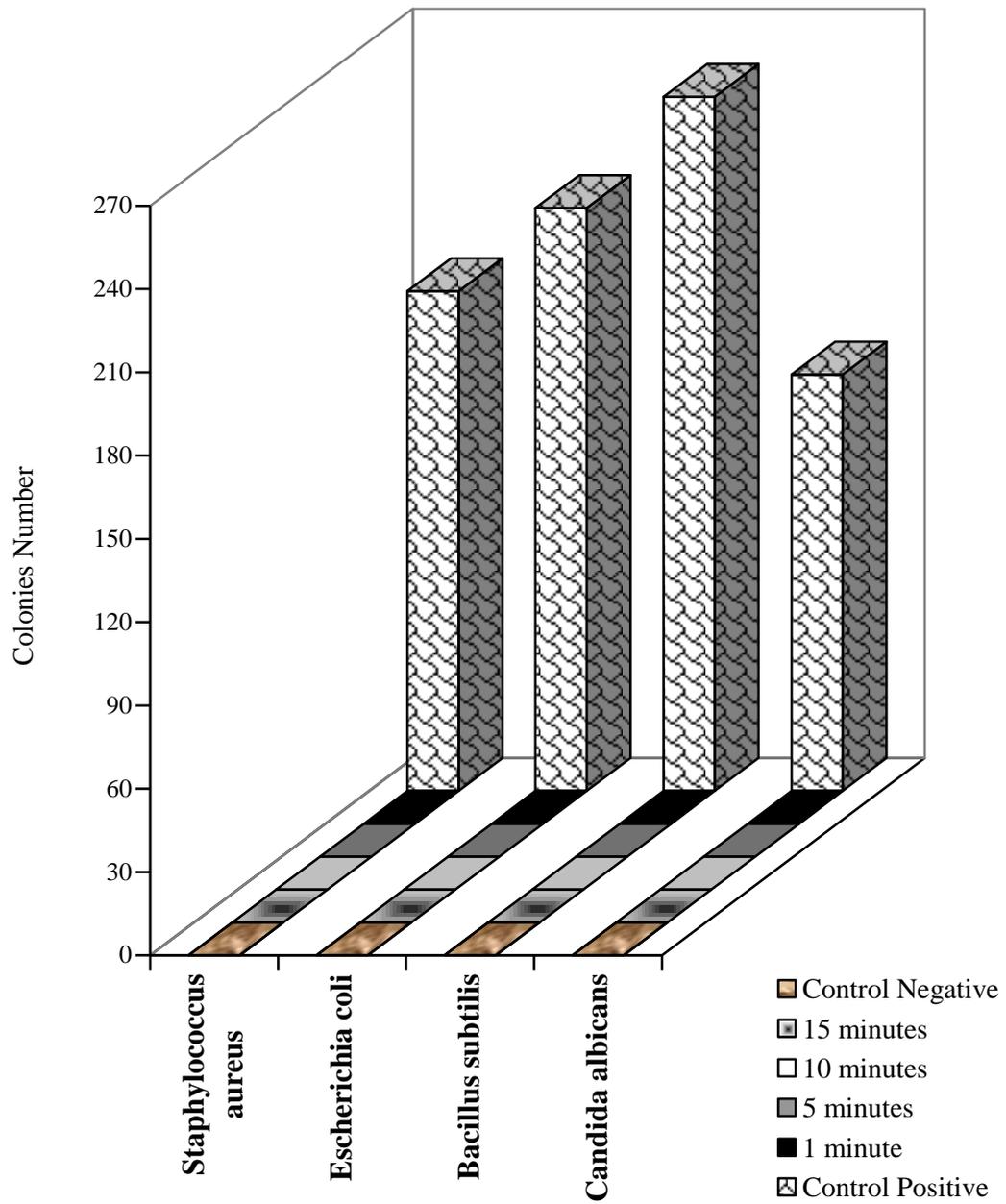


Figure 1. The effect of 6% hydrogen peroxide in decontamination of gutta percha from different microorganisms at different periods

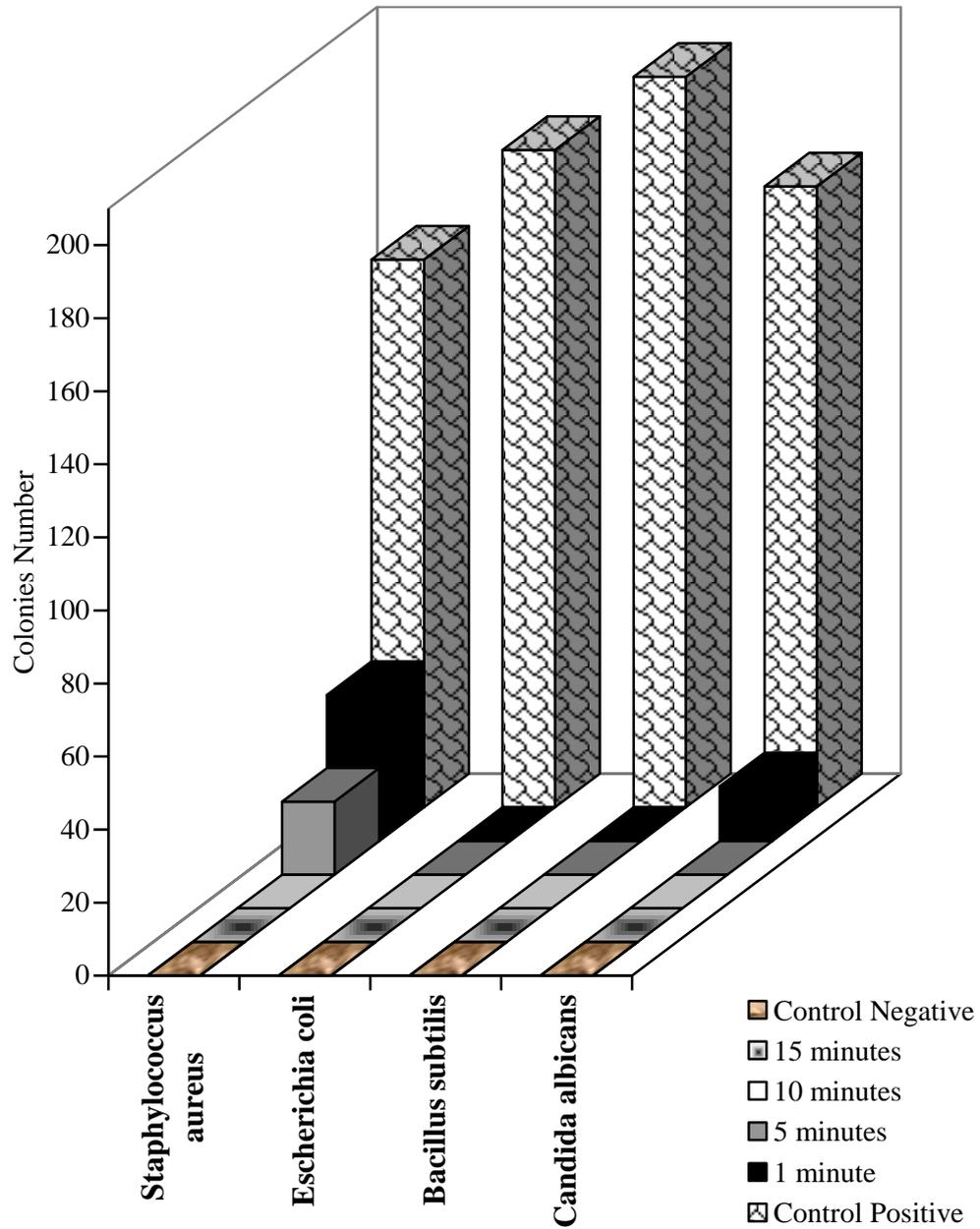


Figure 2. The effect of 2% Chlorhexidine in decontamination of gutta percha from different microorganisms at different periods

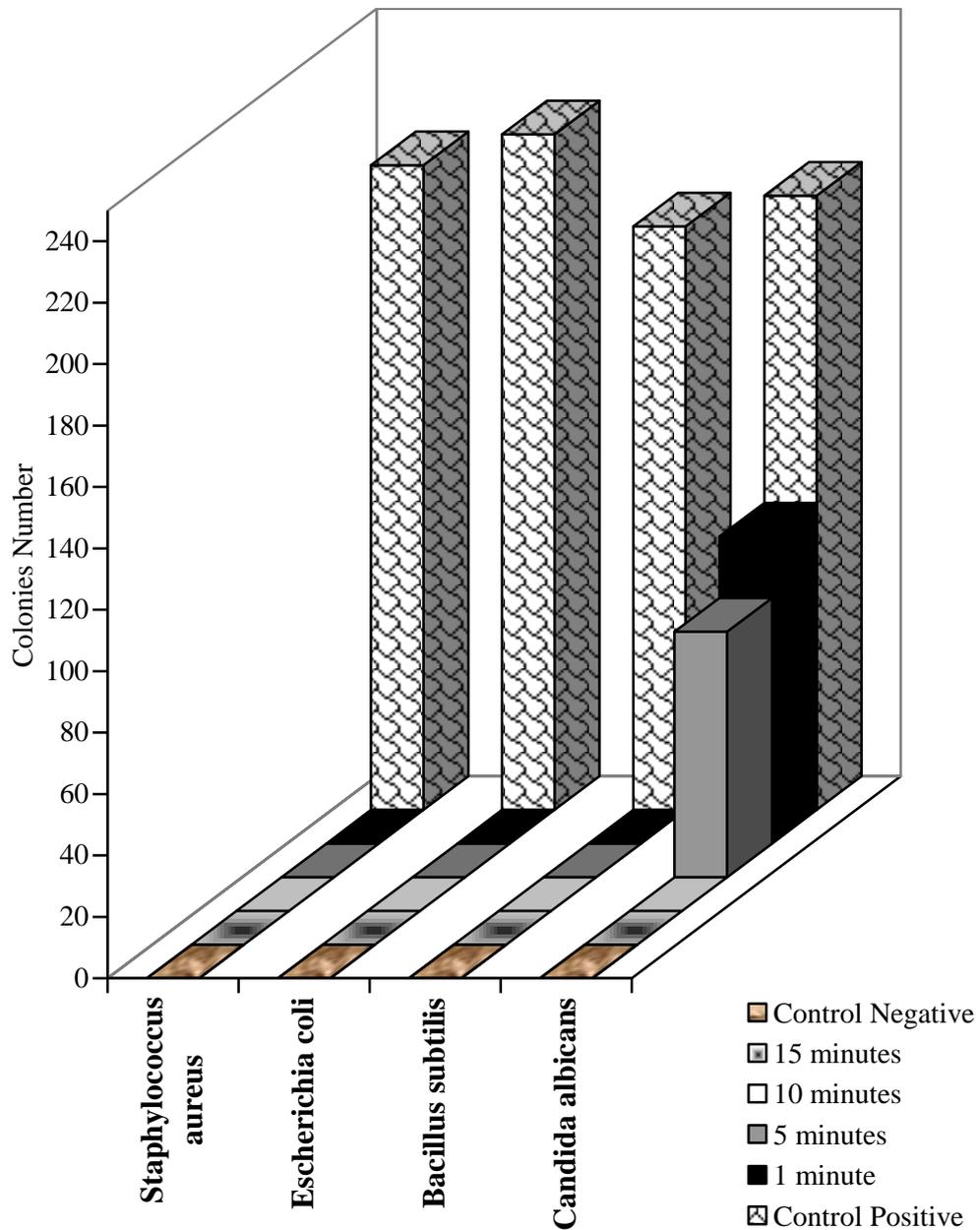


Figure 3. The effect of 1% Sodium Hypochlorite in decontamination of gutta percha from different microorganisms at different periods

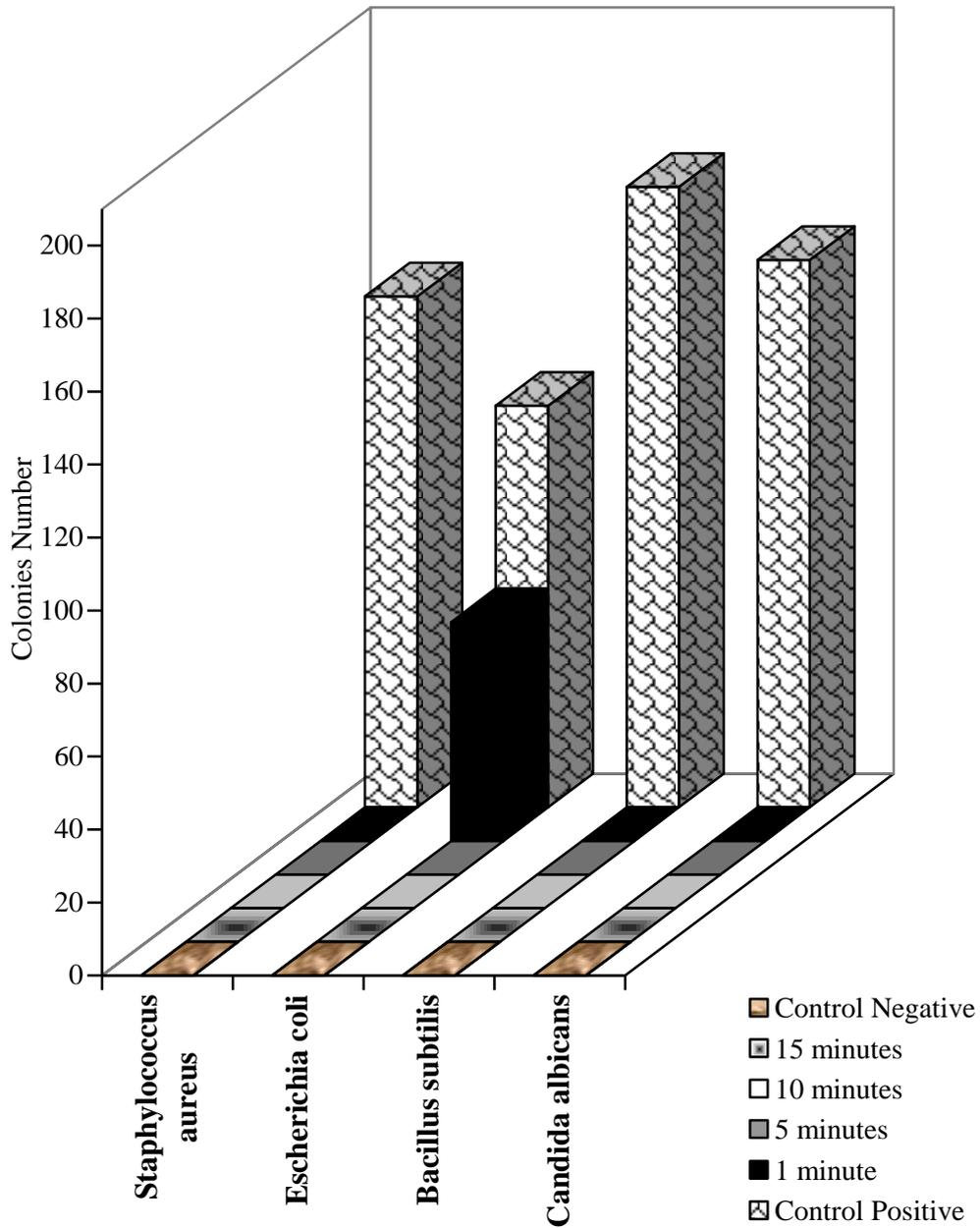


Figure 4. The effect of 70% Ethyl Alcohol in decontamination of gutta percha from different microorganisms at different periods

### DISCUSSION

A major objective of endodontic therapy is the establishment of a root canal system free of contaminants, especially microorganisms. Considerable effort to remove microorganisms already present in the root canal system<sup>(9)</sup>. However, in contrast to the care that is taken in cleaning the can-

als, obturation is often accomplished using gutta percha cones directly from their storage container without regard to their sterility. Since most manufactures do not claim that their cones are sterile, this practice could reduce the achieving of a successful result<sup>(10)</sup>. Although most gutta percha cones appear to be initially sterile,

there is a risk of contamination from both air borne and physical sources during their storage<sup>(11)</sup>.

The selection of chemical agents for decontamination of gutta percha cones in the present study was based on literature data<sup>(5,10, 11,12,13)</sup>. Among the chemical agents tested, hydrogen peroxide at 6% which was the most efficient product. It eliminated bacterial cells and fungi in 1 minute. Pennanchin and Alvers<sup>(12)</sup> investigated the efficiency of hydrogen peroxide in the decontamination of gutta percha cones. Cones were inoculated with saliva, purulent materials obtained from extracted teeth or from patients with apical abscesses. Hydrogen peroxide at 6% was effective in the rapid decontamination of cones in 10 minutes. Such differences probably due to the effect of pus or saliva on the efficiency of hydrogen peroxide. While the results of the study of Cardoso *et al.*<sup>(11)</sup> was comparable with the present study concerning hydrogen peroxide on the same microorganisms.

The use of 2% chlorhexidine in the present study, showed ability to decontaminate gutta percha cones after 10 minutes. Stablholz *et al.*<sup>(13)</sup> showed that 1.5% chlorhexidine was effective within 30 second for disinfection of cones from *Staphylococcus aureus*, *Streptococcus*, *Bacillus subtilis*, and *Candida albicans*. In another study the efficiency of 2% chlorhexidine to the gutta percha cones decontamination after 10 minutes was evidenced<sup>(6)</sup>. Such differences between different studies is probably due to several factors such as differences in the concentration of chemical agent and strain of microorganisms.

The use of 1% of sodium hypochlorite in this study showed that it was effective after 10 minutes. While several studies confirmed the efficiency of 5.25%, 5%, 4.5%, and 2.5% of sodium hypochlorite, there were few studies of the effect of 1% sodium hypochlorite<sup>(4,7,10,14,15)</sup>. Gomes *et al.*<sup>(16)</sup> evaluated the effectiveness of 5.25% sodium hypochlorite at in disinfecting of gutta percha cones from *Bacillus subtilis*. Results showed that sodium hypochlorite eliminated spores from gutta percha in 1 minute which is comparable with the present result. Ozalp *et al.*<sup>(17)</sup> studied the

effectiveness of a lower concentration of sodium hypochlorite (2.5%) for rapid sterilization of gutta percha cones contaminated with *Bacillus subtilis* and found similar results. Pang *et al.*<sup>(18)</sup> found similar effect on *Staphylococcus spp.*

With regard to the effectiveness of 70% of ethyl alcohol in rapid gutta percha cones decontamination. The present study showed that its effect after 5 minutes. Stabholz *et al.*<sup>(13)</sup> and Cardoso *et al.*<sup>(12)</sup> showed that bactericidal activity of 70% ethyl alcohol occurred in 1 minute, and this agent was unable to destroy *Bacillus subtilis* even after 15 minute of contact. The differences in decontamination effect of present study from other studies may have been related to several factors such as experimental methods, concentration and type of chemical agent, characteristic of the microorganisms, and time of analysis or exposure.

### CONCLUSIONS

The four chemical agents were effective for rapid decontamination of gutta percha cones, as hydrogen peroxide requiring shorter period of use about 1 minute, sodium hypochlorite and chlorhexidine were effective after 10 minutes, and finally ethyl alcohol was proved to be effective after 5 minutes.

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