

***In vitro* evaluation of different chemical agents for the decontamination of gutta-percha cones**

Avaliação in vitro de diferentes agentes de descontaminação de cones de gutta-percha

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ABSTRACT: This study evaluated the effectiveness of three disinfectants used in Dentistry for decontamination of gutta-percha cones. Sixty gutta-percha cones were contaminated with standardized pure cultures of five species of microorganisms (*Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 25923, *Candida albicans* ATCC CBS-ICB/USP 562, *Bacillus subtilis* spores ATCC 6633 and *Streptococcus mutans* ATCC 25175). The cones were treated with 10% polyvinylpyrrolidone-iodine aqueous solution (PVP-I; Groups 1 and 2), 5.25% aqueous sodium hypochlorite (Groups 3 and 4) and paraformaldehyde tablets (Group 5). All chemical agents were efficient for the cold sterilization of gutta-percha cones in short time periods.

DESCRIPTORS: Decontamination; Gutta-percha; Microbiology; Endodontics.

RESUMO: A eficiência de três desinfetantes usados em Odontologia foi estudada na descontaminação de 60 cones de gutta-percha contaminados com culturas puras e padronizadas de cinco cepas de microrganismos (*Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 25923, *Candida albicans* ATCC CBS-ICB/USP 562, *Bacillus subtilis* em esporos ATCC 6633 e *Streptococcus mutans* ATCC 25175). Os cones foram tratados com solução aquosa de polivinilpirrolidona-iodo 10% (PVP-I; Grupos 1 e 2), solução aquosa de hipoclorito de sódio 5,25% (Grupos 3 e 4) e pastilhas de formaldeído (Grupo 5). Nossos resultados indicam que todos os agentes químicos foram eficientes para a esterilização a frio dos cones de gutta-percha em curtos espaços de tempo.

DESCRIPTORIOS: Descontaminação; Guta-percha; Microbiologia; Endodontia.

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 success⁹. Considerable effort should be made to remove the existing microorganisms from the root canal and to prevent others from entering. During endodontic therapy, an aseptic sequence is one of the professional's main concerns⁸ and must not be broken¹².

Infectious microorganisms can be eradicated with biomechanical preparation¹³. However, in contrast with the care that is taken in cleansing the canals, gutta-percha cones are usually used directly from the package without regard to their sterility. Several studies tested the contamination of gutta-percha cones from unopened packages

and show that all the cones tested were sterile^{3,6}. However, Montgomery⁷ (1971) found that 8% of the tested cones were contaminated.

There is no consensus on the need for decontamination of the gutta-percha cones used to fill the root canal system. Nevertheless, the gutta-percha cones are not sterilized by standard autoclave or high temperature methods, because these procedures would cause deformation. Therefore, other methods of rapid decontamination of gutta-percha cones must be available in the clinic, such as paraformaldehyde, chlorhexidine, ethyl alcohol, polyvinylpyrrolidone-iodine, sodium hypochlorite, hydrogen peroxide, quaternary ammonium, and recently, electronic irradiation¹. However, there is no agreement among authors on which of these methods is the best.

The aim of this investigation was to evaluate *in vitro* the antimicrobial effect of different chemical

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agents used for decontamination of gutta-percha cones contaminated with microorganisms. The chemical agents used were 10% polyvinylpyrrolidone-iodine solution with and without 96°GL alcohol, 5.25% sodium hypochlorite and paraformaldehyde tablets.

MATERIAL AND METHODS

Enterococcus faecalis ATCC 29212, *Staphylococcus aureus* ATCC 25923, *Candida albicans* ATCC CBS-ICB/USP 562, *Bacillus subtilis* spores ATCC 6633 and *Streptococcus mutans* ATCC 25175 were tested.

Pure microorganism culture strains were cultivated in test tubes containing 5 ml of the broth BHI (Brain Heart Infusion), and incubated for 24 h at 37°C or in anaerobic jars in a 10% CO₂ atmosphere. After growth the concentration was agitated and regulated to 0.5 McFarland scale (1.5 × 10⁸ CFU/ml).

This study used 12 no. 40 principal gutta-percha cones (Tanari®, Tanariman Industrial Ltda., Manacapuru, AM, Brazil) for each bacterial strain. Two gutta-percha cones were transferred directly from the package into sterile medium (negative control Group). The 60 principal gutta-percha cones were divided into 5 groups of 12 cones each and transferred individually into 5 tubes containing 5 ml of each bacterial suspension (1.5 × 10⁸ CFU/ml), for 1 h. The positive control Group was formed by two gutta-percha cones transferred to sterile test tubes containing sterile BHI without the decontamination method.

The chemical gutta-percha cones decontamination agents were: 10% polyvinylpyrrolidone-iodine solution (PVP-I) (Bioflora Manipullarium, Ribeirão Preto, SP, Brazil), 5.25% sodium hypochlorite (Bioflora Manipullarium, Ribeirão Preto, SP, Brazil) and 500 mg paraformaldehyde tablets (Ricie®, Wirath Indústria e Comércio Ltda, São Paulo, SP, Brazil).

Five different decontamination methods were tested to disinfect the contaminated gutta-percha cones of each bacterial strain, with two samples in each group. After each decontamination method all the gutta-percha cones were transferred to sterile trial tubes containing sterile BHI and incubated at 37°C for 24 h, or under a 10% CO₂ atmosphere in anaerobic jars. Growth, as indicated by turbidity, was then recorded.

Group 1: the contaminated gutta-percha cones were immersed for 3 s in 10% PVP-I solution and for 3 s in 96° GL alcohol. Group 2: the gutta-percha cones were placed for 3 s in 10% PVP-I solution. Group 3: the cones were kept for 45 s in 5.25% sodium hypochlorite. Group 4: the cones were kept for 15 s in 5.25% sodium hypochlorite. Group 5: the gutta-percha cones were placed in paraformaldehyde tablets for 1 h. After these procedures, the gutta-percha cones were dried in sterile gauze and transferred immediately to sterile BHI medium.

RESULTS

Results show that all the chemical agents of decontamination of gutta-percha cones were efficient (Table 1).

TABLE 1 - Decontamination treatment of gutta-percha cones.

Microorganisms	Chemical agents of decontamination of gutta-percha cones										Positive control		Negative control			
	Group 1		Group 2		Group 3		Group 4		Group 5		Positive control	Negative control				
	Sample number												1	2	1	2
	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
<i>E. faecalis</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	
<i>S. mutans</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	
<i>C. albicans</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	
<i>S. aureus</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	
<i>B. subtilis</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	
Package sealed cones														-	-	

DISCUSSION

Montgomery⁷ (1971) suggested the use of 10% PVP-I for gutta-percha cone decontamination (*S. epidermis*, *S. aureus*, *F. diffusum*, *B. fusiformis* and peptostreptococci) after 10 and 30 s and 1 through 6 minutes. Cardoso *et al.*² (2000) evaluated the effectiveness of 10% PVP-I for 1, 5, 10 and 15 min and observed that this agent was bactericidal after 1 to 5 min for *S. aureus*, *E. coli*, *E. faecalis* and *B. subtilis* spores decontamination. Our results showed that the 3 second treatment with 10% PVP-I (alone or associated to 96° GL alcohol) was efficient for gutta-percha cone disinfection. However, alcohol favors gutta-percha cone drying.

Senia¹¹ *et al.* (1975) studied the effect of sodium hypochlorite on disinfection of gutta-percha cones and confirmed the efficiency in decontamination of 4.5, 5 and 5.25% solutions. Cardoso *et al.*² (2000) studied the efficiency of 1% sodium hypochlorite decontamination of gutta-percha cones and confirmed its efficiency in 1 to 5 min. However, Gomes *et al.*⁴ (2001) observed that the 1% sodium hypochlorite was only efficient after 5 min. In our study the 5.25% sodium hypochlorite showed effi-

ciency in decontaminating gutta-percha cones in 45 and in 15 sec.

Senia *et al.*¹⁰ (1977) evaluated the antimicrobial action of formocresol vapors on gutta-percha cone disinfection and concluded that bactericidal and sporocidal effects occurred in 16 h. Stabholz *et al.*¹⁴ (1987) observed that paraformaldehyde vapors were an effective method of decontaminating gutta-percha cones from the bacterial strains tested after 24 h^{5,11}. Our investigation evaluated and confirmed the antimicrobial effect of paraformaldehyde vapors in 1 h. Higgins *et al.*⁵ (1986) observed that formaldehyde volatilizes quickly, as shown by the fact that no formaldehyde was detected on the cones 24 h after powder removal. If formaldehyde is present on the cone surface at the time it is inserted into the canal, it may be released via dentinal tubules or the apical foramen, with unknown side effects.

CONCLUSIONS

1. All gutta-percha cone chemical decontamination agents studied were efficient.
2. Gutta-percha cones may be stored in sterile conditions, in contact with paraformaldehyde vapors for 1 h.
3. Although some cones from unopened packages were not contaminated, it is recommended that cold sterilization be used.

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