

# Effect of Time on Disinfection of Gutta-Percha Cones with Sodium Hypochlorite: Experimental Research

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## Abstract

The success of endodontic treatment is to eliminate as much bacteria as possible, reaching a point where the organism is able to remain free of the infectious process. Gutta-percha cones are one of the most biocompatible dental materials, not interfering in the repair process that occurs after obturation, are the most used means in obturation of the root canal and, therefore, responsible for preventing microorganisms from penetrating in the root canal after obturation initiating a new infectious process. The objective of the present study was to investigate the efficacy of sodium hypochlorite in the concentration of 2.5% in the decontamination of gutta-percha cones contaminated with microorganisms after their manipulation. Contaminated cones were treated by immersion in 2.5% sodium hypochlorite solution for 2, 3, 4 and 5 minutes and rinsed with sterile distilled water. The treated cones were inserted into Petri dishes with the culture medium nutrient agar to verify the existence and proliferation of microorganisms. The sodium hypochlorite solution after the 4 minute exposure period eliminated all microorganisms, making the cones safe for use.

*Key Words: Guta-percha cones, Sodium hypochlorite, Decontamination*

## Introduction

Endodontic treatment has the purpose of eliminating the largest number of bacteria existing in the root canal, reducing them to a level that the organism can by itself combat them, and calls for the development of an infectious process [1,2]. The obturation process has as main objective to prevent the entry of new microorganisms into the root canal [2,3].

Gutta-percha is one of the most biocompatible materials among those used in dentistry, not interfering with the tissue repair process that forms after root canal filling. For this reason, they are the most used material for root canal filling [3,4].

According to the literature, gutta-percha cones are composed basically of 19.0% to 20.0% gutta-percha, 59.0% to 75.0% zinc oxide and the remainder of radiopacifiers (barium sulfate), waxes, coloring agents, antioxidants and metal salts [4]. The presence of zinc oxide confers antibacterial activity on the cones of gutta-percha and for this reason; several authors defend the need for disinfection prior to the obturation stage [5].

The susceptibility of the gutta-percha cones to be contaminated, we then take care of the time required for sodium hypochlorite, at the concentration of 2.5% to eliminate these microorganisms, making the use of these cones safe to maintain the success of endodontic treatment [6].

In view of this premise, the objective of this work was initiated to verify these characteristics, after the first bacterial culture realized in the cones of gutta-percha, we verified the growth of microorganisms in the body of gutta-percha cones tested.

## Materials and Methods

The previous decontamination of gutta-percha cones, when used during endodontic treatment in order to prevent contamination of the canal system, is quite controversial in endodontics. However, the most used method according to the literature is the immersion of gutta-percha cones in sodium hypochlorite.

### Statistical analysis

The statistical analysis of the data was performed and interpreted by the author of the present study. For data analysis, a database was built in the Microsoft Excel spreadsheet, which was exported to the Minitab 18 statistical program. We performed a statistical analysis of the common descriptive and Anderson-Darling normality tests for all variables and controls, with remission  $p > 0.10$  as "normal". As the normality test was non-parametric for all samples, it was followed by Kruskal-Wallis analysis, adopting alpha level lower than 0.05 as statistically different.

### Disinfection medium of gutta-percha Cones

Sodium hypochlorite is the most commonly used disinfection agent in endodontics. This occurs due to factors such as its bactericidal properties, organic material solvent, and cytotoxicity, allied to its low cost. For this work were used 150 cones of gutta-percha from three different brands, separated into 15 different groups and immersed in sodium hypochlorite.

The cones were divided into 15 groups and submitted to disinfection protocols, according to *Table 1*.

**Table 1.** Groups of gutta-percha cones from three different brands that were immersed in sodium hypochlorite.

	2 minutes	p-value	3 minutes	p-value	4 minutes	p-value	5 minutes	p-value	Control
Gapadent	I	>0.05	IV	>0.05	VII	>0.05	X	>0.05	XIII
Dentsply	II	>0.05	V	<0.05*	VIII	>0.05	XI	>0.05	XIV
Tanari	III	<0.05*	VI	>0.05	IX	>0.05	XII	>0.05	XV

\* There were significant statistical differences.

- Group I-Dentsply/Maillefer perga gutta cone, immersed in 2.5% sodium hypochlorite for 2 minutes
- Group II-Tanari gutta cone, immersed in 2.5% sodium hypochlorite for 2 minutes
- Group III-Gapadent gutta cone, immersed in 2.5% sodium hypochlorite for 2 minutes
- Group IV-Dentsply/Maillefer gutta conga cone, immersed in 2.5% sodium hypochlorite for 3 minutes
- Group V-Tanari gutta cone, immersed in 2.5% sodium hypochlorite for 3 minutes
- Group VI-Gapadent gutta cone, immersed in 2.5% sodium hypochlorite for 3 minutes
- Group VII-Dentsply/Maillefer perga gutta cone, immersed in 2.5% sodium hypochlorite for 4 minutes
- Group VIII-Tanari gutta cone, immersed in 2.5% sodium hypochlorite for 4 minutes
- Group IX-Gapadent gutta cone, immersed in 2.5% sodium hypochlorite for 4 minutes
- Group X-Dentsply/Maillefer perga gutta cone, immersed in 2.5% sodium hypochlorite for 5 minutes
- Group XI-Tanari gutta cone, immersed in 2.5% sodium hypochlorite for 5 minutes
- Group XII-Gapadent gutta cone, immersed in 2.5% sodium hypochlorite for 5 minutes
- Group XIII-Gutter cone Dentsply/Maillefer, control, without the use of any substance
- Group XIV-Cone of gutta-percha Tanari, control, without the use of any substance
- Group XV-Cone gutta percha Gapadent, control, without the use of any substance

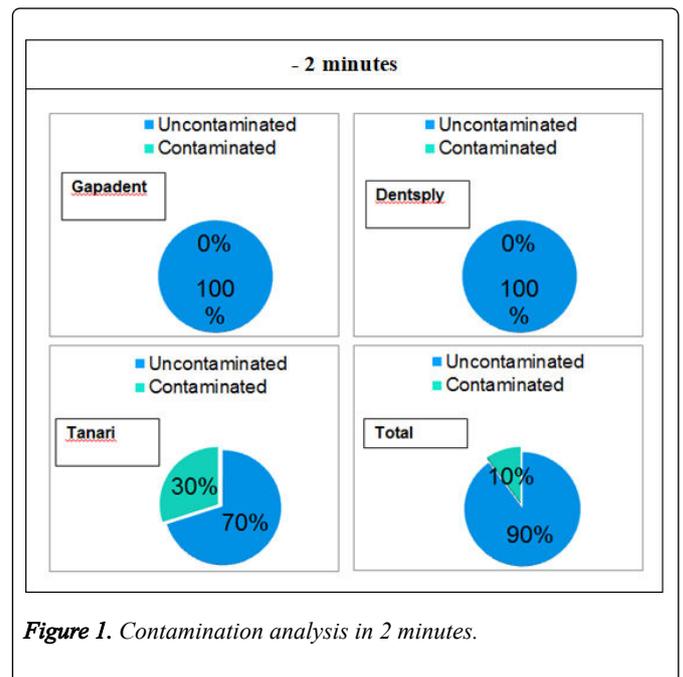
**Results**

The Gapadent brand did not present contamination by any type of microorganisms. The Dentsply brand did not present contamination by any type of microorganisms. The Tanari brand had fungus contamination in 30.0% of its cones. There was contamination of 10.0% of the total cones (Figure 1).

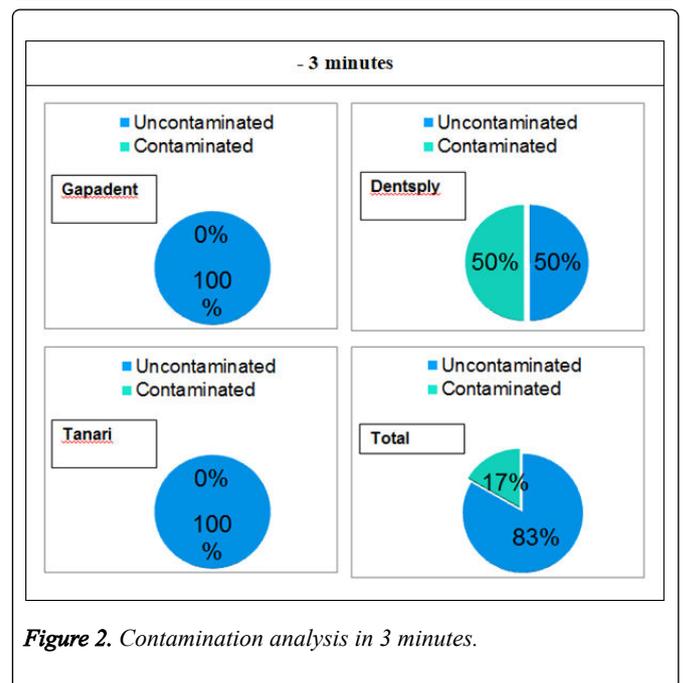
The Gapadent brand did not show contamination by any type of microorganisms. The Dentsply brand had fungus contamination in 50.0% of its cones. The Tanari brand did not show contamination by any type of microorganisms. There was contamination of 16.7% of the total cones (Figure 2).

The Gapadent brand did not present contamination by any type of microorganisms. The Dentsply brand did not present contamination by any type of microorganisms. The Tanari brand did not present contamination by any type of

microorganisms. There was no contamination of the cones (Figure 3).



**Figure 1.** Contamination analysis in 2 minutes.



**Figure 2.** Contamination analysis in 3 minutes.

The Gapadent brand did not present contamination by any type of microorganisms. The Dentsply brand did not present contamination by any type of microorganisms. The Tanari brand did not present contamination by any type of

microorganisms. There was no contamination of the cones (Figure 4).

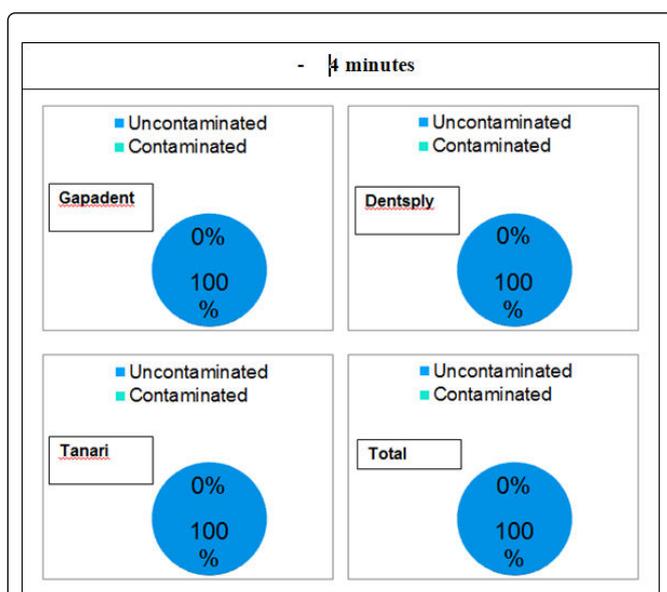


Figure 3. Contamination analysis in 4 minutes.

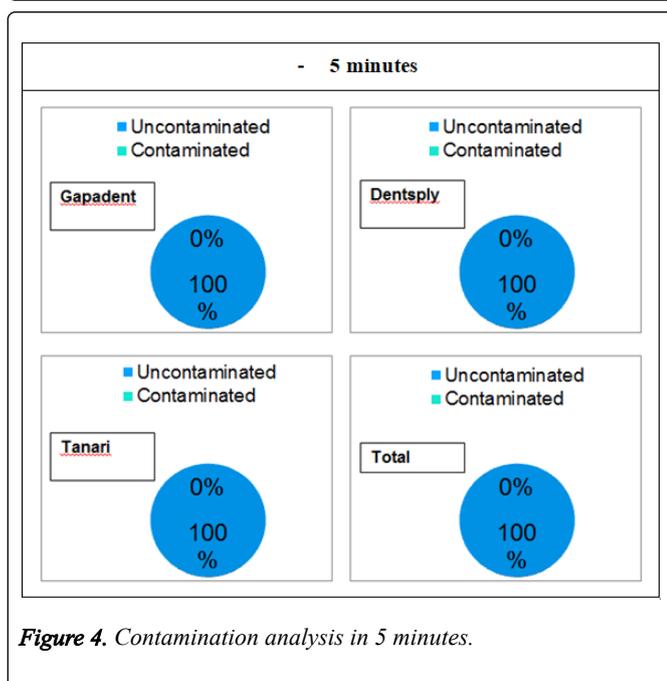


Figure 4. Contamination analysis in 5 minutes.

## Discussion

According to the context of the results of the present study, the literature also showed similar results. As literary support, gutta-percha (GP) contamination may occur during storage and handling.

Thus, the use of sodium hypochlorite for rapid decontamination of gutta-percha cones was proposed by Silva et al [1]. These authors demonstrated that gutta-percha cones contaminated with *Staphylococcus epidermis*, *Corynebacterium xerosis*, *Escherichia coli*, and *Enterococcus faecalis* were decontaminated after immersion in Clorox® (5.25% sodium hypochlorite) for 30, 45 and 60 seconds, respectively.

In the present study, we initially demonstrated that new gutta-percha cones removed from the box may be contaminated by microorganisms and therefore it is not safe to use them without decontamination first, otherwise the chances of unsuccess of the endodontic treatment. The practicality, due to the use of sodium hypochlorite during the irrigation phase in the endodontic treatment, prevents the Dentist from having to buy and use two substances. It is the most used disinfection medium in endodontics [7-10]. This occurs due to factors such as its bactericidal properties, an organic solvent, and cytotoxicity, coupled with its low cost [11-13].

In addition, we cannot associate sodium hypochlorite with chlorhexidine because the interaction between them results in para-chloroaniline, a carcinogenic precipitate [14,15]. This precipitate has amber coloration and, according to several authors, may generate an undesirable chromatic effect on the dental crown [16,17]. Finally, a careful evaluation of the results, especially groups VI, IX, and XII, was carried out to determine if there was or not contamination of the cones, due to the presence of bacterial colonies.

Thus, a study showed that the use of extracts of medicinal plants can be used as an alternative medicine for the preoperative disinfection of GP cones. Thus, the antimicrobial activity and efficacy of lemongrass oil (LG), basil oil (BO), and obscure tea extract (OT) were studied in the disinfection process of GP cones. The agar diffusion method was used to evaluate the antimicrobial efficacy of LG, BO, OT and sodium hypochlorite (control) against common contaminants, such as *Enterococcus faecalis*, *Staphylococcus aureus* and *Candida albicans*. One hundred and twenty GP cones were contaminated and cut into 2.

The first half was placed in the broth and incubated; while the second was treated with herbal extracts for 1 minute and then incubated for 24 hours in the broth. Any inhibition of bacterial growth was observed with the presence/absence of turbidity. LG showed the highest inhibition zones ( $29.9 \pm 6.9$  mm) for all organisms tested, followed by OT extract ( $16.3 \pm 1.8$  mm), sodium hypochlorite ( $16.0 \pm 1.6$  mm) and BO ( $14.5 \pm 5.3$  mm). Statistically, a significant difference was observed between LG and other plant extracts ( $p < 0.05$ ). All extracts proved to be potent rapid disinfectants for the LG cones surgery with LG, showing the largest antimicrobial activity [18].

A literary review work has shown that efficient irrigant delivery and agitation are prerequisites for promoting root canal disinfection and removal of debris and improving successful endodontic treatment [19]. Thus, several different systems of mechanical activation of irrigators to improve endodontic disinfection were analyzed, such as manual agitation with gutta-percha cones, endodontic instruments or special brushes, vibration systems activated by low-speed handpieces or by sonic energy or subsonic use, ultrasound or laser energy to mechanically activate irrigators and apical negative pressure irrigation systems [19].

In addition, this study described systems to improve intracanal bacterial decontamination by specific chemical action, such as ozone, direct laser action or light activated disinfection. Ultrasonic activation of root canal irrigators and sodium hypochlorite in particular still remains the gold

standard for which all other mechanical agitation systems analyzed in this paper have been compared. From this overview, it is evident that the use of different irrigation systems can provide several advantages in the clinical endodontic outcome and that the integration of new technologies, together with improved techniques and materials, can help in daily clinical practice [19].

In addition, another study analyzed the disinfectant effect of Aloe vera extract on gutta-percha (GP) components. As a result, ninety percent Aloe vera gel as disinfectant did not alter the tensile strength of the GP cones [20].

Also in this context, a study analyzed and compared the disinfectant effect of 5.25% NaOCl and Biopure MTAD versus CHX and CFC at 2.0% on gutta-percha cones, with 1 min exposure to effective disinfection of all the samples. Biopure MTAD could remove *E. faecalis* from the gutta-percha samples in 30 seconds while requiring 1-minute exposure to the Resilon cones. Both the CHX and the 2.0% CFC could not disinfect the samples with a 1-minute exposure and a minimum exposure of 5 minutes was required. A 5.25% NaOCl and Biopure MTAD required less time on the side of the chair to disinfect all samples effectively compared to 2.0% CHX and CFC [21].

In this context, a recent study analyzed the diameter of the main cones GP was significantly larger than that of the corresponding files at all levels in all brands. The diameter of the ProTaper GP was the closest to the diameter of the file in D1 (GP=0.35, File=0.35 mm) and D3 (GP=0.48, File=0.49). Within the same manufacturer, the diameters of the GP cone do not match the diameters of their corresponding files. Doctors are advised to use a GP meter to cut the tip so as to appropriate the diameter of a smaller GP cone [22].

## Conclusion

Gutta-percha cones are susceptible to contamination by microorganisms, necessitating their decontamination before use in endodontic treatments. The decontamination of the cones can be carried out using sodium hypochlorite, being necessary the permanence of the gutta-percha organisms in the solution of sodium hypochlorite in the concentration of 2.5% for at least 4 minutes for the complete disinfection of these making safe its use. Furthermore, gutta-percha cones can also be disinfected with the use of herbal extracts.

## Conflict of Interests

There is no conflict of interest between authors.

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