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Evaluation Of Surface Changes On Gutta-Percha Points Treated With Four Different Disinfectants At Two Different Time Intervals - A Sem Study

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***Abstract**: The purpose of this study is to identify the alteration of surface texture and physical properties of gutta percha cones after 1 minute and 5 minutes soaking into 4 chemical disinfectants using SEM.*
Materials and Methods : A total number of 50 gutta percha points of size F2 are taken from freshly opened boxes and arranged in 5 groups. The cones are then immersed in 5.25% NaoCl, 3% CHX, 13% Benzalkonium chloride, MTAD respectively for 1min and 5 min separately. Then the cones are removed from the respective solutions , air dried and 0.5 mm thick cross section of samples are prepared .The topography of the cones are then analysed under SEM.
Results:Surface changes were seen on gutta-percha cones in all groups at both intervals with maximum changes seen in cones disinfected using sodium hypochlorite .
***Keywords:** gutta-percha, disinfection, Sodium hypochlorite, Chlorhexidine, MTAD, Benzalkonium chloride.*

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I. Introduction

The purpose of endodontic treatment is the cleaning, shaping and disinfection of the root canal, followed by the obturation of the endodontic system. The presence and re-entry of microbes inside the canal is the main reason for post-treatment infection, which is an endodontic failure.[1]Therefore, disinfection throughout the treatment is very important.

Obturation is the final stage of endodontic treatment which marks its success . This is achieved by introduction of a biocompatible root-filling material combined with a sealer. Gutta-percha cones (GP) are the most widely used material for this purpose.[1]

Gutta Percha cones are usually purchased in sterile, sealed packages,but once exposed to the dental office environmentor even by handling, they can be contaminated by number of microorganisms. Due to their thermoplasticised nature ,conventional methods of sterilization cannot be used. [2,6]Therefore a chairside disinfection using different chemical disinfectants before obturation are recommended. Various chemical agents have been proposed as GuttaPercha disinfectants, includingsodium hypochlorite (NaOCl) , glutaraldehyde, alcohol,Chlorhexidine,MTAD, iodine compounds and hydrogen peroxide. The appropriate disinfectant should be the one that can be used routinely in dental clinics, and which provides afast disinfection without modifying the structure of the cone.

In order to accomplish the success of decontamination the disinfectants should be strongly active against the bacteria and microorganisms.Enterococcus faecalis is the most common bacteria that is seen in the root canal space even after the endodontic treatment.[1]

Eventhough chemical disinfection helps in eliminating microorganisms upto an extent ,it has some drawbacks like causing surface changes in the gutta-percha cones. Different concentrations at different time periods have varying effect on microorganisms.Several studies have shown effect of chemical disinfectants on surface texture of gutta percha cones.

Therefore the aim of this study is to evaluate the surface changes on gutta-percha points on disinfection with four different disinfectants at two different time intervals.

II. Materials And Methods

- Fifty gutta-percha cones of F1 size is used in this study. They are divide into various groups depending upon type of solution – Sterile water,5.25% NaOCl, 3% Chlorhexidine, MTAD,13% Benzalkonium Chloride.

- Group 1A; Guttapercha points in sterile water for 1 min
- Group 1B; Guttapercha points in sterile water for 5 mins

- Group 2A; Guttapercha points in 5.25% NaoCl for 1 min
- Group 2B; Guttapercha cones in 5.25% NaoCl for 5 mins

- Group 3A; Guttapercha cones in 3% CHX for 1 min
- Group 3B; Guttapercha cones in 3% CHX for 5 mins

- Group 4A; Guttapercha cones in MTAD for 1 min
- Group 4B; Guttapercha cones in MTAD for 5 mins

- Group 5A;Guttapercha points in 13% BAK for 1 min.
- Group 5B; Guttapercha points in 13% BAK for 5 mins.

After disinfection of guttapercha cones , they are air dried and gold coated for the conduction .The samples are then evaluated using SEM under 100X and 500X.

Fig. A. shows 4 disinfectants that were used (i) 5.25% NaOCl (ii) 3% CHX (iii) 13% Benzalkonium Chloride (iv) MTAD

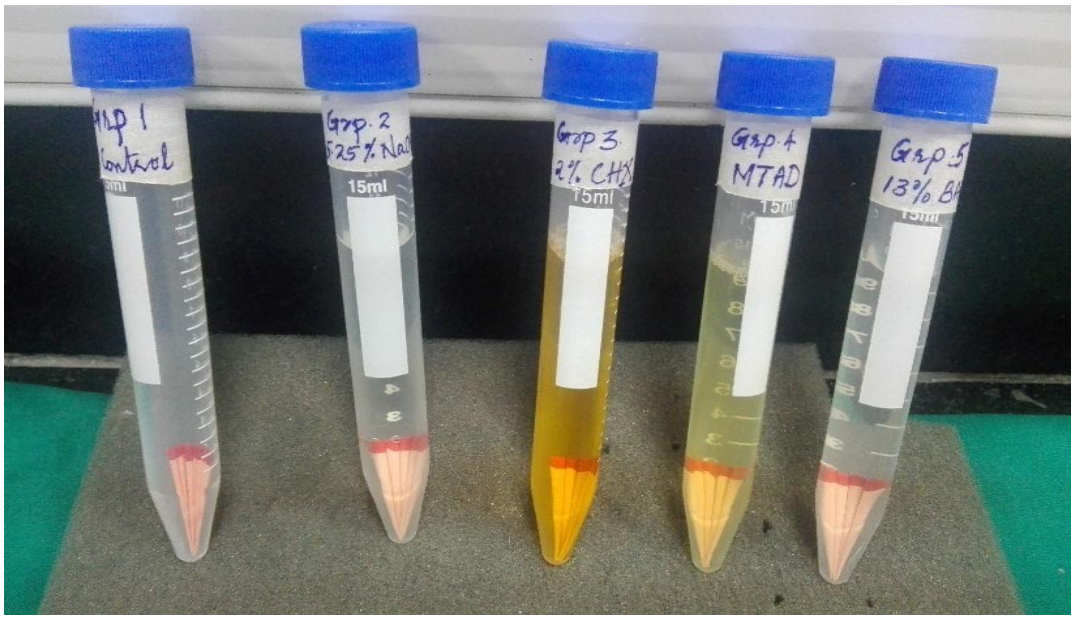


Fig .B. shows gutta-percha cones immersed in respective disinfectants for 1 min and 5 mins intervals

Fig .C. shows gutta percha cones placed for gold coating

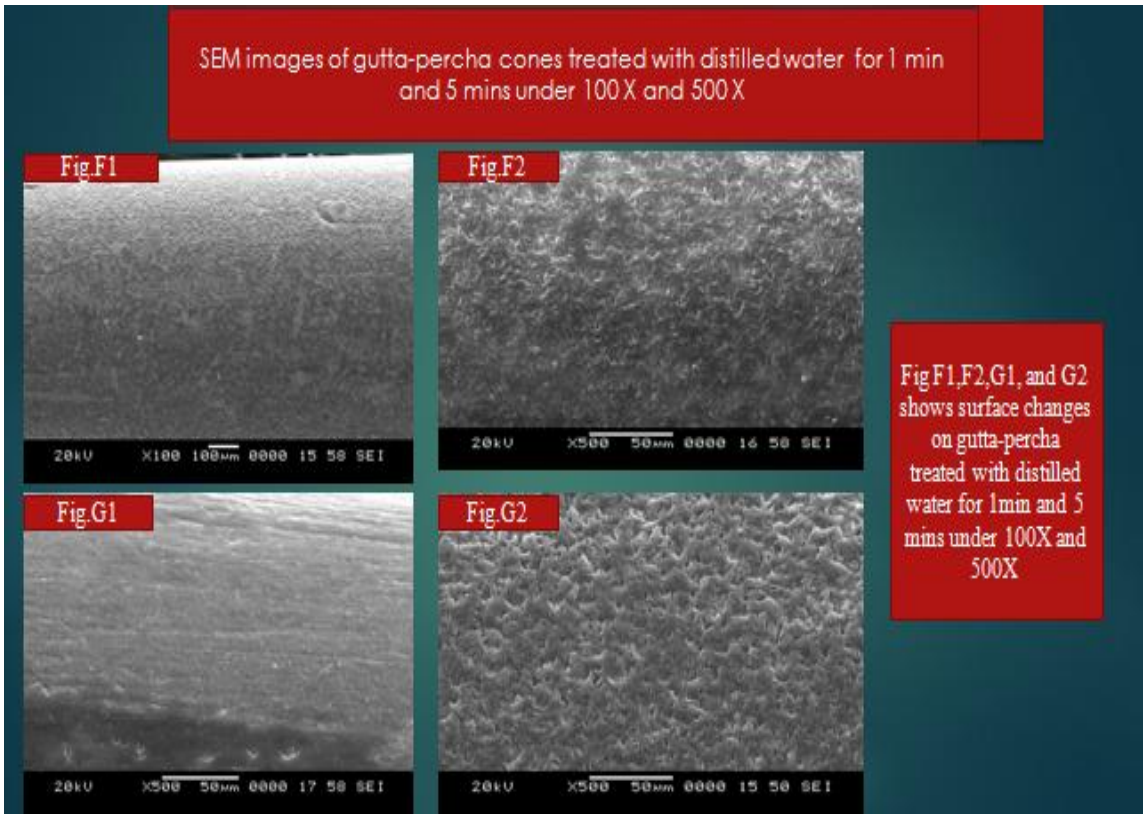
Fig D. gold coated gutta-percha cones

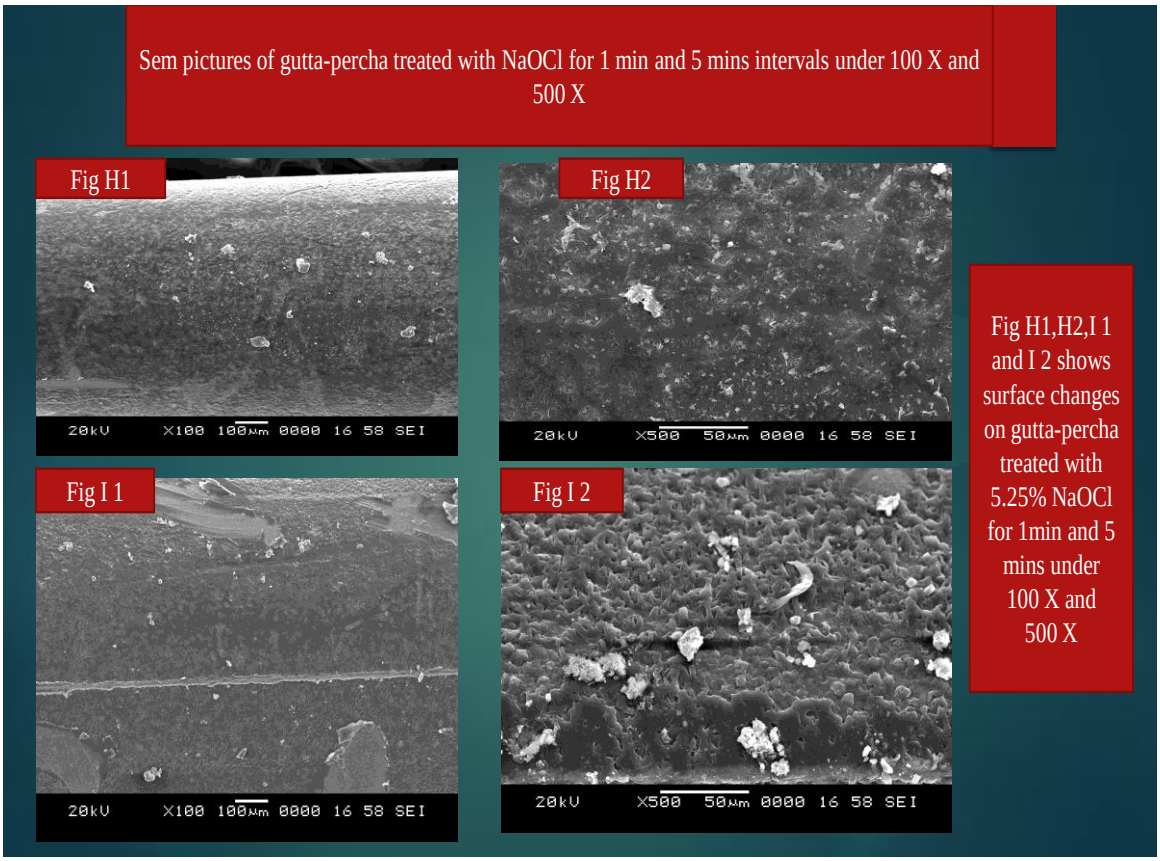
Fig. E Scanning ElectronMicroscope

III. Results

Topographic examination of gutta-percha cones revealed surface changes and deposits after disinfection. All the samples had shown surface changes except control group.

- NaOCl disinfection had shown surface deposits after 1 min. Five minutes immersion showed precipitate with cluster of crystals.
- Guttapercha disinfected within CHX showed surface deposits and irregularities less than NaOCl after 1 min and 5 mins exposure.
- MTAD disinfection showed no surface deposits in 1 minute, though surface irregularity was evident in 5 minutes exposure.
- Gutta-percha cones disinfected with benzalkonium chloride had less surface irregularities in 1 minute exposure and crystal-like deposits in 5 minute exposure.


SEM images of gutta-percha cones treated with distilled water for 1 min and 5 mins under 100 X and 500 X
Fig.F1
Fig.F2
Fig.G1
Fig.G2
Fig F1,F2,G1, and G2 shows surface changes on gutta-percha treated with distilled water for 1min and 5 mins under 100X and 500X


Sem pictures of gutta-percha treated with NaOCl for 1 min and 5 mins intervals under 100 X and 500 X
Fig H1
Fig H2
Fig I 1
Fig I 2
Fig H1,H2,I 1 and I 2 shows surface changes on gutta-percha treated with 5.25% NaOCl for 1min and 5 mins under 100 X and 500 X

SEM images of gutta-percha cones treated with CHX at 1 min and 5 mins interval under 100 X and 500X

Fig J1

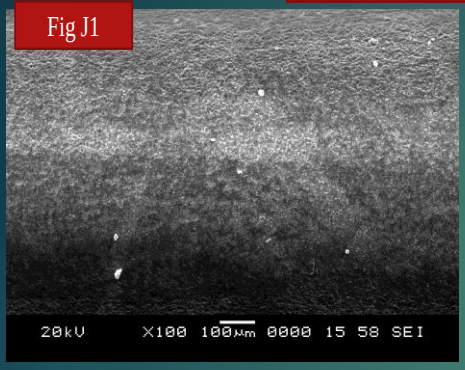


Fig J2

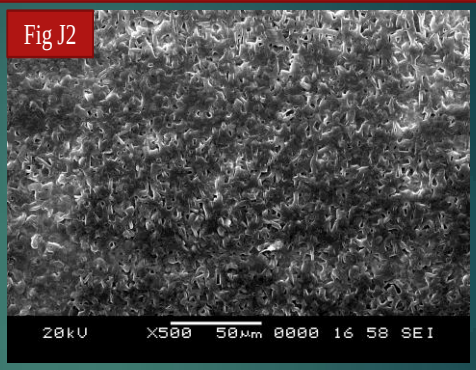


Fig J1,J2,K1 and K2 shows surface changes on gutta-percha treated with CHX for 1min and 5 mins under 100X and 500 X

Fig K1

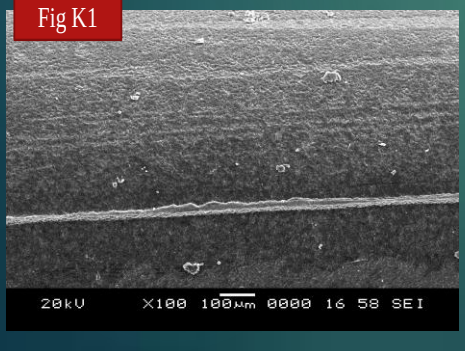
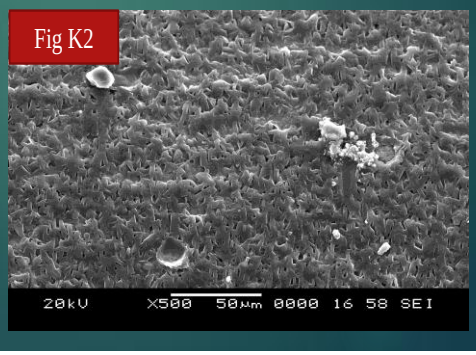


Fig K2



SEM images of gutta-percha cones treated with MTAD for 1min and 5 mins intervals under 100X and 500X

Fig L1

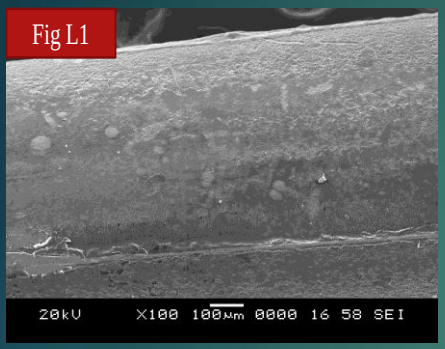


Fig L2

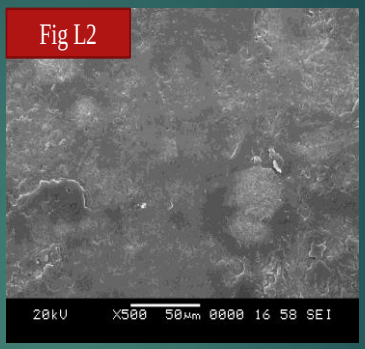


Fig L1,L2,M1 and M2 shows surface changes on gutta-percha treated with MTAD for 1 min and 5 mins under 100 X and 500X

Fig M1

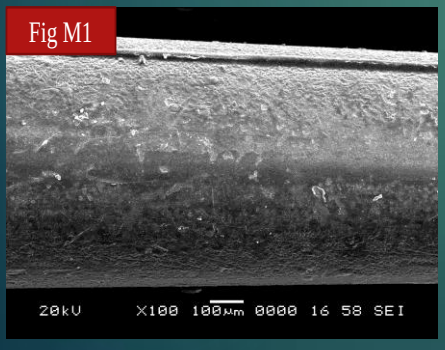
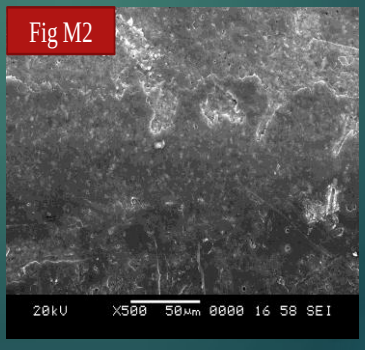
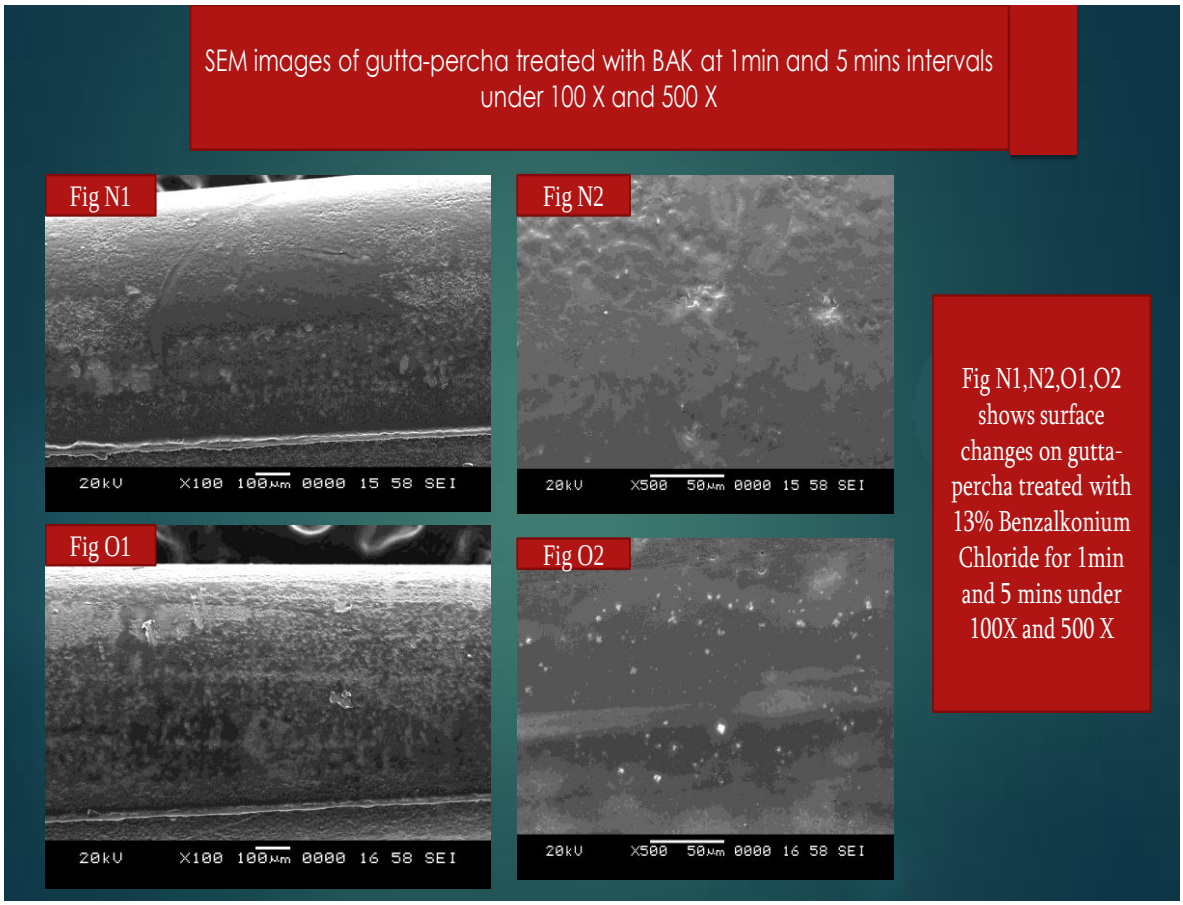


Fig M2





IV. Discussion

Gutta-percha cones cannot be sterilized by heat. Therefore a chairside decontamination using a chemical agent should be adopted in routine endodontic practice to render them, free of microorganisms. Furthermore, it is difficult to know beforehand how many accessory cones will be used during lateral condensation. Therefore, an effective chemical agent that acts quickly against surface contaminant microorganisms should be used for their decontamination.[1,3]

Eventhough gutta-percha cones are usually sterile during storage they can be easily contaminated if not properly manipulated. Gomes et al verified that 100% of the guttapercha cones manipulated with gloves showed microbial growth, thus demonstrating the importance of disinfection procedures.Present study evaluated by means of SEM the changes in the surface of cones after disinfection with different solutions.

NaOCl has been widely used as an endodontic irrigant and has a sterilizing action on artificially contaminated cones. It is found to be effective in disinfecting the gutta-percha cones in different concentrations by many investigators. In the present study,when 5.25% of NaOCl was used presence of chloride crystals was observed with more surface roughness with 1 minute and 5 minutes exposure respectively. [3]As the concentration and time increases it can lead to the elongation of gutta percha cones which may interfere with the proper obturation and success of treatment.Studies have shown that as a strong oxidising agent,5.25% NaOCl causes extreme topographic alterations in the cones which might be indicative of aggressive deterioration.Valois et al, reported that 5.25% NaOCl resulted in surface deterioration of gutta-percha cone that it was due to the loss of gutta percha cone components by the oxidising agent. [10]

The properties of CHX, such as broad spectrum of antimicrobial activity, substantivity, low toxicity, and water-solubility, have increased the interest in its use as an endodontic disinfectant. It has been used in endodontics either as an irrigant solution or as an intracanal medication, giving good performance. In the present study we used 3% CHX and it showed surface alteration and deposits on the gutta-percha cones during 1 minute and 5 minutes time interval.This might be due to the high concentration of solution.

According to Gomes et al 2% chlorhexidine does not show any topographical changes in gutta cones ,this may be due to the lesser concentration of solution.[2]However, Valois et al. detected surface alterations after short periods of exposure to 2% chlorhexidine. Such difference in the findings may be due to the different techniques used in the analyses.[4,5,6,7]A study by Isci et al suggested that disinfection of gutta-percha cones

using 2% CHX for 30 minutes does not change the properties of gutta-percha.This suggests that CHX may be less prejudicial to the structure of gutta percha.[9]

Royal et al. demonstrated that MTAD, an irrigant introduced as a final irrigant for disinfection of the root canal system, can be used in the rapid disinfection of gutta-percha and Resilon cones. The present study evaluated the action of MTAD on the topography of the cones and verified that the use of MTAD without rinse caused significant changes in the surface of gutta-percha cones. When the solution dried on the surface of gutta-percha, it formed a layer that solidified and modified completely the topography. This finding could be due to the organic characteristic of the solution.[8]The results of MTAD disinfection in this study showed no surface deposits, though irregularity was observed after 5 minutes exposure.

Benzalkonium chloride is a nitrogenous cationic surface-acting agent belonging to the quaternary ammonium group. It has been considered as one of the safest synthetic biocides known, and has a long history of efficacious use in eyewashes, hand, and face washes, mouthwashes, spermicidal creams, and in various other cleaners, sanitizers, and disinfectants.[1]In the present study 13 % Benzalkonium chloride shows less surface alteration and less surface deposits compared to other three disinfectants.In 1 minute exposure it showed minimal surface alteration , with 5 minutes exposure crystal deposits formed on the surface of gutta-percha cones.

Changes in the surface topography of gutta-percha were observed with all disinfectants as crystal deposits, granular deposits, or surface irregularity. These changes were best observed when the gutta-percha cones weredisinfected for 5 minutes when compared to 1 minute disinfection. These surface changes and deposits will impair the contact between the cone and the sealer and compromise the obturation seal and consequently the success of endodontic therapy.

V. Conclusion

Within the limitations of this study, it can be concluded that

- The disinfecting solutions cause superficial morphological alterations on the gutta-percha points because of their oxidative power; also, these alterations were proportional to the period for which the points were immersed into the solutions; .
- The disinfection of the gutta-percha points should be performed for the shortest period recommended so that the morphological alterations are minimum, once very altered gutta-percha points would influence on the apical sealing and increase microleakage.
- A 5-minute immersion is required for the complete disinfection and a final rinse of gutta-percha cones with distilled water is essential to eliminate the surface deposits.

CONFLICT OF INTEREST **:** None

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