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"Evaluation of disinfection of gutta-percha cones using various chemical solutions- An in-vitro study."

K.V.L Jyothsna[1], S.Sunil kumar[2], S.Datta Prasad[3], C.Sunil kumar[4], N.Vamsee Krishna[5], K.S.Chandra Babu[6].

[1, 2,3,4,5,6*] *c.k.s. theja institute of dental sciences and research, tirupati department of conservative dentistry and endodontics*

Corresponding Author; K.V.L Jyothsna

Abstract: ***Introduction:*** *The primary objective of root canal therapy is to eliminate microorganisms in the root canal. This can be attained by following strict asepsis during endodontic treatment. Even though gutta-percha cones are manufactured under aseptic conditions, they can be contaminated by handling, aerosols. Decontamination of GP cones is critical because they cannot be sterilized by moist or dry heat. Thus coldsterilization, using disinfectants should be used. Various chemical agents have been proposed as GP disinfectants. An appropriate disinfectant should be one that can be used routinely in dental clinics, providing fast disinfection without modifying the structure of the cone.*

Aim: *To evaluate and compare the efficacy of NaOCl, Aloevera, CHX in disinfecting gutta-percha cones.*

Materials & methodology: *sixty-four gutta-percha cones taken from freshly opened sealed packet were used. They were immersed in bacterial suspension for 30min. Cones were then immersed in 3% Naocl, 2% CHX, Aloevera for 1 and 5 min. In the control group, the gutta-percha cones were not contaminated with microorganisms and were placed in distilled water for 1 and 5 min. After the disinfection procedure, cones were incubated in broth medium at 37^0c for 48 hours, and the presence of bacterial growth was analysed by turbidity of the medium. All the data obtained will be tabulated and statistical analysis will be done.*

Results: *Turbidity was noticed in aloevera solution and chlorhexidine whereas it was absent in the sodium hypochlorite and control group.*

Conclusion: *Sodium hypochlorite was found to be more effective, followed by Chlorhexidine and Aloevera solution.*

Keywords: *sodium hypochlorite, chlorhexidine, aloevera,turbidity, staphylococcus species.*

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I. Introduction

The most precious material in endodontics is Gutta-percha.A day of endodontist wouldn't go without the use of Gutta-percha. In this world of advancement with upgrading technology, we prefer things to be more comfortable and faster. Contamination of gutta-percha with microorganisms can reintroduce microorganisms to the root canal system andtherefore extend infection by delaying or inhibiting healing.[1] The most crucial procedure that determines the success of endodontic therapy is obturation. The main motive of obturation is to encourage healing and prevent the ingress of microorganisms into the periapical area. This can be attained by maintainingstrict asepsis during endodontic therapy. The practitioner should be concerned not only withendogenous microbial flora of the oralcavity but also withexogenous bacterial contamination as well.[2] In spite of many advancements in obturation, Gutta-percha points are most commonly used. Although gutta-percha cones are manufactured under aseptic conditions, they can easily get contaminated upon exposure to the dental office by handling, aerosols and natural sources during the storage process.[3] The possibility of contamination of unused or remaining gutta-percha is higher during routine treatment.Gutta-percha cones cannot be sterilized by moist or dry heat because they cause alteration in the gutta-percha structure.[3] Thus cold sterilization with various disinfectants has to be used. Different chemical solutions can be used as disinfectants such as sodium hypochlorite, chlorhexidine, ethyl alcohol, glutaraldehyde, povidine iodine. An ideal disinfectant should be the onethat can be used routinely in the dental office with a faster disinfection action without modifying the structure of the cone.[4]

Staphylococcus genus is a facultative anaerobic coccus and it contaminates gutta-percha cones during handling. Guimarãeset al. stated thatthe recovery rate of the Staphylococcus genus from an infected root canal is about 15.7%; this result explains the need for gutta-percha disinfection.

The aim of this study was to compare the effectiveness of 3% NaOCl, 2% chlorhexidinegluconate (CHX),an indigenously prepared aloevera solution to disinfect GP cones contaminated by staphylococcus species after immersion periods of 1 min or 5 min.

II. Materials And Methodology

A total of sixty-four gutta-perchacones taken from a freshly opened sealed packet of size 35 (Dentsply) and 6% were used. They were divided into various groups according to the type of disinfectant 3%Naocl, 2%Chlorhexidine, Aloevera solution and control group.

MICROBIOLOGY PROCEDURES: 30 grams Nutrient broth powder was dissolved in 1 liter distilled water to prepare 30 g/l Nutrient broth solution.

PREPARATION OF ALOEVERA SOLUTION: At first, the leaves of the plants were washed with distilled water and surfaces of the leaves were disinfected with 70% ethyl alcohol. After cutting and opening the leaves, the fresh pulp was collected and homogenized. Eighty grams of the gel was dissolved in 20 milliliters distilled water to prepare 80% Aloe Vera solution.[5]

EXPERIMENTAL GROUPS

Group 1: 16 cones of gutta-percha were contaminated with staphylococcus for 30 min.8 cones were immersedin 3% NaOCl for 1 min and eight cones for 5 min.

Group 2: 16 cones of gutta-percha were contaminated with staphylococcus for 30 min.8 cones were immersed in 2% Aloevera for 1 min and eight cones for 5 min.

Group 3: 16 cones of gutta-percha were contaminated with staphylococcus for 30 min.8 cones were immersed Chlorhexidine solution for 1 min and eight cones for 5 min.

Control:16 cones of gutta-percha taken from freshly opened sealed packets werenot contaminated with staphylococcus. Eight cones were immersed in distilled water for 1min and eight cones for 5min.

After disinfecting, the samples were transferred to individual test tubes containing nutrient broth with the help of sterile tweezers and were incubated at 37^0c for 48hrs to determine the presence or absence of turbidity.

III. Results:

Groups	1 min	5 min
Sodium hypochlorite(n=16)	0	0
Alovera (n=16)	100	100
Chlorhexidine (n=16)	37.5	0
Control (n=16)	0	0

Table 1: shows % of samples showing turbidity after 1 and 5 min.

Table 1 shows the percentage of samples showing turbidity and table 2 shows graphical respresentation of samples showing turbidity after 1 and 5 min. The presence of turbidity was noted in samples treated with chlorhexidine after 1 min and in aloevera solution after 1 and 5 min, whereas there is complete absence of turbidity in the samples treated with sodium hypochlorite, distilled water after 1 and 5 min and in chlorhexidine after 5 min as shown in figure 1 and 2.

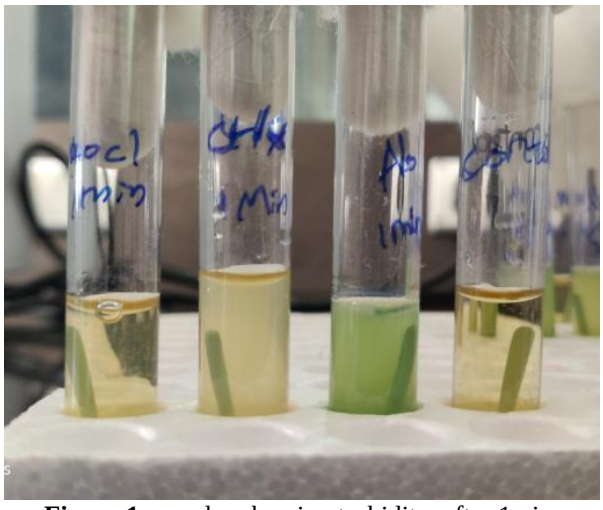

Figure 1:samples showing turbidity after 1min

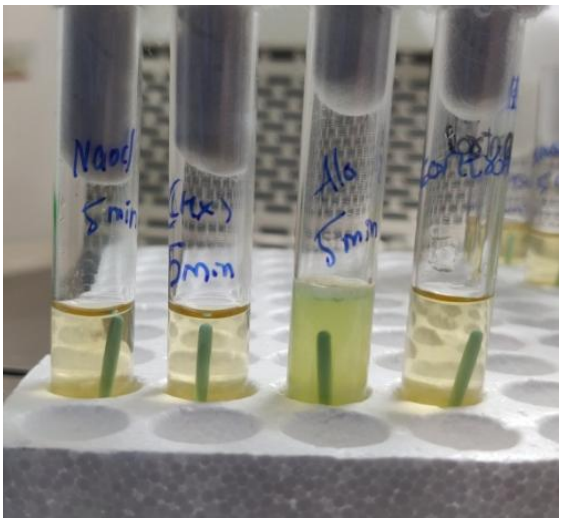

Figure 2:samples showing turbidity afer 5min

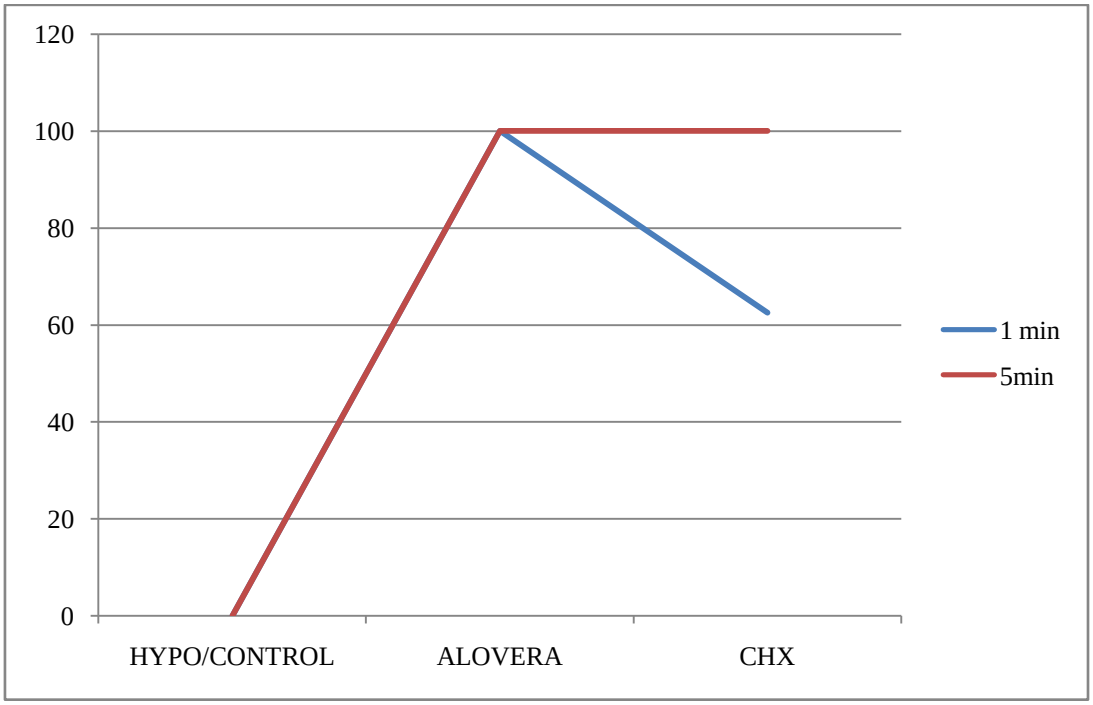

Table 2:Graphical representation of samples showing turbidity.

IV. Discussion

The primary cause of failure in endodontic therapy is the presence and persistence of microorganisms in the root canal. Improper cleaning and shaping, inadequate filling of the canal, and the use of contaminated materials for these procedures can be a possible explanation for this problem.[4]

The critical step during endodontic therapy is the sterilization of endodontic instruments and materials. Gutta-percha cones which are commonly used for filling the canals has several advantages such as biocompatibility, radio-opacity, antibacterial activity, easily removed from the canal, dimensionally stability and it does not stain the tooth structure.[2]

Even though gutta-percha cones are manufactured under aseptic conditions, they can easily be contaminated by improper storage, aerosols, and physical handling. Studies have shown the presence of microorganisms in 5-19% of freshly opened gutta-percha packs. Although the number of these organisms was comparatively low at the time of packaging, clinically, it is routine practice for dentists to use gutta-percha points 'straight out of the box' without an idea about its sterility.[6,7] With this ideology in the present study, the samples in the control group were immersed in distilled water without any treatment. As the gutta-percha cones werenot contaminated by handling or aerosols which resulted in no turbidity suggestive of no contamination of gutta-percha during manufacturing or packing.

Because of the thermoplastic nature of gutta-percha, they cannot be sterilized by traditional methods.[2] So various chemical agents have been used for chairsidedisinfection of gutta-percha such as Naocl, Chlorhexidine, glutaraldehyde, povidine iodine, MTAD.

Routine endodontic treatment should include this timesaving and rapid procedure of chairside disinfection of gutta-percha for every case as a part of treatment.

As per the results of the study,Naocl was found to be most effective, followed by chlorhexidine and aloevera solution.

Naoclis a gold standard and widely used irrigant during biomechanical preparation of the rootcanal. The antibacterial effect of Naocl is mainly affected by its concentration, andits activity is primarily due to hypochlorous acid (HClO) in solution which has oxidative action on sulphydryl groups of bacterial enzymes.[2] It is a broad-spectrumantimicrobial agent. Various studies have shown theeffectiveness of 5.25% NaOCl in eliminating mostmicroorganisms.[6] In a study, it was concludedthat NaOCl and chlorhexidine used in gutta-perchadecontamination, increased the surface free energy,promoting high interaction between gutta-percha/resilonand sealers used.[8]

Chlorhexidine kills vegetative bacteria by disruptingthe membrane integrity and causes the precipitation ofthe cytoplasm. The various properties of CHX are broad-spectrum antimicrobial activity, substantivity, low toxicity, and water-solubility, which have build up the interest in its use as an endodontic irrigant.[3]Because of antibacterial, sporicidal activity and substantivity CHX is used as an irrigantin endodontics.[4]

Studies conducted by Sahinkesenet al. found that both 5.25% NaOCl and 2% CHXare found to be more effective.[9]

The disinfecting action of aloevera was ascribed to saponins, ascorbic acid, anthraquinones, sterols, cinnamic acid, p-coumaric acid, pyrocatechol. Aloevera gel has antibacterial activity. Nevertheless,Aloevera solution displayed antimicrobial activity; the lesser disinfection action was due to lesser acidic content and a lower amount of total monomeric anthocyanins.[10]

Various studies conducted by Cardoso, Brenda and Nurban ozalp also reveals that Sodium hypochlorite was more effective in the sterilization of gutta-percha cones when compared to chlorhexidine and glutaraldehyde.[2]

Clinical Implications

Although GP cones are usually provided in aseptic packages, once opened and used, they may be contaminated. So routine endodontic treatment should include this timesaving and rapid procedure of chairside disinfection of gutta-percha for every case as a part of treatment.

Limitations

Root canal infections are polymicrobial. In this study, I have used only one particular organism. Hence, further studies are required to estimate the disinfection action against other microbes like bacteria(different species), fungi, viruses and yeasts.Also, additional research regarding the exact mechanism of disinfection action ofthe herbal solutions is required.

V. Conclusion

- Within the limitations of the study, NaOCl was an effective agent for a rapid high disinfection level of gutta-percha cones, followed by chlorhexidine.
- So for disinfection of GP treated with Naocl can be coated as a promising and rapid sterilization approach.
- Routine endodontic treatment should include this timesaving and rapid procedure of chairside disinfection of gutta-percha for every case as a part of treatment.

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