



Comparative Evaluation of the Changes in Surface Topography and Crystallization of Gutta Percha Cones by Four Chemical Solutions: An SEM Study

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DOI: 10.31080/ASDS.2020.04.0980

Received: October 17, 2020

Published: November 09, 2020

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Abstract

Aim: The aim of the study was to observe the surface topography and crystallization of GP cones by aloe vera, glutaraldehyde, sodium hypochlorite and propolis - using a Scanning electron microscope (SEM).

Materials and Methods: Seventy GP points of size 80 and 2% taper were divided into five groups depending on the type of chemical agents used for disinfection.

The groups were as follows:

- Group 1 - Control group
- Group 2 - Aloe vera
- Group 3 - Glutaraldehyde
- Group 4 - Sodium hypochlorite
- Group 5 - Propolis.

In each of the groups, fourteen GP points were immersed in the respective chemical agents separately for 2 minutes and observed under SEM to evaluate for changes in surface topography and presence of chloride crystals. Statistical analysis was done using Chi-square test.

Results: Propolis showed least changes in surface topography with minimal chloride crystal formation when compared to Aloe vera, Glutaraldehyde and Sodium hypochlorite.

Conclusion: Within the limitation of the study, propolis proved to be a better disinfectant for GP cones with minimal surface changes when compared to other groups.

Keywords: Gutta Percha; Surface Topography; Chloride Crystals; Propolis; Sodium Hypochlorite

Introduction

Gutta percha points are frequently used endodontic obturating materials. The microorganisms both endogenous and exogenous bacteria such as cocci, rods and yeasts, may cause potential de-

filement once the GP points are exposed to chair-side clinical surroundings [1].

Gutta percha cones cannot be cleansed by the usual conventional methods wherein moist or dry heat methods are used as it may

cause surface alteration to the gutta-percha cone structure due to their thermoplastic characteristics [2]. Senia, *et al.* reported that the most effective, definitive, appropriate and inexpensive method for disinfecting GP cones is rapid disinfection technique [1]. Rinsing gutta percha cones in sodium hypochlorite (NaOCL) solution (3% and 5.25%) for a minute is a recognized standard method [1].

Propolis collected by bees, mainly from plants is a brown resinous substance. It is a potent antimicrobial, antioxidant and anti-inflammatory agent. Aloe vera also known as "*Aloe Barbadosis Miller*" belongs to family Liliaceae is a cactus-like plant that has an advantage of growing in both hot and dry climates. This medical herb possesses potent antibacterial, antifungal, antiviral and antioxidant properties [3].

The suggested method for decontamination of GP points consists of immersing the cones in 1% Sodium hypochlorite for 1 minute (Milton's solution) or 0.5% Sodium hypochlorite for 5 minutes (Dakin's solution). Here, the chances of Sodium hypochlorite causing crystal impurities within the canals that can hinder the obturation cannot be ignored [4].

Sodium hypochlorite produces crystal impurities within the canals and might cause deterioration of GP points which includes the increased depth of surface irregularities and loss of elasticity which can hinder the obturation [2]. Therefore, an ideal antiseptic should be one that can be used every day in dental clinics, delivering a better disinfection without modifying the structure of the cone [2]. According to several studies, *Staphylococcal* microorganism was found to be contaminating gutta-percha cones inside the boxes and after using with gloves [5]. Hence, rapid chair side asepsis of Gutta percha cones is of prime importance to have an aseptic chain during root canal procedures.

Aim of the Study

The aim of this SEM study was to evaluate and compare the surface changes on gutta percha cones when treated with the following chemical solutions.

Materials and Methods

Seventy standardized Gutta percha cones of size eighty and two percent taper were randomly selected from new boxes and divided into five groups based on the type of agents used for sterilization. The cones were checked for any deformity before the procedure was undergone.

In group 1 (control): 14 GP points were directly taken from the sealed pack with the help of locking tweezers and pictures were captured under scanning electron microscope (SEM) (Figure 1a).

In group 2 (100% aloe vera): 14 GP points were selected and were immersed and soaked in 100% aloe vera juice (Krishna's herbal and Ayurveda, India) for 2 minutes and the cones were transferred to a sterile 4-inch × 4-inch gauze pads and allowed to air dry for 30 minutes followed by which they were placed under scanning electron microscope (SEM) and pictures were taken (Figure 1b).

In group 3 (2% glutaraldehyde): 14 GP points were selected and were immersed and soaked in 2% solution of glutaraldehyde (korsolex Rapid, Raman and Weil pvt, India) for 2 minutes and the cones were transferred to a sterile 4-inch × 4-inch gauze pads and allowed to air dry for 30 minutes followed by which they were placed under scanning electron microscope (SEM) and pictures were taken (Figure 1c).

In group 4 (3% sodium hypochlorite): 14 GP points were selected and were immersed and soaked in 3% sodium hypochlorite solution (Hyposol, Prevest dent pro, India) for 2 minutes and cones were transferred to a sterile 4-inch × 4-inch gauze pads and allowed to air dry for 30 minutes followed by which they were placed under scanning electron microscope (SEM) and pictures were taken (Figure 1d).

In group 5 propolis (10%): Propolis (10%) was prepared by dissolving 10gram of propolis dry extract (Hi-Tech Natural Products Ltd. Delhi) in 100 ml of glycerin.

14 GP points were selected and were immersed and soaked in propolis (10%) solution for 2 minutes and the cones were transferred to a sterile 4-inch × 4-inch gauze pads and allowed to air dry for 30 minutes followed by which they were placed under SEM and pictures were taken (Figure 1e).

Scanning electron microscope (SEM) evaluation

GP points from all the five groups were analyzed under scanning electron microscope (ZEISS, conventional SEM) at 250X magnification to observe for surface topography and crystal formation on the GP cones.

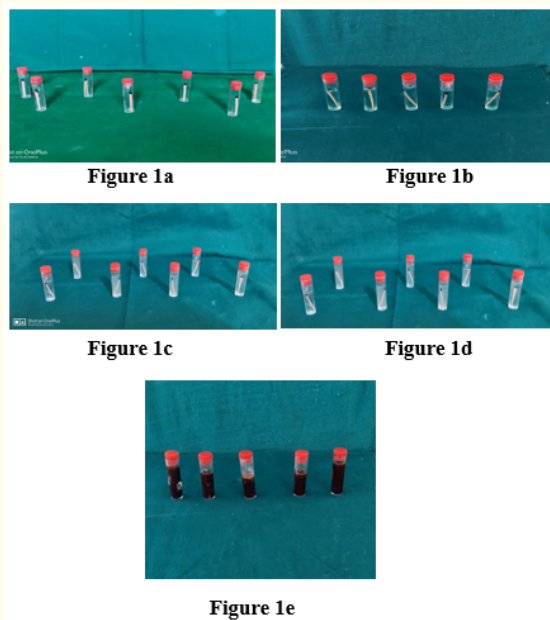


Figure 1: (a) GP cones in control group. (b) GP cones in Aloe vera group. (c) GP cones in glutaraldehyde group. (d) GP cones in sodium hypochlorite group. (e) GP cones in propolis group.

Statistical method

Statistical analysis was done using the Chi square test to compare the changes seen on the surface of the gutta percha cones. The results were tabulated as shown in table 1 and graphs (Graph 1) and (Graph 2) were accordingly made.

Results

SEM images revealed propolis showing least crystal formation on the surface of gutta percha cones (Figure 2a) followed by aloe vera (Figure 2b), glutaraldehyde (Figure 2c) and sodium hypochlorite (NaOCl) (Figure 2d).

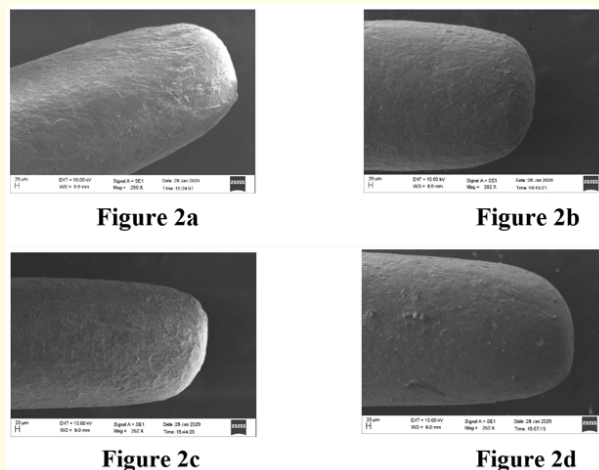


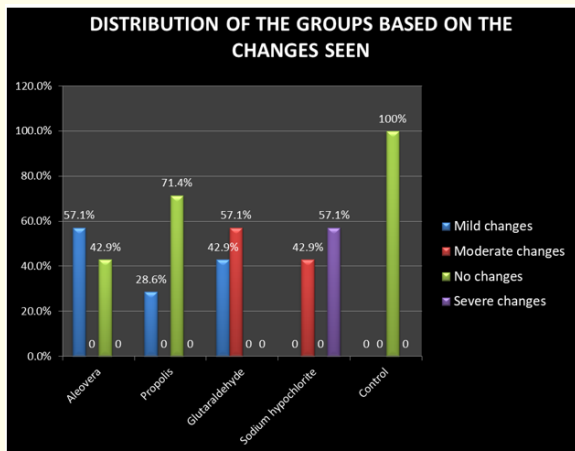
Figure 2: SEM images of (a) Propolis. (b) Aloe vera. (c) Glutaraldehyde. (d) Sodium hypochlorite.

Table 1 and graph 1 shows the distribution of groups based on the surface changes of GP cones. Out of fourteen, seven Gutta percha cones were selected from each group and the percentage was calculated by the number of cones that showed changes divided by the total number of cones.

		Changes seen				Total
		Mild changes	Moderate changes	No changes	Severe changes	
Aloe vera	Count	4	0	3	0	7
	Percent	57.1%	0.0%	42.9%	0.0%	100.0%
Propolis	Count	2	0	5	0	7
	Percent	28.6%	0.0%	71.4%	0.0%	100.0%
Glutaraldehyde	Count	3	4	0	0	7
	Percent	42.9%	57.1%	0.0%	0.0%	100.0%
Sodium hypochlorite	Count	0	3	0	4	7
	Percent	0.0%	42.9%	0.0%	57.1%	100.0%
Control	Count	0	0	7	0	7
	Percent	0.0%	0.0%	100.0%	0.0%	100.0%
Total	Count	9	7	15	4	35
	Percent	25.7%	20.0%	42.9%	11.4%	100.0%
Chi-square value- 46.63						
P value- 0.00*						

Table 1: Distribution of the groups based on the changes seen.

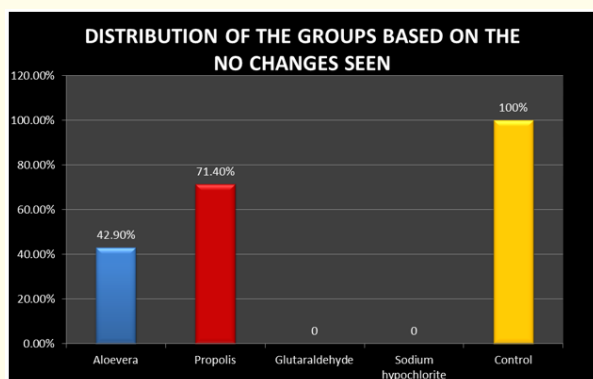
*Significant.



Graph 1: Graphical representation of the groups based on changes seen.

In the Aloe vera group, it showed least or no changes with respect to 42.9% and mild changes with respect to 57.1% of GP cones. The Propolis group showed the least or no changes i.e. 71.4% while 28.6% showed mild changes. The Glutaraldehyde group showed moderate changes with respect to 57.1% and mild changes with respect to 42.9% of GP cones. The Sodium hypochlorite group showed severe changes with respect to 57.1% and 42.9% showed moderate changes on the surface of GP cones.

Graph 2 shows the distribution of groups based on no changes seen on the gutta percha cones. It's seen that the aloe vera group showed 42.9% no changes, it was followed by propolis group with 71.4% showing no change and the control group which showed 100% no changes on the surface of gutta percha cones.



Graph 2: Graphical representation of the groups based on no changes seen.

Discussion

One of the foremost goals in endodontic therapy is complete elimination of the microorganisms [1]. Thus, sterilization of endodontic instruments and materials becomes an important step [2]. Though at the time of packaging the number of organisms was quite low, clinically it is routine practice for dentists to use gutta-percha points 'straight out of box' without a thought about its sterility. It has been demonstrated that the clinical usage of the package increased the number of microorganisms contaminating the gutta percha cones [5]. Thus, chemical disinfection of gutta percha cones becomes an important step as the physical sterilization process cannot be undergone [6]. Gomes, *et al.* stated that gutta-percha cones manipulated with gloves showed the growth of microbes, indicating the importance of disinfection procedures [7]. Rapid disinfection technique is a convenient and inexpensive method for these cases [8]. Since 96% ethyl alcohol, 70% isopropyl alcohol and distilled water were able to remove chloride crystals that form on gutta-percha, it is useful to use the above mentioned agents after the rapid disinfection technique. It is prudent to produce the most sterile root canal system, maximizing the most hermetic seal possible [9].

Ingle stated that dropping a cone into a good germicidal solution for a fair period of time will evidently decontaminate the cone [1]. The use of sodium hypochlorite as a disinfecting agent has been recommended by several studies. However, at higher concentration (5.25%) they produce chloride crystals on the surface of gutta percha cones that could impair the obturation and hermetic seal.

Glutaraldehyde because of its sporicidal activity can sterilize gutta percha cones and has been used as a preservative and sterilization agent [1].

The medicinal property of different herbs has been discussed in various fields of endodontics. Propolis being a natural antibiotic, has better anti-inflammatory and antioxidant properties. Flavonoids, phenolic and various aromatic compounds constitute the chemical composition of propolis.

Aloe vera, is another medicinal herb which is composed of around 75 active ingredients which includes vitamins, enzymes, sugars, minerals, lignin, saponins, salicylic acid and amino acids, which have antioxidant, antiviral and antibacterial properties. In addition to its efficacy as decontaminant of gutta-percha cones, it's also used in cases of lichen planus, aphthous ulcers and alveolar osteitis [4].

In the present study, propolis (10%) showed least or no changes in surface topography and minimum crystallisation were seen in GP cones treated with propolis followed by aloe vera, while substantial changes in surface topography and crystallization were seen with both glutaraldehyde and sodium hypochlorite group which can impair the canal obturation and affect the success of the treatment.

One among the many beneficial properties of propolis is that its anti-inflammatory and cariostatic properties prevent and breaks down fungal cell wall and cytoplasm. Awadeh., *et al.* in his *in vitro* study compared the antifungal effect of propolis, 2% chlorhexidine and 3% sodium hypochlorite and concluded that propolis can produce clean root canals and be used as an endodontic irrigant [10].

Glutaraldehyde has been proved to be a high level chemical sterilizer and disinfectant [11]. Results of this study are also supported by the study conducted by Nair and Bandhe where they concluded that propolis (10%) showed better anti-microbial efficacy at both 5 and 10 minutes when compared to aloe vera and chlorhexidine [3].

Conclusion

Within the limitation of the study, propolis proved to be a better chemical solution which caused minimal surface changes of the gutta percha cones among the five groups tested.

Conflict of Interest

There are no conflicts of interest.

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