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Comparative Evaluation of Surface Topography of Gutta Percha After Rapid Disinfection Using Various Solutions- A Scanning Electron Microscope Study

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Abstract:
Background*: The success of the endodontictherapymainlydepends on the obturation of root canal system. Hence, the sterility of the materialused for obturation is of utmost importance. Gutta percha is one of the mostcommonlyusedfillingmaterial. Eventhough gutta perchaconescomes in pre-sterilizedboxes,it caneasilygetcontaminatedduring handling. This elicits the need of a rapid and effective method of disinfection of gutta percha.This study aimed to assess the surface topography of gutta percha after rapid disinfection using 5% sodium hypochlorite, 70microgram per milliliter silver nanoparticle solution and 80% aloe vera gel using scanning electron microscope.*
Materials and Methods*: A total of 80 gutta percha cones of size 30,6% (Dentsply, Maillefer) were taken from sterile boxes and was divided into four groups. The cones where then immersed in respective solutions of each group for 2 min and where then allowed to dry by placing on 4*4 inch sterile gauze pad.Finally, all GP cones selected were mounted on aluminium studs individually, gold sputtering was done and they were analyzed under SEM to observe for surface topography changes.*
Results*:Sodium hypochlorite showed greatest topographical changes of gutta percha when compared to aloe vera gel and silver nanoparticle solution.*
Conclusion: *Both aloe vera and silver nanoparticle solution can be used as alternatives for the conventional method of disinfection of gutta percha using sodium hypochlorite.*
Keywords*:**Sodium hypochlorite, Aloe vera gel, silver nanoparticle solution, Rapid disinfection, Surface topography.*

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I. Introduction

A complete three dimensional and fluid tight seal of the root canal system is the final component of the endodontic triad. Even if proper care is taken during the biomechanical preparation of the root canal, obturation is often acheived using gutta percha cones directly drawn from their storage boxes without regard of their sterility. Even though gutta percha cones are manufactured under aseptic conditions and have antimicrobial properties due to their zinc oxide component, it can get easily tainted by aerosols and handling. (1)

Due to the thermoplastic nature of gutta percha, the accustomed process of moist and dry heat sterilization cannot be implemented. (2,3) Numerous studies have recommended exposing the GP cones to paraformaldehyde vapor for 3 hrs. Senia et al had found that formocresol vapor sterilized gutta percha cones within 16 hrs. (4,5,6) Such methods may be executed for long term storage of GP cones but is not felicitous for quick decontamination of gutta percha during treatment. This evokes the need for a rapid and effective chair side disinfection of gutta percha using a solution without causing alterations in its structure. The chemicals used for disinfection of gutta percha cones include polyvinyl pyrolidone iodine, sodium hypochlorite, glutaraldehyde, hydrogen peroxide etc. (2,7) Apart from chemical disinfectants, diverse, safe and effective herbal disinfectants are also attempted, amongst which aloe vera gel is found to be effective in decontaminating GP cones. Furthermore, various nanoparticles are also being used for disinfection, of which silver nanoparticles have emerged as effective antimicrobial agents due to their broad-spectrum effect.(8,9,10)

The objective of this study was to assess the surface topography of gutta percha after rapid disinfection using 5% sodium hypochlorite, 70microgram per milliliter silver nanoparticle solution and 80% aloe vera gel using scanning electron microscope.

II. Materialsand Methods

A total of 80 gutta percha cones of size 30,6% (Dentsply, Maillefer) were taken from sterile boxes and was divided into four groups.

Group 1: 20 cones were taken directly from the sterile boxes using locking tweezer and pictures were captured under SEM.

Group 2: 20 cones were taken and immersed in a petridish containing 5% sodium hypochlorite for 2 min and was then allowed to air dry by placing in a 4*4-inch sterile gauze pad for 30 min.

Group 3 :20 cones were taken and immersed in petridish containing 80% aloe vera gel for 2 min and was then transferred to 4*4 -inch sterile gauze pad to air dry for 30 min.

Preparation of 80% Aloe vera gel:

Leaves of the Aloe vera plant were first washed with distilled water and were then disinfected using 70% ethyl alcohol.After cutting and opening the leaves, the fresh pulp collected was homogenized. 80 grams of the collected aloe vera pulp was mixed with 20 ml distilled water in order to obtain 80% of aloe vera gel solution. (11)

Group 4: 20 cones were taken and immersed in 70 microgram per milliliter silver nanoparticle solution for 2 min and was allowed to air dry in a 4*$ inch sterile gauze pad for 30 min.

Finally, all the Gutta percha cones selected were mounted on aluminium studs, gold sputtering was done and was analyzed under SEM (JCM 6000 PLUS) for surface topography changes.

Chi Square Test was used to compare surface topographical changes between 4 groups. The level of significance was set at P<0.05.(Table 1)

Comparison of Topographical changes between groups using Chi Square Test

Surface Changes	Aloe Vera Group		NaOCl Group		Ag Nano particle Group		Control Group		p-value
	n	%	n	%	n	%	n	%	
No Change	7	70%	0	0%	2	20%	8	80%	<0.001*
Mild Changes	3	30%	0	0%	6	60%	2	20%	
Moderate Changes	0	0%	3	30%	2	20%	0	0%	
Severe Changes	0	0%	7	70%	0	0%	0	0%	

* - Statistically Significant

III. Result

Aloe Vera & Control groups demonstrated predominantly no change in the surface topography [70% & 80%] respectively[Figure 3&1]. Sodium hypochlorite group showed predominantly severe surface changes [70%] and majority of silver nano particle group with mild surface changes [60%], [Figure 2&4].

SEM images of gutta percha cones treated with different solutions

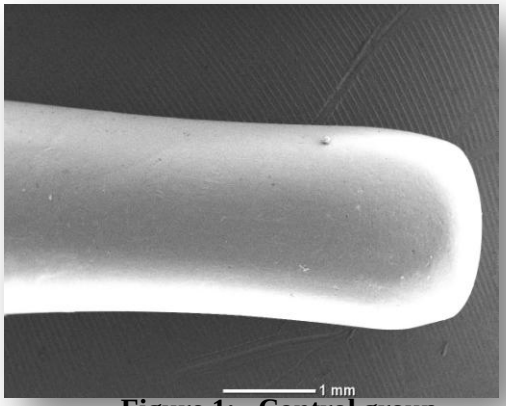


Figure 1: Control group

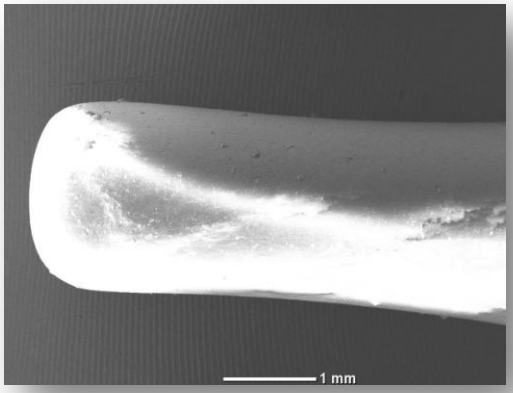


Figure2:Sodium hypochlorite group

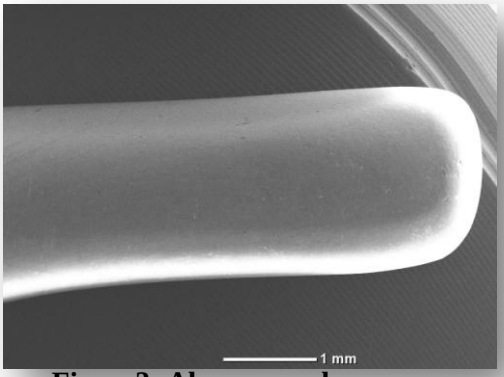


Figure3: Aloe vera gel group

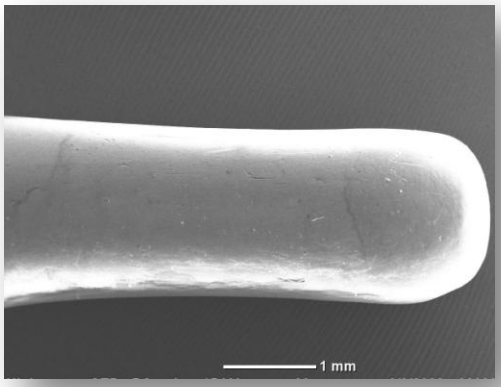


Figure4: silver nanoparticle group

These differences in the surface topography between 4 groups were statistically significant at $p<0.001$. [Figure 5]

IV. Discussion

The main aim of endodontic treatment is to establish a root canal system free of microorganisms. According to the contemporary concepts of infection control, each instrument and material which is to be placed in the root canal system needs to be sterilized. Gutta-percha cones being the most commonly used filling material for root canal, has several advantages such as radio-opacity, antibacterial activity, biocompatibility, easy removal from the root canal, dimensional stability and also does not stain the tooth .[(1)] Even though gutta-percha cones are available in presterilized packages, they can be easily contaminated if incorrectly manipulated.[(12)]Since conventional autoclaving methods cannot be used for the disinfection of gutta percha, a rapid chairside method is reliable for disinfection.[(2)]

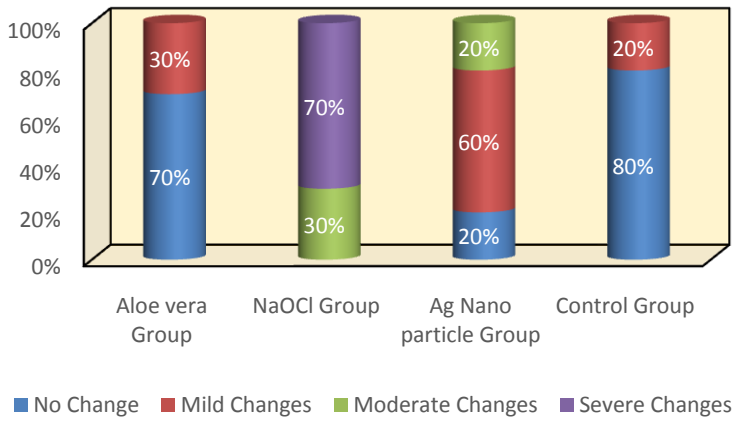
Sodium hypochlorite being a widely used endodontic irrigant has been used here because of its known sterilizing action at different concentrations. [(7)] The antimicrobial property of aloe vera is due to ascorbic acid, p-coumaric acid and cinnamic acid and has proved its efficiency in decontaminating GP cones within 1 min. [(7,13)]

Nowadays nanoparticles are used in almost all aspects of dentistry. The smaller particle size with larger surface of nanoparticles had showed its antimicrobial activity even at low levels.Silver being the most frequently used nanoparticle are found to be non-toxic to human body at low concentrations. [(14,15)] To check the cytotoxicity of silver nanoparticles, hela cells were exposed to different concentrations of silver nanoparticles which showed 80 microgram per milliliter concentration was harmful. Hence a concentration of 70 microgram per milliliter was considered in the study. [(4)]

In the present study, control group was not exposed to any disinfecting solutions. Sodium hypochlorite, a routinely used irrigant was used as one of the disinfectants because of its known antibacterial activity due to the presence of hypochlorous acid in the solution. But it showed to cause utmost changes in the topography of gutta percha. [(17.18)] Disinfection using aloe vera gel showed almost no changes in the topography

when compared to the control group, which shows it is efficient in decontaminating gutta percha cones within 2 min without altering the surface topography. Whereas, silver nanoparticle solution showed less surface deterioration than sodium hypochlorite but slightly more when compared to the aloe vera group.

Figure 5: Topographical changes between different groups



Statistically significant differences were seen among all the groups and disinfection of gutta percha cones using aloe vera gel and silver nanoparticle solution showed better results in comparison with sodium hypochlorite solution.

V. Conclusion

Deep irregularities created through disintegration of GP cones generates interfacial gaps between the GP cones and root canal wall, intensifying the risk of leakage and reinfection. [14,16] As the sterility of GP cones is essential for the success of the treatment, a suitable solution which provides adequate disinfection but produces less topographical changes should be advised for the disinfection of gutta percha.

This study was done in an attempt to develop a rapid procedure for sterilization without topographical alterations in the structure of gutta percha. Both aloe vera and silver nanoparticle solutions can be used as alternatives for the conventional method of disinfection using sodium hypochlorite. As there are not much changes in the topography of gutta percha in both aloe vera and silver nanoparticle groups and aloe vera being more economical, it is an appreciable option to be considered.

References

[1]. K.V.L Jyothsna1 , S.Sunil kumar2 , S.Datta Prasad3 , C.Sunil kumar4 , N.Vamsee Krishna5 , K.S.ChandraBabu.Evaluation of disinfection of gutta-percha cones using various chemical solutions- An in-vitro study.IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) Volume 19, Issue 1 Ser.8 (January. 2020), PP 41-45

[2]. Nausheen A, Makne SG, Nanda Z, Rane PS, Rudagi K, Reddy KK, Tekwani RA. Effect of Different Chemical and Herbal Disinfectant Solutions on the Mechanical and Physical Properties of Gutta-percha: An In Vitro Study. Journal of Operative Dentistry and Endodontics. 2019 Jul;4(2):84-7.

[3]. de Almeida Gomes BP, Vianna ME, Matsumoto CU, et al. Disinfection of gutta-percha cones with chlorhexidine and sodium hypochlorite. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology 2005;100(4):512–517. DOI: 10.1016/ j.tripleo.2004.10.002.

[4]. Mishra P, Tyagi S, Tripathi D. Comparative evaluation of silver nanoparticles and 5.25% sodium hypochlorite for rapid chairside decontamination of artificially infected gutta-percha with Escherichia coli: An In vitro Study. Dentistry and Medical Research. 2019 Jan 1;7(1):23.

[5]. Buchbinder M. Sterilization of cotton points and gutta percha points: Description of technique. *N* Y J Dent 1966;36:200-1.

[6]. Senia ES, Marraro RV, Mitchell JL. Cold sterilization of gutta-percha cones with formocresol vapors. J Am Dent Assoc1977;94:887-90

[7]. Varghese AM, Joshua JA, Shetty D, Damda A, Bhandary S. Evaluation Of Surface Changes On Gutta-Percha Points Treated With Four Different Disinfectants At Two Different Time Intervals-A Sem Study.

[8]. Mishra P, Tyagi S. Surface analysis of gutta percha after disinfecting with sodium hypochlorite and silver nanoparticles by atomic force microscopy: An in vitro study. Dental research journal. 2018 Jul;15(4):242.

[9]. Kim JS, Kuk E, Yu KN, Kim JH, Park SJ, Lee HJ, et al. Antimicrobial effects of silver nanoparticles. *Nanomedicine*. 2007;3:95–101.

[10]. Pal S, Tak YK, Song JM. Does the antibacterial activity of silver nanoparticles depend on the shape of the nanoparticle? A study of the Gram-negative bacterium *Escherichia coli*. *Appl Environ Microbiol*. 2007;73:1712–20.

[11]. Sahebi S, Khosravifar N, Sedighshamsi M, Motamedifar M. Comparison of the antibacterial effect of sodium hypochlorite and aloe vera solutions as root canal irrigants in human extracted teeth contaminated with enterococcus faecalis. J Dent (Shiraz). 2014 Mar;15(1):39-43.
[12]. Özalp N, Ökte Z, Özcelik B. The rapid sterilization of gutta-percha cones with sodium hypochlorite and glutaraldehyde. Journal of Endodontics. 2006 Dec 1;32(12):1202-4.
[13]. Valois CR, Silva LP, Azevedo RB. Structural effects of sodium hypochlorite solutions on gutta-percha cones: atomic force microscopy study. Journal of endodontics. 2005 Oct 1;31(10):749-51.
[14]. Karunakar P, Reddy MR, Faizuddin U, Karteek BS, Reddy CL, Rasagna M. Evaluation of surface analysis of gutta-percha after disinfecting with sodium hypochlorite, silver nanoparticles, and chitosan nanoparticles by atomic force microscopy: An in vitro study. Journal of Conservative Dentistry: JCD. 2021 Jan;24(1):63.
[15]. Correa JM, Mori M, Sanches HL, Cruz AD, Poiate E, Jr, Poiate IA. Silver nanoparticles in dental biomaterials. *Int J Biomater*. 2015;2015:485275.
[16]. Rosa PC, Oliveira SH, Vasconcelos RA. Morphological analysis of gutta-percha points subjected to different treatments and the influence on obturation sealing. *Braz Dent Sci*. 2012;15:24–31
[17]. Rao SA, Chowdary MN, Soonu CS, Muralidhar T. Effectiveness of three chemical solutions on gutta-percha cones by rapid sterilization technique: A scanning electron microscope study. Endodontology. 2019 Jan 1;31(1):17.
[18]. Moorer WR, Genet JM. Antibacterial activity of gutta-percha cones attributed to the zinc oxide component. Oral Surg Oral Med Oral Pathol1982;53:508-17

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