

Evaluation of disinfection of gutta percha cones using different chemical solutions after immersing into *Enterococcus Faecalis*

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Abstract

Gutta percha cones are radiopaque cones that are used to fill and seal the canal after undergoing endodontic therapy. The success of endodontic treatment is determined by the biochemical preparation and the use of sterilized techniques during the procedure. Care should be taken during the treatment to avoid contamination of instruments and filling materials as this is to avoid cross - infection in the root canal. Various disinfection have been used to sterilize gutta-percha cones including sodium hypochlorite (NaOCl). The aim of this study is to evaluate and compare the efficiency of 3% of NaOCl, Cidex solution and 17% of Edta in disinfecting gutta-percha cones after immersing it into bacterial suspension of enterococcus faecalis. Twelve gutta percha cones of size 70 were used in this study were divided into various groups depending upon the type of solution 3% NaOCl solution, Cidex Solution, 17% EDTA solution with time of exposure to each solution (15 min) and type of microorganism (Enterococcus Faecalis) Sodium Hypochlorite was found to be effective disinfectant. The outcome of this study confirmed the efficacy of 3% NaOCl in the disinfection of gutta percha cones.

Key words: Gutta Percha cones, sodium hypochlorite, cidex solution, 17% Edta, Endodontic Treatment, Root Canal therapy

I. INTRODUCTION

Gutta percha cones are radiopaque cones that are used to fill and seal the canal after undergoing endodontic therapy. Even long before gum was introduced into the western world, it had been employed in crude type by the natives of Malaysian archipelago for creating knife handles, walking sticks and for numerous different functions. As we go through the history of gum, there's an interesting story concerning its discovery. The first person to get this material was John Tradescant, who brought this material when he travels from far-east in 1656, he named this material as "Mazer wood". However the honour of introduction of this material goes to Dr. William Montgomerie, who was a medical man in Indian service. He was the primary to understand the potential of this material in drugs and that he was awarded the laurel wreath by the Royal Society of arts, London in 1843. Before it was introduced, it was found to be used as an insulating medium within the birthing of underground H₂O cables (2). The primary Gutta percha patent was taken by Alexander, Cabriollayers known as "Gutta-percha fabric". The success of endodontic treatment is determined by the biochemical preparation and the use of sterilized techniques during the procedure (1). Care should be taken during the treatment to avoid contamination of instruments and filling materials as this is to avoid cross - infection in the root canal (2).

Due to their chemical and physical properties, gutta percha cones are not responsive to the usual methods of sterilization in an autoclave or in hot air oven (3). Therefore, for an effective sterilization of gutta percha, chemical sterilization is required (3). Even though gutta percha cones are manufactured under aseptic conditions, they can be contaminated by handling, aerosols, and during the storage process (4,5).

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Sodium hypochlorite (NaOCl) is a broad-spectrum antimicrobial agent. Various studies have shown the effectiveness of 5.25% NaOCl in eliminating most microorganisms. (6,7) In a study, it was concluded that NaOCl and chlorhexidine used in gutta percha decontamination, increase the surface free energy, promoting high interaction between gutta percha/resilon and sealers. [8] Lee evaluated the changes in tensile strength and elongation rate of gutta percha cones after storage in NaOCl. [9]

EDTA 17% Solution is buffered to a neutral pH and it is an effective calcium binding that is used to facilitate instrumentation of root canals and for smear layer removal. EDTA makes it easier to enlarge and shape the canal with files and framers as it decalcifies the canal walls.

Cidex solution is known as a high level disinfectant for reprocessing heat sensitive reusable semi-critical medical devices, for which sterilisation is not practical. Cidex solution are used in automated endoscope reprocesses and in manual systems.

Furthermore, there is no study in the literature which has compared these three disinfectants for gutta percha disinfection. Hence, the aim of this investigation was to evaluate and compare the efficiency of 3% NaOCl, Cidex Solution and 17% EDTA in disinfection of gutta percha cones after immersing into bacteria suspension of *Enterococcus Faecalis*.

II. MATERIALS AND METHODS

Twelve gutta percha cones of size 70 were used in this study were divided into 3 various groups depending upon the type of solution 3% NaOCl solution, Cidex Solution, 17% EDTA solution with time of exposure to each solution (15 min) and one type of microorganism (*Enterococcus Faecalis*)

Group EDTA 1 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into 17% EDTA Solution for 15 mins.

Group EDTA 2 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into 17% EDTA Solution for 15 mins.

Group EDTA 3 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into 17% EDTA Solution for 15 mins.

Group NS1 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into 3% of NaOCl Solution for 15 mins.

Group NS 2 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into 3% of NaOCl Solution for 15 mins.

Group NS 3 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into 3% of NaOCl Solution for 15 mins.

Group C1 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into Cidex Solution for 15 mins.

Group C2 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into Cidex Solution for 15 mins.

Group C3 - one single gutta percha cone immersed into *Enterococcus Faecalis* for 30 mins and then, it was immersed into Cidex Solution for 15 mins.

Positive control: 3 gutta percha cones contaminated with bacterial suspension and then immersed in saline solution (0.09%).

After disinfecting, the gutta percha were washed with normal saline to uncoat and aggregate the bacteria . Then ,the contaminated normal saline was spread onto a nutrient agar plate and incubated for a day .Bacterial growth was observed the next day and calculated .

III. RESULTS

Positive control group showed more bacterial growth than negative control group.In this study , NaOCl shows the most effective results compare to the other two control group which are cidex solution and 17% EDTA . Then,followed by cidex solution .

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Edta	3	30.3333	5.03322	2.90593
Cidex	3	16.6667	7.63763	4.40959
3% saline	3	12.6667	5.50757	3.17980
normal saline	3	16.3333	10.50397	6.06447

Statistics

	Edta	Cidex	3% saline	normal saline
N Valid	3	3	3	3
Missing	0	0	0	0
Mean	30.3333	16.6667	12.6667	16.3333
Std. Deviation	5.03322	7.63763	5.50757	10.50397
Variance	25.3333	58.3333	30.3333	110.3333

According to the results above,Sodium hypochlorite seems to be the most effective as it shows minimal amount of bacterial growth.The mean value for 3% sodium hypochlorite (NaOCl) is 12.6667,followed by cidex solution which is 16.6667 and then followed by 17% of Edta solution with mean value of 30.3333.

The results were calculated by SPSS systems(version 2007).

IV. DISCUSSION

Gutta percha cannot be sterilized by typical ways as a result of its thermo plasticity. Hence, varied chemical disinfectants like alcohol, povidone iodine, NaOCl, and antiseptic, MTAD are studied for its medical aid. [12,13]

NaOCl has been wide used as associate degree dentistry irrigant and features a sterilizing action on unnaturally contaminated cones. It's found to be effective in disinfecting the gutta percha cones in numerous concentrations by doing several investigators.(10) Passageway preparation and also the use of irrigating solutions like blanching agent is answerable for eliminating the bulk of microorganisms in associate degree infected passageway system. However, the utilization of intracanal dressings is crucial to eliminate extant microorganisms (11).

Cidex resolution may be a common resolution for antimicrobial or medical aid functions. CIDEX® OPA resolution provides a broad-spectrum activity against bacterium, mycobacteria, viruses and fungi. CIDEX® OPA resolution offers glorious materials compatibility and might not be a good option for medical instruments fabricated from Al, brass, copper, chrome steel, plastics, elastomers and dental materials.

Ethylenediaminetetraacetic acid (EDTA) is understood as chelating agent which will be part of metals through four treat and 2 paraffin teams. Besides that , it's a polyamino acid and a colorless, soluble solid, that is wide wont to dissolve lime scale. it's glorious to created as many salts, notably disodium EDTA and atomic number 20 disodium EDTA. EDTA reacts with the atomic number 20 ions in dentine and forms soluble atomic number 20 chelates(12).17% EDTA is that the most used cheating agent and it's glorious for its robust hydrogen ion concentration price (1).EDTA reacts with the atomic number 20 ions in dentine and forms soluble atomic number 20 chelates. EDTA decalcified dentin to a depth of 20–30 μm in five min [4,23]. The decalcifying method is self-limiting, as a result of the chelator is employed up.According to Patterson,[2,8] EDTA had restricted medicinal drug activity. It appears that the medicinal drug activity of EDTA is as a result of the chelation of cations from the outer membrane of bacterium. Metal ions cause prejudicious effects in many industrial processes and within the formulation of the many product. Earth alkalies powerfulness cations such Ca(II), Mg(II) and Ba(II) kind insoluble precipitates with carbonates, sulfates and phosphates. Additionally, the presence of transition metal ions like those of copper, iron, metal and metallic element could trigger chemical processes of corrosion, chemical change degradation, polymerisation inhibition, reaction reactivity and changes within the coloring of products1. In industrial processes these metal cations could come back from the method waters, raw materials, instrumentality erosion and corrosion. They'll even be intercalary as a selected metal species, however they'll later suffer unwanted alterations as a result of changes in concentration, pH, oxidation, or reactions with alternative ingredients throughout the method. EDTA may be a chelate matter with a high affinity constant to make metal-EDTA complexes, being deliberately intercalary to sequester metal ions .

EDTA was proprietary in FRG in 1935 by F. Munz. The molecule may be a substituted organic compound typically marketed as its metal salts. It's a strong complexing agent of metals and a extremely stable molecule, giving a substantial skillfulness in industrial and menage uses . Since it's applied preponderantly in liquid medium, it's free into the surroundings through wastewaters. Its presence in soils could also be as a result of agrochemical application or to the disposal of product containing EDTA in garbage reservoirs. it's extremely unlikely to seek out the compound within the air as a result of the impossibility of volatilization from waters or soils. Though this might occur for instance, within the event of aerial application of the compound (e.g.: agrochemical application). There is increasing concern concerning the direct or indirect potential effects of the presence of EDTA within the setting. varied field studies have shown that complexation with EDTA might mobilize contamination metal ions. EDTA might avoid the precipitation of significant metals in answer or, on the contrary, cause a dissolution impact of significant metals adsorbate in sediments(7-11). Hence, the result's Associate in Nursing increased mobilization of significant metals. Attention has conjointly been paid to the very fact that EDTA will solubilize radioactive metals and increase their environmental mobility (12-14).

Another side to be thought of, is that the potential contribution of EDTA in eutrophication water processes. Sillanpää warns that this development has relevancy, since the molecule contains or so 100 percent of chemical element that would eventually be out there to the aquatic microbiota. EDTA would even have Associate in Nursing indirect impact, once it redissolves the metal and ferrous phosphates, cathartic chemical element and so contributive to a rise within the productivity of the waters. There might even be a bigger bioavailability of Fe+3 (essential substance for microalgae) so stimulating their growth.

Although the isolated molecule doesn't gift a risk of bioaccumulation, the ligand-metal complexes might considerably increase the bioavailability of very dangerous significant metals. In fact, the dissolution and bioavailability of significant metals are phenomena of bigger attention. Vassil et al. learning the role of EDTA within the consumption of lead during a type of the mustard plant, discovered a concentrating impact of seventy five times, that is very important if account is taken that it's a doubtless dangerous development in terms of metal biomagnification processes. Increased uptake of significant metals by plants has been extensively studied because of its potential use in significant metal phytoextraction technologies, however special attention has been paid to their concomitant lixiviation and migration phenomena(16-18).

As per the results of this study, 3% NaOCl was simplest followed by cidex resolution .17% of Edta resolution was the smallest amount effective as most of the samples as shown additional microorganism growth .A study done by Subha et al., found that a hundred and twenty fifth peracetic acid to be simpler than third of NaOCl in gutta percha. Another similar study done by Kanika Yadav, shows that a hundred and twenty fifth peracetic acid is simpler than three take advantage of NaOCl in gutta percha.

V. CONCLUSION

Within the limitations of this study, it can be concluded that sodium hypochlorite is effective in rapid disinfection of gutta percha. Though NaOCl has its disadvantages, it is still considered the gold standard in Endodontic irrigation. Irrigation plays a key role in the success of Endodontic outcome.

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