



Endodontics

EVALUATION OF TENSILE STRENGTH OF GUTTA PERCHA CONES WITH DIFFERENT DISINFECTANT SOLUTIONS – AN IN VITRO STUDY.

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ABSTRACT This study was done to evaluate the tensile strength of gutta-percha using 5% sodium hypochlorite NaOCl, 2% chlorhexidine CHX and 1% peracetic acid disinfectant solutions. 40 gutta-percha cones of size 30 (6% taper) were obtained from sealed packs as 4 different groups. Experimental groups were disinfected using 5% NaOCl, 2% CHX, 1% peracetic acid respectively except the control group. Then tensile strength of gutta-percha cones were measured using the universal testing machine. The mean tensile strength values for group I, II, III, IV are 7.003MPa, 8.49 MPa, 6.60MPa and 9.45MPa respectively. Results were subjected to statistical analysis one-way analysis of variance test and unpaired 't' test. 1% peracetic acid decreased tensile strength significantly as compared to 5% NaOCl and 2% CHX. The result concluded that the least decreased in tensile strength is for CHX followed by NaOCl and peracetic acid.

KEYWORDS : gutta-percha cones, tensile strength, sodium hypochlorite, chlorhexidine, peracetic acid.

INTRODUCTION

Root canal obturation is an important step in achieving a successful endodontic treatment.⁽¹⁾ The primary objective of endodontic therapy is to maintain complete aseptic condition in root canal treatment. Eliminating or decreasing the microbial count is of considerable importance for the success of endodontic treatment.⁽²⁻³⁾ The root canal filling material should also be free from microorganism to avoid canal contamination.⁽⁴⁾ Gutta-percha is the most commonly used root canal core filling material, which might become contaminated by pathogens during handling and /or storage process in the clinics. Cultivable microorganism is quite low at the time of opening of package; clinical use of packages increased the number of microorganisms contaminating the gutta-percha cones.⁽⁵⁻⁶⁾ The sterilization of gutta-percha cones before root canal filling is recommended because gutta-percha cones are not readily sterilized by heat, other disinfection methods. A large variety of chemical disinfectants have been used to sterilize gutta-percha cones before root canal fillings. These includes NaOCl, glutaraldehyde, alcohol, chlorhexidine, hydrogen peroxide, polyvinyl pyrrolidone iodine and MTAD⁽⁷⁻¹⁴⁾ Peracetic acid is a high level disinfectant which has antibacterial, antifungal, sporicidal and antiviral properties even at low concentrations.⁽¹⁵⁾

The physical changes that occur in the gutta-percha cones after chemical sterilization have been reported. The aim of this study were to evaluate the tensile strength of gutta-percha cones with different disinfectant solutions.

MATERIALS AND METHODS

40 Gutta-percha cones of size 30, 6% (DENTSPLY) were taken for the study. Gutta-percha cones were opened under sterile conditions from the sealed packets and divided into 4 groups of 10 each.

- Group 1:** 10 cones of gutta-percha was disinfected with 20 ml of 5% NaOCl (D5) in a petri dish for 1 minute.
- Group 2:** 10 cones of gutta-percha was disinfected with 20 ml of 2% CHX (Hexidine) in a petri dish for 1 minute.
- Group 3:** 10 cones of gutta percha was disinfected with 20ml of 1% peracetic acid in a petridish for 1 minute.
- Group 4:** Control group.

Then 10 cones of gutta-percha were transferred individually and rinsed in 5ml of distilled water for 1 minute and allowed to dry in sterile petri dishes containing sterile filter paper pads.



Fig.1 Gutta percha cones dissolved in 5% NaOCl, 2% CHX, 1% peracetic acid and control group respectively.

The tensile strength of gutta-percha cones after disinfection was measured using computer controlled universal testing machine. Each cone was standardized to 14mm length by cutting the cone from the base, 2mm from each side of the cone was inserted into either ends of the holders of universal testing machine and load was applied at a crosshead speed of 1mm/min, until maximum tensile failure was obtained and values were recorded.



Fig.2 The tensile strength of all Gutta-percha cones after disinfection was measured using computer controlled universal testing machine

The data was compared for differences using one way analysis of variance, followed by significant differences using unpaired 't' test.

RESULTS:

Results showed that the mean tensile strength of gutta-percha cones in experimental groups treated with NaOCl, CHX, peracetic acid significantly decreases when compared with control group.(Table 1)

The results are considered as statistically significant at $p \leq 0.05$. This is shown in Table 2 and 3.

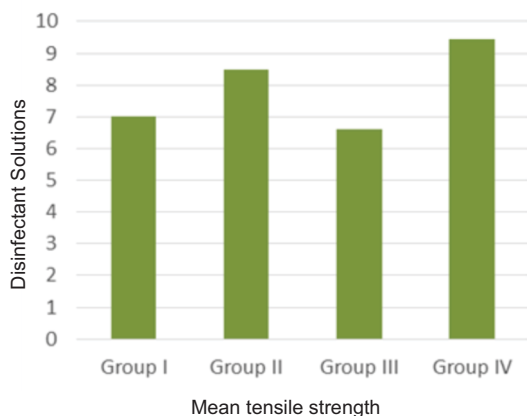
Table 1: Mean tensile strength values.

Sr. No.	Tensile strength			
	Group I	Group II	Group III	Group IV
1	7.45	8.23	6.85	10.92
2	7.57	8.49	6.02	9.53
3	6.55	8.75	5.83	9.63
4	6.94	8.14	6.58	8.21
5	6.63	8.62	7.75	8.96
6	6.72	8.48	6.74	8.58
7	7.48	8.97	6.46	8.66
8	7.32	8.18	6.85	9.45
9	6.88	8.26	6.60	8.32
10	6.49	8.87	6.35	8.24
AVG	7.003	8.49	6.60	9.45

Table 2: One way analysis of variance for evaluating the tensile strength of gutta-percha cones in different disinfectant solutions.

Pair of comparison	Mean tensile strength	SD	SE	T value	p value
NaOCl and control	7.003	0.3945	0.2992	-6.8422	0.000
	9.05	0.8062			
CH and control	8.49	0.2824	0.2847	-1.9351	0.0344
	9.05	0.8062			
PA and control	6.60	0.4979	0.3158	-7.7475	0.000
	9.05	0.8062			

Table 3: The unpaired t test is applied at 95.5 confidence level to compare the mean tensile strength of gutta-percha among the disinfectant solution



DISCUSSION:

Gutta-percha cannot be sterilize by conventional methods because of its thermoplasticity. Hence, various chemical disinfectants such as alcohol, povidone iodine, NaOCl, and CHX, MTAD have been studied for its disinfection.¹⁶⁻¹⁷

As NaOCl is known to be strong oxidizing agent and has a potential to reduce the chemical stability of chain polymer, resin, and waxes of gutta-percha cones. Such a chemical instability would adversely affect the mechanical properties of a gutta-percha cones. Reduction in polymer component might lead to decrease in resistance of cones to tensile tension, which causes decrease in tensile strength.¹⁸⁻²⁰ It is found in this study that NaOCl leads to the deterioration on mechanical properties of gutta-percha cones.

Pang *et al*¹⁸ evaluate the effect of 5.25% of NaOCl and 2% of CHX solution on tensile strength and surface texture of Gutta-percha cones. Results found that 5.25% of NaOCl decreases tensile strength and left a cuboidal crystal on the surface of gutta-percha cones after one minute of immersion, Conversely CHX would not effect properties of Gutta-percha cones.

Peracetic acid- based disinfectant is commonly used in the food industry, for water or sewage treatment, decontamination, and sterilization of thermosensitive medical and hospital equipment and devices. Peracetic acid is effective against bacteria, fungi, viruses and spores.¹⁵ It is not inactivated in the presence of organic material, does not leave residues and does not produce harmful byproduct.²¹ Subha *et al* found 1% peracetic acid to be more effective than 3% NaOCl in gutta-percha and resilion disinfection. It is found in this study that 1% peracetic acid would lead to the deterioration on the tensile strength of gutta-percha more than 5% NaOCl and 2% CHX.²²

The rationale behind selecting the size of protaper whether there is any influences of taper of gutta-percha on tensile strengths. According to weine, minimum apical preparation should be till 30 size so master apical file size 30 was chosen.

It is found in this study that the mean tensile strength of Gutta-percha in experimental groups treated with 5% NaOCl, 2% CHX, 1% peracetic acid significantly decreases when compared with control group. In this study the mean tensile strength of NaOCl, CHX and peracetic acid was compared. It has shown that peracetic acid affected more than rest of solutions.

CONCLUSION:

Within the limitation of the study it can be concluded that average tensile strength of Gutta-percha is significantly affected by all the three disinfectants. It has been proved that the least decrease in tensile strength is for CHX followed by NaOCl and peracetic acid.

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