

**Comparative evaluation of tensile strength of gutta percha by using a herbal disinfectant - An in-vitro study**

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**Conflicts of Interest:** Nil

**Abstract**

**Context:** The primary objective of endodontic therapy is to maintain a complete aseptic condition in root canal treatment, right from access opening to the permanent coronal restoration of the tooth.

**Aim:** The aim of this study was to compare the effect of 5.2% Sodium hypochlorite, 2% chlorhexidine and freshly extracted aloe vera gel on tensile strength of gutta percha cones.

**Study setting and design:** This was an experimental prospective in-vitro study conducted at dental learning institution.

**Material and Methods:** 40 Gutta percha points were selected in this study having a uniform size and taper divided into four groups in which one served as a control group. Each group was immersed in three different herbal disinfectants for 1 min each. and then kept under universal testing machine for measurement of tensile strength of gutta percha.

**Statistical analysis:-** Statistical analysis was done by Turkey's post hoc test to find pair wise comparison.

**Result:** there was no significant difference in mean tensile strength values of control group and 'freshly extracted aloe Vera gel treated gutta percha group as well as there

was no significant difference in 2% chlorhexidine group and aloe vera group

Conclusion: Within the limitations of the study, it is concluded that freshly extracted Aloe vera gel is considered as safer GP disinfectant as it does not alter the tensile strength and topography of GP.

**Keywords:** Tensile strength, 5.25% Sodium hypochlorite, 2% Chlorhexidine, Aloe vera gel, Universal testing machine.

### Introduction

The primary objective of endodontic therapy is to maintain a complete aseptic condition in root canal treatment, right from access opening to the permanent coronal restoration of the tooth. Eliminating or decreasing the microbial count is of considerable importance for the success of endodontic treatment.

Several studies revealed that the selection of an ideal disinfectant for Gutta-percha (GP) cones is very important, because the disinfectant may affect the mechanical properties and surface texture of GP cones, thereby the outcome of obturation.<sup>(1)</sup>

Sodium hypochlorite is a strong oxidizing agent and effective decontaminant that causes extreme topographic alterations and aggressive deterioration[2] in the cones, which in turn results in decrease of adhesion or bond strength of GP cones to endodontic sealer.<sup>(3)</sup>

Moreover, there is decrease in tensile strength of GP cones and formation of cuboidal shaped crystals on the surface of GP with 5.25% SH, which could affect the sealing ability, reinforcement within the root canal, and outcome of endodontic treatment. Therefore an effective, but safer chemical is desirable for disinfecting GP cones.<sup>(4)</sup>

Aloe vera gel (AV) is bacteriostatic against *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Salmonella paratyphi* and found to be an effective medium in decontaminating GP cones. The purpose of the

study was to evaluate and compare the effect of 90% AV gel and 5.25% SH on the tensile strength of GP cones.<sup>(5,6)</sup>

Current root canal obturation technique involves the use of several chemicals for GP cones disinfection. Among these chemicals, 5.25% sodium hypochlorite and 2% chlorhexidine with their antimicrobial action are the most effective disinfectants for GP cones.<sup>(7)</sup>

### Material and methods

A total no of 40 gutta percha points (Sure –endo korea) of size 25 and taper 6% were selected for this study.

The gutta percha points were cut from the base to make them standardized of 21 mm length .

All these 40 gutta percha points of standardized length and taper were then divided into 4 groups according to the disinfectants used.

These 4 groups were as follows:-

Group A:- Control group.

Group B:- 5.25% Sodium hypochlorite

Group C:- 2% Chlorhexidine.

Group D:- Freshly extracted aloe vera gel.

1. Group A:- 10 Gutta percha cones of size 25 and taper 6% having uniform length of 21 mm were taken from freshly opened box. And then the tensile strength of this group was measured under crosshead speed of 1 mm/min in universal testing machine. This group served as a “Control Group”.
2. Group B:- 10 Gutta percha cones of size 25 and taper 6% having a uniform length of 21 mm were taken from freshly opened box. And then these Gutta percha cones were immersed in a beaker containing 20 ml of 5.25% of sodium hypochlorite for 1 min.<sup>(1)</sup>
3. Group C:- 10 Gutta percha cones of size 25 and taper 6% having a uniform length of 21 mm were taken from a freshly opened box. And then these gutta percha cones were immersed in 20 ml of 2% Chlorhexidine solution in petridish for 1 min.<sup>(1)</sup>

4. Group D:- 10 Gutta percha cones of size 25 and taper 6% having a uniform length of 21 mm were taken from a freshly opened box. And then these gutta percha cones were immersed in freshly extracted aloe vera gel for 1 min.<sup>(8)</sup>

**Armamentarium**



Fig.1: Armamentarium

**Measurement of Tensile Strength of gutta percha:**

The tensile strength of all gutta percha cones after disinfection was measured using “computer controlled universal testing machine.”

About 2 mm from each side of the cone was inserted into either end of the holders of universal testing machine and load was applied at a crosshead speed of 1 mm/min, until maximum tensile failure was obtained and values were recorded.

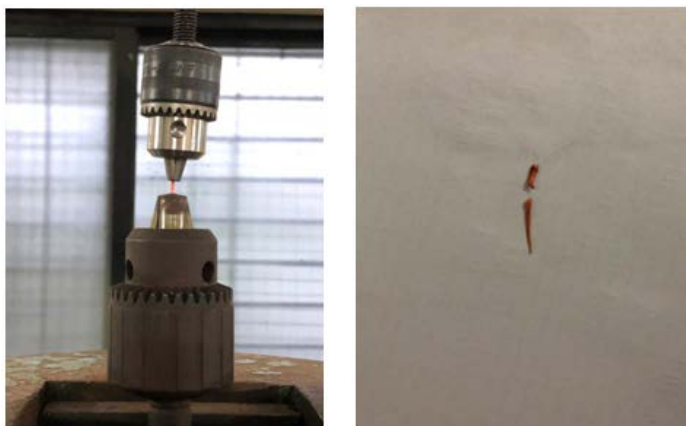


Fig. 2:Tensile Strength Measurement At Universal Testing Machine At Crosshead Speed Of 1mm/Min.

**Statistical analysis**

The data was analysed by using one way Anova test and Turkey's Post hoc test to find pairwise comparison.

Graph 1: Graphical Representation of Tensile test(Load vs Dispersion) in mm

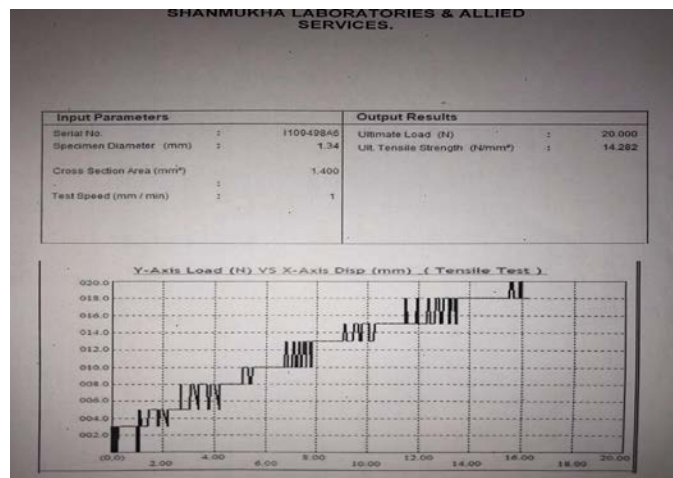


Table 1: Statistical Analysis

Comparative statistics of tensile strength of gutta percha cones immersed in different disinfecting solution	Mean	S.D	Anova F Test	p value, Significance
Group A (CONTROL)	14.54	1.87	F = 38.194	p <0.001**
Group B (5.25% NAOCL)	9.78	0.75		
Group C (2% CHX)	13.32	0.29		
Group D (ALOEVERA GEL)	13.60	0.24		
<b>Turkey's post hoc test to find pairwise comparison</b>				
Group	Comparison Group	Mean Difference	p value, Significance	
Group A (CONTROL)	Group B (5.25% NAOCL)	4.76	p <0.001**	

	Group C (2% CHX)	1.66	p =0.003*
	Group D (ALOEVERA GEL)	1.34	p =0.031*
<b>Group B (5.25% NAOCL)</b>	Group C (2% CHX)	3.0	p <0.001**
	Group D (ALOEVERA GEL)	3.42	p <0.001**
<b>Group C (2% CHX)</b>	Group D (ALOEVERA GEL)	0.12	p = 0.792

p >0.05 – significant    p <0.05 – not significant

### Result

Results showed that the tensile strength values of gutta percha cones after immersing in '5.25% sodium hypochlorite' for 1 min. showed a significant reduction as compared to control group.

Whereas, The tensile strength values of gutta percha cones immersed in '2% chlorhexidine' and 'freshly extracted aloe vera gel' showed no significant reduction as compared to control group, Which showed maximum tensile strength among all the groups.

### Discussion

The success of endodontic treatment depends on ability to clean, shape, disinfect, and three dimensionally fill a root canal system.<sup>(9)</sup>

As, root canal filling cones must remain in the root canal over a long period of time, and therefore they must be able to withstand rigorous sterilization procedures. Studies on the effects of disinfection on the mechanical properties and surface texture of GP cones have been reported.<sup>(10,11)</sup>

The mechanical properties of GP cone were indicative of a partially crystalline polymeric material and found to obey to Hook's law.<sup>(12,13)</sup>

As Sodium hypochlorite is a strong oxidizing agent and a strong base (pH > 11). It causes degradation and hydrolysis of amino acid by forming the chloramine molecules. It has the ability 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 guttapercha cone and can cause negative effect on the bond strength between adhesive restorations and dentin. After disinfection, the gutta percha cones should be washed with ethyl alcohol to eliminate sodium hypochlorite crystal before obturation . because these crystals may lead to failure of hermetic seal.<sup>(8)</sup>

Earlier study by Ismail et al. showed that there was a significant reduction in tensile strength of gutta-percha points after disinfection with sodium hypochlorite solution in 5.25% concentration. There was no significant difference in the tensile strength of GP cones in the control group (no disinfection) and tensile strength of GP cones disinfected with 90% A. vera gel.<sup>(4)</sup>

Mahali et al. evaluated the tensile strength of gutta-percha points after treated with 5.25% sodium hypochlorite and 90% A. vera gel. He concluded that A. vera gel does not alter the tensile strength of gutta-percha points.<sup>(1)</sup>

Several studies demonstrated that tensile strength was correlated to gutta-percha component of gutta-percha cone while modulus of elasticity and percentage of elongation were determined to be related to zinc oxide component of GP cones, and flexibility of the cone affected by wax and resin components of GP cone.<sup>(14)</sup>

Currently, there is an increasing interest in the antibacterial activity of CHX in endodontic practice. It has antibacterial properties with broad spectrum and relatively low toxicity. Nevertheless, it has been reported that it is ineffective against spores except at high temperatures. CHX has additional properties such as substantivity and

biocompatibility compared with NaOCl. CHX is less prejudicial to the structure of Gutta-percha. However, the effect of 2% CHX on tensile strength of Gutta-percha cones has not been fully investigated till date.

Aloe vera gel has antimicrobial properties which is due to its components p-coumaric acid, ascorbic, and cinnamic acid.<sup>(1)</sup>

These acidic components in A. vera might be responsible for small reduction in tensile strength of gutta-percha cones in this study which was statistically not significant.<sup>(15)</sup>

Topographical examinations conducted by 'Rao et al' on aloe vera disinfected gutta percha cones showed no changes on topography of gutta percha cones as well as no chloride crystal formation was observed. It has been also proved that A.vera is very effectively bacteriostatic against microorganisms such as Streptococcus pyogenes and streptococcus aureus after 1 min of disinfection.

Whereas Naocl group showed severe topographic alterations and chloride crystal formations on gutta percha cones.<sup>(16)</sup>

### Conclusion

Within the limitations of the study, it is concluded that freshly extracted Aloe vera gel is considered as safer GP disinfectant as it does not alter the tensile strength and topography of GP, which eventually will lead to enhanced sealing ability and reinforcement of the root canal. To establish Aloe vera as a GP disinfectant, further research has to be done exclusively on surface topography, modulus of elasticity and percentage elongation of GP cones on a larger sample size.

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