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Comparative Evaluation of Modulus of Elasticity and Tensile Strength of Gutta Percha Cone after Disinfection with 5.25% Sodium Hypochlorite and Neem Extract

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ABSTRACT

Background: The aim of this in-vitro study is to evaluate and compare the modulus of elasticity & tensile strength of GuttaPercha cones after disinfection with 5.25% Sodium Hypochlorite and Neem Extract.

Materials and Method: Thirty GuttaPercha cones of size 30 and 2% taper were taken from the sealed packs and will be divided into 3 different groups with 10 GuttaPercha cones in each group. Experimental groups were than disinfected with 5.25% Sodium Hypochlorite (Group1) ,Neem Extract (Group2) and the control group(Group3). After disinfection the GuttaPercha cones wererinsed in distilled water for 1 minute and were allowed to dry in sterile petri dishes containing sterile filter paper pads. After drying the modulus of elasticity and tensile strength of GuttaPercha cones were measured using the universal testing machine. The values were recorded and data was compared using statistical analysis.

Results: Results revealed that 5.25% SH would decrease the tensile strength and increase the modulus of elasticity of GP cones after 1 min of disinfection, which had a significant difference from the control group (1) and Neem Extract (3) group.

Conclusion: It was concluded that Neem extract is considered as safer Gutta Percha disinfectant as it does not alter the modulus of elasticity and tensile strength of Gutta Percha.

Keywords: Disinfectant, Gutta percha, Neem.

INTRODUCTION

The foremost 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. Reducing the microbial count is of great importance for the success of endodontic treatment[(1)]. Guttapercha was introduced to dentistry by Edwin Truman in 1847[(2)] and is still considered as an integral component in the completion of the endodontic therapy. But one of the major concerns in its use is that it gets contaminated easily by microorganisms and hence, caution must be taken to avoid root canal contamination.Gutta percha cones usually come in sterile, sealed packages,but once exposed to the dental office environment, they are contaminated by a number of

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microorganisms[3]. Common gutta percha contaminants in post endodontic infection are – Staphylococcus sp., Enterococcus faecalis and Escherichia coli[4].

Due to their physical and chemical properties, gutta percha cones cannot be sterlized by usual methods of physical sterilization (autoclaving or hot air oven). Infactthe degree of heat required would alter the shape and cause adherence of points to one another[5]. A large variety of chemical disinfectants have been used to sterilize guttapercha cones before root canal obturation. These includes chemicals such as, Hydrogen Peroxide, 2% Chlorhexidine[4],2% Glutaraldehyde[6],70% Ethyl Alcohol[7], Polyvinyl Pyrolidone iodine[8], Quartenary Ammonium compounds, MTAD [9][10].

Different disinfectants have been reported to have an effect on the mechanical properties such as modulus of elasticity and tensile strength of guttapercha cone. 5.25% sodium hypochlorite solution has been studied and has proved to be an effective disinfection agent.[4], [6] But being a strong oxidizing agent it has been reported to cause extreme topographic alterations and aggressive deterioration in the cones, which in turn results in decrease of adhesion or bond strength of gutta-percha cones to endodontic sealer. Moreover, there is decrease in tensile strength of guttapercha cones and formation of cuboidal shaped crystals on the surface of guttapercha with 5.25%Sodium Hypochlorite[1], [11]. On the other side in a study it has been reported that 5.25% Sodium hypochlorite causes increase in modulus of elasticity after one minute of disinfection. Herbal solutions are commonly available in Indian market and have shown dramatic results as antimicrobials. The popularity of herbal medications has increased due to the search for more accessible and natural form of alternatives.[12], [13] Neem, (Azadirachtaindica) used to be the conventional medicine for many diseases and used for cleaning the oral cavity. It is also an effective medium in decontaminating GP cones.[11] The purpose of the study is to evaluate and compare the effect of5.25% Sodium Hypochlorite and Neem extract on the modulus of elasticity and tensile strength of guttapercha cones

MATERIALS & METHOD

30 GuttaPercha cones (Dentsply) of size 30 and 2% taper were taken from the sealed packs and was divided into 3 different groups with 10 GuttaPercha cones in each group.

Group 1 - 10 cones of gutta-percha were disinfected with distilled water for 1 minute and allowed to dry in sterile petri dishes containing sterile filter paper pads.

Group 2 - 10 cones of gutta-percha were disinfected with 5.25% sodium hypochlorite (GDP Chloraxid) in a petri dish for 1 minute.

Group 3 - 10 cones of gutta-percha were disinfected with Neem extract for 1 minute in a petridish.

Extract Preparation: Dry powder extract of Neem (Indian HerboPharma) was dissolved in ethanol at 1:10 (weight/volume) ratio in a beaker. The contents were than filtered through filter paper and the filtrate was evaporated for dryness. [11]

After drying the modulus of elasticity and tensile strength of GuttaPercha cones were measured using the 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 load and elongation was obtained and values were recorded. The data was compared for differences using one way analysis of variance, followed by significant differences using unpaired't' test.

RESULTS

Results revealed that 5.25% SH would decrease the tensile strength and increase the modulus of elasticity of GP cones after 1 min of disinfection, which had a significant difference from the control group (1) and Neem Extract (3) group.

Table 1: Mean tensile strength and its comparison among the groups.

Groups	Mean	SD	Anova test	p value
Control (Group 1)	0.1191	0.168	0.034	0.97
Sodium hypochlorite (Group 2)	0.1062	0.027		
Neem extract (Group 3)	0.108	0.019		
Tukey HSD Post-hoc Test... Group 1 vs Group 2: Diff=-0.0029, 95%CI=-0.1125 to 0.1067, p=0.9976 Group 1 vs Group 3: Diff=-0.0111, 95%CI=-0.1207 to 0.0985, p=0.9659 Group 2 vs Group 3: Diff=-0.0082, 95%CI=-0.1178 to 0.1014, p=0.9812				

Table 2: Mean modulus of elasticity and its comparison among the groups.

Groups	Mean	SD	Anova test	p value
Control (Group 1)	0.001855	0.00048	10.09	0.0005*
Sodium hypochlorite (Group 2)	0.0039	0.0015		
Neem extract (Group 3)	0.003	0.0008		
Tukey HSD Post-hoc Test... Group 1 vs Group 2: Diff=0.0020, 95%CI=0.0009 to 0.0032, p=0.0003* Group 1 vs Group 3: Diff=0.0011, 95%CI=0.0000 to 0.0023, p=0.04* Group 2 vs Group 3: Diff=-0.0009, 95%CI=-0.0020 to 0.0002, p=0.14				

DISCUSSION

GuttaPercha cone is one of the most popular materials used for obturating root canal space. As root canal filling cones must remain in the root canal over a long period of time, they must be able to withstand rigorous sterilization procedures. The Gutta Percha decontamination is very important to prevent any bacterial contamination of the root canal before obturation and is now a widely recognized step in endodontic practice.[1]Although most gutta percha cones appear to be initially sterile, there is a risk of contamination from both air borne and physical sources during their storage.[20]

Sodium Hypochlorite at 5.25% has been found to be rapid, reliable effective in disinfecting GP cones because of its strong antibacterial, oxidizing, and sporicidal activity [14].

As Sodium Hypochlorite is known to be a strong oxidizing agent and has the potential to reduce the chemical stability of chain polymer, resin, and waxes of GP cones. Such, a chemical instability would adversely affect the mechanical properties of a GP cone.Reduction in polymer component in GP cone by 5.25% SH might lead to a decrease in tensile strength. Also it leads to increase in modulus of elasticity [1][4].

In search for an alternative to chemical decontaminants, this experiment investigates the effectiveness of medicinal plant extract. Due to their availability, cost effectiveness and no known side effects these natural extracts can be a great substitute in endodontic treatment.[11] It is well known that neem leaves (A. indica or AI) have antibacterial, antifungal, antiviral, antioxidant, anti-inflammatory, antipyretic, and analgesic effects without any side effect. AI has several active constituents like nimbidin, nimbin, nimbolide, gedunin, azadirachtin, mahmoodin, margolone, and cyclictrisulfide which are responsible for its antibacterial action.[15] Various studies have been put on its antimicrobial activities. A study by **Elavarasu et al** [16]stated that neem oil was effective by reducing the growth of plaque causing micro organisms[21]. **Bohora et al**[17]found that the neem extract showed significant antimicrobial effect against E. Faecalis and C.albicans. Several studies demonstrated that tensile strength was correlated to GP component of GuttaPercha 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 [18]. It has been reported that the higher values of the elastic modulus of gutta-percha cones means they are less flexible under the loading forces indicating that gutta-percha cones need more forces to adapt to root canal walls [19].

Also decrease in tensile strength of endodontic filling material is not advantageous because it means cones will be fractured by lower forces[10]. The rationale behind selecting the size of guttapercha was according to weine that minimum apical preparation should be till 30 size so master apical file size 30 was chosen. In the present study results showed significant difference in modulus of elasticity values but the tensile strength values were not much significant. Results revealed that Sodium Hypochlorite would increase modulus of elasticity (table 2) and decrease tensile strength (table1) after 1 minute disinfection as compared to control group. But there was less difference in modulus of elasticity and tensile strength of guttapercha cone after 1 minute disinfection with Neem extract.

CONCLUSION

Within the limitations of the study, it is concluded that Neem extract is considered as safer GuttaPercha disinfectant as it does not alter the modulus of elasticity and tensile strength of GuttaPercha, which eventually will lead to enhanced sealing ability and reinforcement of the root canal.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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