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Research Article

THE EFFECT OF BIOCERAMIC SEALERS WITH BIOCERAMIC IMPREGNATED GUTTAPERCHA ON THE FRACTURE RESISTANCE OF ENDODONTICALLY TREATED TEETH-AN IN VITRO STUDY

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A B S T R A C T

Aim: To compare and evaluate the effect of Bioceramic sealers with Bioceramic Impregnated GuttaPercha on the fracture resistance of endodontically treated teeth. **Materials and Methods:** A total of thirty single-rooted mandibular premolar teeth weredecoronated to standardize the root length of 13mm.Cleaning and shaping was done and the samples were randomly divided into three groups. Group I: Bioceramic Sealer (Ceraseal B) with Bioceramic Impregnated GuttaPercha (SURE ENDO), Group II: Bioceramic Sealer (Ceraseal B) with normal GuttaPercha, Group III: AH Plus sealer along with normal gutta-percha. All the teeth were embedded in acrylic resin blocks and fracture force was measured using a universal testing. Then, the data will be statistically evaluated using two-way analysis of variance (ANOVA). **Results:**The fracture resistance of group III >group II> group I. However, the results were statisticllay not significant .Ceraseal-B sealer along with bioceramic impregnated gutta-percha (BIO-GP) showed the maximum fracture resistance compared to the other two groups. **Conclusion:** From this study, it can be concluded that the fracture resistance of Ceraseal-B sealer with Bio GP Points was better than that of Ceraseal-B sealer with traditional gutta-percha, although the difference was not statistically significant. The bioceramic sealer (Ceraseal-B) combined with Bio GP Points had a better fracture resistance than that of AH Plus sealer with traditional gutta-percha and the difference was statistically significant.

INTRODUCTION

Vertical root fracture (VRF) is one of the most common complication of the endodontically treated tooth.[1] This is due to over instrumentation of the canal, dehydration of dentin after endodontic therapy, uncontrolled pressure during obturation.[2-4]Obturation materials are play vital role in supporting strength of the endodontically treated teeth.[5] The most commonly used root canal filling material is gutta-percha incombination with sealer , but the low elastic modulus of gutta-percha presents little or no capacity to reinforce roots after treatment.[6]Guttapercha has poor sealing ability and its inability to further strengthen the teeth, increases its susceptibility to fracture.[2]

New bioceramic imprenated guttapercha (BIO-GP) was introduced into the market. The manufacturers claim that it can create monoblock obturation in root canal when used with bioceramic sealer and form a true gap-free seal. [7]

Ceraseal-B is a newly introduced MTA based bioceramic sealer which resin and monomer free and ensures zero shrinkage and biocompatibility. Its high pH and bioactive properties help remineralization due to hydroxy-apatite formation. It is thought that adhesion and mechanical interlocking between the root canal filling material and radicular dentin reduces the risk of fracture and strengthens the remaining tooth structure.[8]

METHODOLOGY

A total of thirty single-rooted mandibular premolar teeth will be collected. The teeth with calcified canals, cracks or fractures, development defects, multiple canals, root caries, and endodontically treated teeth were excluded . The teeth was decoronated to standardize the root length of 13mm. Cleaning and shaping will be done with Protaper Gold files . The canals was irrigated by using 5 mL 3% NaOCl solution, and as soon as the instrumentation is completed, the smear layer was removed by flushing the root canals with 5 mL 17% ethylene diamine tetraacetic acid solution then irrigated again with NaOCl. Finally, the canal was flushed with 3 ml distilled water then dried with paper points. The teeth was then divided into three groups.

- Group I: Bioceramic Sealer (Ceraseal B; MAARC) with Bioceramic Impregnated GuttaPercha (BIO-GP; SURE ENDO)

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- Group II: Bioceramic Sealer (Ceraseal B; MAARC) with traditional GuttaPercha
- Group III: AH Plus sealer along with traditional gutta-percha.

To permit the sealers to fully set, the specimens was kept in incubator for 7 days (at 37°C and 100% relative humidity). To simulate a periodontal ligament, the root surface was covered with a thin-layer polyvinylsiloxane impression material to 2 mm apical to the coronal end of the root. Each tooth was then mounted vertically into acrylic resin exposing only 2 mm from the root using a plastic ring as a mold for packing acrylic. Fracture resistance testing was done using a universal testing machine. A cylindrical steel rod with round tip 2 mm in diameter attached to the upper part of the universal testing machine was used to apply force on the root at a crosshead speed of 1 mm/min until fracture occurred. The maximum force required to fracture each specimen was recorded in Newtons (N).

Statistical analysis

All statistical analysis was performed by using the SPSS software. The mean and the standard deviation was calculated for each variable. Analysis of the data between groups was carried out by 2- way analysis of variance (ANOVA). P < 0.05 was considered as statistically significant.

RESULTS

The mean fracture resistance (MPa) and standard deviations (SD) of all the three groups are given in table 1. The highest mean of fracture resistance was found in Group I (BIO-GP + Ceraseal-B) 421.340 N, followed by Group II (GP + CEARSEAL-B) 465.8 N, while Group III (GP + AH-Plus) shows the least mean 399.9N (table no . 1). 2-way ANOVA test exhibited significant differences (p=0.0303) among the groups. Posthoc analysis showed significant differences (p=0.0237) between group III and group I specimens (Table 2) whereas the mean difference seen between group 1 and group 2 as well as between group 2 and group 3 was not statistically significant.

Table 1 Mean, standard deviation, and test of significance using ANOVA between the three groups

Group Name	Number of samples	Mean and standard deviation	Minimum	Maximum	P- value
Group 1	10	470.51±66.01	380.6	560.8	
Group 2	10	388.38±64.48	284.8	465.8	
Group 3	10	287.92±36.29	235.7	345.7	0.0000006*

*P value < 0.05 is considered as statistically significant

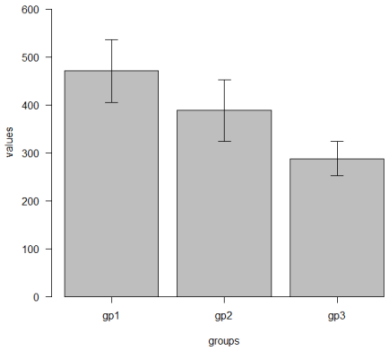
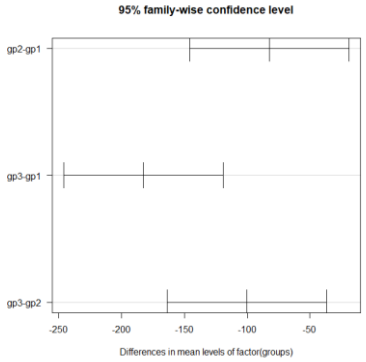


Table no. 2 – Post Hoc test for pair wise comparison of test of significance between groups

Pair wise comparison	M.D(95% C.I of difference)	P value
gp2-gp1	-82.127 (-145.6091, -18.64489)	0.0093*
gp3-gp1	-182.581 (-246.0631, -119.09889)	0.0000003*
gp3-gp2	-100.454 (-163.9361, -36.97189)	0.0015*

*P value < 0.05 is considered as statistically significant



Results inference

There is a statistically significant difference that exists between all the 3 groups.

DISCUSSION

Obturation material has a potential to strengthen the root structure and increases fracture resistance of tooth .[9] In the present study, Ceraseal-B sealer along with bioceramic impregnated gutta-percha (BIO-GP) showed the maximum fracture resistance compared to the other two groups. The reason for this was good bonding between bioceramic particles .This bonding forms a primary Monoblock pattern which improves the strength of the sealer with dentin and thus reducing the stress that occurs inside the tooth structure.[10]Also, the Bioceramic coated guttapercha cones has the capability to absorb water from the tooth environment and expand in the lateral direction only to hermetically seal the root canal. [11]This study is in consistent with the results of Celikten et al who reported root canal obturation with bioceramic sealer and bioceramic guttapercha strengthened the prepared root.[12]The result of this study was also in accordance with the study conducted by Hasnain, *et al*. and Sağsen et al.[13,14]In a study performed by Gerveni et al showed that the roots filled with either Bc Sealer/ Bioceramic – Coated Points or AH Plus Sealer/conventional guttapercha points gutta showed similar resistance to fracture.[15]In an another study by Osiri et al showed that the fracture resistance of BCC/BCS was higher than GP/AH.[16]In this study, BCS showed better fracture resistance that AH Plus sealer.This may be due to the formation of chemical bond with dentine through hydroxyapatite production during setting in bioceramic sealers. [11] Also due to BC Sealer's ability to penetrate dentinal tubules and interact with dentine moisture, optimum dimensional stability and the least amount of shrinkage was obtained. [17]Han and Okiji stated that permeation of the sealer's mineral content into the intertubular dentine results in denaturing the collagen fibers and the formation of a mineral infiltration zone.[18] This can be explained by the incorporation of Ca and Si in dentin with subsequent chemical, physical and structural modification of dentin, resulting in higher fracture

resistance and strength.[19]This results was in accordance with other studies such as Patil et al., Nagpal et al and Cobankara et al.[20-22]Delong et al. in his study concluded that Bioceramic sealer showed highest strength than AH plus sealer when used in a single cone technique.[12]

In contrast with Dibaji et al., which found that bioceramic group showed less fracture resistance than AH Plus.[23]

CONCLUSION

From this study, it can be concluded that the fracture resistance of Ceraseal–B sealer with Bio GP Points was better than that of Ceraseal – B sealer with traditional gutta-percha, although the difference was not statistically significant. The bioceramic sealer (Ceraseal- B) combined with Bio GP Points had a better fracture resistance than that of AH Plus sealer with traditional gutta-percha and the difference was statistically significant. However, further in-vitro and in-vivo studies with a larger sample and the teeth with complex anatomies are required to validate its clinical efficacy**.**

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