

Original Research

Comparison of efficacy of two different root canal sealers used on the fractured resistance of endodontically treated teeth

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ABSTRACT:

Background: The greatest incidence of vertical root fracture occurs in teeth after endodontic therapy. Most commonly used root canal sealer is the zinc oxide-eugenol (ZOE) sealer and has been used for several decades because of its satisfactory physicochemical properties. However, leakage and recontamination of the root canal system due to eugenol or zinc oxide loss through continuous hydrolysis which causes post treatment complication. Hence; the present study was undertaken for assessing and comparing the efficacy of two different root canal sealers used on the fractured resistance of endodontically treated teeth. **Materials & methods:** A total of 90 freshly extracted mandibular first premolars were included in the present study. De-coronation of all the specimens was done. After decoration, bio-mechanical preparation of all the specimens was done with intermittent irrigation. All the specimens were divided into three study groups with 30 specimens in each group as follows: AH Plus group: AH plus sealer was used for completing the obturation, ZOE group: ZOE sealer was used for completing the obturation, and Control group: Unobturated specimens. After completion of obturation, all the specimens were embedded in acrylic blocks and were subjected to universal force testing machine for assessing the maximum fracture force. **Results:** Mean fracture force required among the specimens of AH plus group, ZOE group and control group was found to be 214.3 N, 139.1 N and 78.4 N respectively. While comparing the mean fracture force among the three study groups, it was observed that AH plus required maximum fracture force, followed by ZOE, and lastly control; the results of which were found to be statistically significant. **Conclusion:** AH plus sealer had highest fracture force in comparison to ZOE sealer.

Key words: Root canal sealer, Fracture resistance

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INTRODUCTION

The bacteria responsible produce organic acids as a by-product of their metabolism of fermentable carbohydrates. The caries process is a continuum resulting from many cycles of demineralization and remineralization. Demineralization begins at the atomic level at the crystal surface inside the enamel or dentine and can continue unless halted with the end-point being cavitation.¹The

objective of the endodontic treatment is the complete obturation of the duct system after an adequate cleaning and conformation of the same. The conformation of the duct system allows a more effective disinfection by creating a reservoir for irrigation and medication, while creating space for the filling material. The ideal sealing material should ensure a hermetic seal of both the apical and coronal portions, adapting to the canal walls

everywhere. Incomplete obturation of the canal causes the failure of the endodontic treatment.^{2,3}

The greatest incidence of vertical root fracture occurs in teeth after endodontic therapy. The reason most often cited has been the dehydration of dentin after endodontic therapy, excessive pressure during obturation, and the removal of tooth structure during endodontic therapy. Vertical root fracture at the time of canal obturation or during subsequent use of the tooth is one of the most serious complications of root canal therapy, and most of these cases require extraction of the affected tooth.⁴⁻⁶ Most commonly used root canal sealer is the zinc oxide-eugenol (ZOE) sealer (Kerr sealer-Rickert, California, USA) and has been used for several decades because of its satisfactory physicochemical properties. However, leakage and recontamination of the root canal system due to eugenol or zinc oxide loss through continuous hydrolysis which causes post treatment complication.^{7, 8} Hence; the present study was undertaken for assessing and comparing the efficacy of two different root canal sealers used on the fractured resistance of endodontically treated teeth.

MATERIALS & METHODS

The present study was undertaken for assessing and comparing the efficacy of two different root canal sealers used on the fractured resistance of endodontically treated teeth. A total of 90 freshly extracted mandibular first premolars were included in the present study. Carious, grossly decayed and deformed teeth were excluded. Through cleansing of all the specimens was done. Decoronation of all the specimens was done. After decoration, bio-mechanical preparation of all the specimens was done with intermittent irrigation. All the specimens were divided into three study groups with 30 specimens in each group as follows:

AH Plus group: AH plus sealer was used for completing the obturation,

ZOE group: ZOE sealer was used for completing the obturation, and

Control group: Unobtured specimens

After completion of obturation, all the specimens were embedded in acrylic blocks and were subjected to universal force testing machine for assessing the maximum fracture force. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Student t test was used for evaluation of level of significance.

RESULTS

In the present study, analysis of a total of 90 tooth specimens was done. All the specimens were divided broadly into three study groups: AH Plus group, ZOE group and control group. Mean fracture force required among the specimens of AH plus group, ZOE group and control group was found to be 214.3 N, 139.1 N and 78.4 N respectively. In the present study, while comparing the mean fracture force among the three study groups, it was

observed that AH plus required maximum fracture force, followed by ZOE, and lastly control; the results of which were found to be statistically significant.

Table 1: Mean fracture force for AH plus sealer, ZOE sealer and control

Sealer	Mean fracture force (N)	SD
AH Plus	214.3	53.2
ZOE	139.1	31.5
Control	78.4	23.8

Table 2: Comparison of Mean fracture force for AH plus sealer, ZOE sealer and control

Comparison	t-value	p-value
AH plus Vs ZOE	-125.88	0.00*
AH Plus Vs Control	-196.21	0.00*
ZOE Vs Control	-231.83	0.01*

*: Significant

DISCUSSION

Endodontic treatment is fairly predictable in nature with reported success rates up to 86–98%. An endodontically treated tooth should be evaluated clinically as well as radiographically for its root canal treatment to be deemed successful. Patient should be scheduled for follow ups to ascertain that the treatment is a success and the tooth in question is functional.⁹ Clinicians have long sought to reinforce remaining tooth structure. The instrumented root canal seems to be an ideal environment for obtaining the maximal bond of the sealer. The bonding of endodontic sealers to interradicular dentin after root obturation might possibly enhance the resistance to fracture of endodontically treated teeth. The use of a root canal sealer with properties similar to those of other sealers and with the additional quality of strengthening the root against fracture would then be of value.¹⁰ Hence; the present study was undertaken for assessing and comparing the efficacy of two different root canal sealers used on the fractured resistance of endodontically treated teeth.

In the present study, analysis of a total of 90 tooth specimens was done. All the specimens were divided broadly into three study groups: AH Plus group, ZOE group and control group. Mean fracture force required among the specimens of AH plus group, ZOE group and control group was found to be 214.3 N, 139.1 N and 78.4 N respectively. Resilon has an appearance similar to that of Gutta-percha and is therefore called resin-percha. It is available in standardized points that match endodontic instruments and in various tapers, and also as accessory points and pellets for use with the Obtura II delivery system. The placement of the Resilon obturation system involves the removal of the smear layer with EDTA, drying the canal with the paper points followed by placement of sealer SE using paper points. Excess primer is wicked out of the canal using paper points. This is followed by

placement of the sealer, and finally, Resilon obturation with the method of choice. Light curing for 40 s provides an immediate coronal seal. If not light-cured, the material sets within 1 h.¹⁰⁻¹² Resilon obturating material prevents the microleakage by a factor of 6 times and strengthens the root. There is a reported 22% increased resistance to root fracture. The hybrid layer was observed both by transmission electron microscopy and confocal microscopy and is order of 1–2 μm . The other advantages of the Resilon includes – better radiopacity than Gutta-percha, dual cure capabilities for immediate coronal seal and better biocompatibility, it can be removed using conventional techniques.¹³⁻¹⁶

In the present study, while comparing the mean fracture force among the three study groups, it was observed that AH plus required maximum fracture force, followed by ZOE, and lastly control; the results of which were found to be statistically significant. Dibaji F et al assessed the fracture resistance of roots following the application of different sealers including Epiphany, iRoot sealer and AH-plus. Fifty extracted human single-canal premolars without caries, curvature or cracks were used in this study. Tooth crowns were cut to yield 13-mm-long roots. Five roots were put in the negative control group and were left unprepared. Forty-five canals were prepared using ProTaper rotary files up to F3 and were then randomly divided into three groups based on the sealer type (n=15). The root canals were filled using cold lateral condensation technique with gutta-percha and AH-Plus sealer, gutta-percha and iRoot sealer and Resilon and Epiphany sealer, in groups one to three, respectively. The mean fracture resistance was 673.38 ± 170.42 N in AH-Plus, 562.00 ± 184.68 N in iRoot, 708.03 ± 228.05 N in Resilon and 592.59 ± 117.29 N in the control group. No statistically significant difference was found between the experimental groups and the negative control group (P=0.26). Application of AH-Plus, bioceramic and Resilon sealers did not change the fracture resistance of roots compared to that of unprepared root canals.⁹ Phukan AH et al compared the in vitro effects of four different root canal sealers on the fracture resistance of endodontically treated teeth. Seventy-five freshly extracted human mandibular premolars were used for the study. Teeth were divided into five groups based on type of root canal sealers used. Gutta-percha was used for all the samples: Group I: AH Plus root canal sealer, Group II: MTA Fillapex root canal sealer, Group III: Apexit root canal sealer, Group IV: Conventional zinc oxide-eugenol (ZOE) sealer, Group V: Control (unobturated teeth). Group I and Group II showed higher resistance to fracture than other three groups. There was comparable difference in fracture force between Group I and Group II. Resin-based sealer was more effective as compared to other sealers and the control group. However, no significant differences were observed between ZOE and control group.⁸

CONCLUSION

From the above results, the authors concluded that AH plus sealer had highest fracture force in comparison to ZOE sealer. However; further studies are recommended.

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