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Original Research

Comparison of fracture resistance of the endodontically treated roots with different sealer types

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ABSTRACT:
Background: To compare resistance of fracture in endodontically treated roots with different sealers. **Materials & methods:** A total of 40 freshly extracted human mandibular premolars were enrolled. Teeth were divided into four 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 Fill apex root canal sealer, Group III: Apexit root canal sealer, Group IV: Control (unobturated teeth). The results were analysed using SPSS software. All groups showed statistically significant result ($P < 0.05$). **Results:** The distribution of mean deviation of fracture force of Group I (AH Plus) was 245.36 N, Group II (MTA Fill apex) was 182.52 N, Group III (Ap exit) was 122.64 N, and Group IV (Control) was 96.20 N. **Conclusion:**Resin-based sealer was more effective as compared to other sealers and the control group.
Keywords: Sealer, AH Plus, Fracture

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INTRODUCTION

The strength of endodontically treated teeth depends on the remaining amount of tooth structure after canal preparation. The factors affecting root fracture after endodontic therapy are over instrumentation, dehydration of dentine after endodontic therapy, and also uncontrolled pressure during obturation. All of these factors cumulatively and in addition to occlusal load increase the possibility of a root fracture. Furthermore, synergetic actions of intra canal irrigants and medicaments may also influence the physical and mechanical properties of the root dentine, which leads to failure or fracture of endodontically treated teeth. [1] In endodontically treated teeth, the root canal system is reinforced by obturating the root canal in order to increase the resistance of the tooth to compressive strength. [1] To provide a hermetic seal, the bonding of root canal sealer to the dentine is paramount in maintaining the integrity of the seal in a root canal filling. [2] Thus, a root canal sealer with the property of strengthening the tooth against root fracture would be of obvious value. Various research methodologies have developed materials which facilitate adhesion to the root canal system as it is thought that adhesion and mechanical interlocking may strengthen the remaining tooth structure thus reduce the risk of fracture. [3] 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. [4] However, leakage and recontamination of the root canal system due to eugenol or zinc oxide loss through continuous hydrolysis which causes post treatment complication. [4,5] Resin-based dental materials have been proposed to reinforce an endodontically treated tooth through the use of adhesive sealers in the root canal system. [6] However, bonding agents and resins studied to date as root

filling materials had problems in working properties, radiopacity and lack of re-treatability when used for endodontic purposes. [7,8]

Apexit Plus (IvoclarVivadent, Schaan, Liechtenstein) is a calcium hydroxide (Ca(OH)2)-based root canal sealer. It triggers healing by inducing hard tissue formation, has antibacterial activity, and mediates the degradation of bacterial lipopolysaccharides thereby controlling inflammatory root resorption. [9]Ca(OH)2-based root canal sealers have been found to have good biological apical sealing with deposition of calcified tissue at the apical foramen. The therapeutic property of this sealer depends on its ionized form, for which it must be partly soluble.[10,11] Hence, this study was conducted to compare resistance of fracture in endodontically treated roots with different sealers.

MATERIALS & METHODS

A total of 40 freshly extracted human mandibular premolars were enrolled. Teeth were divided into four 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: Control (unobturated teeth). The teeth were embedded in acrylic resin blocks and fracture force was measured using a universal testing machine (Asian Test Equipments). Data obtained were statistically evaluated. The results were analysed using SPSS software. All groups showed statistically significant result ($P < 0.05$).

RESULTS

A total of 40 samples were included. They were divided into 4 groups. The distribution of mean deviation of fracture force of Group I (AH Plus) was 245.36 N, Group II (MTA Fillapex) was 182.52 N, Group III (Apexit) was 122.64 N, and Group IV (Control) was 96.20 N. Group I (AH Plus) exhibited the highest fracture force, while Group IV (Control) showed the lowest fracture force.

Table 1: Mean values of fracture force

Groups	Mean force
AH Plus	245.36
MTA Fillapex	182.52
Apexit	122.64
Control	96.20

DISCUSSION

Root canal therapy is an intelligent practical solution to an age old problem – Loss of teeth. The major objectives of root canal therapy are removal of the pathologic pulp, cleaning and shaping of the root canal system; disinfection of the contaminated root canals; and three-dimensional obturation to prevent reinfection. The purpose of the obturation phase of a root filling is in two-fold; it is done prevent microorganisms from re-entering the root canal system, and also to isolate any microorganisms that may remain within the tooth from nutrients in tissue fluids. However, cleaning and shaping procedure involves removal of dentin from the root canal thus weakening the roots. [12] Root filled teeth are more susceptible to fracture than teeth with intact pulps. The reasons for the fracture include dehydration of dentine after the endodontic procedures and loss of tooth structure during the endodontic and restorative procedures. [13,14]Hence, this study was conducted to compare resistance of fracture in endodontically treated roots with different sealers.

In the present study, a total of 40 samples were included. They were divided into 4 groups. The distribution of mean deviation of fracture force of Group I (AH Plus) was 245.36 N, Group II (MTA Fill apex) was 182.52 N, Group III (Apexit) was 122.64 N, and Group IV (Control) was 96.20 N. A study by Mohammed YT et al,sixty single-rooted mandibular premolar teeth were used in the study. After the decoronation of the crowns of the teeth, we got a 13 mm root length. All samples instrumented using Pro Taper Next system reaching file size ×4 as the final master apical file. Group I: AH Plus sealer + GP, Group II: GuttaFlow 2 sealer + GP, Group III: MTA-Fillapex sealer + GP, Group IV: TotalFill BC sealer + GP, and Group V: control (instrumented but unobturated teeth). Group IV showed higher resistance to fracture than other groups significantly. There was a nonsignificant difference in fracture force between Group I, Group II, and Group III. Group V showed the least fracture resistance than other groups. TotalFillbioceramic-based sealer was more effective when compared with other sealers and the unobturated group showed the lowest mean fracture resistance. [15]

In the present study, Group I (AH Plus) exhibited the highest fracture force, while Group IV (Control) showed the lowest fracture force. Another study by Khan S et al, 90 freshly extracted single-rooted human mandibular premolar teeth endodontically treated, were cut at the cemento-enamel junction, and were randomly divided into three groups of 30 each as teeth of Group A (Control) received no obturation, Group B teeth were obturated using Gutta-percha/AH26, and Group C teeth were obturated using Resilon/Epiphany obturating kit. The results obtain after analysis showed no significant differences in the fracture resistance between the two tested groups of endodontic sealers.[16]Nagas et al. [17] related high fracture resistance of AH Plus to its low shrinkage while setting and long-term dimensional stability. It is resilient, and in combination to Gutta-percha, it forms a perfect seal with dentinal walls giving it a good strength and resistance to fracture. McMichen et al. in their study showed that AH Plus had low solubility and greater film thickness than other sealers which might play a role in its better bond strength. [18]

Milot and Stein [19] revealed that the surface of a core segment abutting the dentin had a more substantial effect on the fracture resistance of the teeth subjected to root canal treatment ($p < 0.05$) than the design of the post. This study showed that the fracture values of

the group 2 (Fiber Site and AH Plus) were significantly lower than the group 3 (glass fiber with a composite core and Sure-Seal Root). This result could be attributed to the Fiber Site's core design. It is probable that the fracture resistance of the Fiber Site post specimens were decreased by the design of the core of the FiberSite post where the post abuts the coronal section of the root, thereby rejecting the null assumption. It was reported by Schwartz et al. [20] that the success of the teeth placed in the canal varies according to the type of post, filling material, and sealer selected. In this study, AH Plus (with a resin base) and Sure-Seal Root (with a bioceramic base) root canal filling materials were used. It has been shown by numerous studies that AH Plus root canal sealer has a greater strength of adhering to the root canal dentin and might enhance the strength of endodontically treated teeth against root fracture in comparison to other root canal fillers. [21-23]

CONCLUSION

Resin-based sealer was more effective as compared to other sealers and the control group.

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