ORIGINAL RESEARCH

Comparative Evaluation of Fracture Resistance of Endodontically Treated Teeth Using Three Different Resin Sealers – An *In vitro* Study

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ABSTRACT

Background: The properties of an ideal root filling material include the ability to adhere to dentine, seal the root canal system, must not be toxic, and should have dimensional stability, insoluble, and unaffected by the presence of moisture. The purpose of this study is to compare the fracture resistance of three resin-based root canal sealers REAL SEAL, REAL SEAL SE, and AH Plus when used in endodontic obturation along with single gutta-percha cone.

Materials and Methods: A total number of 45 extracted human maxillary premolars were used in the present study. The teeth were randomly divided into four groups: Group I, Group II, Group III, Group IV, each group consisted of 10 teeth, and Group V consisting of 5 teeth depending on different materials.

Results: The result shows that the group which was obturated using the resin-based sealer REAL SEAL SE (337.0 kg) was the best among the experimental groups and statistically significant followed by AH Plus (287.7 kg) and REAL SEAL (260.4 kg).

Conclusion: This study concludes that the use of resin-based sealers increases the fracture resistance and among the different resin sealers, the self-etch REAL SEAL, i.e., REAL SEAL SE showed increased fracture resistance among all sealers used under this study.

Keywords: Endodontically treated teeth, Resin sealers, Root canal treatment.

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INTRODUCTION

Endodontically treated teeth usually present excessive loss of tooth structure resulting from caries, unnecessary hard tissue removal, previous restorations, fractures, and some iatrogenic causes.[1,2] There is a clinical impression that endodontically treated teeth are more friable and fracture easily thus may have to be removed. Several attempts have been made to reinforce the crown; however, reinforcing the root would also enhance the fracture resistance of the tooth.[3] To reinforce the instrumented teeth against fracture, sealers are used in conjunction with a core filling material. It would be advantageous if the root canal obturation, in addition to providing an adequate seal, could contribute to the reduction in the incidence of tooth fractures.[4] The properties of an ideal root filling material include the ability to adhere to dentine, seal the root canal system, must not be toxic, and should have dimensional stability, insoluble, and unaffected by the presence of moisture.[5] As adequate information on bond strength of the fourth-generation sealers are lacking, an attempt is being made to use conventional gutta-percha along with resin-based sealers (IV generation sealer) to find the effect of the same in the fracture resistance of the tooth, so the purpose of this study is to compare the fracture resistance of three resin-based root canal sealers REAL SEAL, REAL SEAL SE, and AH Plus when used in endodontic obturation along with single gutta-percha cone.[5-7]

MATERIALS AND METHODS

A total number of 45 extracted human maxillary premolars were used in the present study. The teeth were randomly divided into four groups: Group I, Group II, Group III, Group IV, each group consisted of 10 teeth, and Group V consisting of 5 teeth. All the samples will

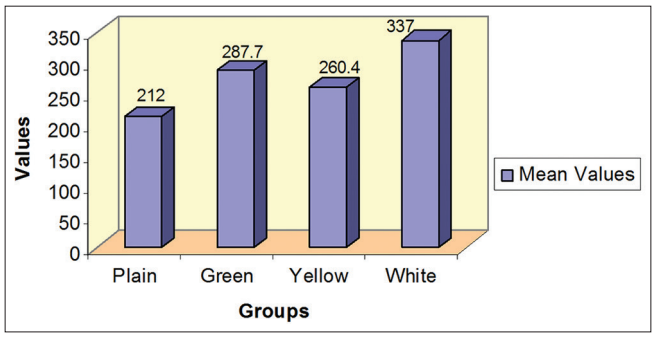
be uniformed to a length of 15 mm. Working length will be measured using no, 10/15 K-file which will be passed through the canal so that 1 mm of the file is visible through the apical foramen. Coronal enlargement was made using Gates-Glidden drill up to size 2, then biomechanical preparation of the root canals will be done till 14 mm using Protaper rotary instrument till F3 file and irrigated using 3% sodium hypochlorite (NaOCl), and 17% ethylenediaminetetraacetic acid (EDTA) to remove the smear layer formed, the final flush being EDTA sol. Later, the obturation was done, using F3 size Protaper gutta-percha points and three different resin-based root canal sealers according to their respective groups were color coded for easy identification, as shown in Table 1.

RESULTS

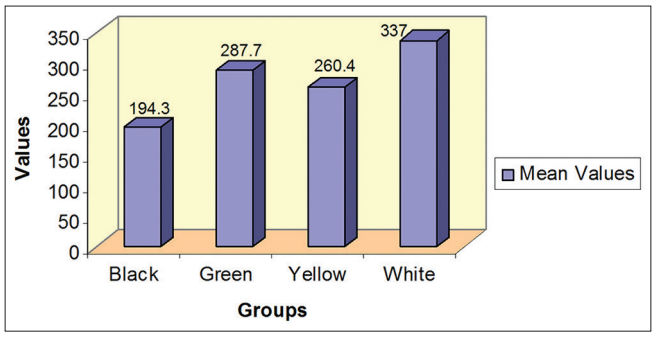
The present *in vitro* study was undertaken to compare and evaluate fracture resistance of teeth obturated using three different resin-based sealers. Group white and green were found to be statistically significant with the control group as shown in Graph 1 and Graph 2. The result shows that the group which was obturated using the resin-based sealer REAL SEAL SE (337.0 kg) was the best among the experimental groups and statistically significant followed by AH Plus (287.7 kg) and REAL SEAL (260.4 kg).

Table 1: Color code and groups

Color	Group
Green	Group 2, GP+AH Plus
Yellow	Group 3, GP+REAL SEAL
Red	Group 4, GP+REAL SEAL SE
Plain (no color)	Group 1, non-obturated
Black	Group 5, un-prepared



Graph 1: Experimental groups with negative control



Graph 2: Experimental groups with positive control

DISCUSSION

To date, four generations of methacrylate resin-based sealers have been introduced. The first-generation Hydron (Hydron Technologies, Inc., Pompano Beach, FL) appeared in the mid-1970s when scientific foundations behind dentin bonding were at their infancy stage of development. The use of poly(2-hydroxyethyl methacrylate) as the major ingredient rendered the sealer very hydrophilic. The second-generation sealer is EndoREZ. This is bondable sealer, non-etching, and hydrophilic in nature and does not require the adjunctive use of a dentin-adhesive. It is designed to flow into accessory canals and dentinal tubules to facilitate resin tag formation for retention and seal after smear layer removal with NaOCl and EDTA. To simplify bonding procedures, new generations of self-etching (third generation) and self-adhesive (fourth generation) luting resin composites have been introduced to restorative dentistry during the past 5 years. The third-generation self-etching sealers contain a self-etching primer and a dual-cured resin composite root canal sealer. The fourth-generation methacrylate resin-based sealers (e.g., MetaSEAL, Parkell Inc.; REALSEAL SE, SybronEndo) are functionally analogous to a similar class of recently introduced self-adhesive resin luting composites in that they have further eliminated the separate etching/bonding step. Hence, the study was done to compare bonding ability of recent root canal resin-based sealer to dentin when used in obturation procedure and comparing with commonly used AH Plus.[8-11] In the present study, the five groups are taken to compare the fracture toughness of endodontically treated teeth using three resin sealers.

In positive control samples, the teeth were prepared and they were not obturated, and in negative control, the teeth were neither prepared nor obturated so that could be compared for the minute changes in fracture toughness. In the AH Plus group, the etching and bonding procedure was done separately before the application of the sealer. There was no use of any thinning agent along with sealer in this group. Then, it was obturated using 6% gutta-percha cones and the sealer. In the REAL SEAL group, etching and bonding was done as in the same manner done for the AH Plus group, but in this group, the primer or the thinning agent was used along with the sealer. Later, the samples were obturated using 6% gutta-percha cones and REAL SEAL sealer. In the REAL SEAL SE group, there was no need for etching or bonding agent as the sealer was a self-etching and self-adhesive material.

The results obtained in the present study showed that the REAL SEAL SE group showed the highest resistance to fracture which was statistically significant. The reason for the improved resistance being that the sealer is self-etching and self-adhesive, there is better etching and bonding taking place over all the surfaces of the prepared canal including apical third. As a result, there will be greater sealer penetration into the dentinal tubules, which gives high fracture resistance. The present study proves that the use of resin sealers for obturation definitely increases the fracture resistance compared to samples that do not use sealers (positive and negative control groups), and REAL SEAL SE showed the highest fracture resistance.

CONCLUSION

This study concludes that the use of resin-based sealers increases the fracture resistance and among the different resin sealers, the self-etch REAL SEAL, i.e., REAL SEAL SE showed increased fracture resistance among all sealers used under this study.

The group which was obturated using the resin-based sealer REAL SEAL SE (337.0 kg) was the best among the experimental groups and statistically significant followed by AH Plus (287.7 kg) and REAL SEAL (260.4 kg).

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