



Effect of Immediate and Delayed Postpreparation on the Integrity of the Apical Seal: An *in vitro* Study

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ABSTRACT

Aim: The aim of this *in vitro* study was to evaluate if there is any significant difference in apical leakage when gutta-percha is removed immediately after obturation for postspace preparation or after a week.

Materials and methods: Two commonly used sealers AH26 and tubliseal were used in four groups each consisting of 20 teeth each. The tooth was sectioned at the amelocemental junction to leave a root portion of 12 to 14 mm. Canals were checked for patency and prepared to No-55 K file size. Two people, using a stereomicroscope, independently evaluated each tooth-half for the extent of apical leakage.

Results: The leakage results were analyzed using a one-way ANOVA according to present study, immediate postpreparation is preferable than delayed postpreparation. The relationship of *in vitro* leakage measurements to the *in vivo* situation has not been established.

Clinical implication: Hence, immediate postpreparation is preferable than delayed postpreparation.

Keywords: Postspace preparation, Apical microleakage, Stereomicroscope study, Immediate postpreparation, Delayed postpreparation.

How to cite this article: Bhondwe S, Kamra A, Choudhari S, Srilatha S, Desai NC, Pandit VS. Effect of Immediate and Delayed Postpreparation on the Integrity of the Apical Seal: An *in vitro* Study. J Contemp Dent Pract 2012;13(2):153-156.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

As we know successful endodontic therapy depends on several factors. Preserving the seal of the endodontic space ensures the permanence of success overtime. Common method of restoring endodontically treated tooth is by post, core and crown construction. The root canal must be prepared before a post can be placed. This preparation involves removal of the root canal filling material, removal of dentin along the walls of root canal or combination of

both. During mechanical preparation of postspace it is quite possible that the root filling may be twisted or vibrated with disruption of seal.¹

The postspace may be prepared either immediately after the obturation of root canal system or alternatively at a later stage after full setting of the sealer. The method used to remove obturation material is an equally important consideration in postspace preparation.² During the postspace preparation, encroachment on the apical third of root canal filling may disrupt its integrity of apical seal.²⁻⁴ Disruption of seal is the basic problem to be concerned very seriously. Its well documented that according to the hollow tube theory, fluid in the apical part of the canal leads to degradation of this fluid and formation of toxins and induces and maintains periapical inflammation.⁵

Various factors must be taken into consideration when gutta-percha is removed for postspace preparation. It includes different techniques of obturation, methods of removal of root filling, the time period between the obturation and postpreparation and remaining level of gutta-percha. There are controversies existing on the manifestation of microleakage after postspace preparation on gutta-percha (GP) filled teeth. While some authors demonstrate there was no difference between immediate and delayed postspace preparation,⁶ others revealed that delayed removal of GP resulted in more leakage than immediate removal.⁷

Therefore, the purpose of this study is to determine if there is any significant difference in apical leakage when gutta-percha is removed immediately after obturation for postspace preparation or after a week. Two commonly used sealers, AH26 and tubliseal, are used in this study.

MATERIALS AND METHODS

Sample preparation: In this *in vitro* study, freshly extracted single-rooted human maxillary incisor teeth were used. The

tooth was sectioned at the amelocemental junction to leave a root portion of 12 to 14 mm. Canals were checked for patency and prepared to No-55 K file size. Teeth were randomly divided into four groups of 20 teeth each.

Group I: Zinc Oxide-Eugenol/Immediate Postpreparation

The teeth were prepared and obturated with gutta-percha and tubliseal sealer. A postspace was immediately prepared after obturation with Gates-Glidden drills to a size 4, leaving 5 mm of remaining filling.

Group II: Zinc Oxide-Eugenol/Delayed Postpreparation

The teeth were prepared and obturated in the same manner as group I and then placed in 100% humidity for a week to be certain that the sealer had fully set. The postspace was then prepared as in group I.

Group III: AH26/ Immediate Postpreparation

The teeth were prepared and obturated with gutta-percha and AH26 as the sealer. Postspace was immediately prepared as in group I.

Group IV: AH26/Delayed Postpreparation

The canals were prepared and obturated in the same manner as group III and teeth were stored in 100% humidity for a week. Postspace was then prepared in the same manner as other groups.

After the completion of obturation and postspace preparation, the external surfaces of all teeth as well as the coronal opening were covered with two layers of sticky wax,

except for the apical 2 mm. All the teeth were placed in vacuum flasks and attached to a vacuum pump. Teeth were suspended in air with a wire, and the air was evacuated for 10 minutes. Then they were lowered into a 2% aqueous methylene blue solution for 15 minutes and then the vacuum was released slowly. The samples were kept in the dye for 72 hours. They were then removed, washed and bench dried for 24 hours.

The sticky wax over the root specimens was scrapped off with the blade of a sharp lacron carver. Two vertical slits, one opposite the other were made on the root specimens. Air rotor bur was used with no water spray to prevent washing off of the dye during slit preparation. Using the blade of the lacron carver as a wedge in the slits, the teeth were split apart longitudinally. Two people, using a stereomicroscope, independently evaluated each tooth-half for the extent of apical leakage (Figs 1A to D).

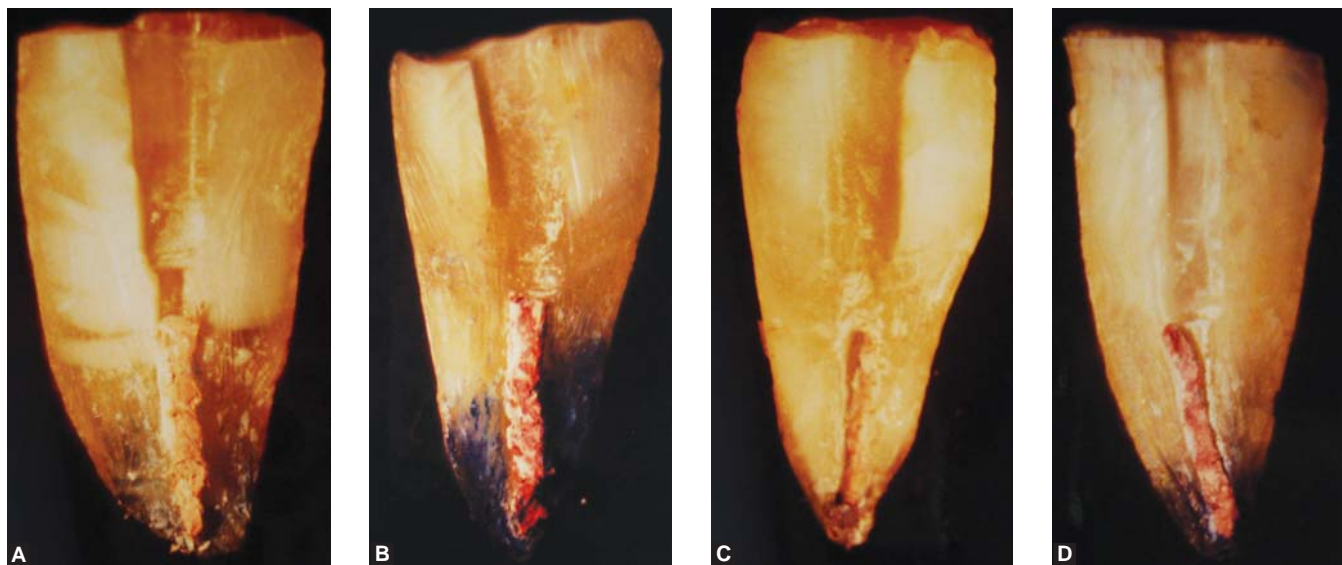
RESULTS

The linear measurement for the dye penetration for each specimen was noted and mean average for each group was calculated (Graphs 1A and B). The leakage results were analyzed using a one-way ANOVA.

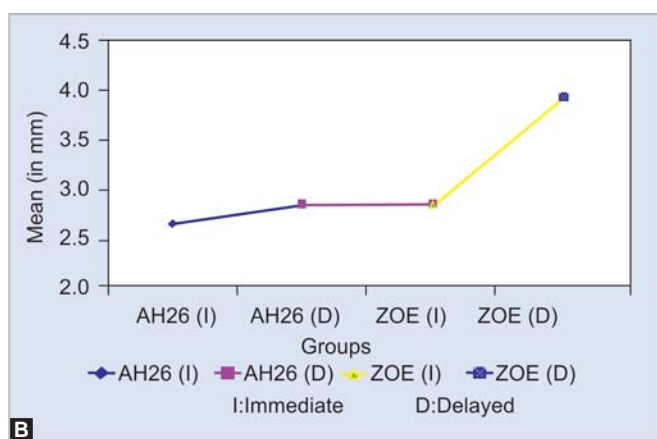
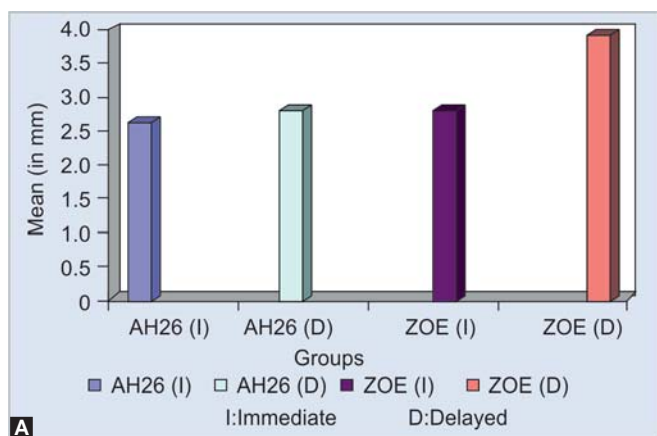
Data indicated that there were no significant differences between group I (ZOE/immediate), III (AH26/immediate) and IV (AH26/delayed). Group II (ZOE/delayed) had a significantly greater penetration of the dye (bar diagram). The positive controls leaked the entire length of the canal whereas the negative control did not leak at all.

DISCUSSION

Hermetic sealing ability, insolubility in tissue fluids, no shrinkage and good adhesion are the important properties



Figs 1A to D: Photomicrograph: (A) group I (ZOE-I), (B) group II (ZOE-D), (C) group III (AH26-I), (D) group IV (AH26-D)



Graphs 1A and B: Linear measurement for the dye penetration for each specimen

of sealer cement. The mean leakage values of the present study are comparable with the values found in the study by Virgina K et al in 1996.⁸ Similar results were found in the study by Portell et al who used only a zinc oxide-eugenol sealer.⁹ Abramovitz et al used AH26 as a sealer and found that immediate postpreparation did not differ from delayed preparation.⁶

Leakage after immediate postpreparation was found to be similar with both sealers, because the sealers had not yet set or polymerized, and thus the flow of the material could fill any gaps or voids or disturbances caused by the preparation, before setting or polymerization.

Excellent apical sealing has been found with epoxy resin based sealers. However, such sealers do not give the most favorable biological response.¹⁰ The long lasting seal of AH26 could be the result of its expansion as reported by Wiener and Schilder. Such expansion or self-repair phenomenon may compensate the volumetric change caused by setting shrinkage or dissolution of the material.¹¹

David stated that the unreacted eugenol remains trapped in the zinc-eugenolate and tends to weaken the mass.¹² Tubliseal cement contains 7.5% of free eugenol after thorough mixing of two pastes.

Sealers must be capable of flowing into minute irregularities in the canal walls and also into lateral canals. An average flow of AH26 is 19.2 to 25.5 cm and that of tubliseal is 2.5 to 6.3 cm. Flow facilitates good contact with the canal walls.

As suggested by Grossman adhesive properties of sealer cements are imparted by the resin component.¹³ Thus, AH26 is a strong adhesive sealer. Average force required for dislodgment of AH26 sealer was found to be 1000 gm, whereas 400 gm for tubliseal. Though strength of sealer cements is not always considered an important characteristic, it is one of the factors involved in durability and permanence. Strength is partly dependent on the adhesion of the cement to the tooth wall and gutta-percha point.¹⁴ On the other hand, Bodrumlu et al demonstrated Resilon/Epiphany obturation achieved better sealing ability than GP/AH-26 when mechanical techniques were used for postspace preparation.¹⁵

AH26 showed 16.5 kg/cm² tensile bond strength to root dentin. Jaffery and Saunders showed that relatively small forces are required to disturb the bond between tubliseal and gutta-percha.¹

The difference in the results with the delayed preparation occurred because of the differing properties of the two sealers. Lack of both, tensile strength and adhesion to dentin of ZOE cement probably caused gaps and voids by crumbling the set material. AH26 was able to resist the crumbling and also provided a better seal when the postpreparation was done even after setting.

Immediate postpreparation has an additional advantage of minimizing the risk of perforation or stripping at the time a postpreparation as the operator is well familiar with the canal system. It can be done under rubber dam using the same aseptic condition and condensation of the remaining gutta-percha filling can be assessed and improved if necessary. Comparing delayed (>24 hours) vs immediate removal of gutta-percha, two studies found little or no difference on the apical seal,¹⁶ while another study found less leakage when immediate removal of gutta-percha was done.¹⁷

According to present study, immediate postpreparation is preferable than delayed postpreparation. The relationship of *in vitro* leakage measurements to the *in vivo* situation has not been established. Therefore, as with any *in vitro* study, extrapolation of the results to the *in vivo* situation must be done with great caution.

CONCLUSION

Following conclusions are drawn from this study:

1. Immediate postpreparation, using AH26 as a sealer was found to be the most effective (leakage value of 2.39 mm).

2. The immediate and delayed postpreparation using AH26 as a sealer has not shown any significant difference statistically.
3. The immediate and delayed postpreparation using AH26 and immediate postpreparation using tubliseal showed no significant difference statistically.
4. Delayed postpreparation using tubliseal as a sealer demonstrated poor apical seal with maximum mean leakage value 3.94 mm.

Hence immediate postpreparation is preferable than delayed postpreparation.

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