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COMPARATIVE EVALUATION OF SEALING ABILITY OF FOUR DIFFERENT ROOT CANAL SEALERS USING A STEREOMICROSCOPE – AN IN VITRO STUDY

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ABSTRACT

Context: Root canal sealers are principally used to fill the irregularities of the root canal system or to attach the gutta-percha to the root canal walls. Endodontic sealers are used in the obturation of root canal systems to achieve a fluid-tight seal throughout the canal including the apical foramen and canal irregularities and minor discrepancies between the dentinal wall of the root canal and the core filling material. **Aim:** To evaluate the sealing ability of four different root canal sealers using a stereomicroscope using lateral condensation obturation technique. **Methodology:** 40 single rooted teeth with mature apices were used for this study. Samples were randomly divided into 4 groups. The samples were prepared and obturated using gutta percha and sealer with lateral condensation technique. Group 1 samples were obturated using AH Plus sealer, group 2 with Bio C sealer, group 3 with MTA fillapex and group 4 with Sealapex. The samples were sectioned longitudinally and were studied under a stereomicroscope of 5X magnification. **Statistical Analysis:** One way ANOVA test followed by Tukeys post hoc analysis was used to compare the Mean Dye Penetration depth (in mm) between four groups. **Results:** Significant difference was seen between the sealing ability of AH Plus, Bio C sealer, MTA Fillapex and Sealapex. AH Plus sealer showed better results compared to the other sealers.

INTRODUCTION

The predictable outcomes of endodontic treatment rely on mechanical instrumentation and cleaning of the root canal system, elimination of the microorganisms and organic debris, as well as filling the entire root canal.

It is commonly accepted that microleakage between the root canal walls and root canal filling material might adversely affect the outcome of the endodontic treatment. Consequently, sealing the entire root canal system after cleaning and shaping is of utmost importance to prevent oral pathogens from colonizing and re-infecting the root and periapical tissues.

Root canal sealers are principally used to fill the irregularities of the root canal system or to attach the gutta-percha to the root canal walls. They are used in the obturation of root canal systems to achieve a fluid-tight seal throughout the canal including the apical foramen and canal irregularities and minor discrepancies between the dentinal wall of the root canal and the core filling material.

There are myriad of root canal sealers available. They have their own advantages and disadvantages. They are selected according to their sealing ability, biocompatibility, and antimicrobial efficacy and adhesive properties.[2]

The AH Plus is an epoxy-resin-based sealer.
MTA Fillapex is a bioceramic and resin sealer.
The Bio C is a novel bioceramic, nonresin sealer.
The aim of the present study was to evaluate the effectiveness of the sealing ability obtained by using AH Plus, Bio C sealer, MTA Fillapex and Sealapex when used in conjugation with cold lateral condensation of obturation using gutta-percha.

MATERIALS AND METHODOLOGY

Forty single rooted teeth with mature apices were collected, cleaned and stored in distilled water. The teeth were decoronated apical to the cemento-enamel junction to standardize the canal length to 14mm using a low speed circular diamond disk. A number10 K-file was introduced into the canal and was pushed towards apical part until the tip of the instrument was just visible at the apical foramen. This length of the file was recorded and 1mm was subtracted from the recorded length and the working length was determined. Using Step-back technique with recapitulation of files to establish a progressively tapering root canal preparation, the canals were cleaned and shaped with K-files. Depending on the size of the original canal, the apical portion was enlarged

to a minimum of 30 or 50 number K-file. After each instrument was used, the canals were irrigated and the irrigants were delivered through a 26-gauge needle which was placed as far as possible into the canal. On completion of the instrumentation process a 10 number K-file was passed through the apical foramen to ensure that the foramen was patent for dye penetration. After drying the canals with paper points, standardized gutta-percha cones were selected as master points.

The sealers used were as follows: Group 1: AH Plus (Resin based), group 2: Bio C sealer, group 3: MTA fillapex, group 4: Sealapex (Calcium Hydroxide based). All the teeth were filled with a root canal sealer and gutta percha points using the cold lateral condensation technique. Radiographs were taken to evaluate the obturation. The access cavities were sealed and the teeth were kept for a week for the sealer to set. The teeth were then placed in 2% methylene blue dye solution for 24 hours. The samples were then taken out from the solution and were thoroughly bathed in running tap water. The samples were sectioned longitudinally using a low-speed circular round disk in a path roughly parallel to the axis of the tooth and through the apex. After sectioning, the samples were studied under a stereomicroscope using 5X magnification. The end point of dye infiltration was calculated as the point where the dye no longer penetrated the obturating material. The measurement from the apex to the end point of dye penetration was observed and documented in mm.

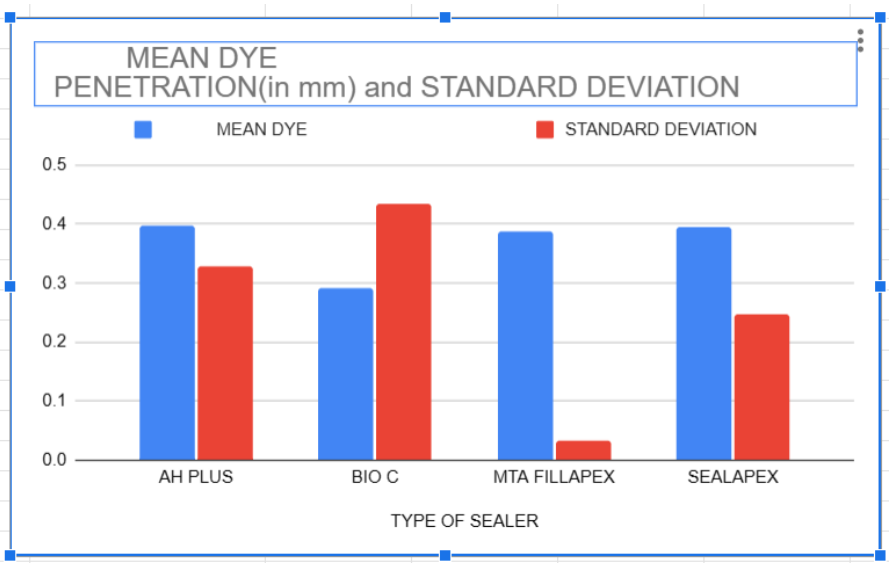
Statistical analysis

One way ANOVA test followed by Tukeys post hoc analysis was used to compare the Mean Dye Penetration depth (in mm) between four groups.

GROUPS	SEALER	NUMBER OF SPECIMENS	MEAN DYE PENETRATION(in mm)	STANDARD DEVIATION	p VALUE
1.	AH PLUS	10	0.398	0.329	<0.05
2.	BIO C	10	0.291	0.434	>0.05
3.	MTA FILLAPEX	10	0.387	0.432	>0.05
4.	SEALAPEX	10	0.396	0.246	>0.05

Figure: Descriptive statistics of mean dye penetration values (in mm) for each group.

RESULTS



DISCUSSION

The entire root canal system should be cleaned and shaped and then filled three dimensionally for a successful endodontic outcome. The characteristics and physicochemical properties of endodontic sealers are fundamental to allow effective sealing.

The AH Plus is an epoxy-resin-based sealer. It is used because of its reduced solubility, better apical seal, microretention to root canal dentin, and less shrinkage.

The MTA Fillapex is a bioceramic and resin sealer. It is biocompatible and encourages apatite-like crystalline deposits along the apical and middle third of the canal walls.

The Bio C is a novel bioceramic, nonresin sealer, which stimulates tissue regeneration.

The present study showed high dye penetration with respect to AH Plus followed by Sealapex, MTA Fillapex and finally Bio C Sealer.

Al-Haddad et al. stated that hydrophobicity of AH Plus sealer facilitates the permeation of resin into open dentinal tubules and creates efficient microretention when 17% EDTA was used as the final irrigant.

Shivangi Trivedi et al. stated that the AH Plus sealer is slightly acidic and might result in self-etching when in contact with dentin, unlike the alkaline bioceramic-based sealers, thereby enhancing interfacial bonding and adaptation. Superior adaptation of AH Plus is due to its ability to bond to root dentin chemically by reacting with the exposed amino groups in collagen to form covalent bonds between the epoxy resin and collagen.

According to Halenur Altan et al, Sealapex and AH Plus showed better sealing ability than MTA Fillapex and can be related to different factors such as micromechanical and chemical bonding. AH Plus and Sealapex produce rigid and strong crosslinked polymer with dentin collagens.

According to Miri et al, the better penetration of AH 26 into a canal compared to Bio C sealer may be the reason for the better sealing potential**.** In Bio C sealer, hydroxyapatite crystals are formed between the dentin and sealer to the extent that separating these crystals from the dentin walls and dentinal tubules may be challenging resulting in the sealing ability.

According to Hubbe et al, AH Plus had better sealing ability because it is a thixotropic fluid, this sealer undergoes transformation of its internal structure, which promotes the alteration of the flow speed, accounting for the abrupt flow, after certain time.

According to João et al, Sealapex showed an adequate sealability compared to MTA Fillapex. It contains calcium hydroxide that will only be biologically active if calcium and hydroxyl ions are released over time. An increase of pH has been shown to be bactericidal, interfering with the osteoclastic activity and promoting an alkalinization in the adjacent tissues.

CONCLUSION

Even though the root canal sealers are used only as adjunctive materials in the obturation of root canal, they have shown to influence the outcome of the endodontic treatment. An ideal root canal sealer should be biocompatible and have a good sealing ability.

Significant difference was seen between the sealing ability of AH Plus, Bio C sealer, MTA Fillapex and Sealapex. AH Plus sealer is considered to be the gold standard sealer in endodontics due to its biocompatibility, ease of use, good sealing ability.

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