

EVALUATION OF ADAPTABILITY OF THREE DIFFERENT ROOT CANAL SEALERS. (IN VITRO STUDY)

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ABSTRACT

Introduction: This study aimed to compare Guttaflow bioseal, MTA-Fillapex, and AH plus with regards to their adaptability on dentin surface.

Methods: Thirty (n=30) single rooted human teeth were instrumented and divided into three groups according to the type of sealer used (each n=10). All root canals were obturated with lateral compaction technique. Roots were cut longitudinally and evaluated for adaptability using scanning electron microscope (SEM) at 1500x. Five readings were taken for the widest gap distances at the three thirds of the root for each specimen.

Results: AH plus group showed less mean values of gap distances than the other groups at apical and middle two thirds, while GuttaFlow bioseal mean gap distance was less at the coronal one third. MTA-F group showed the higher mean values among the three thirds of the root with no significant difference.

Conclusion: AH plus showed superior adaptability than GuttaFlow bioseal, while the worst was MTA-Fillapex.

KEYWORDS Adaptability, GuttaFlow bioseal, Sealer-dentine interface.

INTRODUCTION

Root canal sealers are necessary for forming a bond between the obturating core material and the root canal wall, sealing off of voids, accessory canals, apical ramifications, and multiple foramina. Thus the interface between sealer and dentin is critical^{1,2}. However, adaptability of sealer on dentin

interface without voids depends on sealer's physical properties³. Although sealing ability of root canal filling material represents a great challenge for endodontists, there is no standardized test for sealing ability that applies to ISO 6876:2001 ('Dental root canal sealing materials) till now. Thus, many studies analyzed sealer dentin interface using SEM as an indication of sealing ability.⁴

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AH Plus is an epoxy-resin sealer which was developed more than 50 years ago and is well known for its good adaptation on dentin wall⁵. It has been shown to have excellent flow characteristics, and good adhesion⁶. The sealer sets through addition polymerization which guarantees long-term dimensional stability.⁷ MTA Fillapex (Angelus, Londrina, PR, Brazil) is MTA based endodontic sealer that contains 13% MTA and 38% resin in its composition⁸. MTA fillapex has been shown to have higher values of solubility than accepted values of American National Standards Institute/American Dental Association (ANSI/ADA) specifications as claimed by Borges et al, FariaJunior et al, Viapiana et al.² GuttaFlow Bioseal (Coltène/Whaledent, Langenau, Germany) was introduced in market in 2015 as a new advancement of Guttaflow 2. Coltene claims that in addition to its bioactive property, Guttaflow Bioseal also has slight setting expansion which ensure maximum seal⁹. It was reported that GuttaFlow Bioseal has good physicochemical properties regarding setting time, solubility, radiopacity, flow¹⁰ in addition to its high penetration to dentin¹¹.

MATERIALS AND METHODS

Thirty extracted human mandibular incisors with no signs of internal or external resorption were used. Teeth were decoronated at the level of cement-enamel junction using diamond disc mounted in a low speed hand piece under water coolant to standardize roots length at 13mm. Size 15 K file was used to assure patency of the canal and the apical foramen. The working length was established by subtracting 1 mm from the length obtained when the file tip just

appeared at the apical foramen. Root canals were instrumented using ProTaper Universal rotary files * up to F4. Irrigation with 2ml of 2.5 % NAOCL ** and 17 % EDTA *** was done, then final rinse with saline was performed. All teeth were divided randomly into three groups according to the sealer used for obturation; Group (A) GuttaFlow bioseal group, group (B) MTA Fillapex group, and group (C) AH plus group. MTA Fillapex sealer and AH plus sealer were mixed according to the manufacturer's instructions, while GuttaFlow bioseal was injected into root canals.

Roots were obturated with lateral compaction technique using master cone size 40 taper 2%; quality of obturation has been assessed by standardized radiographs, specimens containing voids have been excluded. All roots were kept in 100% humidity at 37°C for 24 hours to ensure complete setting of sealers. Roots were cut into 2 longitudinal sections and evaluated for adaptation of the sealer on the dentinal wall using scanning electron microscope at magnification x1500. Five readings were taken at the widest gaps in each third of the root then mean value was calculated. Data were collected, tabulated and statistically analyzed using SPSS® Software****.

RESULTS

The analysis of the interaction between sealer and root dentin has been assessed using SEM. All materials showed gap containing and gap-free regions along the interface between sealer and dentin. In most of the AH plus samples gap free regions were observed more. Widest gaps distance between sealer and dentin at each third of the root

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**** SPSS, Version 25, Inc., an IBM Company, NY, USA.

were measured on SEM micrographs and mean values AH plus showed superior adaptation was calculated. Mean and Standard deviation on dentin walls followed by GuttaFlow Bioseal then (SD) values for comparison between groups were MTA Fillapex. Statistically there was no significant presented in *table (1) and figure (1)*. According to difference between groups (P-value > 0.001).

TABLE (1) Comparison of Gap distance between groups.

		Apical	Middle	Coronal	P (within group)
GuttaFlow Bioseal	Mean	5.19	4.07	.88	.247ns
	Std. Deviation	4.23	5.58	1.96	
	Median	4.52	.00	.00	
MTA-F	Mean	8.60	8.04	6.07	.368ns
	Std. Deviation	12.83	7.97	6.20	
	Median	4.52	.00	.00	
AH Plus	Mean	.38	.00	1.19	.368ns
	Std. Deviation	.85	.00	2.65	
	Median	.00	.00	.00	
P (between groups)		.186ns	.138ns	.165ns	---

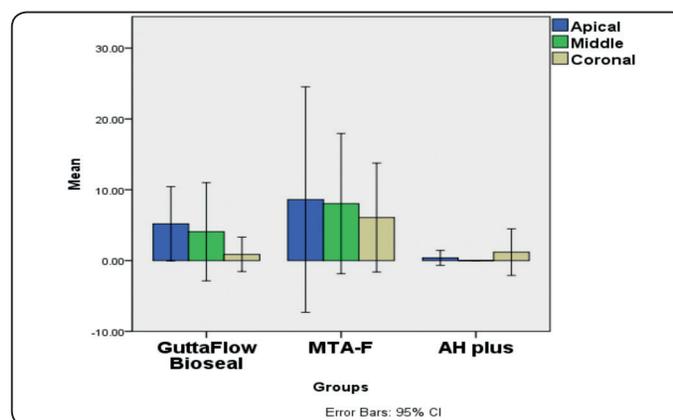


Fig. (1) Bar chart showing mean gap distance among groups.

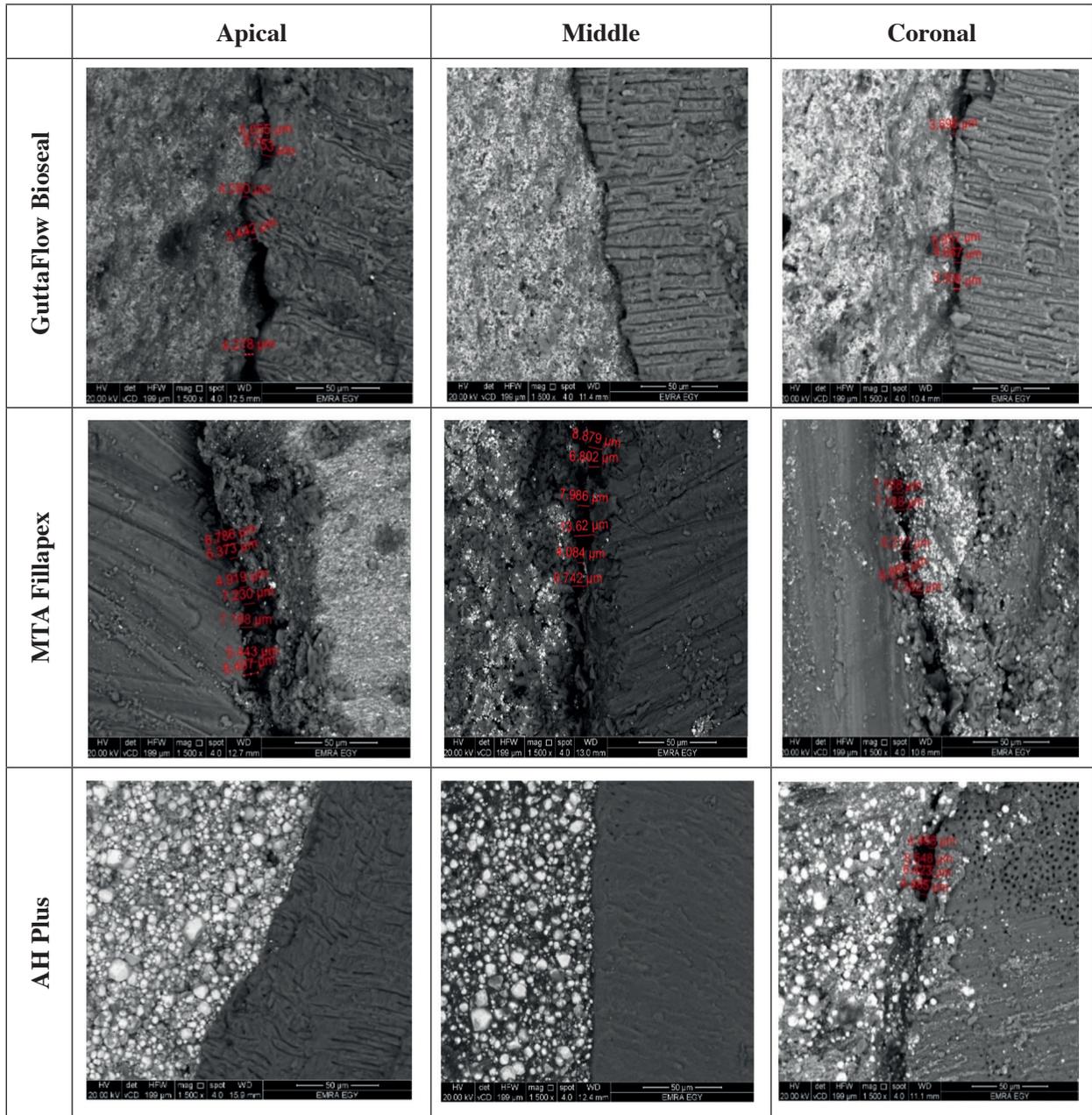


Fig. (2) SEM micrographs showing measurements of gap distance between sealer and dentin.

DISCUSSION

The most common reason of failure of root canal treatment is bacterial invasion from filled root canals into the periapical tissues, thus a perfectly tight seal should be obtained in order to block the pathway of communication between root canal systems and periradicular tissues and guarantee long term success¹². A strict cleaning protocol of the root canals was done before obturation. The instrumented root canals were flushed with EDTA gel after copious irrigation with NAOCL in order to remove smear layer. Smear layer adversely affect adhesion of sealers to dentin and increase the presence of gaps at sealer-dentin interface^{13, 14}. Longitudinal root sections were scanned under SEM for measurement of gaps distance along sealer dentin interface. For the sake of accuracy, readings of the largest gap distance were measured and mean gap distance was calculated at each third of the root¹⁵. Results revealed the presence of both gap-free regions and gap-containing region in canals filled with the three materials, overall AH plus sealer was superior to GuttaFlow bioseal at apical and middle thirds, while GuttaFlow Bioseal showed better adaptation at the coronal one third without a statistically significant difference. Our results are in agreement with studies held by **Amoroso-silva et al²**, **Sevimay et al¹⁶** which stated that AH plus sealer was the best sealer regarding adaptability on dentin surface when compared with other sealers. This can be explained by the fact that epoxy resin present in AH Plus can react with the amine group of the collagen network and create a covalent bond between sealer and dentin⁴. On the other hand **Zhang et al¹⁷** stated that AH plus sealer was equivalent in adaptability to the bioceramic sealer, IRoot SP. Low adaptability of MTA-F on root dentin may be related to its chemical composition, in which the resinous component may adversely affect its bonding behavior¹⁸.

CONCLUSION

GuttaFlow Bioseal showed less adaptability on dentin wall than the gold standard AH plus while the worst was MTA-Fillapex.

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