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Original article

Comparative evaluation of sealing ability of Gutta Flow2 and Apexit Plus sealers in laterally condensed guttapercha: A dye leakage study

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ABSTRACT

Introduction: The foremost commonly used core material for root canal filling is gutta-percha and as the gutta-percha by itself cannot obturate the total root canal system, owing to its poor sealing properties. Henceforth, a sealer is utilized in combination with root filling material. The sealer is more critical than the core filling material. The sealer plays an auxiliary role by simply strengthening (binding or luting) the gutta-percha to the canal walls, nevertheless, it is presently confirmed that the sealer has a prime role in sealing the canal by blocking the irregularities between the canal space and the center core filling material.

Objective: To explore the viability of the apical seal gotten by Gutta Flow and Apexit Plus used in conjugation with cold lateral condensation technique of obturation utilizing guttapercha beneath stereomicroscope.

Materials and Methods: Twenty-two single-rooted with one canal extracted human mandibular premolars were used for this study. The sealers tried were Gutta Flow and Apexit Plus. The specimens were examined beneath a stereomicroscope. For the data analysis, independent sample t-test was employed.

Results: All the test samples showed microleakage. However, the mean measured was considerably higher in the Gutta Flow sealer at 4.91mm and 6.27mm for the Apexit Plus sealer.

Conclusion: Gutta Flow had lesser leakage than Apexit Plus with statistical differences among the experimental groups. The shrinkage related to setting and potential disintegration might risk the adequate seal of the root canal driving to treatment failure.

Key Words: Apexit Plus; Dye Leakage; Gutta Flow 2

INTRODUCTION

The essential function of the root canal obturationis sealing the in-growth of the bacteria from the exterior to the canal, entombment of residual microbes, and fluid-tight obturation.[1] The foremost common

orthogradeobturating method worldwide is gutta-percha. As, gutta-percha by itself cannot obturate the total root canal system, owing to its poor sealing properties, a sealer is utilized in conjunction with gutta-percha.[2]All the modern obturating strategies make use of the sealer to get the effective seal of the root canal filling.[3]

Gutta flow 2(Coltene/Whaledent, USA) is a first sealer/guttapercha combination that is flow able at room temperature that can be used as a sealer as well as obturating material without a solid master cone.It contains guttapercha (<30 μm), and polydimethylsiloxane as a sealer. The manufacturer claims a better seal and good adaptability because of good flowability and the fact that this material expands slightly (0.2%) on setting, enhancing its adaptation to root dentinwalls.[4]

Apexit Plus (IvoclarVivadent, Schaan, Lichtenstein) isan example of calcium-hydroxide-containing salicylate sealers. Calcium hydroxide [Ca(OH)2] is both alkaline and antimicrobial. Sealers containing calcium hydroxide were designed to promote osteogenesis and cement genesis as well as create an antimicrobial environment.[5]

Sealers are resorbable when exposed to tissues and tissue fluids.[5]The purpose of this study was to compare, in vitro, the sealing ability of two different root canal sealers; Gutta Flow 2andApexit Plus once clean, shaped and obturated by the measurement of linear dye penetration using the stereomicroscope.

MATERIAL AND METHODS

This study was approved by Institutional Review Committee (IRC/630/015) and it was conducted from September 2015 to August 2016.

Using the dye penetration method, two root canal sealers were tested in the extracted teeth for their sealing ability. Twenty-two freshly extracted teeth were obtained from the Dept. Oral and Maxillofacial Surgery, CODS, BPKIHS, Dharan. The extracted teeth with evidence of craze lines, resorption, caries below the cement enamel junction, previously endodontic ally treated tooth, and tooth with extreme root curvature were excluded from the study. The teeth were cleaned of visible debris and calculi ultrasonically and stored in a 10% formalin solution until further use.[7]

The access preparation was carried out with endo access bur 1 (Dentsply Maillefer). On entering the pulp chamber, the #10K file was introduced into the canal to check for the canal patency. The working length was decided with the #15 K file until the instrument tip exited from the apex. The ultimate working length was considered after shortening 1 mm from the observed root canal length.[7]

Canal cleaning and shaping were carried out ina crown-down fashion utilizing rotary protaper universal files in sequence as per manufacturers' instruction (Dentsply Maillefer). The coronal portion of the canal was broadened with the SX file followed by mid-canal shaping by S1, S2, and the final preparation with the F3 file. On change of each instrument, canals were irrigated with 1.0 mL of 4% sodium hypochlorite (NaOCl). Once instrumentation was completed, 3.0 mL of 17% ethylene diamine tetra acetic acid (EDTA) were placed and permitted to stay in the canal for one minute. Furthermore, saline was used to flush EDTA, then the final flush with 1 ml of NaOCl was done followed by 5.0 mL of saline lastly.[7]

Grouping of the Samples

The study group comprised of two groups, with 11 samples in each arm. Group I comprised of Gutta Flow 2sealer and Group II of Apexit Plus sealer. The composition of sealers is detailed in Table 1.[6]

Table 1: Composition of Sealers[6]

Sealer	Composition
Gutta Flow 2 Sealer (Group I)	Base: Zirconium oxide, Polymethylvinylsiloxane, Polymethylhydrogensiloxane, Gutta-percha Catalyst: Zirconium oxide, Polymethylvinylsiloxane, Platinum catalyst
Apexit Plus Sealer (Group II)	Base: Hydrated collophonium, Calcium hydroxide, Calcium oxide, Silicon dioxide, Phosphoric acid alkyl ester Activator: Disalicylate, Bismuth hydroxide, Bismuth carbonate, Silicon dioxide, Phosphoric acid alkyl ester

Obturation of the Samples

Canals were obturated using the lateral compaction method. Sealers were manipulated as per manufacturers' guidelines. Master apical gutta-percha (GP) of size F3 (DentsplySirona) was verified up to working length. Once verified, the GP cones were coated with one of the sealers, and canals were obturated. The spreader was used to make additional space for the accessory cones and the cones were added until there was no more space at the coronal end. Excess GP was sheared off with a heated instrument and the access cavity was restored with Fuji IX GIC (GC Corporation, Japan).[7]

Preparation of Specimen for Stereomicroscopic Analysis of Dye Penetration

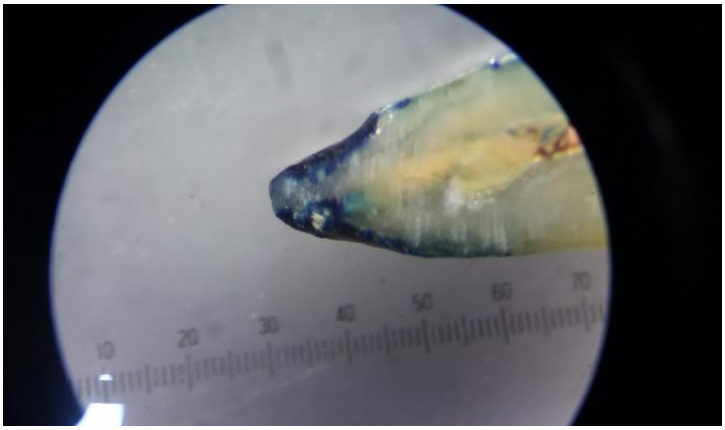
The samples were dried for two minutes and two layers of nail varnish were coated on the external root surfaces. The apical 2 mm was spared to permit color entrance into the canals. Subsequently, the samples were immersed in freshly prepared 1% methylene blue color for 48 hours in a dapen dish. After two days, the nail varnish was removed from the root surface with an aid of acetone. Following this, the roots were longitudinally sectioned and prepared for assessment. Microleakage related to distinctive root canal sealers were assessed and the estimation of dye penetration was scored in millimeter.[7]

STATISTICALANALYSIS

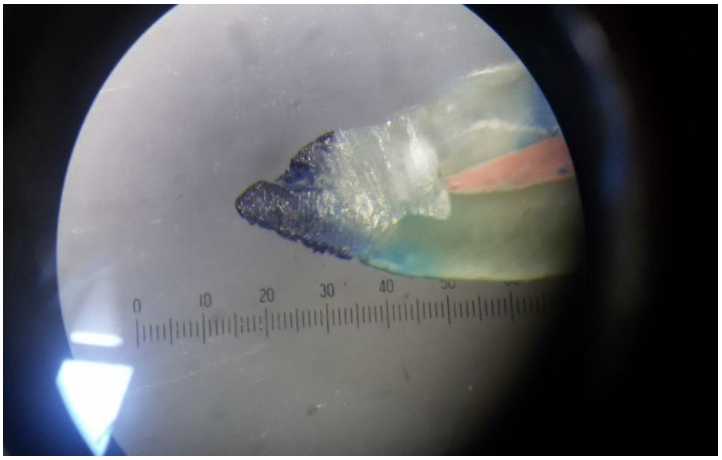
The results were analyzed using independent samplest-test in SPSS version 11 software at $p<0.05$.

RESULTS

The mean dye penetration for Apexit Plus was high overall with as high as 6.27 mm and 4.91 mm for Gutta Flow sealer. Almost 100% of the samples showed leakage with a standard deviation for Gutta Flow was 0.9mm and that for Apexit Plus was 1.33mm. The inferential statistics using independent samples t-test between the test groups was <0.013, thus, signifying that Apexit Plus sealer had more leakage when compared to Gutta Flow sealer.



Picture 1: Leakage seen in Gutta Flow 2 Sealer under a stereomicroscope



Picture 2: Leakage saw in Apexit Plus sealer under a stereomicroscope

The means and standard deviation of the tested group are shown in Table 2.

Table 2: Comparison of linear dye leakage in mean (SD) [n=11] between Gutta Flow 2 and Apexit Plus sealer

Gutta Flow 2 Sealer (Group I) n=11 Mean (SD) mm	Apexit Plus Sealer (Group II) n=11 Mean (SD) mm	Mean difference (95% CI) mm	P-value`
4.91 (0.99)	6.27 (1.33)	1.36 (0.32 - 2.41)	**<0.013**

Bold signifies statistical significance at p<0.05; Independent samples t-test

DISCUSSION

The sealing of the root canal apically by the sealer is vital to prevent communication of the root canal with periapical tissue. The properties of sealers like flow, consistency, setting characteristics, solubility, and attachment to root canals are critical in getting an airtight seal of the root canal.[5] Irrespective of the fact that an airtight seal isn't continuously achievable by the currently utilized sealers, a fluid-tight seal is atleast desirable. The insufficient obturation of the root canal with poor apical sealing has been one of the major causes of endodontic failures.[15]

The apical leakage of the endodontic sealers has been measured in several ways; by the degree of penetration of a dye,[8] microbial leakage tests,[9] scanning electron microscopy,[10]electrochemical means,[11] and radioisotope penetration,[12] fluid filtration method.[13] Among them, linear measurement of the tracer dye penetration technique is most frequently used.[14]

Various dyes are used to assess leakage like methylene blue (MB), India ink, eosin, procion, brilliant blue, 50% silver nitrate, and pelican ink. Among these, MB is a broadly used dyeand provides the same leakage as butyric acid, a microbial metabolic product that has greater penetration than India ink.[15] Henceforth, this study was done to assess the sealing capacity of two distinctive sealers and thus, both conventional and recent sealers were compared.

Polydimethylsiloxane has been utilized in dentistry for a long time owing to its properties. It has an amazingly low surface tension, which gives a high flow rate, restricted dimensional change on setting (0.6-0.2%), and low water sorption. These properties would permit this material to flow into small spaces and tubules. It is insoluble and has great radiopacity. However, it does not develop a chemical bond with dentin, it does expand 0.2% on setting, which comes about in its close adaptation to the canal wall.[16]

Gencoglu et al. examined microleakage and found the better results in teeth in which silicone-based sealers were used.[17] Concurring to a fluid leakage study by Malić I et al., our study also had less leakage with Gutta Flow 2.[18]

On the contrary, these results can be explained by the fact that Apexit Plus discharges calcium and hydroxyl particles amid a process in which the material disintegrates, driving to cleavage formation in set material. These results concur with the results of Shemesh et al.[19] in which Apexit showed inferior outcome compared to AH26, AH Plus, Diaket and Ketac-Endo. Comparable results were observed by Georgopoulou et al.[20] who found the most leakage seen when Sealapex (calcium hydroxide based sealer), was used as an endodontic obturation sealer.

LIMITATION

This is a destructive study in which during the procedure, the samples were split longitudinallyinto two halves and for this reason, there is a chance of gutta-percha being drawn from the canalmodifying the results of this study.

CONCLUSION

Sealing of the root canal with the gutta-percha core and the sealer remains the gold standard for the obturation of the root canal. Apexit Plussealer have been outperformed by the Gutta Flow 2 sealer which have the better sealing abilityand flow, which enhance the sealing of the root canal.

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CONFLICT OF INTEREST

None

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