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An in-vitro study to compare RealSeal and AH Plus as endodontic sealers

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ABSTRACT

Background: Real Seal and AH Plus are endodontic sealers used in the obturation of endodontically treated teeth.
Objective: To compare the area of sealer and voids in root canals obturated with AH Plus and Real Seal .
Material and Methods: Forty premolars were decoronated, cleaned and shaped. Obturation was done with Gutta-Percha using Real Seal and AH Plus as sealers. Comparision of the area of sealers and voids were done.
Results: There was a significant statistical difference between gutta-percha/AH Plus and gutta-percha/RealSeal for both the variables of sealer+void/root canal area as well as for void/root canal area (p = 0.00000200 and 0.00191479 respectively).
Conclusion: In the obturation of root canals, resin based sealers have a better outcome.

KEYWORDS :

Introduction:
In root canal treatment, complete sealing of the root canal system after shaping and cleaning is critical to prevent oral pathogens from colonizing and re-infecting the root canal and periapical tissues through any communication between oral cavity and the periapical tissues.[1] The ingress of oral or tissue fluids via such communication may maintain the viability of residual bacteria that survive the treatment.[2] Therefore, the development and maintenance of a seal is desirable and considered to be a major prerequisite to improve the outcome of root canal treatment.[3]

Among the numerous obturation techniques and filling materials available, gutta-percha continues to be the material of choice, owing to its unique chemical and physical properties. Many different materials have been proposed as root canal fillings, but none have replaced gutta-percha, which is universally accepted as the "gold standard" filling material because of its working properties, radiopacity, and retreatability.[sb38] Gutta-percha has been used in dentistry for over 150 years.[4] Gutta-percha is used in a number of forms in practice, with various filling techniques, and associated with different types of sealers.[5] Despite the inability of gutta-percha to routinely obtain an impervious seal along the dentinal walls of the root canal, they are still considered and used as the standard treatment in endodontics.[6] Countless products have been introduced claiming to perform better than gutta-percha. However, no material has been as successful or as widely accepted as gutta-percha because of its ease of manipulation, biocompatibility and thermoplasticity.[7,8]

Materials and Methods:
Mandibular human premolars which were extracted due to orthodontic purposes were collected and stored in saline solution at 4°C until actual experiments. Their crowns were removed at the cemento-enamel junction by using a water-cooled, low-speed diamond disc (Mani, Japan). The roots were reduced to a size of 15 mm from the coronal aspect. The working length was established 1 mm short of the apical foramen. The canal orifices were coated with sticky wax resin to prevent the outflow of irrigating solution through the apical foramen. The canal orifices were enlarged with Gates Glidden (Moyco Union Broach) drills number 1, 2 and 3.

Roots were further instrumented with EasyRaCe NiTi rotary files (FKG, Swiss Dental Products) in a crown down technique and enlarged to a size 40/0.04 taper. After each instrument, the canals were irrigated with 5mL 2.5% sodium hypochlorite (NaOCl). Irrigation procedures were performed with the roots held upside down to prevent pooling of the irrigant. After preparation, the root canals received a final irrigation of 5mL 17% ethylenediaminetetracetic acid (EDTA) and 5mL 2.5% NaOCl, after which the canals were flushed with 10mL distilled water to avoid the prolonged effect of the irrigating solutions. Root canals were dried with paper points and randomly assigned into 2 obturation groups (n=20/each).

In group 1, AH Plus sealer was applied into the root canals and a size 40/0.04 taper gutta-percha master point (Dentsply/Maillefer) was seated into the root canal with tug-back. Lateral compaction was performed and approximately 4 accessory cones were inserted per root canal, and the quality of the filling was confirmed with radiographs. Excess cones were removed with a warm excavator, and the final vertical compaction was completed with a hand plugger to a depth of approximately 1 mm.

In group 2, RealSeal primer was placed into the canal with a syringe, and after 30 seconds, the excess was removed with a paper point. Thereafter, a size 40, 0.04 taper gutta-percha master point (Dentsply/Maillefer) was seated into the root canal with tug-back. Lateral compaction was performed as with group 1 by using accessory gutta-percha cones. Removal of the excess gutta-percha cones and final vertical compaction was accomplished in a similar manner.

The coronal access of specimen was restored using a hybrid resin composite material (Spectrum TPH; Dentsply), using a total-etch/single-bottle adhesive system (Prime & Bond NT; Dentsply). All clinical procedures were performed by the same operator.

Sectioning and Image Analysis:
The specimens were stored for 2 weeks at 37°C and 100% humidity to allow the sealer to set completely. Horizontal sections were obtained of the coronal, middle and apical third at levels of 14-mm, 8-mm and 2-mm from the apex respectively. During sectioning, the specimens were subjected to continuous water cooling to prevent frictional heat and, thus, smearing of Resilon or gutta-percha that could tend to hide areas of sealer. The coronal surfaces of the sections were then digitally photographed at 100X magnification under a light microscope and transferred to an IBM-compatible PC and saved as Adobe (Adobe, San Jose, CA) files. Using Image J (Wayne Rasband; National Institute of Health, Bethesda, MA) software, the cross-sectional area of the root canal and the area filled by the sealer (and voids, if present) was calculated.

For each specimen, the ratio of sealer plus voids to root canal area was calculated by dividing sealer plus void area to the root canal area. The ratio of voids (alone) was also calculated by dividing the area of voids by the root canal area. Thereafter, statistical analysis of the data was done. For each section (coronal, middle and apical) statistical comparisons between the Resilon and gutta-percha groups were made with Kruskal-Wallis Test and intergroup comparisions were made by Mann-Whitney *U* test with Bonferroni correction. Differences within each obturation group for each level of sectioning was analyzed statistically. A pvalue<.05 was considered as statistically significant.

Results:
Mann Whitney U Test: post hoc with Bonferroni correction (sealer + void / rc area)

Comparison groups	N	Min	Max	Mean rank	Median (25^{th}, 75^{th})	Z	P value
GPAH	30	0.11	0.62	41.22	0.2915 (0.2273, 0.4353)	4.753	**0.0000 0200**
GPEP	30	0.00	0.40	19.78	0.0915 (0.0712, 0.2258)		

Discussion:

Traditionally, it has been assumed that root filling of a good technical quality provides an effective seal of the obturated root canal, whereas leakage along a filling of poor quality will result in failure.[9] Leakage through an obturated root canal has been shown to take place at the interface between the sealer and gutta-percha or the sealer and dentin.[10] These interfaces or spaces may not have been filled either by the obturating material or by the sealer, thereby creating voids in the obturation. Microleakage, whether from an apical or a coronal direction, remains a clinical problem and a possible cause of failure of endodontic therapy.[11]

Endodontic sealers are capable of filling imperfections and increasing the adaptation of the root canal core filling material. Root canal sealers are not dimensionally stable over time and may dissolve partially over time as a result of their low resistance to leakage. Thus, to achieve optimal results, the amount of sealer should be minimized, while increasing the mass of the core filling material.[12]

There was a significant statistical difference between gutta-percha/AH Plus and gutta-percha/Epiphany for both the variables of sealer + void/root canal area as well as for void/root canal area ($p = 0.00000200$ and 0.00191479 respectively). This may be attributable to the fact that Epiphany forms a chemical bond to the root canal dentinal walls unlike the epoxy resin-based sealer AH Plus. This has been shown in a study by Ungor et al where the authors found the highest bond strength between gutta-percha/Epiphany combination.[13]

Although AH Plus may adhere to the root canal walls, they are unable to bond to the gutta-percha core material. Upon setting, the sealer pulls away from the gutta-percha core, leaving gaps which are avenues for microleakage.[14] Moreover, in case of AH Plus, searing off the sealer from the canal orifices with a heat source could have expedited the setting of the sealer and undermined its capacity to flow.[15]

Conclusion:

With the advent of adhesive dentistry, endodontic treatment too can become more promising. However, more researches in this aspect is deemed necessary for better outcomes.

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