The Effect of Ultrasonic Activation of two Root Canal Sealers on Sealing Ability and Interfacial Adaptation

Thesis submitted to Faculty of Dentistry -Ain Shams University for partial fulfillment of requirements of the Master Degree in Endodontics

By

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B.D.S

College of Dentistry – University of Baghdad 2002

(2018)

بِسْـــمِ اللَّهِ الرَّحـْمَنِ الرَّحِيـــمِ

وَيُعَلِّمُكُمْ مَا لَمْ تَكُونُوا تَعْلَمُونَ

صدق الله العظيم

البقرة (151)

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Acknowledgement

*First and for most, thanks are due to **ALLAH**, the most beneficent and merciful.*

*I would like to express my very deep gratitude and appreciation to **Dr.Abeer Abdelhakim Al-Gendy** Professor of Endodontics, Endodontic Department, Faculty of Dentistry, AinShams University. It has been a great opportunity for me to be honored to work under her kind and precious supervision, **Dr. Mohmed Mokhtar Nagi** Associate Professor, Endodontic Department, Faculty of Dentistry, Ain Shams University, for his support and guidance throughout all steps.*

Dedication

I would like to state my sincere gratitude for my father, mother, brother and sisters, for their continued support throughout my journey it wouldn't have been the same without them, and my lovely wife and sons, that they were so patient along all years of studying.

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The long-term success of an endodontic treatment is achieved by preventing oral pathogens from colonizing and reinfecting the root and periapical tissues. This could be achieved by the complete sealing of the root canal system during the obturating phase.

Gutta-Percha is the main core obturation material, because of its several advantages; which it is inert, compactable, adapts to the irregularities, can be softened and made plastic, and dimensionally stable, but the most important disadvantage of Gutta-Percha is lack of adhesiveness, hence a sealer is mandatory to be used in combination with Gutta-Percha for complete sealing of the root canal sealer.

Grossman [(1)] listed ideal sealer requirement, as the sealer should create hermetic seal, particles of powder should be very fine for easy mixing with liquid, not stain tooth structure, set slowly, soluble in a common solvent, non-irritating to periradicular tissue, most important of them are; sealer should be tacky when mixed to provide good adhesion between it and the canal wall when set, not shrink upon setting, radio opaque, biocompatible, bacteriostatic, and insoluble in tissue fluid.

MTA Fillapex, an MTA based sealer which has good biological properties, presents an alkaline pH and

promote calcium releasing that stimulate tissue mineralization procedure [2][3], AH Plus has excellent radiopacity, low shrinkage, low solubility, biocompatibility, and thermoplastic properties make it easy to remove [4] [5].

Ultrasonic energy was first introduced in endodontics by **Richman** [6] in 1957, currently, it has been widely used in different endodontic procedures, beginning from access cavity and ending with endodontic surgery, passing by greater agitation of irrigating solutions promoted by ultrasound that intensifies the penetration in an area of anatomic complexity consequently improving the cleaning ability.

The ultrasonic activation of root canal sealers can possibly improve its penetration inside the dentinal tubules, and also the interfacial adaptation along the canal walls, providing an increase in sealability and antimicrobial effects, so studying the effect of ultrasonic activation of the MTA fillapex root canal sealer on sealability and interfacial adaptation is of great importance.

Sealing ability of different root canal sealers;

Schäfer E and Olthoff G 2002 [7], assessed the seal obtained in straight and curved root canals filled with either laterally compacted gutta-percha or Thermafil obturators. Each technique was used in combination with three different sealers (RSA RoekoSeal, AH Plus, AH 26). Thermafil obturators were also used without sealer, resulting in a total of 14 test groups of 16 teeth each, 60 teeth served as positive or negative controls, and 142 extracted teeth with straight and 142 with curved root canals, then instrumented to size 40, and obturated placed in India ink for 48 h. Canals filled with Thermafil obturators had significantly more extrusion of filling material than canals filled by lateral compaction. Thermafil without sealer showed significantly greater dye penetration.

Miletić I et al 2002 [8], compared the sealing ability of five root canal sealers (AH26, AH Plus, Apexit, Diaket, and Ketac-Endo) on 60 single-rooted teeth after 1 yr of storage, by a fluid transport model. Root canals were prepared with Gates Glidden drills by using a step-back technique before lateral condensation of gutta-percha with the tested sealers. The specimens were stored in saline solution for 1 yr at 37°C. The leakage was measured by the movement of an air

bubble in a capillary glass tube connected to the experimental root section. Apexit (0.490 µl) leaked significantly more than AH Plus (0.378 µl) and Ketac-Endo (0.357 µl), whereas AH26 (0.390 µl) and Diaket (0.429 µl) showed no significant difference from either Apexit or from AH Plus and Keto-Endo.

Kardon BP et al 2003 [9], evaluated sealing ability of a new urethane methacrylate resin-based sealer, EndoRez, using a fluid-filtration model, 64 single-rooted lower bicuspids were decoronated, instrumented, and divided into 3 groups of 20 each with 4 teeth used as controls. In group A roots were obturated with EndoRez and a single cone of gutta-percha, group B with AH Plus and a single cone of gutta-percha, and group C was obturated using gutta-percha with warm vertical compaction and AH Plus sealer. The leakage of group A was significantly higher than the other two groups. There was no significant difference in leakage between groups B and C.

Oruçoğlu H et al 2005 [10], evaluated the apical leakage of three root-canal sealers: AH Plus, Diaket, and EndoREZ was using a new computerized fluid filtration meter, 45 extracted human premolar teeth with single root and canal were used, coronal part of each tooth was removed and the root canals were prepared using GT Rotary files and crown-down technique, samples were divided into three groups of 15,

filled with one of the test materials and gutta-percha cones by the cold lateral condensation technique, one-week later, apical parts of roots of 10 ± 0.05 mm were attached to computerized fluid filtration meter. Apical leakage quantity was determined as μl/cmH2O/min−1. Statistical analysis indicated that root fillings with Diaket in combination with cold lateral condensation technique showed lower apical leakage than the others.

Saatchi M H and Rabie 2005 [(11)], compared the apical sealing ability of three root canal sealers, the apical sealing ability of root canal sealers AH26, AH Plus and zinc-oxide eugenol (ZOE) were tested on 100 single-rooted teeth, coronal part of each tooth was removed about 2mm above the cementoenamal junction, root canals were instrumented using the step-back technique, then divided into three groups of 30 teeth each, filled with test sealers and gutta-percha points by the cold lateral condensation technique, teeth were immersed in 2% methylene blue for 3 days, then longitudinally sectioned and evaluated for linear apical dye penetration, the differences in leakage among AH26 (2.08mm;SD 0.215), AH Plus (3.64mm;SD 0.182) and ZOE (5.41mm;SD 0.274), were statistically significant.

Stratton RK et al 2005 [(12)], compared the sealing ability of gutta-percha and AH Plus sealer versus Resilon and

Epiphany Resin Root Canal sealer using three different final irrigants with the fluid filtration model, 140 teeth prepared using a crown-down method to a size 50 file, then divided into two groups: (A) GP and AH Plus and (B) Resilon and Epiphany. After removal of the smear layer, obturation was performed using the continuous wave of condensation. The teeth were stored for 20 days in 100% humidity before testing. Significantly it was less leakage in using Resilon with Epiphany sealer compared to gutta-percha and AH Plus sealer. There was no statistical significance between any of the irrigants used for either obturation group.

Onay EO et al 2006 [13], assessed the apical sealing ability of the new resin-based Epiphany-Resilon root canal filling system, and to compare this with the sealing abilities of different pairings of AH plus, gutta-percha, Epiphany, and Resilon. Seventy extracted human single-rooted teeth were used, all teeth were instrumented using a set of ProTaper rotary instruments. Canal were filled with different combinations: G1 AH Plus + gutta-percha; G 2 AH Plus + Resilon; G3 Epiphany + Resilon; G4 Epiphany + gutta-percha. Apical leakage quantity was measured with the computerized fluid filtration meter. Epiphany gutta-percha combination had the least amount of microleakage than all other groups, AH Plus gutta-percha combination had second