Apical and Coronal Microleakage of Three Plasticized Obturation Techniques A Comparative In Vitro Study

Thesis

Submitted to the Faculty of Oral and Dental Medicine,

Cairo University, in Partial Fulfillment of Requirements

for Master Degree in Endodontics

By

Amira Galal Ismail

B.D.S

Faculty of Oral and Dental Medicine

Cairo University

Department of Endodontics

Faculty of Oral and Dental Medicine

Cairo University

2008

Supervisors

Dr. Alaa El Din H.Diab

Associate Professor of Endodontics
Faculty of Oral and Dental Medicine
Cairo University

Dr. Nadia Lashin Soliman

Associate Professor
Oral and Dental Medicine Department
National Research Centre

Dr. Nihal Ezzat Sabet

Lecturer of Endodontics
Faculty of Oral and Dental Medicine
Cairo University

بسم الله الرحمن الرحيم

" يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ "

صدق الله العظيم

Acknowledgement

I would like to express my most sincere gratitude and grateful appreciation to *Prof Dr. Alaa el Din Hussein Diab*, Associate Professor of Endodontics, Faculty of Oral and Dental Medicine, Cairo University. It was a great honor to work under his great supervision, and be inspired by his sparkling enthusiasm and endless knowledge. His encouragement, help, and patience will always be extremely remembered.

Many thanks to *Dr. Nadia Lashin Soliman,* Associate Professor of the Oral and Dental Medicine Department at the National Research Centre for her kind support, care and considerable effort.

My warmest thanks and appreciation are due to Dr. *Nihal Ezzat Sabet,* Lecturer of Endodontics, Faculty of Oral and Dental Medicine, Cairo University, for her extraordinary decency, effort, advice and fruitful assistance during the course of this research.

I would also like to thank *Dr. Hend Abo El Nasr,* Associate Lecturer of Endodontics, Faculty of Oral and Dental Medicine, Cairo University, for her kindness, friendly spirit and valuable suggestions.

My love, indebtedness, appreciation and countless thanks are warmly presented to my *parents.* Their endless love, sincerity, care and devotion have always strengthened me throughout my life.

I sincerely thank my husband *Karim* and my beloved *Kanzy* for their love, support and immeasurable backing during this study.

Last but not least, I would also like to thank *my sister and brother* who overwhelmed me with their beautiful feelings and supported me till this day to come.

Amira Galal Ismail

List of Contents

List of Tables

List of Figures

Introduction

"A mouth without teeth is like a mill without its stone, and you must value a tooth more than a diamond"

-Miguel de Cervantes, Don Quixote

Endodontic therapy over a period of time has developed into an art and science to retain grossly carious, infected and badly mutilated teeth whenever possible, hence valuing each and every tooth more than a diamond and increasing its longevity in the mouth to the greatest possible extent.

The objective of a successful endodontic treatment is the three dimensional obturation of the root canal system after meticulous chemomechanical cleaning and shaping.

Root canal filling must seal the canal space both apically and coronally to prevent the ingress of microorganisms or tissue fluids into the canal space. Apical leakage is considered a common reason for clinical failure of endodontic therapy. Likewise, coronal leakage can also be an important cause for failure.

The development and maintenance of a seal is desirable and considered to be a major prerequisite to improve the outcome of root canal treatment. Hence, sealing properties of different obturating materials have played an important role in their development. Gutta percha with sealer remains to be the most commonly used root canal filling material to which other obturating materials are compared, but yet, has not completely sealed the root canal system.

Recent Advances in dentine bonding have led to the development of an adhesive root filling material. Resinate system is a new thermoplastic synthetic resin core and a dual curable dental resin composite sealer. Resilon cones have the same handling properties as gutta percha creating a root filling that is claimed to act as a solid monoblock.

Moreover, a new established silicon based root canal filling material, has recently been introduced in the endodontic clinical practice. GuttaFlow is a cold flowable obturation system. It is the modification of RSA, (Roekoseal Automix), a polydimethyl siloxane based sealer, which has been improved by adding gutta percha powder to create the latter.

Among different obturation techniques, warm vertical compaction has been demonstrated to produce an optimal three dimensional filling. The advantage of this technique is that the filling material is more adaptable to small irregularities that exist in the root canal wall.

Along the track of seeking perfection of a well compacted and tightly adapted root filling material, GuttaFlow and Resilon have invaded the world of endodontics seeking to be promising and aiming to accomplish a higher rate of success compared to the present obturation systems.

Hence, this research was done, to compare between those two novel materials and gutta percha with sealer regarding their sealing ability apically and coronally.

Review of Literature

Microleakage of the root canal can be defined as the passage of bacteria, fluids, and chemical substances between tooth and root canal obturating material[20]. Obturation of the root canal system, both apically and coronally prevents leakage and contamination of the root canal space which may often lead to periapical lesions and failure of root canal therapy. The question then arises, is there an obturation system that accomplishes an impervious seal? Gutta percha, Resilon and GuttaFlow were the three obturating materials dealt with in this study and were conveyed as follows:

I. Gutta Percha

For over 100 years, gutta percha has enjoyed being the core filling material of choice in endodontic practice to which other obturating materials are compared. However, studies have questioned the ability of gutta percha to fully entombing bacteria. In addition, lack of adhesion between gutta percha, sealer and canal dentin creates avenues for leakage. Coronal leakage is one of the important causes of failure of endodontic treatment. Hence root canal obturation should promote adequate coronal sealing. Many techniques have been introduced over the years for efficient and effective filling of root canal with gutta percha. This review will discuss how the unique environment of root canals present a particular challenge for gutta percha revealing its cons and pros in comparison with bonded materials and how the intervention of thermoplastification of gutta percha affects the apical and coronal seal.

Kataia *et al* 1994 [1] compared the sealing ability of the multiphase gutta-percha obturation technique, to the traditionally used lateral compaction technique using the dye penetration method. Thirty single rooted human teeth were selected and divided into two equal groups according to obturation technique. Tubliseal sealer was used in both groups. After obturation, teeth were suspended in methylene blue dye for three days. Linear dye penetration was measured after longitudinal cross sectioning of teeth. Multiphase technique showed a statistically significant lower mean value of leakage than the lateral compaction technique. It was concluded that multiphase technique was promising. Later on **Gillhooly *et al* 2000** [2] assured these results.

Al Dewani *et al* 2000 [3] also studied the sealability of gutta percha fillings in extracted human teeth using lateral condensed gutta-percha versus low-temperature thermoplasticized one. All root canals were flushed with 17% EDTA solution and 2.5% NaOCl to remove the dentinal smear layer. Sealability of each technique was assessed by dye penetration methodology. Results revealed that canals filled with thermoplasticized gutta-percha had significantly less apical dye penetration than those obturated by lateral condensation.

Kardon *et al* 2003 [4] assessed the apical microleakage of single cone gutta percha fillings when coupled with EndoRez sealer or AH Plus sealer versus warm vertically compacted gutta percha with AH Plus sealer by fluid filtration model. Results showed that the highest leakage values were obtained withe EndoRez. There was no statistical significant difference in leakage between the other two groups. Therefore AH Plus was more effective in apical sealing than the EndoRez sealer.

Lea *et al* 2004 [5] also studied quantitatively the density of standard cold lateral gutta percha compaction and warm vertical condensation. Forty transparent acrylic blocks with 30 degree curved root canals were instrumented in a crown down manner. The blocks were weighed before and after obturation. Warm vertical compaction produced an obturation with greater density than conventional cold lateral condensation.

Shafie *et al* 2004 [6] investigated the adhesiveness of four root canal sealers (Endo-fill, CRCS, AH Plus and Ketac-Endo) to gutta-percha and to dentin in the presence and absence of smear layer. Apical microleakage was tested using scanning electron microscope (SEM). Flow of all sealers was with acceptance limit to ANSI/ADA specification. AH Plus showed an intermediate significant flow whereas Endo-fill showed the highest. There was no statistical significant difference between sealers in microleakage assessment in presence or absence of smear layer.

De Moor and De Bruyne 2004 [7] evaluated the sealing ability of AH 26 and AH Plus in conjunction with 3 different obturation techniques at different intervals of time. Nine hundred and forty single rooted teeth were mechanically prepared and obturated by: lateral condensation, hybrid condensation of gutta percha and thermafil. Apical and coronal dye penetration was measured using stereomicroscope after 1 day, 1 week, 2 weeks, 1month and 6 months. There was no significant difference between the two sealers at different observation periods. Coronal leakage was higher for thermafil than for hybrid condensation at 1 day, 1 week and 2 weeks for both sealers and was higher for lateral condensation compared to hybrid at 1 week for AH Plus. It was concluded that both AH 26 and AH Plus resulted in comparable

sealability when used with the same obturation technique & comparable coronal sealability at 1 and 6 months.

Venturi and Breschi 2004 [8] examined the quality of the endodontic sealing of the apical 4mm of narrow and curved canals of human extracted teeth using four different thermoplasticized filling techniques. Canals were filled with gutta- percha cones and Pulp Canal Sealer using the following techniques: Schilder's warm vertical compaction, Schilder's technique modified by using an electric heater, Schilder's technique modified by compaction of the apical tract at body temperature, modified vertical compaction with apical back filling. A methylene blue dye penetration test was performed on specimens followed by clearance technique. Results revealed that the least dye penetration occurred when backfilling was used. It was concluded that in narrow canals, vertical compaction technique allowed the creation of an effective plug apically accompanied by excellent adaptation of back-filled gutta-percha to root canal walls.

Withworth *et al* 2005 [9] tested the hypothesis that AH Plus and Roeko Seal Automix (RSA) sealers alone are no less effective in preventing coronal microleakage than gutta percha compacted with sealer. Specimens of prepared sheep incisor root canals were obturated with warm gutta-percha alone, AH plus alone, RSA alone, and warm gutta percha with AH Plus, and warm gutta percha with RSA. Coronal leakage was assessed with Indian ink and tooth clearing. It was found that sealer only backfills allowed less leakage than those containing warm gutta percha.

Yucel and Ciftci 2006 [10] assessed the speed of bacterial penetration in 5 different obturation techniques. One hundred and twenty