Evaluating the Susceptibility of three different Root Canal Sealers to Degradation by salivary lipase: An in vitro study

Thesis Submitted to Faculty of Dentistry,
Ain Shams University
In partial Fulfillment of the Requirement for
Master's Degree in Endodontics

By

MAHMOUD LOTFY ELGHARIB
B.D.S Faculty of Dentistry, Ain Shams University
(2012)

Faculty of Dentistry
Ain Shams University
2019

بسم الله الرحمن الرحيم

﴿رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ
الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ
وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ
وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ
الصَّالِحِينَ﴾

آية: ١٩ سورة النمل

Supervisors

Dr. ABEER ABDELHAKIM ELGENDY

Professor of Endodontics
Faculty of Dentistry
Ain Shams University

And

Dr. TAREK El SEWEIFY

Lecturer of Endodontics
Faculty of Dentistry
Ain Shams University

Dedication

I would like to dedicate this work to my father 's soul and my wife

Acknowledgment

I express my deepest gratitude to ***Dr Abeer El Gendy*** *professor of Endodontics, Faculty of Dentistry, Ain Shams University for her constant guidance, support, motivation and untiring help during this work. Her depth knowledge has been extremely beneficial for me.*

I express my profound sense of reverence to my supervisor ***Tarek El Seweify*** *lecturer of Endodontics, Faculty of Dentistry, Ain Shams University, for the time and guidance he devoted to me.*

I would like to thank also ***Ain shams endodontics staff*** *for offering me much support, effort throughout the whole work.*

List of Figure

List of Table

Introduction

The main goal of endodontic treatment is to seal and isolate the whole root canal system from the outside environment with a proper obturating material and eradicate all residual microorganisms [1]. Sealer along with solid obturating material acts synergistically to create hermetic seal and three dimensional filling ,and seal all radicular canals and their accessory spaces after completing cleaning and shaping of the root canal system to avoid the existence of microorganisms and enhance the repair of periradicular tissues [2].

Grossman[3] listed requirements for an ideal root sealer material that is required to be tacky when mixed , and provide a hermetic seal, Also it should be radiopaque so that it can be visualized in the radiographs, offers slow setting and no shrinkage, non-staining to tooth structure, bacteriostatic, or at least does not encourage bacterial growth, Tissue tolerant and nonirritating to periapical tissue, Insoluble in tissue fluids and soluble in a common solvent if it is necessary to remove the root canal filling.

Different types of root canal sealers are available, Epoxy resin-based sealers were introduced into endodontics field, At present AH Plus is considered the gold standard in endodontic

research , This epoxy resin–based sealer has excellent physicochemical biological[4] antimicrobial[5] properties.

Mineral trioxide aggregate (MTA) is a calcium silicate based hydraulic cement [6]. MTA has gained wide acceptance in different fields of dentistry since its introduction in the 1990s [7] going back to its good physical properties and biocompatibility. The superior properties of MTA such as good biocompatibility, bioactivity, and osteoconductivity encouraged worldwide scientists to develop other MTA-based endodontic sealers. Recently, new calcium silicate–based sealers such as MTA Fillapex and Endosequence BC sealer have been introduced and received an attention because of its favorable physical and biological properties.

Root canal sealers may become exposed to body fluids, mainly blood, through the apical foramen or accessory canals[8]. While early exposure to body fluids can critically impair the sealer's setting process , late exposure may also alter the sealer's physical properties and impair its sealing ability [9], Of particular concern in regards to exposure to body fluids are esterases which are group of enzymes that exist in blood, saliva and bacteria, Human blood contains cholesterol esterase (CE) and pseudocholine esterase (PCE). Saliva and bacteria exert CE-like and PCE hydrolase activities [10] .As well, specific bacterial

esterase from cariogenic bacteria acts concurrently with salivary or simulated salivary degradative activities to enhance biodegradation of polymers, including methacrylate resins used in dentistry , decreasing their bond to dentine and increasing bacterial biofilm proliferation within resin-dentine interfaces, Some of these bacteria that were isolated from biofilms and sulfur granules of refractory periapical lesions (*Pseudomonas aeruginosa, Enterococcus faecalis* and various *Actinomyces strains*) have the potential to secrete lipases. Most enzymes involved in substrate degradation are inducible enzymes, This means that lipases may only be secreted in large quantities by these microbes if the specific substrate is present in the direct surrounding as a carbon or nutrient source[11].

Lingual lipase is a member of a family of digestive enzymes called triacylglycerol [12]it exhibits maximal ester cleaving activity for water-insoluble polyesters. Lipases released by either bacteria, yeast or fungi can cleave the ester bonds where microbes utilize the breakdown products to produce carbon and energy.

Rare information present about the degradability of MTA Fillapex, calcium silicate based Endosequence BC, or expoxy resin based AH plus by salivary lipase. Therefore, this study was

conducted to assess the susceptibility of these sealers to the enzymatic hydrolysis by lipase enzyme found in saliva.

REVIEW OF LITERATURE

Endodontic sealers are used in obturation of root canal systems to achieve a fluid-tight or hermetic seal throughout the canal including the apical foramen and canal irregularities and minor discrepancies between the dentinal wall of the root canal and the core filling material [13], Therefore, sealers help to prevent leakage, reduce the possibility of residual bacteria from the canal to invade the periapical tissues, and resolve the periapical lesion[14].

Several endodontic sealers are available. They are classified into five main groups according to their chemical composition: zinc-oxide–eugenol sealers, sealers containing calcium hydroxide, resin-based sealers, silicone-based sealers, and glass–ionomer-based sealers [15].

I –Chronological Evolution of endodontic sealers:

Zinc-oxide-eugenol materials have dominated the past 70 to 80 years, zinc oxide eugenol sealers have a history of successful use over an extended period of time, early zinc oxide eugenol sealer was introduced by Rickert and Dixon marketed as Rickert's sealer and Kerr pulp canal sealer, this powder liquid sealer contained