بِسْمِ اللهِ الرَّحْمَنِ الرَّحِيمِ

" اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ (١) خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ (٢) اقْرَأْ وَرَبُّكَ الْأَكْرَمُ (٣) الَّذِي عَلَّمَ بِالْقَلَمِ (٤) عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ (٥) "

سورة العلق

Bond Strength and Solubility of New Bioceramic Retrograde Filling Material

(An In-Vitro Study)

Thesis submitted to the Endodontic Department,
Faculty of Dentistry, Ain Shams University

For
Partial fulfillment of requirements of the Master Degree in Endodontics

By

Tariq Yehia Abdelrahman

B.D.S. 2008
Faculty of Dentistry, Ain Shams University

2013

Supervisors

Prof. Dr. Hossam Mohamed Essam El Din Tawfik

Professor of Endodontics
Dean of Faculty of Dentistry, Ain Shams University

Assist. Prof. Dr. Kariem Mostafa Ibrahim El Batouty

Assistant Professor of Endodontics
Faculty of Dentistry, Ain Shams University

Dedication

To my Caring Father

To my Lovely Mother

To my Adorable Fiancé

Acknowledgement

I would like to express my deep gratitude to ***Professor Doctor Hossam Tawfik,*** *Professor of Endodontics, Dean of Faculty of Dentistry, Ain Shams University for his kind guidance, sincerity, extraordinary supervision and unlimited support and help throughout my academic and clinical work.*

I would like to thank ***Assistant Professor Doctor Kariem El-Batouty,*** *Assistant Professor of Endodontics, Faculty of Dentistry, Ain Shams University for his excellent advice, valuable stimulating guidance and help during this study.*

I would like to thank ***all members of Endodontic department,*** *Faculty of Dentistry, Ain Shams University for their valuable help and cooperation.*

List of Contents

List of Figures

List of Tables

Introduction

The main goal of endodontic treatment is to eliminate infection within the root canal system and to avoid its recontamination. When nonsurgical root canal treatment fails or is unadvisable, surgical root canal treatment is often carried out to save teeth. This procedure routinely consists of root-end exposure of the involved apex, resection of its apical end, a retrofilling preparation and the placement of a root-end filling material to seal the root canal system. Ideal material for sealing root-end cavities should be able to prevent leakage, in addition to its dimensional stability, superior adhesion to root canal dentin, resistance to moisture, resistance to resorption, and biocompatibility.

Mineral trioxide aggregate (MTA) was introduced in 1993 as a possible root-end filling material or for repair of lateral root perforations. ProRoot MTA is the commercial version of MTA introduced in 1998 that consists of 75% Portland cement, 20% bismuth oxide and 5% dehydrated calcium sulphate. A white MTA was developed in 2002. This version improved esthetics and differs from the grey MTA (GMTA) in that it has a significant reduction in the proportion of the tetracalcium aluminoferrite component.

MTA exhibits poor handling characteristics and long setting time. Several formulations have been introduced to overcome these shortcomings. MTA-Angelus is composed of 80% Portland cement and 20% bisthmus oxide with the removal of calcium sulphate to decrease setting time. Recently, Bioaggregate (BA), a calcium silicate–based material, has been introduced. Most of the constituents are similar to those in white MTA, differing mostly by being aluminium free. It is composed of tricalcium silicate (C_3S), dicalcium silicate (C_2S), calcium phosphate monobasic, and amorphous silicon dioxide with the addition of tantalum pentoxide, instead of bisthmus oxide in MTA, for radiopacity. Monobasic calcium phosphate in BA adjusts its hydrate setting. Injectable root canal repair filling material (iRoot BP) is a BA based, convenient ready-to-use white hydraulic premixed injectable paste developed for permanent root canal repair and filling applications.

Endodontic materials, particularly root-end filling materials, are exposed to tissue fluids once set. The solubility of these materials in use is important. Root-end filling materials should both be able to prevent bacterial leakage and remain

in place under dislodging forces, such as functional pressures on the teeth or the application of other materials over the first obturation. Therefore, the push-out strength of root-end fillings is an important factor.

Review of Literature

Most endodontic failures occur as a result of leakage of irritants into the periapical tissues. The success of retrograde filling material is greatly influenced by its ability to seal the pathways of communication between the root canal system and its surrounding tissues. It should be insoluble in tissue fluids. It should remain in place and resist dislodging forces exerted upon by the postoperative oedema.

Solubility and physical properties of materials under investigation:-

Torabinejad et al. [(1)] conducted a study to compare the solubility of MTA with those of amalgam, Super-EBA, and Intermediate Restorative Material (IRM). The degree of solubility of the materials was assessed according to modified American Dental Association specifications. The results showed that except for IRM, none of the materials tested showed any solubility under the conditions of this study.

Fridland et al. [(2)] tested MTA solubility and porosity with different water-to-powder ratios. This study also determined the chemical composition of the salts dissolved by MTA. Four sets of specimens using the following water-to-powder