بسم الله الرحمن الرحيم

قالوا سبحانك لا علم لنا إلا
ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

سوره البقره آيه (٣٢)

In-Vitro Study of the Sealing Ability of Mineral Trioxide Aggregate versus Portland Cement When Used as an Apical Plug

A thesis submitted to the Faculty of Oral and Dental Medicine, Cairo University, in partial fulfillment of the requirements of the Master Degree in Endodontics

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Dedication

I dedicate this work to my dear father for his always encouraging and pushing me in the way of success.

To my lovely mother with her endless love and sacrifices.

To my brother and sisters.

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Introduction

Introduction

The main challenge in performing root canal treatment in teeth with wide-open apices is to obtain an optimal apical seal. The wide foramen requires a large volume of filling material that may extrude from the root canal into the periapical tissues creating foreign body responses and compromising the apical seal.

Apexification is defined as a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp. Several procedures utilizing different materials have been recommended to induce root-end barrier formation. Apexification with calcium hydroxide is the most commonly advocated therapy for immature teeth with non vital pulp and the healing rate is high. However, a number of disadvantages are apparent e.g. the length of the treatment, the risk of fracturing the root during and after the apexification treatment and the fragility and porosity of the calcified apical barrier, resulting in possible apical extrusion of gutta-percha during treatment.

An alternative for calcium hydroxide apexification is a single-step technique using an artificial apical barrier; the one-visit apexification has been described as the non-surgical compaction of a biocompatible material into the apical end of the root canal, thus, creating an apical stop and enabling immediate filling of the root canal.

Mineral trioxide aggregate (MTA) has been suggested for one-visit apexification. It has been described as a good alternative to the $Ca(OH)_2$ apexification procedure due to its favorable properties such as biocompatibility, good canal sealing ability and the ability to promote periradicular tissue regeneration; when MTA is applied as an apical plug, favored apexification and periapical healing noticed.

However, the high cost of MTA has urged researcher to find cheaper substitutes. Portland cement has been found by several authors to have similar properties to MTA e.g. biocompatibility and sealing ability, which could make it a less expensive alternative to MTA in different clinical applications e.g. one-visit apexification. Thus the purpose of the present study was to compare the sealing ability of Mineral Trioxide Aggregate (MTA) and Portland cement when used as an apical plug in an artificial model of immature teeth.

Review of Literature

Review of Literature

▪ Mineral Trioxide Aggregate

Mineral Trioxide Aggregate (MTA) was introduced to endodontics by Torabinejad et al in. 1993 to address shortcomings of routinely-used root-end filling materials. The principle components in MTA cement are tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide (**Abedi et al. 1995**). MTA is a powder consisting of hydrophilic particles that set in the presence of moisture (**Torbinejad et al. 1995a**). Hydration of the powder results in a colloidal gel that solidifies to a hard structure. Characteristics of set MTA depend on the size of the particles, the water to powder ratio, temperature and humidity at the application site and the amount of air trapped in the mixture (**Torbinejad et al. 1993**).

Mineral Trioxide Aggregate was first marketed as ProRoot MTA by Dentsply Tulsa Dental (Tulsa, OK). The Brazilian company, Angelus Dental Solutions (Odonto-Logika, Ind. Prod. Odont. Ltda, Londrina, Parana, Brazil) selected a Portland cement and added bismuth oxide to provide radiopacity similar to that of ProRoot MTA. This product is commercially available as MTA-Angelus (**Duarte et al. 2003**).

Several studies of MTA have demonstrated that the material possesses many ideal Properties. The sealing ability of MTA in root-end fillings was found to be superior to that of amalgam, IRM and Super-EBA using both dye (**Torbinejad et al. 1994**) and bacterial (**Torbinejad et al. 1995a**) leakage methods. When MTA was used as a root-end filling material in monkeys, results revealed no periradicular inflammation, new bone formation and the growth of cementum directly against the MTA material (**Torbinejad et al. 1997**).