

Chapter 1

INTRODUCTION

1.1 Background of the study

The ideal of endodontic treatment depends integrally on root canal treatment stages: eliminate microbial, cleaning and shaping, and dense obturation of the root canal system (Singh *et al.*, 2015). In specific, three-dimensional obturation is an crucial key of the endodontic success which suggests obliteration of the root canal space with inert filling material, production of a hermetic seal in order to prevent the reinfection and passage of bacteria to periapical tissues (Anantula and Ganta, 2011). According to Ingle and colleagues, they indicated that 58% of failed endodontic treatment is due to incomplete obturation, which means no obturation done or inadequate (Ingle, Bakland and Baumgartner, 2008).

In order to achieve a three dimensional obturation in endodontic treatment, sealers play a major role in filling the irregularities of the root canal system. It provided lubricating or to attach the gutta-percha to the root canal walls because gutta-percha alone does not provide bond with dentinal walls (Zhang *et al.*, 2009, Sakr *et al.*, 2017). Various materials used as sealers have been tested from time to time to evaluate their sealing abilities to fulfill the objective of obtaining a hermetic apical seal with varying physical properties. Traditionally, zinc-oxide eugenol sealers have been replaced with epoxy resin based which considered as a gold standard nowadays or silicon based or bioceramic based (Ballullaya *et al.*, 2017).

In particular, AH 26 (Densply, Germany) is introduced as an epoxy-resin based with excellent chemical, physical properties, sealing capacity and tissue compatibility. These characteristics are responsible for the superiority of this sealer over the other epoxy resin based sealers. It included bismuth oxide, methenamine in powder and epoxy resin in resin.

A new silicone-based sealer (GuttaFlow 2, Coltene, Germany) has been introduced as one of various roots filling material. According to the manufacture,

it is the first flowable, non-heated filling system for root canals, combining sealer and gutta-percha in one product. It consists of a polydimethylsiloxane matrix, is eugenol free, and has high biocompatibility. GuttaFlow 2 does not shrink, expands slightly and flows with the matrix into lateral canals and dentinal tubules. Furthermore, it contains micro-silver that provides optimum protection against re-infection of root canal.

Bioceramic-based root canal sealers are reported as a best achieve hermetic seal (Sakr *et al*, 2017). There are two main advantages associated with the use of bioceramic materials in components of root canal sealers. Firstly, their biocompatibility prevents rejection by the surrounding tissues (Koch and Brave, 2009). Secondly, bioceramic materials contain calcium phosphate which enhances the setting properties and results in a deposition of apatite crystalline structure similar to tooth and bone matrix (Ginebra *et al*, 1997), thereby improving sealer-to-root dentin bonding (AL-Haddad and Aziz, 2016).

There are various types of bioceramic-based sealers available on the market, but according to the major constituents, they were classified into 3 types (AL-Haddad and Aziz, 2016) including calcium silicate-based sealer, Mineral Trioxide Aggressive (MTA) based sealer and calcium phosphate based sealer. However, calcium phosphate types did not show many effective effects when used as root canal sealers (Krell and Madison, 1985). The components of 2 other types of bioceramic based sealer are described in Table 1. As the manufacturer described, MTA Fillapex exhibited high radiopacity, slow setting time, sufficient working time, perfect flow to allow the filling of accessory canals, low solubility, effortless removal if re-entry is required, and easy handling with small auto mixing tips (Altan *et al*, 2018). Endosequence BC is available in premixed calibrated syringes with intra-canal tips (Sakr *et al*, 2017). As a hydrophilic sealer or dispersed in non-aqueous but water miscible, it utilizes moisture within the canal to harden for complete the setting reaction and it does not shrink on setting.

Table 1.1: Two types of bioceramic based sealers.

| Type | Brand name | Manufacturer | Components |
|--------------------------------|-----------------|----------------------------------|--|
| Calcium silicate- based sealer | Endosequence BC | Brasseler USA, Savannah, GA, USA | Zirconium oxide, calcium silicates, calcium phosphate, calcium hydroxide, filler, and thickening agents |
| MTA- based sealer | MTA Fillapex | Angelus, Londrina, PR, Brazil | Salicylate resin, diluting resin, natural resin, bismuth trioxide, nanoparticulate silica, MTA, and pigments |

In endodontics, microleakage is one of the significant causes for endodontic failure, which occurs due to poor contacts between the gutta-percha and the sealer, the sealer and the dentin, or through voids within the sealer (Huang *et al*, 2018). Thus, the most prevalent technique to evaluate the sealing ability of root canal sealers is the use of blue methylene dye (Lone *et al*, 2018). Because of its molecular size is similar to bacteria allow better penetration and diffuse more deeply along root canal filling (Steward, 1958). Moreover, it is easy to use, pH manipulation and good availability (Tanomaru-Filho *et al*, 2011, and Figdor 2002). The dye penetration test is based on the linear measurement of the dye penetration between the root filling and the canal wall.

Therefore, in this study, the sealing ability of four root canal sealers though the apical microleakage testing of 4 different root canal sealers AH 26 (Densply, Germany), MTA Fillapex (Angelus, Brazil), Gutta Flow 2 (Coltene, Germany) and Endosequence BC (Brasseler, USA) will be evaluated. The study was carries out with single rooted teeth, obturating with master cone technique using dye penetration under microscope 4X magnification.

1.2 Problem

Is there any difference between the apical microleakage of four root canal sealers.

1.3 Aim of the study

General purpose: Evaluate and compare the apical microleakage value of four root canal sealers: AH 26 (Densply, Germany), Gutta Flow 2 (Coltene, Germany), MTA Fillapex (Angelus, Brazil), Endosequence BC (Brasseler, USA).

Specific purpose:

- Evaluate the apical microleakage of AH 26
- Evaluate the apical microleakage of Gutta Flow 2
- Evaluate the apical microleakage of MTA Fillapex
- Evaluate the apical microleakage of Endosequence BC

1.4 Hypothesis

Null hypothesis: there are no significant differences in the apical microleakage between all the sealer groups tested.

Alternative hypothesis: there are remarkable differences in the apical microleakage between all sealer groups tested in which BC has the least microleakage value.