Comparative Study of the Efficacy of Two Different Obturation Materials on the Filling of Artificial Lateral Canals (An In-Vitro Study)

Thesis

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Dedication

To my parents for their endless love and Sacrifices

To my beloved supporting husband

To my supportive brother and sister

To my precious Pearl "my son"

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1- Introduction

The final objective of endodontic procedure is the three dimensional sealing of the complex root canal system, including the main canal and all ramifications. The existence of numerous lateral and accessory canals often complicates the disease process and the treatment, where they act as pathways for transmission of infection from and to the periodontal tissue.

The filling materials which are most often applied include gutta-percha and an endodontic sealer. Different methods for root canal obturation are employed which involve cold and hot compaction techniques. Among the heat softening procedures is the vertical compaction technique, which offers a better three dimensional obturation of the root canal space, as well as filling of lateral canals.

Endodontic sealers that are available commercially are classified according to their chemical composition. AH plus* is a sealer based on epoxy resin, which according to the manufacturer has an excellent sealing property without the release of formaldehyde; it has also a reduced solubility, improved flow property and micro-retention to root dentin.

Resilon with Epiphany sealer** is an innovative resin obturation system compromising core and sealer. The sealer is a dual-curable methacrylate resin sealer with a self-etching primer, while the core material is a new thermoplastic filled polyester, having better radiopacity than gutta-percha. According to manufacturer it resists leakage significantly better than gutta-percha obturations, with the added benefit of strengthening the root and improved flow property. It can be compacted laterally and vertically, with softening temperature around 70˚C to 80˚C.

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* **AH-Plus, De Trey. Dentsply, Konstanz, Germany.**
** **Pentron, Wallingford, CT.**

The present study was thus developed to evaluate the capability of using warm vertical compaction of Resilon system (core and sealer) compared to gutta-percha and AH-Plus sealer in filling of artificial lateral canals.

2- Review of literature

The review of literature will be divided into:

2.1- Complex root canal morphology and incidence of lateral canals.

2.3- Efficacy of warm vertical compaction technique in achieving three dimensional obturation.

2.3- Efficacy of different root canal sealers in achieving three dimensional obturation.

2.1- Complex root canal morphology and incidence of lateral canals:

The study of the root canal system reveals its inherently complex and irregular anatomy. The presence of lateral and accessory canals can harbor debris despite meticulous instrumentation and the use of different irrigating solutions. Also, they can act as portal of communications with the periodontal tissue causing transmission of pulpal infection and an endoperio problem.

On studying the topography of root apices and accessory foramina, and the number of root canals in maxillary and mandibular anterior teeth**, Green (1956)**[1] found that there were three types of apex configuration; infundibular, tapered, and deflected. More accessory foramina were noted in the infundibular type. Percentage of accessory canals ranged between 10% and 12%. Mean diameter of major foramina were 0.4mm and 0.3mm of maxillary and mandibular teeth, respectively. While that of accessory foramina of all the studied teeth was 0.2mm. Distance of foramina from their apex ranged from 0.2mm to 0.3mm, while that for all accessory foramina ranged from 1 to 2.2mm. Finally all maxillary anterior teeth contained single canals, while 20% of

mandibular incisors contained two major canals, the majority had two foramina exiting from the apex and the remainder had one major foramen.

The incidence of patent lateral or accessory canals in the coronal and middle third of maxillary and mandibular molars roots were determined by **Lowman et al (1973)[2].** They used a radiographic dye which was drawn through the root canal system under vaccum and the teeth were radiographed at various angles. Patent lateral or accessory canals existed in 59% of the molars. The result suggested that lesions that involved the furcation region of multirooted teeth might have an endodontic as well as a periodontal origin which should be considered in the treatment regimen.

Vertucci et al (1974)[3] investigated and determined the incidence of furcation accessory canals in human mandibular first molars. The teeth were decalcified, and injected with dye, then rendered clear. Lateral canals were found in 46% in the furcation region occurring in three distinct patterns. Either a single lateral canal (furcation canal), extending from the floor of the pulp chamber to the furcation in 13%, or lateral canal extended from a major root canal to the furcation region in 23%, or finally both lateral and furcation canals extending in10%. The greater the distance of the pulp chamber floor from the furcation region the higher was the incidence of these canals. A direct relation-ship between pulpal and periodontal pathosis was documented, thus the channels of communication between the pulp and periodontal ligament had to be considered in the treatment of pulp and periodontal pathosis.

Using a scanning electron microscope on human teeth, **Koenigs et al (1974)[4]** found a large number of accessory canals and a greater canal diameter in the maxillary molars compared to mandibular molars. Also the characteristics of

accessory foramina implied a direct and vital endodontal and periodontal involvement. Thus, the endodontist was advised to seal the pulpal floor of molars as well as the apical portion of the root.

Hession (1977)[5] examined the pulpal space morphology of extracted human teeth. Teeth were cleared, infused with a radiopaque material under vaccum, and examined with a magnifying lens after radiographing. Maxillary incisors and canines had high incidence of lateral canals, while the apical ramifications were rare and only one main canal existed. Maxillary premolars had fewer lateral canals than maxillary incisors, while apical ramifications were greater and mainly two main canals and two roots were present. Of all maxillary molars examined only one (a third molar) contained a lateral canal, some with apical ramifications and the number of main canals varied from two to five. In mandibular incisors and canines only one lateral canal was recorded, and five canal systems showed apical ramifications. In mandibular premolars no lateral canals were present and twelve specimens showed apical ramifications. Only one root with one main canal existed in second premolars, while in first premolars two and three canals were present. Few mandibular molars had lateral canals with fewer apical ramifications than in maxillary molars. Also the role of endodontist in sealing the floor of pulp chamber to avoid problems from accessory canals had to be considered.

The prevalence, location, and patency of accessory canals in the furcation region of one hundred and two extracted permanent molars were determined by **Gutmann (1978)**[6]. It was shown that accessory canals were demonstrated in the furcation region in 28.4% of the total samples and 29.4% and 27.4% in mandibular and maxillary molars, respectively. Of the total samples 25.5% exhibited canals on the lateral root surface. Communication