Ex-vivo Apical Seal Comparison of Root Canal Obturation Using MTA Fillapex Versus MTA Orthograde

Original Article

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Abstract

Introduction: Mineral trioxide aggregate (MTA) as an alternative material to gutta-percha for obturation of root canal in special cases has several drawbacks. The purpose of this study was to compare the apical sealing ability of a new MTA-based sealer versus MTA.

Materials and Methods: A total of 36 canals of extracted maxillary central incisors were instrumented and randomly divided into 3 experimental groups (n=10) and two negative and positive control groups (n=3). Lateral compaction technique was performed using AH26 sealer (group 1 or control), and MTA Fillapex (group 2). The canals in group 3 were filled using vertical compaction of MTA alone. Sealing ability was evaluated using dye leakage penetration method. Data was analyzed by one way ANOVA and LSD (Least Significant Difference) test.

Results: The observed leakage in groups 2 and 3 which were filled with MTA Fillapex and MTA orthograde was significantly different from the control group which were filled with AH26 sealer (P=0.015, P=0.001). There was no significant difference between group 2 and 3 which was filled with MTA Fillapex and MTA orthograde (P=0.205).

Conclusion: Within the limitation of this in vitro study, there was no significant difference between apical sealing ability of MTA Fillapex and MTA orthograde.

Key words: •Canal Scaler •Mineral Trioxide Aggregate •Obturation, Root Canal

Introduction

Based on the available data, mineral trioxide aggregate (MTA) can be considered as an alternative material to gutta-percha for obturation of special cases.[1-5] The main drawbacks of MTA as a root canal filling material include discoloration potential, long setting time, high cost, difficult handling, difficult controlling working length, the chance of producing voids, and the absence of a known solvent for this material[6-11]. Recently, a new MTA based sealer (MTA Fillapex, Angelus, Brazil) has been introduced. They claimed that its composition provides long term sealing capacity, high radiopacity and promotes the deposition of hard tissue at the root apex and perforation sites; also low expansion during setting, low solubility in contact with tissue fluids and excellent viscosity for insertion. Furthermore, this eugenol-free material neither stain tooth nor interfere with the setting of resin cements.

A literature search failed to reveal any published study regarding the sealing properties of the new product. Thus, the aim of this in-vitro study was to compare the apical sealing ability of obturation with MTA Fillapex sealer versus MTA orthograde and AH26 sealer.

Materials and Methods

Thirty-six recently extracted human permanent central incisor teeth with single canals and mature apexes were used in this in-vitro study. To eliminate root length as a variable, dental crowns were sectioned at the cementoenamel junction, so that the remaining roots were about 15±1 mm. A #10 K-file (Dentsply, Maillefer) was inserted into the canal until it was just penetrated the foramen. Working length was recorded 1mm short from this level. All root canals were cleaned and shaped with K-files using Step-back technique to #40 file. Flaring was performed by Gates Glidden #1 through #3. Irrigation with 2.5 ml of 2.5% Sodium hypochlorite solution was performed using a 22-gauge needle between each file.

Thirty of roots were randomly divided into three experimental groups (n=10) according to the material used for obturation: AH26 (Dentsply Detrey, Zurich, Switzerland), MTA Fillapex (Angelus, Brazil), and white MTA alone (Angelus, Brazil). The remaining six teeth were used for negative and positive leakage control of the three experimental groups.

Lateral compaction method was used with AH26 (group 1 or control group) and MTA Fillapex sealer (group 2). A no. 40 gutta-percha point (Gapadent, Germany) with tug-back was coated with sealer and gently seated at the working length. The B size finger spreader (Maillefer, Swiss) was introduced within 2 mm of the working length. Condensation was completed using accessory cones until they could not be introduced more than 3 mm into the canal. Once the excess was cut with a flame-heated hand plugger, gutta-percha was condensed.

In group 3 canals were filled with white MTA. Every 1 spoon of MTA was mixed with 1 drop of distilled water for 30 seconds according to manufacture instruction. The homogenous mixture was placed into the canal using MTA syringe (Dentsply, Maillefer). Condensation was performed using pluggers (VDW, Germany). The quality of obturation was tested for each segment. All preparations were completed by a single operator.

In negative leakage control group, two teeth were obturated by lateral compaction of gutta-percha using AH26 and MTA Fillapex and the other by vertical compaction method of MTA alone. Their orifices were filled with wax and the total root surfaces from orifice to the apex were covered by two layers of nail polish. The

three positive leakage control teeth were not obturated. Their root surfaces were not covered with nail polish but the orifices were filled with wax in order to prevent from coronal leakage.

In experimental groups, all root surfaces except for 2mm apically were covered with two layers of nail polish, so that dye could penetrate only from apical. After keeping the apical part of all roots in Pelikan ink(Pelikan, Germany) for 7 days, the roots were washed with water and were left to dry for 24 hrs. Nail polish was then removed by Acetone.

The roots were then sectioned longitudinally in a buccolingual direction. Apical microleakage was assessed blindly by two examiners measuring the most extensive linear dye penetration using a stereomicroscope (Olympus, Tokyo, Japan) and a digital caliper to accurate 0.01mm. The mean score was calculated. Finally collected data was compared using analysis of variance (ANOVA) and LSD (Least Significant Difference) at a significant level of $P<0.05$.

Results

Two teeth in group 3 were fractured during section. The negative leakage control demonstrated no dye penetration while the positive leakage control showed dye penetration along the entire root canal.

The mean linear dye leakage for all groups is shown in Table-1. Observed leakage in groups 2 and 3 which were filled with MTA Fillapex and MTA orthograde were significantly different from the control group which were filled with AH26 sealer ($P=0.015$, $P=0.001$). There was no significant difference between groups 2 and 3 which were filled with MTA Fillapex and MTA orthograde ($P= 0.205$).

Discussion

Longitudinal sectioning of the roots and linear measurement of Pelikan ink penetration were used in this study to measure apical leakage. Previously published reports showed that MTA is a bioactive material that produces calcium hydroxide[9, 10], which is released in solution [11, 12]. Therefore, we used Pelikan ink in this study, because this dye had not been shown to be discolored by calcium hydroxide[13, 14].

Table 1: Mean dye leakage (mm) in all groups

Groups	N	Mean	D
AH26 sealer	10	1.39	0.83
MTA Fillapex sealer	10	2.31	0.43
MTA	8	2.79	1.02

In this study, extracted central teeth with large and straight canals were selected and were instrumented to # 40 file. Therefore, variables such as anatomical variation, canal size and the diameter of the apical foramen which can affect the apical leakage were minimized. As it has been reported that longer roots have a potential for greater leakage, roots with 15±1 mm long were used.

In order to eliminate the operator variable, all preparations were completed by a single operator. Two examiners measured the dye leakage levels in order to eliminate or reduce possible bias and evaluator error.

A simple irrigation method (without chelating agents) was used to avoid the affect of the calcium-chelating property of EDTA on apical seal. EDTA has been shown to disrupt the hydration of MTA, resulting in decreased hardness and less than optimal biocompatibility[15].

According to the results of the present study, AH26 sealer showed significantly less apical seal than MTA Fillapex sealer and MTA orthograde. This is confirmed by previously published reports[16, 17]. They all reported that AH26 sealer provides very good sealing

and optimal condition for all obturation methods.

Our results showed no significant difference in the mean apical dye penetration between groups which were filled with MTA Fillapex sealer and MTA orthograde, however filling the root canals using MTA Fillapex was easier than MTA orthograde.

Conclusion

Within the limitation of this in vitro study there was no significant difference between apical sealing ability of MTA Fillapex and MTA orthograde.

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