

## Sealing ability of different Root-End filling Materials

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### Abstract:

This study evaluated the ability of mineral trioxide aggregate (MTA) to seal the root end effectively. Forty-five single rooted, extracted human teeth were cleaned & shaped using a step-back technique. The root-ends were resected, & a 3-mm deep root-end preparation was made. The teeth were random divided into three groups of 15 & filled with dental amalgam, super-EBA, or MTA, following immersion in 1% methylene blue dye for 72 hours, the roots were sectioned & the depth of dye penetration was evaluated by a stereomicroscope at X-10 magnification. The sealing effectiveness of the retrograde filling materials used in this study was determined by their ability to inhibit dye penetration. MTA cement provides a better seal than amalgam & EBA cement when used as retrograde filling, but the extrapolation of this result into a clinical practice may be questionable.

### Key words:

Mineral trioxide aggregate, Root-End filling materials.

### Introduction:

Apicectomy followed by retrograde filling is a well-established procedure to treat teeth with persistent periapical infections & teeth in which conventional root canal therapy has failed. According to Harty et al<sup>(1)</sup>. Single most important factor in determining the success of an apicoectomy is efficiency of the apical seal. The apical seal inhibits leakage of residual irritants from the root canal in to the periradicular tissues.

The ideal root-end filling material should be easy to manipulate, radiopaque, dimensionally stable, non-absorbable, not affected by the presence of moisture. It should also adhere to the preparation walls & the root canal system, be non-toxic, well tolerated by periapical tissue & promote healing<sup>(2)</sup>. There is plethora of studies published concerning the sealing ability & biocompatibility of retrograde filling materials<sup>(3)</sup>.

Many materials have been suggested as root-end filling materials include reinforced zinc oxide-eugenol

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(Cavit), gutta-percha, zinc oxid eugenol, composite resin & gold foil<sup>(4)</sup>. Amalgam has proved to be successful material for retrograde filling, despite or perhaps because of its microleakage & expansion on setting<sup>(5)</sup>. Recently, an experimental substance, mineral trioxide aggregate (MTA), has been suggested as a potential root end filling material. In a series of in vitro studies, Torabinejad et al<sup>(6)</sup>. Evaluated the sealing ability of MTA, Compared with commonly used root-end filling materials. MTA was recently reported to seal off all the pathways of communication between the root canal system and the external surface of the tooth. The principal compounds present in the MTA are tricalcium silicate, tricalcium aluminate, tricalcium oxide & silicate oxide. In addition, there are a few other mineral oxides which are responsible for the chemical & physical properties of the aggregate on mixing the aggregate with water, hydration of the powder results in a colloidal gel which solidifies to a hard structure in less than 4 hours<sup>(7)</sup>. The purpose of this investigation was to assess the effectiveness of MTA in providing an apical seal in comparison with amalgam & super EBA cement by using a dye penetration method.

## Materials & Method:

Forty-five freshly extracted, humans, single-rooted teeth were collected & stored in saline. The clinical

crowns were removed with a diamond wheel in a hand piece. The working length was determined by subtracting 0.5mm from the length which # 15 K file appeared at the apical foramen. The apical portion of the root canal was prepared to a # 40 K file & the rest of the canal was flared using a conventional step-back technique. NaOCL 2.5% was used as the irrigant. The cleaned & shaped canals were dried with paper points & obturated with laterally condensed gutta-percha & dorifil pulp canal sealer. The access opening was sealed with cavit (dorident Co.). Apical root resections were performed on all roots by removing 3mm of each apex at 90 degrees to the long axis of the tooth with a #701 fissure bur in a high speed hand piece with water coolant. (Fig.1)

A 3mm deep root end cavity was prepared with # 21 stainless steel round burs using a slow speed handpiece. This preparation standardized as the diameter of the head of the round bur is 2mm & depth was determined by placing a plastic stopper on the shank of the bur at 3mm from the tip of the bur, the apical preparation was irrigated with normal saline, and then dried with paper point. The teeth were assigned randomly into three groups of 15 roots each. Group 1 was retro filled with amalgam (vivalloy, Vivadent, Co.). Group 2 with super EBA (Harry J Bosworth Co.) & Group 3 with MTA (proRoot Dentsply Co.). This was use with water

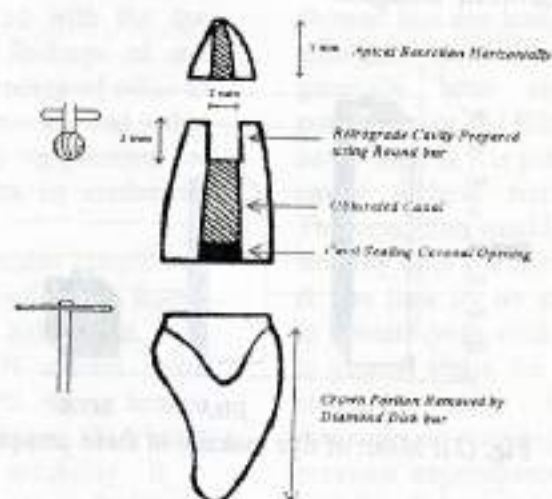


Fig. 1: Diagram of cutting procedure.

to a putty consistency using a powder to water ratio of 3:1. Each of the materials was condensed into the preparation using small pluggers. Two coats of nail polish were applied to the whole surface of the total length of each root except the tip of the root where the retrograde filling found.

All roots were stored in 1% solution of methylene blue for 72 then the roots were rinsed under tap water & the nail polish was removed. The teeth were then sectioned bucco-lingually using a tapered fissure bur in a high-speed hand piece to nearly the depth of the canal. They were then fractured with the end of a large spoon excavator. The depth of dye penetration was evaluated by a stereomicroscope at a magnification as X- 10. Statistical

analysis of the results was performed using ANOVA & t-test to evaluate the significance of difference between the groups.

## Results:

The descriptive statistics, which represent the mean dye leakage (Fig. 2). The statistical analysis of the data by one way - ANOVA showed a statistical significant difference between these three groups. After ANOVA by a t-test was done to identify where the significance did occur (Table 1).

The result showed there was high significant difference between the amalgam and MTA cement, and also highly significant different between MTA and super EBA.

Moreover, there was a significant difference between amalgam group and super EBA group.

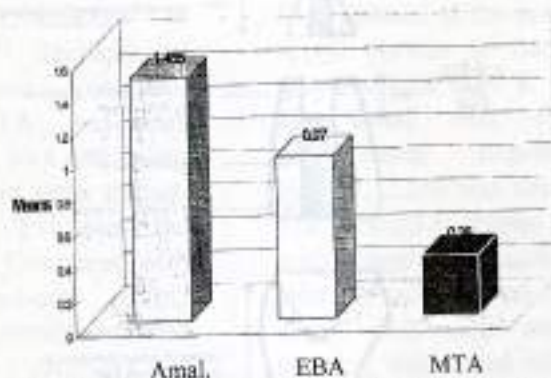


Fig. (2): Mean of dye leakage in three groups.

Table (1): comparing between groups using t-test.

Groups	t-test	Sig <sup>*</sup>
Group 1 & Group 2	6.538	HS
Group 1 & Group 3	15.447	HS
Group 2 & Group 3	8.033	HS

## Discussion:

The purpose of placing a root end filling material is to provide an apical seal which inhibits the leakage of irritants from the root canal system into the periradicular tissues.

Amalgam was the material of choice in our clinic until 1985<sup>(8)</sup>. Although amalgam generally has been

the most commonly used root end filling material, it has a number of disadvantages such as scattering of amalgam particles into the surrounding tissues, corrosion, & setting properties which allow dimensional changes & fluid leakage. The leakage data obtained in this study agreed with the findings of

Gerhard & Wagner<sup>(9)</sup> and Chang et al.<sup>(10)</sup> & showed that all of the amalgam root end fillings leaked with the dye leakage scores. The findings of our study confirmed the finding of other in vitro studies which showed that amalgam without the application of cavity varnish provides an inadequate seal<sup>(11)</sup>.

Super EBA cement consists of two components, powder & liquid. Powder contains 60% zinc oxide, 34% aluminum oxide, & 6% natural resin. The liquid contains 62% ethoxy benzoic acid & 38% eugenol. Super EBA has a neutral pH & low solubility. It is radiopaque & hence facilitates radiographic checkup. EBA cement is the strongest & latest soluble of all zinc oxide eugenol formulations<sup>(12)</sup>. EBA cement is claimed to be non-resorbable when placed in vital tissue & is capable of adhering to dentin<sup>(13)</sup>. Because of the disadvantages with the use of amalgam as a root end filling material, zinc oxide-eugenol compounds such as EBA cement have been considered as alternative root end filling materials<sup>(14)</sup>. However leakage studies on the use of EBA cement as a retrograde filling material show conflicting results. Torabinejad et al,<sup>(7)</sup> using rhodamine B fluorescent dye & a confocal microscope found that MTA leaked significantly less than amalgam & super EBA. During a one-year period, using a fluid transport model, Wu et al, found glass ionomer cements & MTA leaked less than amalgam & EBA cement<sup>(15)</sup>. The

results of our study agree with these studies. Our data indicated that MTA showed less dye leakage compared with amalgam & EBA cement. It has generally been considered that a potential root end filling material should set as soon as it is placed in the root-end cavity without significant shrinkage. This condition would allow dimensional stability after the material of placement & less time for an unset material to be in contact with vital tissues. However, in general terms, the quicker a material sets the more it shrinks. This phenomenon may explain why MTA in previous experiments had significantly less dye & bacterial leakage than other materials tested as root-end filling materials<sup>(6,7)</sup>. Although the results of this study showed that the MTA has the potential of being used as a root end filling material because it provides a hermetic seal.

Dye studies, however, are the easiest method to screen new restorative materials. When a filling material does not allow penetration of small molecules, it has the potential to prevent leakage of larger substances such as bacteria & their by products. Further studies are needed to determine the suitability of this material for in vivo use.

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