ORIGINAL ARTICLE

COMPARISON OF ENDODONTIC SEALERS IN TERMS OF THEIR SEALING ABILITY

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ABSTRACT

The purpose of this in vitro study was to compare the apical sealing ability of mineral trioxide aggregate and glass ionomer cement by a dye penetration test. It was carried out at Queen Marry and Westfield College, University of London during 2010-2011 session. Time duration was 6 months.

A total of 16 samples of elephant tusk dentine (ivory) were prepared and finished for dye penetration test. Mineral trioxide aggregate and glass ionomer cement were mixed and placed in the prepared samples and were left overnight to set. Then two coats of nail varnish was applied onto the set material and allowed to dry. The samples were then suspended in methylene blue dye for 72 hours. Once dyed the samples were sectioned longitudinally and assessed microscopically with a stereomicroscope. The dye penetration in the samples was assessed for two endodontic sealers. It was found that mineral trioxide aggregate showed a mean dye penetration value of 7.625mm as compared to mean dye penetration value of glass ionomer cement 3.875mm.

Key Words: *Mineral trioxide aggregate, Glass ionomer cement, Methylene blue dye, Elephant tusk dentine, Stereomicroscope.*

INTRODUCTION

The success of endodontic treatment depends on the tight apical seal and complete removal of microbes, necrotic debris and their by-products from the root canal. A very good endodontic treatment can fail because of microleakage.[1] Microleakage occurs due to the movement of fluid with bacteria along the interface of the dentinal walls into the root canal.[2] In the past apical microleakage was considered to be the main cause of failure of endodontic treatment. However, research has shown that coronal seal is also important as that of apical seal for the success of an endodontic treatment.[2]

Different endodontic sealers like ethoxy benzoic acid (EBA), glass ionomer cement (GIC), AH 26 root canal sealer, zinc phosphate cement and mineral trioxide aggregate (MTA) were used to determine their sealing ability.[3] Among all the mentioned endodontic sealers mineral trioxide aggregate (MTA) has generated a lot of interest because of its good sealing ability.[4] In the past various methods have been used to check the sealing ability like dye penetration, fluid filtration, electrochemical and bacterial penetration method. According to Funteas et al among all these methods, dye penetration has been widely used because it is easy to perform and the molecules can easily penetrate. Hence, it gives good results to check the sealing ability of an endodontic sealer.[5] Methylene blue dye was chosen to evaluate the sealing ability by dye penetration method because it has very high sensitivity and particles are of same size as of microorganisms. Further this method allows to have cut sections showing leakage in different colours to both restoration and tooth.

The aim of the present in vitro study was to compare the apical sealing ability of mineral trioxide aggregate and glass ionomer cement by a dye penetration test.

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Received for Publication: February 13, 2015
Revision Received: February 26, 2015
Revision Approved: March 7, 2015

Fig 1: Prepared dentine samples for dye penetration test

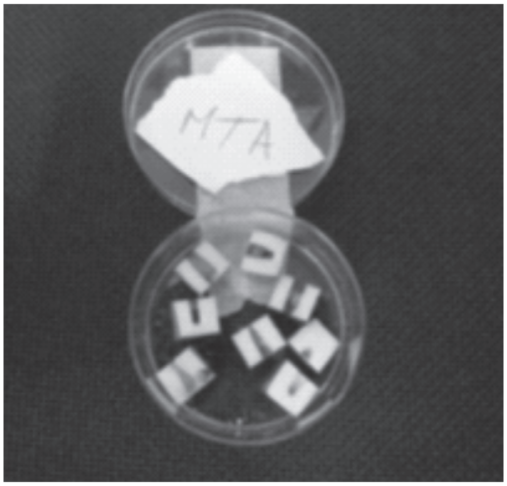

Fig 2: Longitudinally cut dentine samples of mineral trioxide aggregate

Fig 3: Longitudinally cut dentine samples of glass ionomer cement

METHODOLOGY

In the current study total of [16] elephant tusk dentine samples were cut in such a direction that the dentinal tubules were running in a horizontal direction. The purpose of dentinal tubules to be in horizontal direction was that endodontic sealer could easily penetrate into the tubules for better adhesion between the sealer and the dentine surface. The elephant tusk dentine samples were 10 mm long and 10 mm in diameter with canal of 3 mm in depth (Fig 1). The canal was made with the help of 1.6mm smooth drill bit being held in a bench lathe cut machine. During cutting of the samples of both groups copious amount of water was used on the cutter for smooth cutting of samples and to prevent overheating of the cutter. The dentine samples were kept in normal saline before proceeding for the dye penetration test. Immediately before experimentation, the canals of all the dentine samples were prepared by files and reamers of size 15 to 60 (DENCO CE 0197) under normal saline irrigation. The canals of all the dentine samples were then dried with absorbent paper points of size 40 to 60 (HTM CE 0499). The dentine samples were then divided into two groups with eight samples each.

Both Mineral trioxide aggregate (Pro-Root MTA, Dentsply) and Glass ionomer cement (3M ESPE) were mixed following the manufacturer instruction. Samples of Group 1 were filled with MTA and Group 2 were filled with GIC. The excess sealer extruding from the samples were removed, bringing the material to the same level with the samples margin.

All the samples of Group 1 and Group 2 were left in the storage container for 24 hours to allow for effective setting of the material. After 24 hours the sample surfaces were coated with a double layer of nail varnish (CEIL, Sao Paulo, SP, Brazil). Once the first coat of the nail varnish dried, a second layer of varnish was applied in a similar manner as the first layer. After varnish application the prepared samples were suspended with the aid of dental floss in methylene blue dye 1% solution for 72 hours, at a constant temperature of 37C. The samples were suspended to allow the easy penetration of the dye solution through diffusion. The samples were not immersed fully into methylene blue dye solution because in this way a dye cannot penetrate properly or it may penetrate all the way through the samples. The coats of nail varnish were then removed by scraping it off with a scalpel blade making sure not to damage the sample end section surface.

TABLE 1: DYE PENETRATION VALUES FOR GROUP 1: MINERAL TRIOXIODE AGGREGATE AND GROUP 2: GLASS IONOMER CEMENT

Sample	1	2	3	4	5	6	7	8	Mean	S.D
Sample 1 MTA	6mm	5mm	7mm	6mm	10mm	7mm	10mm	10mm	7.625mm	2.065
Sample 2 GIC	4mm	5mm	3mm	4mm	0mm	2mm	10mm	3mm	3.875mm	2.90012

Both types of samples MTA (Fig 2) and GIC (Fig 3) were embedded in impression compound (Hiflex) and sliced longitudinally with lathe cut machine were examined under stereomicroscope to examine the dye penetration, measured in millimeter (mm). Maximum point up to which dye was penetrated were recorded for each sample. Samples were embedded in impression compound at one side just to hold the samples during cutting with lathe cut machine.

RESULTS

In present study dye penetration test was done to compare the sealing ability of mineral trioxide aggregate with glass ionomer cement. Paired 'T' test was used for statistical analysis to calculate the mean, standard deviation and p values. The dye penetration values were measured for group 1 and group 2 (Table 1). The dye penetration values measured in millimeter (mm) ranged from 0mm to 10mm.The results of both the groups showed that mineral trioxide aggregate showed more microleakage (more dye penetrated) than glass ionomer cement. The mean value of mineral trioxide aggregate dye penetration (7.625mm) was found more as compare to mean value of glass ionomer cement dye penetration (3.875mm). Some samples of mineral trioxide aggregate also had dye penetration all the way through the samples with a dye penetration of 10mm.

DISCUSSION

In this study two endodontic sealers MTA and GIC were used to compare their sealing ability. The results of the present study demonstrated that dye penetration of MTA is more than GIC. However, several studies have indicated that MTA exhibits significantly lesser leakage than other materials.[6,7] A dye leakage investigation has showed that the sealing ability of MTA can be increased by the addition of calcium hydroxide when used as a root end filling material.[8] However, the results of bacterial leakage study showed that pre-treatment with calcium hydroxide has no significant effect on sealing ability of MTA as an apical barrier.[9]

The sealing ability of other sealers like AH plus was also found to be better than MTA. Bruno et al concluded from his study that AH plus showed better sealing ability when compared with MTA and sealapex using the fluid filtration method to access sealing ability.[10] Due to difficult manipulation and insertion of MTA it is not routinely employed as a root canal filling material.[11] However, MTA can be used as a root canal filling material, although clinicians should be aware of some of its limitations like difficulty in controlling the length of filling, chance of producing voids and the absence of a solvent for MTA removal.[9] Hovalnd et al also found that MTA showed more micro leakage than other sealers like sealapex and GIC.[12] Glass ionomer cement showed less microleakage than mineral trioxide aggregate because of its chemical adhesion with dentine. Thus, mineral trioxide aggregate did not proved to be the best material in terms of sealing ability as compare to the glass ionomer cement.

In contrast to present study Singh et al[13] found that GIC had the greatest dye penetration followed by calcium phosphate cement and MTA. Mineral trioxide aggregate and calcium phosphate cement had comparatively better sealing ability than glass ionomer cement.

CONCLUSION

In conclusion, the results of the present study revealed that both materials showed microleakage but glass ionomer cement showed less microleakage and good sealing ability as compare to mineral trioxide aggregate. Given the low cost and apparently good sealing ability of GIC, it may be considered as a possible substitute for MTA. However, further in vitro and in vivo investigations should be conducted to determine the suitability of GIC as a better sealing material than MTA.

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