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Original Research

An in vitro comparative stereo microscopic evaluation of marginal seal between MTA and Biodentine as a root end repair material

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ABSTRACT:

Aim: The aim of this study was to comparatively evaluate stereomicroscopically the microleakage of three root end filling materials Mineral Trioxide Aggregate (MTA), &Biodentine. **Material and Methods:** A total of 60 extracted human permanent maxillary anterior teeth were sourced from a department of oral and maxillofacial surgery, the teeth extracted for a reason other than this study. **Results:**The mean vertical depth of penetration in MTA was maximum 0.45 ± 0.20 and minimum in BIODENTINEplus is 0.30± 0.12 mm. Penetration amongroot end filling materials showed a statistically highly significant difference in vertical depth of penetration among sealer with F = 246.05 and p value = 0.01. **Conclusion:** On comparative evaluation of results of this in vitro study, it was concluded that MTA & Biodentine exhibited microleakage with Biodentine showing the least microleakage of all.

Keywords: Microleakage, Root-End Filling, MTA &Biodentine

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INTRODUCTION

The primary aim of root canal treatment is the elimination and exclusion of all the micro-organisms from the root canal system.[1] The most important factor for a successful endodontic treatment is the complete obliteration of the root canal system and development of fluid tight seal.[2] Success of endodontic treatment depends on the removal of infected canal contents followed by root canal filling using a material of adequate compatibility.[3] Despite of new endodontic techniques, development of more effective materials & instruments, the resolution of periapical pathosis is not achieved in certain cases.[4] In cases where conventional endodontic treatment is unsuccessful, surgical endodontic intervention is needed to save the involved tooth.[5] This procedure includes exposure of involved apex, resection of the apical end of the root, preparation of root end cavity & insertion of root end filling material.[6]

It is proposed that an ideal root-end filling material should adhere to the prepared cavity walls forming a tight seal in the root canal system.[7] It should be easy to manipulate, radiopaque, dimensionally stable, and nonabsorbable. An ideal root-end filling material should not be affected by presence of moisture. It should be adhesive to dentin, nontoxic, well tolerated by the periradicular tissues and promote healing.[8]

MTA due to its higher biocompatibility and sealing ability promotes better healing of the tissues when placed in contact with the dental pulp or periradicular tissues over the available root-end filling materials, which has been proved by both in vitro and in vivo studies.[9,10] Its adaptation and properties are not affected by moisture as seen in various studies where it has been proved that there was no significant difference in its retention when a dry or wet cotton pellet was used during its packing into the cavity.[11]

A newly researched material with largely improved physical properties BioDentine has been introduced which can be used as a root end filling material. BioDentine is a calcium silicate basedcement. In addition to the chemical composition based on the Ca3SiO5 and water chemistry which brings the high biocompatibility of already known endodontic repair cements like MTA, it has increased physico-chemical properties like shortsetting time, high mechanical

strength which makeit clinically easy to handle and compatible, not only with classical endodontic procedures, but also for restorative clinical cases of dentine replacement.

The aim of the in vitro study was to compare the microleakage of two different root end filling materials Mineral Trioxide Aggregate(MTA) and newly researched Biodentine using dye penetration method under a stereomicroscope.

MATERIALS AND METHODS

A total of 60 extracted human permanent maxillary anterior teeth were sourced from a department of oral and maxillofacial surgery, the teeth extracted for a reason other than this study. Only teeth with completely formed root apices and free of defects were considered for the purpose of this study. The teeth containing developmental defects, immature apex, root fracture, significant apical curvature, presence of internal resorption, caries, morphological defects, visible cracks, and teeth with previous restorations or endodontic treatment were excluded from the study. For collection of the samples, after extraction, teeth were cleaned of soft tissue debris by an ultrasonic scaler, and inspected for cracks, lesions, or defects, clinically and radiographically. Disinfection of the teeth was carried out by immersion in 5% sodium hypochlorite for 1 hour and subsequent storage in deionized water.

The teeth were cleaned using ultrasonics. Preoperative radiographs were taken and access cavities were made using endo access bur. The pulp tissue was extirpated using barbed broach. K-file was used to confirm the canal patency and the working length was determined with help of a radiograph.A glide path was prepared till the working length with #25 K-File. Canals were then prepared using the complete sequence of hand protaper files using 3% sodium hypochlorite and 17% EDTA as irrigants. Between each sequential protaper file RCHelpwas used as a lubricant.

Canals were dried using absorbent paper points and master cone selection was confirmed with radiographs. Canals were obturated with gutta percha by lateral compaction technique. Radiographs were taken to confirm the quality of obturation and the access cavities were sealed with compositeresin restorative material after 24 hours.

The teeth were then stored in saline for 1 week. They were resected apically at 90° angle axis to the long axis of the root using cross cut fissure bur (556, Mani, Japan) removing 3 mm of the apex.The 3 mm deep retrograde cavity was prepared using straight fissure diamond bur (SF 41, Mani, Japan) the cavities were irrigated with saline and dried. The teeth were randomly divided into 2 groups of 30 specimens each:

1. Group I: Mineral Trioxide Aggregate (MTA) MTA-Angelus
2. Group II: BioDentine (Septodont)

These materials were manipulated according to the manufacturer's instructions and the cavities were filled using a Messing's carrier. The specimens were then coated with 3 coats of nail varnish except at the apical 1mm & then were allowed to dry.

The specimens were then suspended in 1% methylene blue for 72hours. Following this the teeth were rinsed for 15minutes under running water. Clear acrylic blocks were made to stabilize them. The teeth were then sectioned longitudinally and the dye penetration was examined under stereomicroscope & microleakage was evaluated in millimeters.

STATSTICAL ANALYSIS

The collected data was subjected to statistical analysis by using one-way analysis of variance.

RESULTS

Table1: Comparison of the sealing activity of different root end filling materials

Groups	N	Mean	Std. Dev	F value	P value	Post hoc tukey test
MTA	30	0.45	0.20	246.05	0.001	MTA>Biodentine
Biodentine	30	0.30	0.12			

The mean vertical depth of penetration in MTA was maximum 0.45 ± 0.20 and minimum in BIODENTINEplus is 0.30± 0.12 mm. Penetration amongroot end filling materials showed a statistically highly significant difference in vertical depth of penetration among sealer with F = 246.05 and p value = 0.01. Post hoc Tukey test was performed to evaluate the differences in penetration depth between two groups.

DISCUSSION

The goal of a periradicular surgery is to gain access to the affected area, evaluate the root circumference and root canal anatomy and place a biocompatible seal in the form of root end filling that stimulates the regeneration of periodontium. Numerous substances have been used as root end filling materials. The choice of a root-end filling material could be governed by handling properties, biocompatibility, apical seal and long term clinical success.[12]

Most in vitro studies evaluate leakage of the apical seals, but the correlation between dye leakage around root-end filling materials and their clinical performance is uncertain. The clinical significance of microleakage in apical surgery has not been elucidated. However it seems logical that the lesser leakage would prevent migration of bacteria and toxins into the periradicular tissue.

The aim of carrying out surgery in the peri-radicular region is to reach the affected area, to assess the anatomy of the root circumference and the root canal and to put a biocompatible seal in the form of a root

end fill, which promotes periodontal regeneration. Many substances have been used as filling materials for the root end. Handling characteristics, biocompatibility, apical seal, and long-term clinical performance will determine the selection of a root end filling material.[12]

In the present study, each specimen was sectioned transversely in the cervical area to separate crown from the root, keeping a standard length of the remaining root at 12 mm, to maintain standardization among samples. The most widely used root end filling techniqueis the dye penetration method, which was used in the present analysis. Because dyes canbe easily stored, applied, and have their penetration assessed quantitatively, no reactivechemicals are used along with no radiation; hence, the method is safe, and the technique is highly feasible and easily reproducible.[13] However, the dye penetration method is said to have certain drawbacks include small size of the dye molecules when compared to the bacteria. The various advantages of methylene blue compared to other dyes have influenced researchers to use it as medium. It is cost-effective, easy to manage, and strong in color. This coloring has many drawbacks, for example, dissolution during demineralization and clearing processes; in some cases, the maximum point of penetration is also difficult to observe.[14]

MTA has been investigated and used as a root end filling material since its introduction 19,20,21,22. Despite its good physical, biological properties and it being hydrophilic in nature, MTA has somedisadvantages such as long setting time and high cost. The search for alternative materials is aimed to reduce costs and to increase the feasibility to both professional and patient.

BioDentine is similar to MTA in basic composition. The manufacturers claim that it's modified powder composition i.e the addition of setting accelerators and softeners, a new pre dosed capsule formulation for use in a mixing device largely improve the physical properties of the material making it more user-friendly. Biodentine proves superior to MTA as it does not require a two-step obturation & as the setting is faster there is a lower risk of bacterial contamination.

CONCLUSION

On comparative evaluation of results of this in vitro study, it was concluded that MTA &Biodentine exhibited microleakage with Biodentine showing the least microleakage of all. Further research is warranted not only for the sealing ability but also the related physical properties as well as critical manipulative steps.

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