

Original Research

Comparative evaluation of mineral trioxide aggregate, endoseal, and biodentine in furcation perforation repair

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ABSTRACT:

Background: To assess and compare the efficacy of MTA, endoseal and biodentine used as sealing material for furcation perforation. **Materials & methods:** A total of 30 samples of permanent mandibular molars were enrolled and horizontally sectioned at middle third of the root. The samples were divided into 3 experimental groups (n = 10). The result was analysed using SPSS software and statistical analysis was done with Chi-square test. **Results:** A total of 30 samples were enrolled. 4/10 samples in the MTA group, 5/10 samples in the EndoSeal MTA group showed contamination during 30-day incubation period. **Conclusion:** Biodentine showed lesser bacterial leakage compared to MTA and Endoseal at different time intervals. **Keywords:** MTA, Biodentine, Perforation

Received: 18 February, 2023

Accepted: 25 March, 2023

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This article may be cited as: Patel R, Bhargava S, Bashir T, Vyas C, Ankit K, Patil OA. Comparative evaluation of mineral trioxide aggregate, endoseal, and biodentine in furcation perforation repair. J Adv Med Dent Scie Res 2023;11(4):25-28.

INTRODUCTION

Endodontic therapy can often be complex and challenging. Some procedures carry an inherent risk for complication or procedural accidents during access opening, shaping, and debridement.¹ One of these procedural accidents is endodontic perforation that will affect the prognosis of root canal treatment.² An endodontic perforation is an artificial opening in the tooth or its root, created by clinician during entry to the canal system or by biologic events such as pathologic perforation or caries, those resulting in a communication between the root canal and periodontal tissue.¹ A furcation perforation refers to a mid-curvature opening into periodontal ligament space which is a worst possible outcome in root canal treatment. Except for resorptive defect or caries,

furcation, or root perforations are iatrogenic in nature and one of the key causes of endodontic failure.¹ It has been reported that perforations were the second greatest cause of failure.³ To prevent bacterial contamination, perforations should be repaired as quickly as possible with a biocompatible material.⁴ An ideal perforation repair material should provide an adequate seal, be biocompatible, not affected by blood contamination, not be extruded during condensation, bactericidal, induce bone formation and healing, radiopaque, induce mineralization, cementogenesis and easy in manipulation and placement.⁵ Materials which have been used for furcal perforation (FP) repair include silver amalgam, IRM, gutta-percha, Cavit, Super EBA, light cured GIC, composites, and so on.⁶ The principal obstacles to a

proper repair are the lack of isolation, presence of soft tissues, and lack of a wall against which the material can be condensed. Mineral trioxide aggregate (MTA) was introduced by Torabinejad in 1993 as a retrograde filling material. It is a mixture of tricalcium silicate and aluminate with tetra calcium aluminoferrite. ⁷Biodentine is a tricalcium silicate-based restorative cement introduced in 2011. ⁸ Indications for use are similar to that of MTA and it has the added advantage of fast set and easier manipulation. Endoseal is a newer variety of MTA-based sealer. It has a siliceous and luminous material which gets cement-like properties after setting with calcium hydroxide and water. This enables flow of premixed substrate through the delivery tip with adequate working consistency. ⁹ It is indicated for perforation repair, as a sealer, pulp revascularization among other uses. Hence, this study was conducted to compare and evaluate MTA, endoseal and biodentine used as sealing material for furcation perforation.

MATERIALS & METHODS

A total of 30 samples of permanent mandibular molars were enrolled and horizontally sectioned at middle third of the root. Access cavities were prepared, and the canal orifices and the root end cavities were restored with light cured resin. The samples were divided into 3 experimental groups (n = 10). The perforation sites in all the groups were repaired with MTA, EndoSeal, and Biodentine, respectively. The teeth were prepared for appearance of turbidity in the nutrient broth for 30 days, and the findings were noted. The result was analysed using SPSS software and statistical analysis was done with Chi-square test. The P-value less than 0.05 was considered significant.

RESULTS

A total of 30 samples were enrolled. 4/10 samples in the MTA group, 5/10 samples in the EndoSeal MTA group, and 5/10 samples in Biodentine group showed contamination during 30-day incubation period. There was no significant difference between three groups (P > 0.05).

Table 1: Comparison of the sealing ability of mineral trioxide aggregate, Biodentine and EndoSeal

Sealing ability	Turbidity		Total
	Present	Absent	
MTA			
Number	4	6	10
%	40	60	100
Biodentine			
Number	3	7	10
%	30	70	100
Endoseal			
Number	5	5	10
%	50	50	100
Total			
Number	12	18	30
%	40	60	100

DISCUSSION

A perforation, irrespective of location or etiology, hampers the prognosis of endodontic therapy. This mechanical/pathological communication between root canal system and external tooth surface should be sealed with a biocompatible material as soon as possible. ¹⁰ The bond strength of furcation perforation repair materials to dentine is important for maintaining the integrity of the seal in the furcation area. A furcation perforation repair material should have adequate strength against which intracoronal restorative material could be condensed safely. Hence, this study was conducted to compare and evaluate MTA, endoseal and biodentine used as sealing material for furcation perforation .

In the present study, a total of 30 samples were enrolled. 4/10 samples in the MTA group, 5/10 samples in the EndoSeal group showed contamination. 50% of samples showed contamination in endoseal group. Similar results were observed in the past literature. A study by Baralay et

al, in the time interval of 30 days, all the materials showed contamination to varying degrees (MTA Angelus 8/20 samples, Endoseal MTA 10/20 samples, and Biodentine 7/20 samples). There was no significant difference between the three groups (P > 0.05). MTA Angelus, Endoseal MTA, and Biodentine showed contamination in a 30-day incubation period when used as furcation perforation seal materials. ¹¹ In the present study, 5/10 samples in Biodentine group showed contamination during 30-day incubation period. There was no significant difference between three groups (P > 0.05). Another study by Parikh M et al, EndoSeal MTA with Chloroquick irrigating solution irrigation showed the highest push-out bond strength (MPa) with a statistically significant difference among all the groups (P = 0.003). The majority of the samples exhibited cohesive and mixed types of failures. Chloroquick irrigating solution irrigation has no adverse effect on the push-out dentin bond strength of Endoseal MTA and ERRM. ¹² The effect of furcation perforation size on the efficacy of

restorative material is still undetermined. Some studies claimed that tooth size in relation to perforation size directly affects the prognosis, whereas some other studies reported no association between the two variables.¹³ To avoid extrusion of the repair material into surrounding periodontal structures for the success of a perforation repair, internal matrices such as calcium sulfate, hydroxyapatite, collagen, demineralized freeze-dried bone, and Gelfoam® (Pfizer) have been suggested.¹⁴ ERRM is a new bioceramic material which is delivered as a premixed product in low viscosity paste form dispensed from a syringe, fast-set, ready-to-use. Moisture is required to harden and set. Working time is more than 30 min and setting time is 20 min to 2 h depending upon its viscosity. It has an alkaline pH (pH-12.5), biocompatible, and antibacterial properties. It contains Nanosphere particles, which allow the material to penetrate into the dentinal tubules, moistened by dentin liquid and produces a mechanical bond on setting.¹⁵

Bacterial leakage studies have more relevance than others mainly due to the fact that they are biologically more relevant. It is found to be more accurate than dye or isotope penetration studies in vitro.¹⁶ There are certain drawbacks of this method as in the results would be qualitative and they do not take into account the gaps that are smaller than the size of the bacteria.¹⁷ Sjögren et al. reported that bacterial presence was seen in the cases of apical periodontitis in treated cases in 32% of cases after 5 years.¹⁸ Persistent periapical lesions have been associated with bacteria in treated teeth.¹⁹ *E. faecalis* is commonly seen in persistent root canal infections and is most often found in failed endodontic treated teeth. It has properties such as adaptation to oxygen depleted environs, intrinsic resistance to antibiotics, and quorum sensing which makes it ideal to be used to evaluate leakage of FP repair material.²⁰ The prognosis of perforations depends on the location, size, and time of contamination of the lesion. The location of furcal perforations at the level of the epithelial attachment and crestal bone suggested a guarded prognosis. Furthermore, the size of a perforation represents another important factor in determining the success of the repair procedure; larger the size poor the prognosis. Some authors suggest the use of an internal matrix to avoid the extrusion of the sealing material and consequent peri-radicular tissue inflammation.²¹

CONCLUSION

From the above results, the authors concluded that Biodentine showed lesser bacterial leakage compared to MTA and Endoseal at different time intervals, but this was not statistically significant. However; further studies are recommended for better exploration of results.

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