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

[1]Dr. Raman Mishra, [2]Dr. Mandeep Shilpi, [3]Dr. Snehal Gosavi, [4]Dr. Naman Pahuja, [5]Dr. Neelu Verma, [6]Dr. Garima Chaudhary

[1]Associate Professor, School of Dental Sciences Sharda University, Greater Noida, Uttar Pradesh.

[2]Senior Lecturer, Dept. of Orthodontics & Dentofacial Orthopaedics, College of Dental Science And Hospital Rau, Indore, Madhya Pradesh

[3]Senior Lecturer, Department of Conservative Dentistry and Endodontics, Al Badar Dental College and Hospital, Gulbarga, Karnataka.

[4]Senior Lecturer, Department of Paediatric and Preventive Dentistry, Santosh Dental College, Ghaziabad, Uttar Pradesh.

[5]Reader, Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow, Uttar Pradesh.

[6]Senior Lecturer, Department of Paediatric and Preventive Dentistry, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, Uttar Pradesh.

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ABSTRACT

Background: Furcation perforations can have various causes, including excessive pressure during cleaning or shaping of the root canal, improper use of dental instruments, or decay extending into the furcation area. The present study was conducted to compare biodentine, endoseal, and mineral trioxide aggregate in furcation perforation repair.

Materials & Methods: 45 permanent mandibular molars were horizontally sectioned at middle third of the root. Perforations of diameter 1.6 mm were created in the center of the pulpal floor using a round bur in a low-speed handpiece. The teeth were divided into 3 groups. The perforation sites in groups I were repaired with Biodentine, group II with EndoSeal MTA, and group III with MTA Angelus. The system was incubated at 37°C and checked for appearance of turbidity in the nutrient broth for 30 days.

Results: 5/15 samples in Biodentine group, 8/15 samples in the EndoSeal MTA group, and 6/15 samples in the MTA Angelus group, showed contamination during 30-day incubation period. The difference was non- significant (P>0.05).

Conclusion: Materials for furcation perforation repair used are MTA Angelus, Biodentine, and Endoseal MTA At various time intervals, biodentine exhibited reduced bacterial leakage than MTA Angelus and Endoseal MTA.

Keywords: furcation perforation, Biodentine, EndoSeal MTA

Introduction

A furcation perforation in teeth is a complication that can occur during dental procedures, particularly root canal treatment or periodontal surgery.[1] To understand furcation perforation, it's important to grasp the anatomy of multi-rooted teeth.[2] Multi-rooted teeth, such as molars, have furcations, which are spaces between the roots where they meet near the gumline. Furcations can be quite complex, and they are susceptible to damage during dental procedures. If a dentist accidentally creates a hole or perforation in the furcation area, it is called a furcation perforation.[3] Furcation perforations can have various causes, including excessive pressure during cleaning or shaping of the root canal, improper use of dental instruments, or decay extending into the furcation area. The perforation can compromise the integrity of the tooth's structure and create a pathway for bacteria to enter the surrounding tissues, potentially leading to infection and further complications.[4]

Materials which have been used for FP repair include silver amalgam, IRM, gutta-percha, Cavit, Super EBA, light cured GIC, composites, and so on.[5] In 1993, Torabinejad proposed mineral trioxide aggregate (MTA) as a retrograde filler. It is a blend of tetracalcium aluminoferrite, tricalcium silicate, and aluminate. By causing blastic cells to differentiate and migrate, it can cause the creation of hard tissue. 2011 saw the introduction of Biodentine, a restorative cement based on tricalcium silicate.[6] A more recent variant of MTA-based sealers is called endosomal MTA. It is a bright, siliceous material that, when combined with water and calcium hydroxide, takes on qualities similar to cement. This allows for the proper working consistency of the premixed substrate to flow through the delivery tip.[7] The present study was conducted to compare biodentine, endoseal, and mineral trioxide aggregate in furcation perforation repair.

Materials & Methods

The present study consisted of 45 permanent mandibular molars and horizontally sectioned at middle third of the root. Cavities of 2 mm depth were prepared at the root ends. Access cavities were prepared, and the canal orifices and the root end cavities were restored with light cured resin. Perforations of diameter 1.6 mm were created in the center of the pulpal floor using a round bur in a low-speed handpiece. The teeth were divided into 3 groups. The perforation sites in groups I were repaired with Biodentine, group II with EndoSeal MTA, and group III with MTA Angelus. The teeth were inserted individually in an Eppendorf vial which was then placed in a McCartney’s bottle containing nutrient broth. The reservoirs were filled with 0.5 ml of Enterococcus faecalis. The system was incubated at 37°C and checked for appearance of turbidity in the nutrient broth for 30 days, and findings were noted. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I Distribution of specimens

Groups	Group I	Group II	Group III
Material	Biodentine	EndoSeal MTA	MTA Angelus
No. of teeth	15	15	15

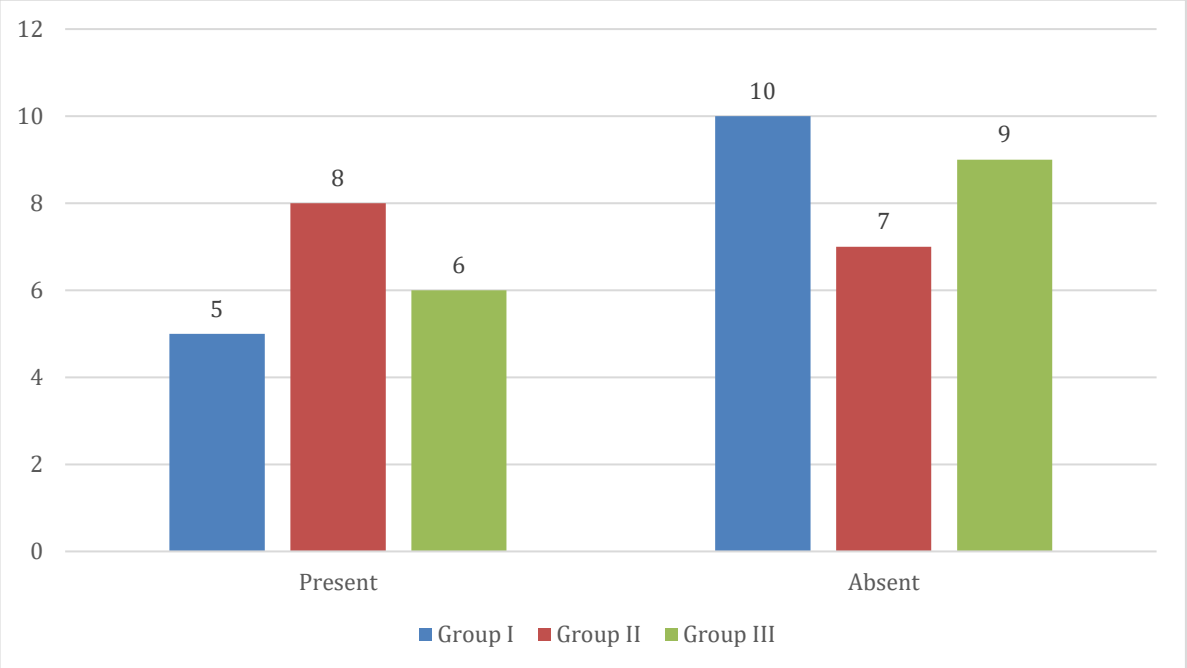
Table I shows distribution of teeth in 3 groups. Each group had 15 teeth.

Table II Comparison of the sealing ability

Turbidity	Group I	Group II	Group III	P value
Present	5	8	6	0.75
Absent	10	7	9	0.92

Table II, graph I shows that 5/15 samples in Biodentine group, 8/15 samples in the EndoSeal MTA group, and 6/15 samples in the MTA Angelus group, showed contamination during 30-day incubation period. The difference was non- significant (P>0.05).

Graph I Comparison of the sealing ability



Discussion

Treatment of furcation perforations typically involves repairing the perforation to prevent further damage and restore the tooth's function and integrity.[8] The procedure may involve identifying and locating the perforation, cleaning and disinfecting the area, repairing the perforation with dental materials like mineral trioxide aggregate (MTA) or biocompatible resins. [9]The choice of material depends on the size and location of the perforation. After repairing the perforation, the root canal

system is sealed to prevent further infection and promote healing.[10] In some cases, furcation perforations may be challenging to repair, especially if they are large or located in difficult-to-access areas. In such situations, the prognosis for the tooth may be less favorable, and additional treatments such as root canal retreatment, surgery, or tooth extraction may be necessary.[11] The present study was conducted to compare biodentine, endoseal, and mineral trioxide aggregate in furcation perforation repair.

We found that 5/15 samples in Biodentine group, 8/15 samples in the EndoSeal MTA group, and 6/15 samples in the MTA Angelus group, showed contamination during 30-day incubation period. Baralay et al[12] tested sealing properties of biodentine, pozzolan-based Enddoseal MTA, and mineral trioxide aggregate (MTA) Angelus for furcation perforation. Sixty-four permanent mandibular molars were chosen, and the middle part of the root was sectioned horizontally. Three experimental groups (n = 20) received the teeth at random. MTA Angelus, EndoSeal MTA, and Biodentine were used to repair the perforation sites in Groups 1, 2, and 3, respectively. Within the 30-day period, the MTA Angelus 8/20 samples, Endoseal MTA 10/20 samples, and Biodentine 7/20 samples all shown varied degrees of contamination. Between the three groups, there was no discernible difference ($P > 0.05$).

Hashem et al[13] in their study the furcation perforations were repaired with and without the use of internal matrix before placement of repair material. Eighty extracted human mandibular first molars were divided into positive (n = 10), negative (n = 10), and three experimental groups (n = 20) according to the repair material used. Each experimental group was divided into two subgroups (n = 10) according to whether internal matrix was used or not. Dye leakage was tested from an orthograde direction, and dye extraction was performed using full concentration nitric acid. Dye absorbance was measured at 550 nm using spectrophotometer. ProRoot MTA (Maillfer, Dentsply, Switzerland) with and without internal matrix and MTA-Angelus (Angelus, Londrina, PR, Brazil) with internal matrix showed the least dye absorbance. IRM (Caulk, Dentsply, Milford, DE) without internal matrix showed the highest dye absorbance. IRM with internal matrix and MTA-Angelus without internal matrix had insignificant difference and came at intermediate level between the other groups.

The limitation of the study is the small sample size.

Conclusion

Authors found that materials for furcation perforation repair used are MTA Angelus, Biodentine, and Endoseal MTA At various time intervals, biodentine exhibited reduced bacterial leakage than MTA Angelus and Endoseal MTA.

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