Volume 20 Issue 48
Originally issued as J7



Global Journal of Medical Research: J
Dentistry & Otolaryngology
Volume 20 Issue 7 Version 1.0 Year 2020
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Evaluation of Sealing Ability of Biodentine and Mineral Trioxide Aggregate in Permanent Molars using Dye Extraction Method-An Invitro Study

By Dr. Vidhya R & Dr. Kannan Vadakkepurayil

Abstract- *Objective:* The aim of this study was to compare the sealing ability of MineralTrioxide Aggregate (MTA) and Biodentine when used to repair the furcal perforations in permanent molars using dye extraction method.

Study design: Recently extracted permanent molars were collected and randomly sealed with MTA and biodentine, after preparing perforations in the furcation area by using a high - speed long shank round bur No:4. After setting of the material, specimens were kept in methylene blue dye for 24 hours to check the microleakage by the dye extraction method. Samples were then placed in vials containing 1ml of 65% nitric acid for three days for the extraction of the dye. The vials were centrifuged at 14000 rpm for 5 minutes to separate debris from the extracted dye. About 200 microlitres of the supernatant from each sample was then analyzed in a UV-visible spectrophotometer at 550nm wavelength using concentrated nitric acid as the blank, and readings were recorded as absorbance units.

Keywords: *biodentine, furcation, mineral trioxide aggregate, UV spectrophotometer.*

GJMR-J Classification: *NLMC Code: WU 220*



Strictly as per the compliance and regulations of:



© 2020. Dr. Vidhya R & Dr. Kannan Vadakkepurayil. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Evaluation of Sealing Ability of Biodentine and Mineral Trioxide Aggregate in Permanent Molars using Dye Extraction Method-An Invitro Study

Dr. Vidhya R [α] & Dr. Kannan Vadakkepurayil [σ]

Abstract- ***Objective:*** The aim of this study was to compare the sealing ability of MineralTrioxide Aggregate (MTA) and Biodentine when used to repair the furcal perforations in permanent molars using dye extraction method.

Study design: Recently extracted permanent molars were collected and randomly sealed with MTA and biodentine , after preparing perforations in the furcation area by using a high-speed long shank round bur No:4.After setting of the material, specimens were kept in methylene blue dye for 24 hours to check the microleakage by the dye extraction method. Samples were then placed in vials containing 1ml of 65% nitric acid for three days for the extraction of the dye. The vials were centrifuged at 14000 rpm for 5 minutes to separate debris from the extracted dye. About 200 microlitres of the supernatant from each sample was then analyzed in a UV-visible spectrophotometer at 550nm wavelength using concentrated nitric acid as the blank, and readings were recorded as absorbance units.

Results: All teeth showed microleakage. But MTA gave higher UVspectrophotometric absorbance values than biodentine (mean absorbance 0.0556 and 0.0046).

Conclusion: Based on the results of this study, Biodentine showed better sealing ability compared to MTA and thus may be a good alternative to MTA.

Keywords: biodentine, furcation, mineral trioxide aggregate, UV spectrophotometer.

I. Introduction

Maintaining the integrity of natural dentition is important for the proper function and aesthetics of an individual. Endodontic therapy can play a vital role in achieving this goal. Occasionally mishaps occur during endodontic treatment, one of them is perforation of the root canal wall and furcation, which can significantly impact the long term survival of the tooth. Perforations can be defined as the mechanical or pathological communications between the root canal system and the external tooth surface. These perforations can be repaired nonsurgically with suitable biocompatible, nontoxic, radiopaque and nonabsorbent material, thus preventing bacterial contamination. In permanent teeth, several materials have been suggested for perforation repairs such as amalgam, calcium hydroxide, reinforced zinc oxide-eugenol cement, mineral trioxide aggregate (MTA), calcium-enriched mixture (CEM) cement, and Biodentine.

Author α: e-mail: vidhyachandran0@gmail.com

MTA is the commonly used material with a wide range of qualities. Since its introduction by Mahmoud Torabinejad in 1992, it gained an important role and emerged as a widely accepted material for various purposes.

MTA was introduced by Lee *et al*. in 1993 for the repair of lateral root perforations.[2] It consists of dicalcium silicate, tricalcium silicate, tricalcium aluminate, and tetra calcium aluminoferrite. Although MTA has certain drawbacks such as long setting time, difficulty in manipulation, relatively high price, it has a superior sealing ability compared to other restorative materials when used for repairing perforations.

In 2011 M/S Septodont introduced their new tricalcium silicate based restorative cement under the name, biodentine. It is mainly composed of highly pure tricalcium silicate, which regulates the setting reaction, calcium carbonate (filler), zirconium dioxide (radiopacifier), calcium chloride (setting accelerator), water reducing agent (superplasticizer), and water. It has been claimed that this material can be used for pulp capping, pulpotomy, apexification, root perforation, internal and external resorption, and also as a root-end filling material in periapical surgery. It is easy to handle, has a short setting time (12 minutes), has high alkaline Ph(12) and is a biocompatible material. These properties make it a favorable material for repair of perforation.

II. Materials and Method

A randomized controlled *in vitro* trial was planned, and the study was conducted in the Department of Pedodontics and preventive dentistry, Govt Dental College, Kozhikode, Kerala in collaboration with the College of Pharmaceutical Sciences, Govt Medical College, Kozhikode.

Five hundred twenty permanent molars were divided into two groups each having two hundred sixty teeth each.

Molars were amputated 3mm below the furcation area. Endodontic access cavity was prepared. Orifices of the canals were negotiated, and the temporary filling was placed over the orifices of each canal. Perforation was created between the orifices to the furcation area by using a high-speed long shank

© 2020 Global Journals

round bur No:4. The tooth was completely covered, including cavity walls and pulpal floor by two successive layers of nail varnish except the area 1mm around the margin of the perforation.

Group 1: MTA was mixed according to the manufacturer's instruction and carried to the perforation site with the help of MTA gun and adapted to the perforation defect with the help of hand pluggers. Moist cotton pellet was placed over MTA to allow its setting for 24 hours.

Group 2: Biodentine was mixed according to the manufacturer's instruction and carried to the perforation site with the help of an amalgam carrier and adapted to the perforation defect with the help of a plugger.

After sealing of the defect and setting of the material, all specimens were kept in 100% humidity for 24 hours. 2% methylene blue dye was applied inside the access cavity of all the teeth for 24 hours to check the microleakage. Teeth were placed under running tap water for 30 minutes to remove all residual dye material.

Samples (10 teeth)) were then placed in vials containing 65% nitric acid for 3 days for the extraction of the dye. The vials were centrifuged at 14000rpm for 5minutes to separate debris from the extracted dye. About 2ml of the supernatant was then analyzed in a UV visible spectrophotometer at 550nm wavelength using concentrated nitric acid as the blank, and readings were recorded as absorbance units.



III. Result

Five hundred twenty teeth were selected. Of which 260 teeth were sealed with MTA and the remaining with biodentine. The absorbance value of 10 teeth were recorded at a time. 26 such such samples were evaluated.

The data obtained were tabulated and computed statistically using independent T- test.

Mean and standard deviation were estimated for each group to evaluate the absorbance of MTA and biodentine.

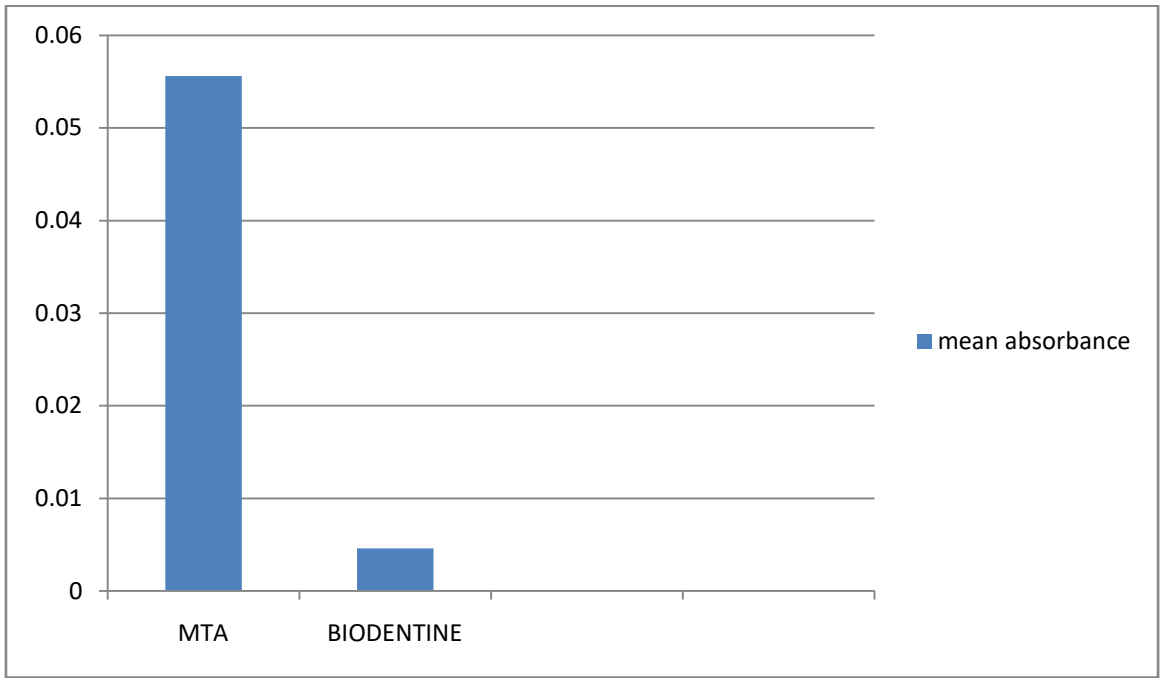
Table 1: Mean value of absorbance for MTA and biodentin in permanent teeth:

GROUP	MATERIAL USED	N	MEAN ABSORBANCE
1	MTA	26	0.0556
2	BIODENTIN	26	0.0046

Table 2: Standard deviation and p- value of absorbance in permanent teeth:

GROUP	MATERIAL USED	N	STANDARD DEVIATION	P VALUE
1	MTA	26	0.0556	0.001
2	BIODENTINE	26	0.0046	0.001

© 2020 Global Journals



Graph 1: Comparison of mean absorbance values of MTA and Biodentine

IV. Discussion

The success of the furcation repair depends on various factors like size and location of the defect, time and duration of exposure to contamination, the material used for repair, the possibility of sealing the perforation, etc. A factor that is under the control of the operator is the choice of material to be used that enhances treatment outcome. To obtain success, the perforation repair material should ideally trigger the formation of new bone, periodontal ligament and cementum. In the search of the ideal material, numerous sealing materials and techniques have been tested over the years with varying success. The search for alternative agents has been aimed to overcome the drawbacks of previously used materials to reduce the cost and to increase the feasibility of both professionals and patients. The present study is the first of its kind to compare the sealing ability of Biodentine and MTA in repairing the furcal perforation in permanent molars using the dye penetration technique.

There are several methods that can be employed to evaluate the sealing ability of repair materials other than dye penetration technique, like SEM, fluid filtration technique, bacterial and protein leakage model, etc. Recent methods include radioactive isotopes, artificial caries, neutron activation analysis and electrical conductivity. The present study has utilized methylene blue as a dye because it is inexpensive, easy to use, has a high degree of staining and a molecular weight even lower than that of bacterial toxins. With regard to dyes particle size, pH and chemical reactivity are believed to affect the degree of penetration.

Biodentine is very similar to MTA in basic composition. The manufacturers claim that the addition of setting accelerators and softeners, in a new predosed capsule formulation for use in a mixing device predominantly improves the physical properties of the material, making it more user-friendly. Biodentine does not require two-step obturation as the setting is faster and thus has a lower risk of bacterial contamination making it superior to MTA.

Allwyn Samuel *et al* (2016) evaluated the sealing ability of biodentine and MTA in primary molars using SEM and concluded that biodentine showed significantly less leakage (0.149) compared to MTA(0,583).

Soundappan *et al* (2014) comparison with MTA and intermediate restorative material (IRM) using SEM. They conducted the study using thirty permanent central incisors and stated that in overall comparison, MTA and IRM were significantly superior when compared to Biodentine in terms of marginal adaptation when used as retrograde filling material.

El Choudary HM *et al* (2011) evaluated sealing ability of four calcium containing cements (MTA, Portland cement, biodentine and tech biosealer). The study showed there was no significant difference between the mean microleakage values obtained in the four tested materials after 24 hours, 1 month, 6 months and 1year. But the microleakage values for each individual material were significantly higher at 24 hours than at the other time intervals.

© 2020 Global Journals

V. Conclusion

Artificially made furcal perforations in permanent molars were randomly sealed with MTA and Biodentine. The teeth were then evaluated for methylene blue dye leakage. The dye extracted using nitric acid was assessed in a UV spectrophotometer and the absorbance units were recorded. In this study, MTA showed higher microleakage and hence higher absorbance values than Biodentine. From the above inferences, the study concluded that Biodentine with better sealing ability compared to MTA and may be a good alternative to MTA in the management of furcal perforations in permanents molars, thereby increasing the longevity of the tooth.

Financial support and sponsorship: Nil.

Conflicts of interest:
There are no conflicts of interest.

References Références Referencias

1. Haghgoo R, Arfa S, Asgary S. Microleakage of CEM cement and ProRoot MTA as furcal perforation repair materials in primary teeth. Iran Endod J. 2013; 8: 187–90. [PMC free article] [PubMed]
2. Lee SJ, Monsef M, Torabinejad M. Sealing ability of a mineral trioxide aggregate for repair of lateral root perforations. J Endod. 1993; 19: 541–4. [PubMed]
3. Oliveira TM, Sakai VT, Silva TC, Santos CF, Machado MA, Abdo RC. Repair of furcal perforation treated with mineral trioxide aggregate in a primary molar tooth: 20-month follow-up. J Dent Child (Chic) 2008; 75: 188–91. [PubMed]
4. Malkondu Ö, Karapinar Kazandag M, Kazazoglu E. A review on biodentine, a contemporary dentine replacement and repair material. Biomed Res Int. 2014; 2014: 160951. [PMC free article] [PubMed]
5. Arens DE, Torabinejad M. Repair of furcal perforations with mineral trioxide aggregate: Two case reports. Oral Surg Oral Med Oral Pathol Oral Radiol. 1996; 82: 84–8. [PubMed]
6. Orosco FA, Bramante CM, Garcia RB, Bernardineli N, de Moraes IG. Sealing ability, marginal adaptation and their correlation using three root-end filling materials as apical plugs. J Appl Oral Sci. 2010; 18: 127–34. [PMC free article] [PubMed]
7. Sahebi S, Moazami F, Sadat Shojaee N, Layeghneghad M. Comparison of MTA and CEM cement microleakage in repairing furcal perforation, an *in vitro* study. J Dent (Shiraz) 2013; 14: 31–6. [PMC free article] [PubMed]
8. Soundappan S, Sundaramurthy JL, Raghu S, Natanasabapathy V. Biodentine versus mineral trioxide aggregate versus intermediate restorative material for retrograde root end filling: An *in vitro* study. J Dent (Tehran) 2014; 11: 143–9. [PMC free article] [PubMed]
9. Kaup M, Schäfer E, Dammaschke T. An *in vitro* study of different material properties of Biodentine compared to ProRoot MTA. Head Face Med. 2015; 11: 16. [PMC free article] [PubMed]
10. Kokate SR, Pawar AM. An *in vitro* comparative stereomicroscopic evaluation of marginal seal between MTA, glass ionomer cement and biodentine as root end filling materials using 1% methylene blue as tracer. Endodontology. 2012; 24: 36–42.

© 2020 Global Journals