

## ROOT END FILLING MATERIAL WHICH IS BETTER IN MARGINAL ADAPTATION? AN INVITRO STUDY.

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### Abstract

**Introduction:** The sealing ability of the root end filling materials to the wall can be assessed by the marginal adaptations. Various materials have been used in the past. This study was conducted to assess the root-end filling materials ProRoot MTA, Biodentine, RetroMTA's marginal adaptation.

**Materials and Methods:** Ninety single-rooted teeth were divided to three equal groups of ProRoot MTA, RetroMTA and Biodentine. After the BMP and obturation, the third (3mm) of the root apex were cut, and cavities made with the ultrasonic technique. The transverse and the longitudinal sections were studied using the epoxy a replica under the SEM. One-way ANOVA was employed to associate the marginal gaps between the groups and  $P < 0.05$  was considered significant.

**Results:** Significant difference in the longitudinal gaps was observed when the three groups were compared. Conversely, in the transverse sections no significant differences were seen in the groups.

**Conclusion:** Biodentine yielded the best marginal adaptability when compared to the other two only in the longitudinal sections. Greater gaps were seen in the transverse sections in all the three groups.

**Keywords:** Mineral trioxide aggregate, Tricalcium silicate, ProRoot MTA, Marginal adaptation

### Introduction

Pulpoperiapical lesions are the consequence of the bacterial invasion.[1,2] Surgical intervention is required if there is a failure of the routine RCT.[3] The foundation for the of periradicular surgeries is the end of the etiologic factor, sealing the apical territory to forestall further disease of the zone and to confine the remaining stimuli into the root canal system.[4,5] Thus, endodontic surgeries comprise of root end resection, root end cavity preparation, and filling them.[3] Several materials are utilized for sealing the retro end cavity preparation for example, Intermediate Restorative Material (IRM), super EBA (Ethoxy Benzoic Acid), amalgam, glass-ionomer cement, Calcium Enriched Mixture (CEM), Mineral Trioxide Aggregate (MTA), composite resin, Biodentine, and gutta-percha.[6] MTA is made of bismuth oxide, tetracalcium aluminoferrite, tricalcium silicate, tricalcium aluminate and calcium sulfate. Because of its sealing and biocompatibility, MTA is utilized as a material of choice for pulpotomy, vital pulp therapy and pulp capping, [7] apical filling & apexification. [8,9] MTA has high sealing ability and osteoblasts stimulation ability.[10,11] Therefore, it's preferred for retro end filling materials.[12] Disadvantages, include, cost, discolorations, long setting time, have prompted the quest for more up to date materials.[13,14]

Biodentine is a calcium silicate based material that has better handling properties than the MTA. [15] Different techniques have been utilized to quantify micro leakage and decide the nature of root canal materials. We conducted an in-vitro study to assess the marginal adherence of RetroMTA, Biodentine and ProRoot MTA as root-end filling materials, utilizing the Scanning Electron Microscopic method.

### Materials and Methods

In our study 90 recently extracted single-rooted teeth were chosen. Radiographs were taken to rule out any defects and diseases. After keeping for a week in thymol solution (1%) [16], teeth are cut at the CEJ, after thorough wash with water. After a thorough obturation with gutta-percha and the AH26 sealer by the lateral compaction technique. The apical 3-mm length of each root was resected, cavities were made to receive the material and care was taken to prevent the cracks. The teeth were divided to three groups of 30 each, group 1- RetroMTA, group 2- Proroot MTA, and group 3- Biodentine. Later the teeth were stored at 37°C at 100% humidity for a week.

Subsequently impressions with extra-light and heavy consistencies of polyvinyl siloxane material were taken from the root-end sections of roots and of the grounded longitudinally sectioned teeth. The gaps at dentin-material

interface was evaluated and measured under an SEM. The longitudinal gaps and transverse gaps in eight areas were recorded. SPSS 25 programming was used for statistical analysis. One-way ANOVA was employed to compare the marginal adaptation in longitudinal & transverse sections with root-end filling materials.  $P \leq 0.05$  was considered significant.

### Results

In our study the least gap was seen in the group 2- Proroot MTA, highest in the group 3- Biodentine. Statistically no significant ( $p = 0.24$ ) transverse gap was noted between the 3 groups where the gaps' mean between the root-end filling material & the wall in the transverse section of the group 1- RetroMTA 19.021 (16.562), group 2- Proroot MTA 7.791 (11.901), group 3- Biodentine 22.411(36.861) [Table 1].

In our study the least gap was seen in the group 3- Biodentine, highest in the group 2- Proroot MTA. Statistically significant ( $p = 0.0072$ ) longitudinal gap was noted between the 3 groups where the gaps' mean between the root-end filling material & the wall in the longitudinal section of the group 1- RetroMTA 8.551(5.251), group 2- Proroot MTA 14.341(10.931) mm, group 3- Biodentine 4.491 (6.091) [Table 2].

### Discussion

The marginal adaptation of the three root end filling materials RetroMTA, ProRoot MTA and Biodentine was assessed by the SEM observations from the epoxy replicas. Epoxy replicas are used instead of the teeth to overcome few defects with the actual tooth observation like two dimensional view, separation of the material and root canal when under high vacuum etc.[17,18] epoxy replicas have shown to adapt at 1–2-mm level.[19] Similar models were used in the study of Ghorbanzadeh et al.[20] According to the current study results, in longitudinal areas, significant variations was observed in the gaps between the three groups with the least gap shown by the Biodentine, depicting its superior marginal adaptability. However no significantly different values were obtained in the transverse sections between the three groups. MTA has been shown to have good marginal adaptability as the particle size is small and has better firmness that allows greater material packing. [21]

In the study of Malhotra and Hegde [22] in 2015, methylene blue penetration technique was used to study the marginal adaptability of the Biodentine, GIC, ProRoot MTA, and MTA Angelus. Similar to the present study the Biodentine showed better marginal adaptation. In the study conducted by Gundam et al.[23] to assess the marginal adaptation utilizing direct SEM observation of IRM, glass-ionomer concrete and MTA as retrofilled root-end materials, MTA showed a good marginal adaptability. Our study is in comparison with the above study. However in their study the type of MTA was not specified.

**Table 1:** Comparison of transverse sections gaps (mm) using One-way ANOVA

Materials	Mean (SD)	P-value
Group 1	19.021 (16.561)	
Group 2	7.791 (11.901)	
Group 3	22.411 (36.861)	0.24

**Table 2:** Comparison of longitudinal sections gaps (mm) using One-way ANOVA

Materials	Mean (SD)	P-value
Group 1	8.551 (5.251)	
Group 2	14.341 (10.931)	
Group 3	4.491 (6.091)	0.0072

The MTA root-end filling material has exhibited more favorable marginal adaptation compared to amalgam, Vitremer, and IRM. [17] Given the similarities between the structures of RetroMTA and MTA, the above-mentioned mechanisms for MTA are applicable to RetroMTA, too. It should be noted that the materials used in the present study for the retrograde procedure were not exposed to a Phosphate-Buffered Solution environment, which is one of the limitations of the present study. It has been accounted for that the cutting angles of tooth roots can affect the consequences of the marginal root-end filling material. [17] Root-end filling materials may have proper marginal adaptation in root canal walls in one direction. In our study Biodentine has shown better adaptation longitudinally than in the transverse sections, where all the three groups showed similar gaps. It is hard to analyze the observations of various studies because of the utilization of various conventions to assess marginal adaptation, that is, replicas vs. direct tooth observations, the angles of the root canal walls, the instruments and apparatuses used to decide gap sizes in various investigations and storage conditions of the specimen. [24, 25] Exposure of root-end filling materials in various conditions before the assessment of marginal adaptation may influence the outcomes. Marginal adaptation is proportionate to the incubation time. [25,26] In various studies the MTA root-end filling material has displayed greater marginal adaptation contrasted with Vitremer, IRM, Amalgam.[17,26] Given the similarities between the structures of RetroMTA and MTA, the previously mentioned components for MTA are pertinent to RetroMTA, as well. It ought to be noticed that the materials utilized in the current examination for the retrograde technique were not presented to a Phosphate-Buffered Solution, which is one of the impediments of the current study.

### Conclusion

In spite of many studies on the various Root Canal filling materials there is no standard established to determine the maximum gap that has clinical implications. Also the

clinical status of the root canal tooth is influenced by the oral microbiota. Hence, further clinical and exploratory investigations are suggested. In this investigation, Biodentine showed the best marginal adaptation in longitudinal areas, yet in transverse segments, no significant difference as noted.

## References

- Gholamhoseini Z, Alizadeh SA, Bolbolian M. In vitro evaluation of antimicrobial activity of three bioceramic endodontic sealers on *Enterococcus Faecalis* and *Staphylococcus Aureus*. *Annals of Dental Specialty* 2018;6:261-3.
- Sharifi M, Bolbolian M, Sabaghi M. Comparison of antimicrobial effects of MTAD and 1.3% sodium hypochlorite against *enterococcus faecalis*. *Annals of Dental Specialty* 2018;6:268-70.
- Tanzilli JP, Raphael D, Moodnik RM. A comparison of the marginal adaptation of retrograde techniques: a scanning electron microscopic study. *Oral Surg Oral Med Oral Pathol* 1980;50:74-80.
- Johnson BR, Fayad MI. Periradicular surgery. In Hargreaves KM, Berman LH, eds. *Cohen's Pathways of the Pulp*. 11<sup>th</sup> ed St. Louis. Missouri: Elsevier Health Sciences; 2016. pp. 387-446.
- Parirokh M, Mirsoltani B, Raouf M, Tabrizchi H, Haghdoost AA. Comparative study of subcutaneous tissue responses to a novel root- end filling material and white and grey mineral trioxide aggregate. *Int Endod J* 2011;44:283-9.
- Mandava P, Bolla N, Thumu J, Vemuri S, Chukka S. Microleakage evaluation around retrograde filling materials prepared using conventional and ultrasonic techniques. *J Clin Diagn Res* 2015;9:Z C43-6.
- Daoudi MF, Saunders WP. In vitro evaluation of furcal perforation repair using mineral trioxide aggregate or resin modified glass ionomer cement with and without the use of the operating microscope. *J Endod* 2002;28:512-5.
- Nekoofar MH, Namazikhah MS, Sheykhrezae MS, Mohammadi MM, Kazemi A, Aseeley Z, *et al.* pH of pus collected from periapical abscesses. *Int Endod J* 2009;42:534-8.
- Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review-Part I: chemical, physical, and antibacterial properties. *J Endod* 2010;36:16-27.
- Camilleri J, Pitt Ford TR. Mineral trioxide aggregate: a review of the constituents and biological properties of the material. *Int Endod J* 2006;39:747-54.
- Darvell BW, Wu RCT. "MTA"-An hydraulic silicate cement: review update and setting reaction. *Dent Mater* 2011;27:407-22.
- Lenzi R, Trope M. Revitalization procedures in two traumatized incisors with different biological outcomes. *J Endod* 2012;38:411-4.
- Adel M, Nima MM, Shivaie Kojoori S, Norooz Oliaie H, Naghavi N, Asgary S. Comparison of endodontic biomaterials as apical barriers in simulated open apices. *ISRN Dent* 2012;2012:359873.
- Bolbolian M, Ghandi M, Ghorbani F, Ranjbar Omidi B, Mirzadeh M. Microleakage comparison of resin modified glass ionomer and OrthoMTA used as a coronal barrier in nonvital teeth bleaching. *Scientific Journal of Kurdistan University of Medical Sciences* 2020;24:1-11
- Ravichandra PV, Vemisetty H, Deepthi K, Reddy SJ, Ramkiran D, Krishna M JN, *et al.* Comparative evaluation of marginal adaptation of biodentine (TM) and other commonly used root end filling materials – an invitro study. *J Clin Diagn Res* 2014;8:243-5.
- Samuel A, Asokan S, Geetha Priya PR, Thomas S. Evaluation of sealing ability of Biodentine™ and mineral trioxide aggregate in primary molars using scanning electron microscope: a randomized controlled in vitro trial. *Contemp Clin Dent* 2016;7:322-5.
- Torabinejad M, Smith PW, Kettering JD, Pitt Ford TR. Comparative investigation of marginal adaptation of mineral trioxide aggregate and other commonly used root-end filling materials. *J Endod* 1995;21: 295-9.
- Oliveira HF, Gonçalves Alencar AH, Poli Figueiredo JA, Guedes OA, de Almeida Decurcio D, Estrela C. Evaluation of marginal adaptation of root-end filling materials using scanning electron microscopy. *Iran Endod J* 2013;8:182-6.
- Teaford MF, Oyen OJ. Live primates and dental replication: new problems and new techniques. *Am J Phys Anthropol* 1989;80:73-81.
- Ghorbanzadeh A, Shokouhinejad N, Fathi B, Raouf M, Khoshkhounejad M. An in vitro comparison of marginal adaptation of MTA and MTA-like materials in the presence of PBS at one-week and two-month intervals. *J Dent (Tehran)* 2014;11:560-8.
- Shah DK, Sanap- Tandale A, Aggarwal S, Borse S, Borse N, Nagrani. Sealing ability of root end filling materials – a systematic review. *Int J Recent Sci Res* 2018;9:25386-90.
- Malhotra S, Hegde MN. Analysis of marginal seal of ProRoot MTA, MTA Angelus biodentine, and glass ionomer cement as root-end filling materials: an in vitro study. *Journal of Oral Research and Review* 2015;7:44.
- Gundam S, Patil J, Venigalla BS, Yadanaparti S, Maddu R, Gurram SR. Comparison of marginal adaptation of mineral trioxide aggregate, glass ionomer cement and intermediate restorative material as root-end filling materials, using scanning electron microscope: an in vitro study. *J Conserv Dent* 2014;17:566-70.
- Badr AE. Marginal adaptation and cytotoxicity of

- bone cement compared with amalgam and mineral trioxide aggregate as root-end filling materials. *J Endod* 2010;36:1056-60.
25. Bidar M, Moradi S, Jafarzadeh H, Bidad S. Comparative SEM study of the marginal adaptation of white and grey MTA and Portland cement. *Aust Endod J* 2007; 33:2-6.
  26. Reyes-Carmona JF, Felipe MS, Felipe WT. The biomineralization ability of mineral trioxide aggregate and Portland cement on dentin enhances the push-out strength. *J Endod* 2010;36:286-91.