

Original Research

Assessment of marginal adaptation of bioceramic root end filling materials using diamond points and ultrasonics

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ABSTRACT:

Background: Properties of a root end filling material play a very critical role in determining success of peri-radicular surgery. The present study was conducted to assess the marginal adaptation of two bioceramic root end filling materials in root end preparation done with diamond points and ultrasonics under scanning electron microscope. **Materials & Methods:** 60 single rooted extracted human teeth were divided into 2 groups. Group I and group II were further divided into subgroup A and subgroup B of 15 samples each. Root end preparations in subgroup A of both the groups were done using ultrasonic tips and in subgroup B of both the groups root end preparations were done using diamond points. In group I, all the root end preparation were filled with MTA and in group II with Biodentine. All were subjected to scanning electron microscopy to see the adaptations of the root end filling materials with the dentin. **Results:** In group I, root end preparation was filled with MTA and in group II with Biodentine. Each group had 30 samples. The mean marginal gap in subgroup A of group I was 0.71 and in subgroup B was 0.85. The mean marginal gap in subgroup A of group II was 0.48 and in subgroup B was 0.56. The difference was significant ($P < 0.05$). **Conclusion:** Root end preparation done using ultrasonics showed better marginal adaptation than diamond points for both filling materials.

Key words: Biodentine, MTA, Scanning electron microscopy

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INTRODUCTION

The goal of endodontic therapy is to seal all pathways of communication between the pulpal and peri-radicular tissues. A mandatory requirement of root canal therapy is that the obturation and restoration of the tooth must seal the root canals both apically and coronally to prevent leakage and percolation of oral fluids and to prevent recontamination of infected canals.¹ Filling of the root canal apical third must be looked upon separately from the filling of the rest of the canal keeping in mind the active and constant metabolic processes occurring in the periapical area. Properties of a root end filling material play a very critical role in determining success of peri-radicular surgery. They seal apical region to avoid bacterial infiltration and their products from peri-radicular tissues to root canal system.²

Despite of new endodontic techniques, development of more effective materials, and instruments, the resolution of periapical pathosis is not achieved in certain cases. In cases where conventional endodontic treatment is unsuccessful, surgical endodontic

intervention is needed to save the involved tooth. This procedure includes exposure of involved apex, resection of the apical end of the root, preparation of root-end cavity, and insertion of root-end filling material.³

Bioceramics are materials which include alumina, zirconia, bioactive glass, hydroxyapatite, calcium phosphates, glass ceramics.⁴ Commonly used Bioceramics in endodontics are Portland cement, MTA, Biodentine, calcium enriched mixture etc. Due to their similarity with biological hydroxyapatite they are excellent biocompatible materials.⁵ Biodentine with active biosilicate technology is one such new calcium silicate based material with few properties superior to MTA like, has better consistency, handling properties and faster setting time.⁶ The present study was conducted to assess the marginal adaptation of two bioceramic root end filling materials in root end preparation done with diamond points and ultrasonics under scanning electron microscope.

MATERIALS & METHODS

The present study comprised of 60 single rooted extracted human teeth which were collected and decoronated to create a standardized length of 14mm and were then endodontically treated. The treated tooth was resected 3mm from the apex at 90 degrees angle to long axis of the tooth. These samples were divided into 2 groups. Each group had 30 teeth. Group I and group II were further divided into subgroup A and subgroup B of 15 samples each. Root end preparations in subgroup A of both the groups were

done using ultrasonic tips and in subgroup B of both the groups root end preparations were done using diamond points. In group I, all the root end preparation were filled with MTA and in group II with Biodentine. The apical portions of the roots were then sectioned to obtain 1mm thick transversal sections. All were subjected to scanning electron microscopy to see the adaptations of the root end filling materials with the dentin. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of teeth

Groups	Group I	Group II
Material	MTA	Biodentine
Number	30	30

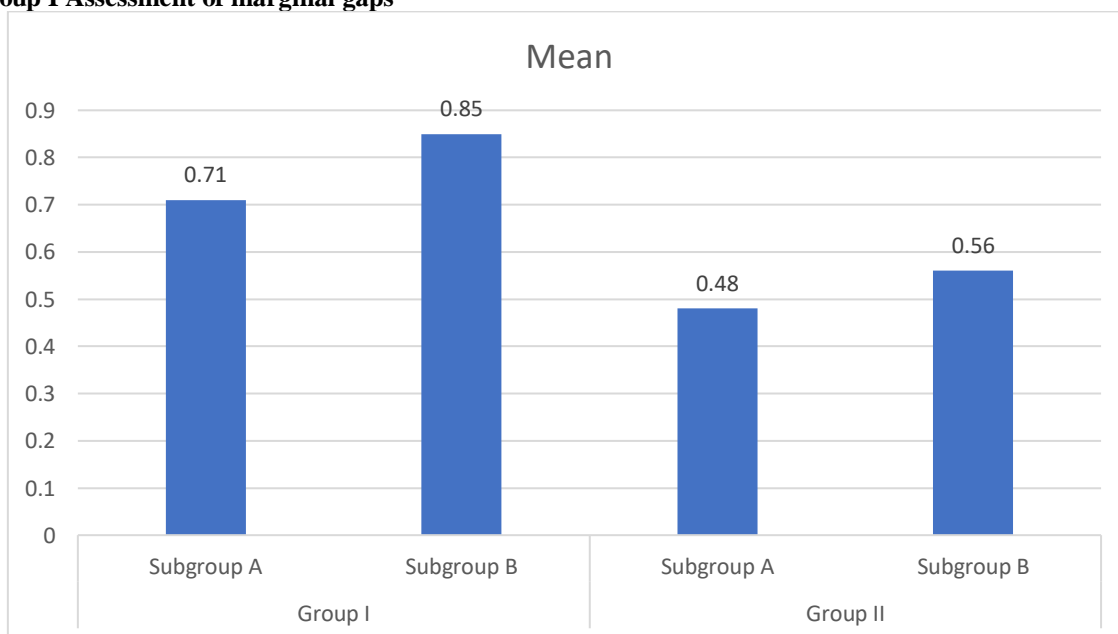
Table I shows that in group I, root end preparation was filled with MTA and in group II with Biodentine. Each group had 30 samples.

Table II Assessment of marginal gaps

Groups	Subgroups	Mean	P value
Group I	Subgroup A	0.71	0.01
	Subgroup B	0.85	
Group II	Subgroup A	0.48	0.05
	Subgroup B	0.56	

Table II, graph I shows that mean marginal gap in subgroup A of group I was 0.71 μm and in subgroup B was 0.85 μm. The mean marginal gap in subgroup A of group II was 0.48 μm and in subgroup II was 0.56 μm. The difference was significant (P < 0.05).

Group I Assessment of marginal gaps



DISCUSSION

The primary aim of root canal treatment is the elimination and exclusion of all the microorganisms from the root canal system.⁷The most important factor for a successful endodontic treatment is the complete obliteration of the root canal system and development of fluid tight seal.⁸The preparation of the cavity in the

resected root end that is dimensionally sufficient for placement of a root-end filling material is of great clinical significance.⁹ The ideal root-end filling materials should prevent leakage of microorganisms and their products into the surrounding tissues.^{10,11}The present study was conducted to assess the marginal adaptation of two bioceramic root end filling materials

in root end preparation done with diamond points and ultrasonics under scanning electron microscope.

We found that in group I, root end preparation was filled with MTA and in group II with Biodentine. Each group had 30 samples. Ahirwar et al¹² compared the sealing ability of biodentine and mineral trioxide aggregate (MTA) as root-end filling material at different depths. 100 freshly extracted maxillary central and lateral incisor teeth were taken and stored in normal saline. All teeth were divided into four experimental groups: Group 1—filled with biodentine; Group 2—filled with MTA; Group 3—positive control group; and Group 4—negative control group. Groups 1–3 were divided into three subgroups, which comprised 10 teeth each. The teeth were immersed in methylene blue dye for 72 hours. The depth of dye penetration was examined under a stereomicroscope with a $\times 10$ eyepiece magnification and $\times 2$ zoom to evaluate the roots for the extent of microleakage. On biodentine filling, at 3 mm showed the least mean (126.72 ± 111.87) followed by 4 mm (137.28 ± 111.87) and 2 mm (195.36 ± 182.99) deep cavities, respectively. On MTA filling, at 4 mm showed the least mean (902.88 ± 321.12) followed by 3 mm (924.00 ± 303.06) and 2 mm (1404.48 ± 539.72) deep cavities, respectively.

We observed that mean marginal gap in subgroup A of group I was 0.71 and in subgroup B was 0.85. The mean marginal gap in subgroup A of group II was 0.48 and in subgroup II was 0.56. Vanti et al¹³ assessed the marginal adaptation of two bioceramic root end filling materials in root end preparation done with diamond points and ultrasonics under scanning electron microscope. 56 single rooted extracted human teeth were collected and decoronated to create a standardized length of 14mm and were then endodontically treated. Lowest mean marginal gap of 0.46 micron meter seen with Group II (a) and highest marginal gap of 0.83 micron meter seen with Group I (b), which were statistically significant ($P < 0.05$).

Saraswathi et al¹⁴ evaluated and compare the apical sealing ability of mineral trioxide aggregate (MTA) Plus, Biodentine, and MTA. 140 maxillary incisors were obturated with gutta-percha and AH Plus sealer. All samples were randomly divided into 2 control and 3 experimental groups of 28 samples each. In the Group I, no apical preparation was done. The apical 3 mm of the samples in the other groups were resected, and 3 mm deep cavity was prepared and filled with gutta-percha, Biodentine, MTA Plus, and MTA, respectively. In negative control group, the entire specimen was coated with three layers of nail varnish; all samples in Groups II-V were coated with three layers of nail varnish except at the apical resected root surface. All samples were immersed in 2% rhodamine B dye for 72 hours. The teeth were then sectioned longitudinally and examined under stereomicroscope. MTA Plus showed less microleakage compared to Biodentine and MTA.

The limitation the study is small sample size.

CONCLUSION

Authors found that root end preparation done using ultrasonics showed better marginal adaptation than diamond points for both filling materials.

REFERENCES

- Garip H, Garip Y, Oruçoglu H, Hatipoglu S. Effect of the angle of apical resection on apical leakage, measured with a computerized fluid filtration device. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011;111:50-5.
- Gagliani M, Taschieri S, Molinari R. Ultrasonic root-end preparation: Influence of cutting angle on the apical seal. *J Endod* 1998;24:726-30.
- Iwami Y, Shimizu A, Hayashi M, Takeshige F, Ebisu S. Three-dimensional evaluation of gap formation of cervical restorations. *J Dent* 2005;33:325-33.
- Vogt BF, Xavier CB, Demarco FF, Padilha MS. Dentin penetrability evaluation of three different dyes in root-end cavities filled with mineral trioxide aggregate (MTA). *Braz Oral Res* 2006;20:132-6.
- Bortoluzzi EA, Broon NJ, Bramante CM, Garcia RB, de Moraes IG, Bernardineli N. Sealing ability of MTA and radiopaque Portland cement with or without calcium chloride for root-end filling. *J Endod* 2006;32:897-900.
- Camilleri J, Formosa L, Damidot D. The setting characteristics of MTA Plus in different environmental conditions. *Int Endod J* 2013;46:831-40.
- Güven Y, Tuna EB, Dincol ME, Aktoren O. X-ray diffraction analysis of MTA-plus, MTA-angelus and diarootbioaggregate. *Eur J Dent* 2014;8:211-5.
- Reyes-Carmona JF, Felipe MS, Felipe WT. Biomineralization ability and interaction of mineral trioxide aggregate and white portland cement with dentin in a phosphate-containing fluid. *J Endod* 2009;35:731-6.
- El Sayed M, Saeed M. In vitro comparative study of sealing ability of DiadentBioAggregate and other root-end filling materials. *J Conserv Dent* 2012;15:249-52.
- Sarkar NK, Caicedo R, Ritwik P, Moiseyeva R, Kawashima I. Physicochemical basis of the biologic properties of mineral trioxide aggregate. *J Endod* 2005;31:97-100.
- Camilleri J. Characterization and chemical activity of Portland cement and two experimental cements with potential for use in dentistry. *Int Endod J* 2008;41:791-9.
- Ahirwar A, John J, Paul M, Baby A, Sara B, Kambiranda SC. Assessment of sealing ability of two root-end filling materials at different depths: A comparative study. *Int J Oral Care Res* 2019;7:61-4.
- Vanti A, Vagarali H, Patil C. Comparative evaluation of marginal adaptation of two root end filling materials in root end preparation done with diamond points and ultrasonics - An in vitro SEM study. *IP Indian J Conserv Endod* 2021;6(2):97-100.
- Saraswathi DD, Tejavath SK, Babu MR, Swetha B, Gandhi B, Shaanthi. A comparative evaluation of the sealing ability of three recent root-end filling materials: An in vitro study. *J Adv Oral Res* 2015;6(2):33-39.