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

Pulmonary 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 periapical 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.6] 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.7 MTA is made of bismuth oxide, tetracalcium aluminoferate, 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.8,9] 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. [10] 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 adaption in longitudinal & transverse sections with root-end filling materials. P ≤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 MTA7.791 (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 MTA14.341(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 vaccume 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 adaption 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

<table>
<thead>
<tr>
<th>Materials</th>
<th>Mean (SD)</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Group 1</td>
<td>19.021 (16.561)</td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>7.791 (11.901)</td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>22.411 (36.861)</td>
<td>0.24</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
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</table>

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 similitudes 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


16. Badr AE. Marginal adaptation and cytotoxicity of
