Research Article

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A Comparative Evaluation of Sealing Ability of Two Perforation Repair Materials

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ABSTRACT

Background: The aim of the present study was to evaluate the sealing ability of Biodentine and mineral trioxide aggregate (MTA), to repair the furcation perforations using field emission gun scanning electron microscopy (FEG SEM).

Materials and Methods: Twenty-four extracted human mandibular molar were collected. After their visual inspection to ensure that the teeth did not show any resorption, fracture lines, caries, curvatures and fusion, the teeth were washed and polished by pumice and water and then stored in 10% formalin. They were divided into two groups and examined under microscope

Results: Quantifiable FEG SEM remarks made in this study illustrated that the mean gap at the dentin–furcation repair material interface was as follows: 4.43 ± 0.41 µm for Biodentine™ [Figure 1] and 3.42 ± 0.32 µm for ProRoot MTA

Conclusion: Biodentine showed a better result than the MTA. The difference between both the group was not significant. Biodentine™ can also be considered as a material of choice for furcation perforation repair.

Keywords: Perforation, MTA, Biodentine.

INTRODUCTION

Numerous treatment procedures of endodontic treatment can cause iatrogenic accidents leading to failures of treatment. One such technical error is perforation of furcation. It accounts for the highest rate of failure among endodontic complications. It also is the second cause of overall endodontic failure.[1,2] Root canal perforation is a pathological or mechanical communication between pulp space and periodontium. There are various causes like caries, internal resorption, operators' error etc. Moreover, it can also occur due to root damage during mini screw or implant placement.[3] Perforations of the furcation may happen as a outcome of distraction of a bur during access preparation. Furcation involvement are most difficult to contain. It often leads to severe complications and ultimately leads to extraction of tooth.

There are different types of materials that are available to completely seal the furcation perforation. The ideal repair material should afford an acceptable seal, be biocompatible, and possess the ability to induce osteogenesis and cementogenesis.[4] In view of this, the aim of the present study was to evaluate the sealing ability of Biodentine and mineral trioxide aggregate (MTA),

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to repair the furcation perforations using field emission gun-scanning electron microscopy (FEG-SEM).

MATERIALS AND METHODS

This study was conducted in Department of Conservative Dentistry, Dr BR Ambedkar dental college and hospital, Patna, Bihar. This study was approved by the institutional review board. This study was carried out from Oct 2018 to Feb 2019.

Twenty-four extracted human mandibular molar were collected. After their visual inspection to ensure that the teeth did not show any resorption, fracture lines, caries, curvatures and fusion, the teeth were washed and polished by pumice and water and then stored in 10% formalin.

An access cavity was prepared in all the tooth by using #5 bur. A required perforation was made by number 11 bur with a high-speed air rotor. The perforation was flushed with water and dried. The diameter of the perforation was equal to the diameter of the bur. Post perforation, the teeth were randomly divided into two groups with 12 samples in each experimental group.

Group A: Perforation site in group A was sealed using Biodentine (Septodont, India). The material was mixed as per manufacturers instructions. As the required consistency was achieved, then it was placed in the perforation, condensed with amalgam pluggers and the perforation was sealed. After the perforation was sealed then the access cavity was sealed with cotton and IRM.

Group B: Perforation site in group A was sealed using ProRoot MTA (ProRoot, Tulsa, Brazil). The material was mixed as per manufacturer's instructions. As the required consistency was achieved, then it was placed in the perforation, condensed with Buchanan pluggers (Hu Friedy, Chicago, IL, USA) and the perforation was sealed. After the perforation was sealed then the access cavity was sealed with cotton and IRM.

All teeth were decoronated 3 mm above the cementoenamel junction. Roots were amputated 3 mm below the furcation, and all specimens were stored in a wet sponge for 7 days at room temperature to create an atmosphere similar to that of oral cavity. The temporary IRM filling were removed; the specimens were desiccated with graded ethanol. They were supplementarily vacuum treated to remove any residue moisture present in the samples. After this, the specimens were mounted on the stubs, sputter coated with 25 nm layer of platinum, and examined with FEG-SEM Microscope.

RESULTS

Quantifiable FEG-SEM remarks made in the this study illustrated that the mean gap at the dentin–furcation repair material interface was as follows: 4.43 ± 0.41 μm for Biodentine™ [Figure 1] and 3.42 ± 0.32 μm for ProRoot MTA [Figure 2]. The difference between Biodentine™ and ProRoot MTA was not statistically significant ($P > 0.05$). Individually, Biodentine and ProRoot MTA showed statistically significant differences.

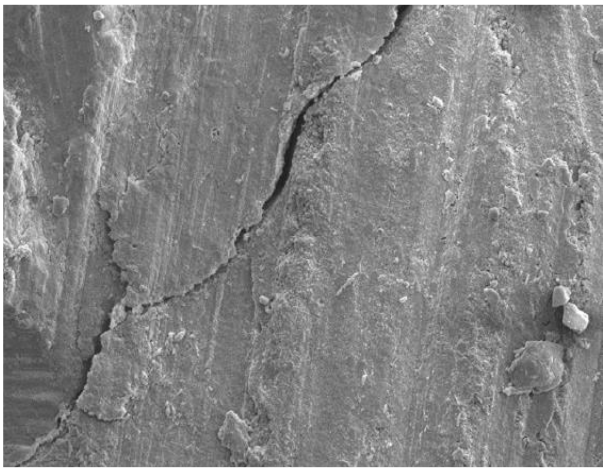

Fig 1: Field emission gun-scanning electron microscope image of gap at the dentin–furcation repair material interface of Biodentine

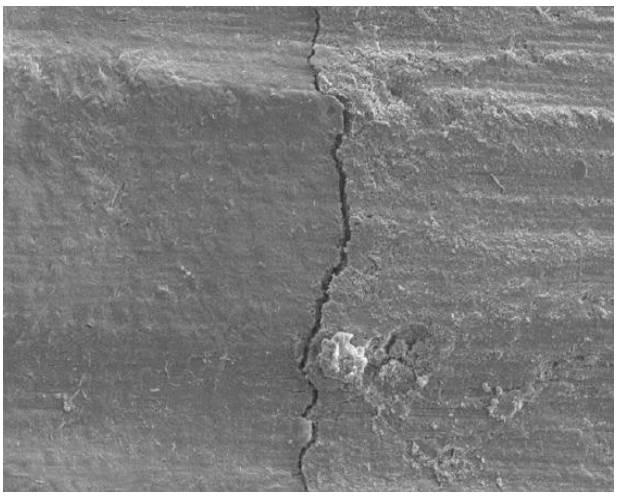

Fig 2: Field emission gun-scanning electron microscope image of gap at the dentin–furcation repair material interface of MTA.

DISCUSSION

Rip during endodontic procedures is cited as the second most common cause of treatment failures.[5] It accounts for 9.6% of the total endodontic failures and hence necessitates immediate treatment for a favorable prognosis. Some past materials such as amalgam, TCA, gutta percha, GIC and resin required moisture free environment at the perforation site.[6,7] The real success of the furcation repair depends on how well an effective seal can be maintained. 10 The search for a better material led to an aim to overcome the drawback of the older materials. Finally, the search ended at MTA and Biodentine. These are capable of causing complete regeneration of the hard tissue.[8] The mandibular molars were chosen because it often gets involved. The current study used FEG-SEM to assess the interfacial seal between dentin and the repaired materials. The FEG-SEM carries several advantages associated to that of a traditional SEM. FEG-SEM uses field emission source producing a cleaner image, less electrostatic distortions, and spatial resolution <2 nm.[9]

In group A the mean value of perforation was little more but it was statistically insignificantly ($P > 0.05$). As an inference we could say that both the materials has good property of repair. The property of slight expansion upon complete setting after 72 h may be responsible for lesser gaps.[10,11]

Group B provided much advanced seal. The result of the current study is similar to a dye extraction study which concluded that MTA provided a superior seal compared to Super-EBA.[12] In addition, Super EBA lacks the property to induce cementogenesis and thus inferior to MTA and Biodentine™.[12]

CONCLUSION

Biodentine showed a better result than the MTA. The difference between both the group was not significant. Biodentine™ can also be considered as a material of choice for furcation perforation repair.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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