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TOOTH ROOT PERFORATION REPAIR MATERIALS IN ENDODONTICS: A REVIEW

Dental Science

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ABSTRACT

Perforation in endodontics was defined as an artificial communication between the supporting tissues of the teeth and root canal of the tooth. The prognosis is poor in case of perforation, and it is not properly managed. Owing to the review of literature, there are descriptions of many materials that have great usage in the treatment of perforation. There are various articles describing the efficacy of one material over other material. The present review aims in describing various materials used for root canal perforation like Biodentine, MTA, Portland cement, Bioaggrregate, Endosequence and New Endodontic Cement.

KEYWORDS

Biodentine, Bioaggregate, Endosequence, MTA, Perforation

INTRODUCTION

Perforation during root canal can occur either due to resportion of the root or present of root caries. Occurrence of the perforation results into poor prognosis of the tooth and can affect the treatment outcome. During the procedure of access cavity preparation if proper care is not taken or there is present of deep caries uptil the furcation area can lead to the formation of perforation. Other reasons for perforation involve internal resorption into peri-radicular tissues and post space preparation.[1,2]

CLASSIFICATION

There are various classification proposed for root canal treatment of which the most accepted is by Fuss & Trope.[3] The classification is as follows:

1. Coronal perforation: Good Prognosis,
2. Crestal perforation: Questionable Prognosis,
3. Apical perforation: Good Prognosis.

However other than described or mentioned reasons for occurrence of perforation, the most common cause is the accidental one. It accounts for 2 to 12% of the total cases of perforation and now a day's it is very common among the unskilled dentist. Such type of accidentally created perforation can lead to the formation of an open channel between the tooth internal environment and the surrounding structures. Such open channel leads to the entry of the bacteria both ways that is from root canal they can enter the surrounding sound tooth supporting structure or vice versa. Such type of channel formation leads to inflammatory response in the bone and leads to bone resorptive mechanism ultimately weakening the tooth structure.[4,5]

In case of the perforation in the lateral side of tooth or directly in the furcation area, there are chances of the gingival over growth in case area, decreasing the prognosis of the tooth. Once the perforation occurs, the factors under the control of the operator are the choice of the material that can be used to close the perforation and increase the prognosis of the tooth. In the earlier times the choice of the materials for the root repair included EBA, Calcium phosphate, Amalgam and Cavit. In order to improve the prognosis and treatment outcome it's very necessary to have knowledge of recently added material for perforation treatment. The back light of the present review is to bring light about all the new repair material that have been introduced in the recent times and also to put highlight on their advantages.[6,7]

Requirements of an ideal Root Repair Material:[8]

There are different required characteristic that makes the perforation sealing material special. To list them they as are follow:

1. Material should provide adequate seal of the perforation defect.
2. Material should also be beneficial to use a resorbable matrix in which the sealing material can be condensed. Material should be biocompatible.
3. Material should have the ability to produce cementogenesis and osteogenesis.
4. Material should be bacteriostatic.
5. Material should be radiopaque, relatively inexpensive, non-toxic, non-cariogenic and easy to place.

Various materials used for perforation repair include:

Portland Cement

In 1824 A.D. Koseph Aspdinin in England was the one to invent the Portland cement. It consists of dicalcium silicate, tetra calcium alumina ferrate, tricalcium silicate and hydrated calcium sulphate. The major advantage of using the Portland cement when used as perforation material is that it induces cementum and bone formation, however the disadvantage include that it does not provide a fluid tight seal and might lead to the treatment failure in future. In the study done by Shahriar S, et al. they compared between the sealing ability of MTA and Portland cement in the repair of furcal perforation repair and they concluded that Portland cement showed better sealing ability than MTA.[9-11]

Mineral Trioxide Aggregate (MTA)

The most commonly used material with wide range is Mineral trioxide aggregate. Mahumoud Torabinejad was the first person to introduced MTA in 1992 describing its various uses. MTA is composed of fine hydrophilic particles of Silicate oxide, calcium sulphate dehydrate, tricalcium oxide, tricalcium aluminate, tricalcium silicate, small amounts of mineral oxides (bismuthoxide) and tertacalcium aluminoferite. The mean setting time of the MTA is around 165±5 minutes. MTA has an advantage of that it stimulates cementoblasts to produce matrix for cementum formation. It is biocompatible with the peri-radicular tissues, hence can show superior sealing ability when used for repair of perforation.[12-14]

Biodentine

in 2009 this calcium silicate based material gained popularity and was commercially available. It was specifically designed with tag line of “dentine replacement material”. It has a wide range of applications that includes various endodontic repairs that includes root perforations, resorptive lesions, apexifications and retrograde filling material in endodontic surgery. It is also used in pulp capping and can be used as a dentin replacement material in restorative dentistry. Biodentin is a bioactive material. It is composed of dicalcium silicate, iron oxide, liquid consist of calcium chloride, tricalcium silicate and hydro soluble polymer. The advantages of using biodentin includes easy handling and manipulation and approximate 12 minutes setting time which is short as compared to others, it has high alkaline pH and is a biocompatible material. Owing to above advantageous biodentin has become a favourable material of choice for tooth perforation repair. In the study done by Guneser et al, he conducted the research on comparison between MTA & Biodentine. He concluded that even after the biodentine was exposed to various endodontic irrigants showed consider perforamance as a sealing of perforation.[15,16]

Endosequence

It is the newly introduced bioceramic material. It is the combination of calcium phosphate and calcium siolicate. The composition is as follows: zirconium oxide, calcium phosphate monobasic, calcium silicates and filler agents.[17]

The working time is approximately 30 minutes. With the presence of moisture the setting reaction is initiated and the final set is achieved in

approximately 4 hours. There is presence of nanosphere particles which allows the material to enter into the dentinal tubules and interacts with the moisture present in the dentin. This results in the formation of the mechanical bond on setting and renders the material with exceptional dimensional stability; along with this the material has superior biocompatibility characteristics due to its high pH.[18]

The advantage of the endosequence is that it simulates phosphate buffered saline, tissue fluid and result in precipitation of apatite crystals that become larger with increasing immersion times concluding it to be bioactive. In the study done by Jeevani et al, there was comparison between MTA, Endosequence and Biodentine for the sealing ability of the perforation. He concluded that Endosequence showed better sealing ability for perforation repair material as compared to MTA and biodentine.[19]

Bioaggregate

It is the new bioceramic material composed of dicalcium silicate, calcium phosphate monobasic, tantalumpent oxide, amorphours silicon dioxide and tricalcium silicate. Bioaggregate is found to induce formation of mineralized tissue and there is precipitation of the apatetie crystals. It is found that these crystals become larger with increasing immersion time which suggest of material to be bioactive. The advantage of bioaggregate is that its biocompatibility and more sealing ability as compared to MTA. In the study done by Hasherm et al., he concluded that in different perforation repair material acidic pH affect more to MTA as compared to the Bioaggregate.[20,21]

New Endodontic Cement

It is also known as Calcium enriched mixture. Composed of calcium carbonate, calcium sulphate, calcium chloride, calcium hydroxide and calcium oxide. It is the bioactive material which is compsed of different calcium compounds. Advantage as compared to other material is like that it sets in aqueous material and the setting time is less than 1 hour. Other advantages includes formation of hydroxyapatite in higher concentrations as it has higher concentration of different calcaium compounds. This relates that new endodontic cement is more preferable furcation repair material. In the study done by Asgary et al., he observed periodontal regeneration and cementogenesis when CEM was used as perforation repair material. When compared to MTA, CEM cement has few advantages like, bactericidal effects, handling characteristics and shorter setting time. Because of such advantages CEM cement is considered more appropriate biomaterial to be used for various treatments in endodontics.[22-24]

CONCLUSION

repair of the endodontic perforation is very difficult to manage. However the management can be done very efficiently by the trained and experienced dentist provided the operator is having knowledge of these new materials and how to use them. However the usage of such material may lead to increase the prognosis of the tooth and improve the treatment outcome.

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