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Review Article

Various materials used as root perforation repair material: A review

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ABSTRACT

Any type of communication that is present artificially between the root canal and the surrounding tissue is known as a root perforation. Root perforation ultimately results as a complication in the treatment procedure and deteriorates the final outcome of the treatment. There are various materials used in the treatment of the root perforation and every material is having its own advantages over the other material.

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1. Introduction

Root perforation can occur due to any cause like accidentally opening during the treatment procedure of root canal, or might happen as a result of root caries or may be due to the process of root resorption. If it is not repaired it may complicate the treatment plan. It is also one of the most commonest mishap that might occur by the clinician. Literature stated that root perforation occurs in 2 to 12 percent of the endodontically treated teeth. This perforation will result in the formation of the pathway to the microorganisms from the oral cavity or from the periodontal surrounding tissue, thus ultimately altering the healing process and results in the contamination at the site of the perforation.¹

1.1. Etiology of the root perforation

Most commonly iatrogenic perforation can happen at any level of the endodontic treatment for e.g. during the process of access cavity preparation, perforation most commonly happens in the coronal portion of the tooth, and the most common cause of the coronal perforation is the misalignment of the bur, or during the process of cleaning and shaping of the root canal, perforation can occur in the coronal portion, middle portion or might occur in the apical root portion. The danger zone of the furcal area present in the coronal third portion of the curved roots, strip perforation most commonly occur in this area. Misuse of the rotary instruments during the process of the preparation of the post space results in the perforation in the mid root portion. Over instrumentation done in the apical region results in the apical perforation. Non iatrogenic perforation may occurs due to secondary to trauma, caries, resorption.²

Trope and fuss classify the perforation on the basis of time, size and location of the perforation.

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1.2. Classification based on time

1. Fresh perforation: It is characterized by the appearance of the fresh blood at the site of the perforation during the time of the procedure. Fresh perforation has good prognosis, if it is diagnosed at the earliest and precaution for the same has been taken.
2. Old perforation: It is the perforation that occurs earlier and didn't get noticed during the earlier appointment or remain un noticed. This type of perforation is having questionable prognosis.

1.2.1. Based on the size of the perforation:

1. Small perforations: These perforations are of smaller than the size of number twenty endodontic instrument. This type of small perforation are very easy to seal and are having a good prognosis.
2. Large perforation: These perforations occurs along with significant damage to the surrounding tissue, and providing adequate seal is very difficult in large perforation, so these large perforations are not having good prognosis

1.2.2. Based on the location

1. Crestal perforation: Perforation which is present at the level of the epithelium which is attached to the crestal bone. This type of perforation is having is having questionable prognosis.
2. Coronal perforation: The perforation which occurs coronal to the level of the crestal bone. In this type of perforation minimal damage to the surrounding soft tissue occurs. coronal perforation is very much easy to seal and is having a good prognosis .
3. Apical perforation: The perforation which is present apical to the level of the crestal bone, this type of perforation is having a minimal risk of contamination from the saliva and is having a good prognosis.

1.3. Diagnosis of the perforation

If there is sudden appearance of bleeding from the root canal during the process of instrumentation is the alarming sign of the potential root perforation. If the patient complaints of severe and continuous pain and continuous bleeding from the root canal, there are chances of root perforation. Radiographs should be taken from different angulation with the use of materials like calcium hydroxide, or barium sulfate which are radiopaque materials or with the use of radiopaque instruments in the canal, helps in confirmation of the perforation. The exact location can be determined with the use of electronic apex locator.

2. Management of the Perforation

2.1. With the help of non-surgical approach

This non-surgical approach of perforation repair done in patients having small perforation which is easily assessable and the bleeding can be stopped from the perforation site easily. Ideal root repair material should follows these properties:

1. It should be able to provide the adequate seal at the perforation site.
2. The material should be bio compatible with the oral structures.
3. It should be available easily
4. It should be economical to be used
5. The material should have the ability to induce osteogenesis as well as cementogenesis.
6. The material should bacteriostatic, it should not favor the growth of the any bacteria.
7. The material should be radio opaque in nature
8. The material should not be cariogenic, i.e. it should not help in the progression of the caries process.
9. The material should be in a matrix which is absorbable in nature.^{3,4}

2.2. Different materials to be used in the repair of the root perforation are as follows

1. Amalgam: Most commonly used material in the field of dentistry, and one of the most ancient material in the field of dentistry. The most common use of this material is the restoration, but along with this property amalgam can also be used in the area of the perforation in the furcation area and shows superior properties than other materials like cavitec and calcium hydroxide.⁵
2. Super EBA: It is basically a zinc oxide eugenol cement which is reinforced with the alumina. This material is having some advantageous properties of ease of handling, having excellent adhesional property and adapts well with the dentinal walls, this material is very much bio compatible, literature stated that this material also shows less micro leakage as compared to the mineral trioxide aggregate.⁶
3. Mineral trioxide aggregate: It was introduced in the year 1992 by Mahmoud torabinejad, this material is very much is bio compatible with the peri radicular tissue, this material evoked cementogenesis, it has been also stated that when mineral tri oxide aggregate has been used in the treatment of self created perforation, shows less micro leakage as compared with amalgam.⁷
4. Glass ionomer cement: This material shows the property of adhesion in a chemical manner. Glass ionomer cement shows greater sealing property when compared to other materials. In glass ionomer cement literature stated that light cured glass ionomer cement

shows better sealing properties than chemically cured glass ionomer cement. Resin modified glass ionomer cement also shows better sealing results in the perforation area than the chemically cured glass ionomer cement.⁸

5. Calcium enriched mixture: When a material is consisting different compounds of calcium it is known as calcium enriched medium. Different calcium compounds are present in higher concentration in calcium enriched medium and therefore it results in rapid precipitation of hydroxyapatite which makes calcium enriched mixture preferable to be used in the perforation site Literature also stated that when calcium enriched medium was used in the treatment of perforation, it shows excellent results and along with it also shows cementogenesis and periodontal regeneration in the perforation site.⁹
6. Bio dentine: It is a bio active material which is based on calcium and silica. It is totally biocompatible with the surrounding peri radicular tissue, having good sealing properties and better handling properties.¹⁰
7. Bio aggregate: It is basically a bio ceramic material, it results in mineralized formation of the tissue. Acidic pH does not influence bio aggregate material, when this material is used as a perforation repair material.^{11,12}

3. Surgical Approach for the Treatment of Perforation

Surgical approach is most commonly used in the repair of large perforation and in the treatment of those perforations which are not treated by the use of non-surgical protocol. The primary goal of the surgical approach is to maintain the tight seal at the perforation site and to make the site free from micro organisms.

In the surgical approach it is advised to do the root canal treatment earlier and after than the flap is raised and the material is directly packed over the perforation site without causing any damage to the surrounding tissue and after than the flap is approximated. In case of apical perforation root resection is done till the sound root structure is achieved and filling with the adequate material should be done. There is a new approach of intentional re implantation can also done, in intentional re implantation the affected with the large perforation is extracted with minimal damage to the cementum and to the surrounding alveolar bone, the defect is treated extra orally with minimal time taken and after that the tooth will be re implanted to the socket again with minimal time to avoid the risk of external resorption of the tooth.

4. Conclusion

There are different materials available for the treatment of the perforation, a clinician should or must have a thorough knowledge of all the materials, so to make the choice which material when to be used.

5. Conflict of Interest

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References

1. Seltzer S, Bender IB, Smith J, Freedman I, Nazimov H. Endodontic failures—an analysis based on clinical, roentgenographic, and histologic findings. II. *Oral Pathol.* 1967;23(4):517–30. doi:10.1016/0030-4220(67)90547-6.
2. Tsesis I, Fuss Z. Diagnosis and treatment of accidental root perforations. *Endod Top.* 2006;13:95–107. doi:10.1111/J.1601-1546.2006.00213.X.
3. Alhadainy HA. Root perforations. A review of literature. *Oral Surg Oral Med Oral Pathol.* 1994;78(3):368–74. doi:10.1016/0030-4220(94)90070-1.
4. Fuss Z, Tsesis I, Lin S. Root resorption-diagnosis, classification and treatment choices based on stimulation factors. *Dent Traumatol.* 2003;19:175–82.
5. Moreinis SA. Avoiding perforation during endodontic access. *J Am Dent Assoc.* 1979;98(5):707–12. doi:10.14219/jada.archive.1979.0146.
6. El-Deeb ME, El-Deeb M, Tabibi A, Jensen JR. An evaluation of the use of amalgam, cavit, and calcium hydroxide in the repair of furcation perforations. *J Endod.* 1982;8(10):459–66. doi:10.1016/S0099-2399(82)80151-9.
7. Weldon JK, Pashley DH, Loushine RJ, Weller RN, Kimbrough WF. Sealing ability of mineral trioxide aggregate and super-EBA when used as furcation repair materials: A longitudinal study. *J Endod.* 2002;28(6):467–70. doi:10.1097/00004770-200206000-00013.
8. Torabinejad M, Hong CU, McDonald F, and TPF. Physical and chemical properties of a new root- end filling material. *J Endod.* 1995;21(7):349–53.
9. Himel VT, Alhadainy HA. Effect of dentin preparation and acid etching on the sealing ability of glass ionomer and composite resin when used to repair furcation perforations over plaster of Paris barriers. *J Endod.* 1995;21(3):142–5. doi:10.1016/s0099-2399(06)80440-1.
10. Lemon RR. Nonsurgical repair of perforation defects. Internal matrix concept. *Dent Clin North Am.* 1992;36(2):439–57.
11. Gunesser MB, Akbulut MB, Eldeniz AU. Effect of various endodontic irrigants on the push-out bond strength of biodentine and conventional root perforation repair materials. *J Endod.* 2013;39(3):380–4. doi:10.1016/j.joen.2012.11.033.
12. Hashem AA, Amin SA. The effect of acidity on dislodgment resistance of mineral trioxide aggregate and bio-aggregate in furcation perforations: An in vitro comparative study. *J Endod.* 2012;38(2):245–9. doi:10.1016/j.joen.2011.09.013.

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