

Root Canal Perforation: A Quick Review

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Abstract

Root canal perforation is a communication between the root canal system and supporting tissues of the teeth (periodontium). Causes of root canal perforation can be due to multiple factors i.e., Caries, Resorption, Iatrogenic, Perforation prognosis depends on multiple factors these are; time size and location, based on the prognostic factors perforation can be classified into, Fresh Perforation, Old Perforation, Small Perforation, Large Perforation, Coronal Perforation, Crestal Perforation, Apical Perforation. A wide variety of materials to seal the perforations have been suggested in literature. Root perforation complicates the treatment and deprives the prognosis if not properly managed. Root canal perforation can be avoided in most of the cases if the clinician follows the basic principle of the root canal treatment protocol.

Introduction

Root canal perforation is a communication that arises between the periodontium and the root canal system. Perforations can be pathological, resulting from caries or resorptive defects, but most commonly occur iatrogenically (during or after root canal treatment). Indeed, perforations occurring during root canal therapy may account for as many as 10% of all failed endodontic cases.

Bacterial infection emanating either from the root canal or the periodontal tissues, or both, prevents healing and brings about inflammatory sequelae where exposure of the supporting tissues is inflicted. Thus, painful conditions, suppurations resulting in tender teeth, abscesses and fistulae including bone resorptive processes may follow.

Down-growth of gingival epithelium to the perforation site can emerge, especially when accidental perforations occur in the crestal area by lateral perforation or perforation in furcations of two- and multi-rooted teeth.

Once an infectious process has established itself at the perforation site, prognosis for treatment is precarious and the complication may prompt extraction of the affected tooth. Yet, if discovered early and properly managed, prolonged survival of the tooth is possible. This review relates specifically to the diagnosis and the impact of various factors on the prognosis, as well as the principles for treatment of root perforations. It also discusses measures for prevention.

Causes

1. **Access Preparation:** Straight line access through the crown is essential to preserve tooth structure integrity. However, sometimes crown and root not aligned that make access opening difficult to imagine and produce. Such cases include teeth with fixed prosthesis (crown), dilacerated and rotated teeth.

These teeth should be studied carefully on parallel or bitewing radiograph and depth of pulp chamber is measured to avoid overzealous preparation.

2. **Canal Identification:** Sometimes it's difficult to find canal orifices due to calcified or sclerotic pulp chamber. These cases require referral to specialist. An endodontist with good experience and with the uses of endodontic microscope. Calcified pulp chambers should not be negotiated using rotary bur as this represents the perfect technique for perforation!
3. **Canal Preparation:** Incorrect use of large stainless steel instruments in curved canal result in perforation. Creating glide path for rotary Ni-Ti files guarantee less iatrogenic errors such as perforation or ledging. Also the overzealous use of gates glidden burs in curved portion of canals can lead to such errors.
4. **Post Space Preparation:** Ideally 4-5 mm of gutta-percha should remain in canal after post space preparation. Inappropriate use of preparation burs and instrument to create space for posts in curved canals can lead to strip perforation. Careful study of tooth anatomy and measurement is a must.

Prognosis

Several Prognostic Factors Can Affect the Treatment Outcome of Perforation

1. **Time:** Is the most crucial and effective factor in prognosis of perforation. Root perforation that repaired immediately in the same appointment carry the best prognosis. If immediate treatment cannot be provided, a temporary restoration is placed and patient referred to a specialist.
2. **Size:** Large perforation may not respond to repair as small perforation. Large perforations are more likely to occur during operative procedures, when aggressive burs are used, causing more traumatic Endodontic root perforation.
3. **Location:** Perforation occurring close to crestal bone and epithelial attachment carry less predictable prognosis, as bacterial

contamination from the oral environment is possible through gingival sulcus. Infection control at the site of perforation is the most important factor in perforation repair, and this factor cannot be efficiently controlled in this kind of perforation, so the prognosis is unpredictable or questionable. Apical migration of epithelial attachment creates a periodontal pocket that nourishes the perforation site with inflammatory component leading to poor prognosis. In this case, both periodontal and endodontic treatment should be provided and the result is not predictable. Furcation perforation carry the same prognosis as crestal perforation. Perforations, apical to the crestal bone and epithelial attachment, are considered to have a good treatment prognosis when adequate endodontic treatment is provided.

Classification

Based on prognostic factors which may assist the clinician to select the proper treatment (proposed by Fuss & Trope)

Fresh perforation Small perforation Coronal perforation Apical perforation	Good Prognosis
Old perforation Large perforation Crestal perforation	Questionable Prognosis.

Perforation Diagnosis

1. Paper point, Presence of blood on paper point, particularly in coronal or middle third can indicate a perforation. However, it should be noted that apical over instrumentation and remnant of vital pulp can also leave blood on paper point.
2. Apex Locator, A reliable method which read short of the working length.
3. Radiograph, a clear communication between the root canal system and the surrounding tissue.
4. Magnification, The illumination and magnification of endodontic microscope make it ideal for locating and treating perforations above the curve line.
5. If perforation is old it can be detected using periodontal probe which show narrow isolated pocket to the site of perforation due to apical migration of epithelial attachment.
6. Cone Beam Computed Tomography CBCT.
7. Clinical sign, sudden appearance of pain and/or blood during access opening, instrumentation or post space preparation can alert the clinician to the possible occurrence of perforation.

Repair Materials

Several materials have been suggested to repair root perforation these are from the past till today these are:

1. Indium foil
2. Amalgam
3. Plaster of Paris
4. Zinc Oxide Eugenol
5. Super EBA
6. IRM (Intermediate Restorative Material)
7. Gutta Percha
8. Cavit
9. Glass Ionomer Cement
10. Metal-Modified Glass Ionomer Cement
11. Composite
12. Dentin chips
13. Decalcified Freezed Dried Bone

14. Calcium Phosphate Cement
15. Tricalcium Phosphate Cement
16. Hydroxyapatite
17. Calcium hydroxide
18. Portland Cement
19. MTA
20. Biodentine
21. Bio Ceramics.

Key Concepts to Avoid Perforation during Endodontic Treatment

- Pre Operative radiograph
- Knowledge of the Root Canal Anatomy
- Use a magnification
- Create a straight line access
- Always follow manufacturer guidelines on rotary instrument protocols
- Never force a file
- If you suspect a blockage or ledge, do not use rotary instruments
- In multi rooted teeth always file away from the furcation with brush strokes of the Instruments
- Use 'fine files frequently' between larger files to prevent blockages and ledge formation
- Use copious irrigation to remove debris
- Negotiate the canal initially with a small size files
- Referral to specialist if needed [1-11].

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