



Review Article

Root Canal Treatment: The complications (A Brief Review)

Arwinder Kaur Sekhon^{1*} Asim Goel² Deepika Ghai³

1, 2. Genesis Institute of Dental Sciences and Research Ferozepur, Punjab, India.

3. Sri Guru Ram Das Institute of Dental Sciences and Research Amritsar, Punjab, India.

***Corresponding Author: Dr. Arwinder Kaur Sekhon**, B.D.S, Genesis Institute of Dental Sciences and Research Ferozepur, Punjab, India.

Received Date: May 11, 2021

Publication Date: June 01, 2021

Abstract

Root canal treatment has been considered a successful option in preserving or saving the tooth. It involves mainly three steps that is access cavity preparation, cleaning and shaping, and obturation of the canal. Through seems simple but complications do occur. This review highlights various types of complications and their management, methods to prevent them.

Keyword: *Root canal treatment, access cavity, cleaning and shaping, obturation, complications.*

Introduction

Root canal treatment is also known as Endodontic treatment is the procedure to remove the inflamed or infected pulp tissue from within the tooth. Endo is derived from the Greek word that means inside and odont also from the Greek word that means tooth. The inflammation or infection can have a variety of causes such as deep decay, trauma, a crack or chip in the tooth. The main objective of this treatment is to eliminate the destructive microorganism, reduce debris and remaining pulp tissues, and complete



the removal of connective tissue. So, as to enable an effective seal to prevent recolonization of the canal with bacteria. [1]

Need for Root Canal Treatment

Tooth decay is caused by bacteria. The pulp defense against the bacteria is inflammation known as pulpitis. As the bacteria enter the pulp it causes tissue destruction by spreading through the pulp and into the canal system. This leads to an infected pulp which if left untreated the bacteria spread out of the tooth and cause pathology and infection in the bone surrounding the tooth which is outlined as a dental abscess. If left untreated, not only a person can lose his teeth but also infection can spread to another part of the body.

Steps for a root canal treatment

After proper diagnosis and treatment planning using intraoral and radiographic evaluation, the procedure for a root canal is carried out. This also helps in knowing the anatomy of the canal. The entire procedure is outlining in three categories: Access Cavity Preparation, Cleaning and Shaping, and Obturation of the canal.

The steps are as follows:

- Placement of rubber dam to isolate the tooth after giving Local anesthesia.
- Access Cavity Preparation to access the root canals and pulp chamber.
- An antibacterial and antiseptic solution is used to clean and disinfect the canals.
- Working Length measurement: this can be done either by the conventional method that used K-file and IOPA, paper point measurement, or other electronic methods such as Apex Locator
- Cleaning of the canal removes nerve tissue, bacteria, toxins as well as other debris harbored inside the tooth.
- **Shaping of the canal: these are divided into 2 techniques:**
 - I. Apico-coronal technique- standardized, step back, balanced force.
 - II. Corona-apical technique- step down, double flared, crown-down-pressure less.
- Disinfection of the canal using sodium hypochlorite is mostly preferred. Specialized blunt-needle



are used to deliver these disinfectants.

- After thorough cleaning and shaping, the canal is dried using paper point.
- Obturation of the canal is carried out as a final step. This seals the canal and is done using two components: a sealer i.e. cement and a Gutta Percha.
- A temporary filling is placed after the obturation of the canal.
- After 7 days if a patient report no pain or any sign of infection such as swelling that permanent filling is done.

Complications of Root Canal Treatment

Various mishaps occur during root canal treatment that can be ranging from minor to major discomfort for the patients. These complications can be

- Access cavity preparation related,
- Instrument-related,
- Irrigant related, and
- Obturation related.

Access Cavity Preparation related: Treating the wrong tooth

- Incomplete removal of the caries
- Canal Blockage
- Missed canal orifices

Treating the wrong tooth

Arriving at a diagnosis and designing a treatment plan can lower down the number of procedural mishaps. This complication can be avoided. Mark a suitable marking on the radiograph and also on the tooth in the oral cavity before the application of the rubber dam. This helps to avoid the treatment of the wrong tooth. Or one can do the initial access cavity into an enamel or dentin-enamel junction before



the rubber dam application. [2]

Incomplete removal of caries

It is recommended that an existing old restoration especially involving occult proximal areas should be removed in total and the access cavity designed accordingly. Another common error occurs in distal carious lesions involving the pulp. So, complete removal of the carious process should be the first principle of the access opening.

Canal Blockage

The blockage in the root canal prevents access to the apical constriction or apical stop. This can be confirmed by taking a radiograph which may show the file is not reaching up to its established working length.

Etiology

- Packed dentinal chips, cotton pellets, and tissue debris.
- Presence of fracture instruments or restorative materials.
- The tip of the instrument used is wider than the canal diameter.

Treatment

- If blockage occur place a small amount of EDTA lubricant on a fine instrument and introduce it in the canal
- Use a gentle watch winding motion along with copious irrigation of the canal to remove the dentin chips or tissue debris.
- Endodontics is used to dislodge the dentin chips by the action of acoustic streaming.

Prevention

- Always use the smaller-sized instruments first
- Use instrument in sequential order



- Use reproducible reference points and a stable silicon stopper on the instrument
- Recapitulate repeatedly
- Use copious amount of irrigant and always work in a wet canal.
- Rotation and excessive pressure of intracanal instruments must be avoided.

Missed canal orifices

There are several teeth that have a predisposition for extra canal which might be missed if not explored accurately while treatment such as mandibular incisors, upper first molar, maxillary premolars. [3]

Etiology

- Lack of knowledge pertaining to root canal anatomy, configuration, and its variation
- Improper access
- Incomplete deroofing of the pulp chamber
- Incomplete removal and shaping of lateral walls of the pulp chamber
- Failure to externalize the internal anatomy.

Prevention and action

- Good periapical radiographs preoperatively and during root canal cleaning and shaping. Observe radiograph under magnification.
- Multiple radiographs in varying angulations help to understand the morphology of the tooth.
- Use of surgical loupes and DOMs with better-enhanced vision and lighting focus area.
- Use ISO K-file to locate the orifices.
- Use of Sodium Hypochlorite: after thorough cleaning and shaping, the pulp chamber is filled with sodium hypochlorite. If bubbles appear in the canal, it means either there is residual tissue present in a missed canal or residual chelator in the prepared canal. This is known as the Champagne test.



Instrument related

- Ledge perforation
- Cervical perforation
- Mid-root perforation
- Instrument aspiration

Ledge perforation:

It is internal transportation of the canal that prevents the positioning of an instrument to the apex.

Etiology

- Complete loss of control of the instrument
- Not extending the access cavity sufficiently to allow adequate access to the apical part
- Incorrect assessment of the root canal curvature
- Forcing or driving the instrument into the canal
- Over-relying on the chelating agents
- Attempting to a prepared calcified root canal.

Management

- Early recognition of having created a ledge is significant.
- Ledges created by the smaller instrument are easier to bypass and make the pathway to the main canal easier.
- Procure or over curve the apical 3-4mm of the file with the same curvature
- If the ledge is closer to the apical terminus complete the canal cleaning and shaping and obturates with the injectable thermoplastic obturation techniques.



Prevention

- A preoperative radiograph is taken to assess and anticipate unusual root canal curvature.
- Patency of the canal should be maintained
- Never force the instrument apically
- Work sequentially increasing the sizes of instruments without jumping to large numbers.

Cervical Perforation

It usually occurs in the form of gouging which leads to crown perforation caused by directing the bur non-parallel to the long axis of the tooth.

Management

- The primary protocol is hemorrhage control with epinephrine followed by perforation repair. Epinephrine used is 1:50,000 and repair is done with MTA. One can open periodontal treatment options.
- Once, there is the flooding of blood in the pulp chamber, one must suspect a perforation likely into periodontal tissues or into the furcation.
- An electronic apex locator is very useful in differentiating a bleeding canal from a perforation.

Prevention

- Study the preoperative radiograph and meticulously evaluate the pulp chamber morphology.
- Access bur penetration for depth and angulation should be confirmed before proceeding.
- Straight-line access
- While preparing access cavities if a ceramic crown or metal crown is existing, it is better to remove the crown and proceed with endodontic access and treatment.
- A DOM is recommended to be an integral part of an endodontic practice as the greater magnification and illumination enables a clinician to prevent and manage procedural error.



Mid-root perforation

Etiology

- Occur in the curved canal with a ledge
- Over-instrumentation
- Overpreparation of the thin wall of root canal

Management

- If the defect is small and hemostasis can be achieved, perforation can be sealed and repaired during three-dimensional obturation of the root canal.
- But in case the perforation defect is large and moisture control is difficult, then one should prepare the canal before going for perforation repair.
- Lemon in 1992 gave the internal matrix concept for the repair of inaccessible strip perforations using microsurgical technique⁴.
- The rationale behind this concept was that a matrix was needed to control the material and thus preventing overfilling of the repair material into the peri-radicular tissues. He suggested the use of hydroxyapatite for this.

Instrument Aspiration

Aspiration of the instrument can be a clinical disaster ending up in life-threatening situations or ending up in the need for major surgery to remove the instrument. [5]

Prevention

- This can be avoided by using a rubber dam.
- High power suction is synonymous with rubber dam application.
- Tying a floss with the endodontic instrument



Obturation related

- Underextended root canal filling
- Overextended root canal filling

Underextended root canal filling

Etiology

- Due to loss of working length as a result of packing dentinal mud onto the pulp space without recapitulation or insufficient irrigation.
- Inadequate working length determination
- Inadequate irrigation and recapitulation
- Packing of tissue debris in the apical portion of the canal.

Management

- Use of small size files to dislodge the packed dentinal mud
- Irrigation with sodium hypochlorite is recommended

Prevention

- Obtain a radiograph after this procedure and reposition the master cone.
- Take a confirmatory radiograph and proceed with the obturation after using a suitable sealer depending upon the technique.

Overextended root canal filling

It occurs due to the filling of the canal beyond 2mm of the root apex. [7]

Etiology

- Over-instrumentation



- Improper determination of the working length
- Apical root resorption
- Incomplete root apex formation.

Prevention

- Accurate estimation of working length
- Reproducible reference points
- An apical stop is mandatory
- When placing a master cone to estimated working length, obtain more than one radiograph.

Irrigant related

Forcefully injecting Sodium hypochlorite or other irrigating solutions into the apical tissue can be disastrous. The patient may complain immediately of severe pain. Other symptoms can be ballooning of the tissues in the area and swelling of the tissue. When sodium hypochlorite enters the peri-apical tissues, it opens the capillaries and minute blood vessels⁸.

Management

- Inform and communicate with the patient.
- If not under local anesthesia, give block anesthesia
- Allow the bleeding from the canal to continuously flow since this is a defence physiological mechanism
- Flood the canal with normal saline so that as much of blood accumulated will come out and decrease the level of pain.

Prevention

- Always use passive irrigation and never pump the irrigant into the pulp space.
- In open apices, never force irrigant at the apical few millimeters.



- To avoid flushing of the canal beyond constriction, keep the needle passively fitting in the canal and do not wedge it against the apical third area.

Miscellaneous

- Zipping
- Stripping or lateral wall perforation
- Vertical root fracture

Zipping

- It is defined as a transposition of the apical portion of the canal. Apical foramen in zipping becomes a teardrop or elliptical shape.
- Etiology
- Forcing instruments in the curved canal
- Use of large, stiff instruments
- Failure to preserve the files.

Management

- Files placed in a curved canal cut more on the outer portion of the canal wall at its apical extent thus causing movement of the canal away from the curve and its natural path.
- When a file is rotated in the curved canal a biomechanical defect known as an elbow is formed coronal to the elliptically shaped apical seat.
- In many cases, the obturating material terminates at the elbow leaving an unfilled zipped canal apical to the elbow. This is a common occurrence with the laterally compacted gutta-percha technique.
- The use of vertical compaction of warm gutta-percha is ideal in these cases to compact a solid core material into the apical preparation.



Prevention

- Use of pre-curved files for curved canal
- Use of flexible files
- Use of incremental filling technique
- Remove flutes of file at certain areas which makes contact with the outer dentinal wall at the apex and portion which makes contact with inner dentinal wall especially in the mid root area.

Stripping/Lateral wall Perforation

- It is caused by the over instrumentation in the canal especially which are thin wall and is most likely to occur on the concave wall of a curved canal.
- It is easily detected by the sudden appearance of the hemorrhage in dry canal. [9]

Management

- Successful repair of stripping relies on the adequacy of the seal established by repair material. Access to mild root perforation is most often difficult and repair is unpredictable.
- MTA or Calcium Hydroxide can be used as a biological barrier against which filling material is packed.

Prevention

- Use of pre-curved files for curved canal
- Use of anti-curvature filling pressure thereby preventing root thinning.

Vertical root fracture

It is the fracture that can occur at any phase of the root canal treatment.

Etiology

Wedging forces within the canal. These forces increase the binding strength of existing dentin causing fatigue and fracture. [10]



Management

- Most cases- extraction
- For multi-rooted teeth-root resection or hemisection

Prevention

- Avoid weakening of the canal wall
- Minimize the internal wedging forces
- Avoid over-preparation of the canal
- Use less tapered and more flexible instruments.

Clinical Features

- Vertical root fracture commonly occurs in faciolingual plane.
- Sudden crunching sound accompanied by pain of the root fracture.
- The fracture begins along the canal wall and grows outwards to the root surface.
- The susceptibility of root fracture increases by excessive dentin removal during canal preparation or post space preparation.
- Also, the excessive condensation forces during compaction gutta-percha while obturation increases the frequency of root fractures.

Conclusion

Root canal treatment or endodontic procedures are considered as bread and butter of dentistry. Through a simple but require a minute or in-depth knowledge of the procedure. These complications can be avoided with the proper diagnosis and treatment planning. However, the key to the success of the prevention of these complications is the knowledge of the anatomy of the root canal.



References

1. Shen, Y., Stojicic, S., Qian, W., Olsen, I. and Haapasalo, M., 2010. "The synergistic antimicrobial effect by mechanical agitation and two chlorhexidine preparations on biofilm bacteria". *Journal of endodontics*, 36(1), pp.100-104.
2. Gutmann, J., 2016. "Grossman's Endodontic Practice-13 [sup] th Edition". *Journal of Conservative Dentistry*, 19(5), pp.494-494.
3. Ingle, J.I. and Baumgartne, J.C., 2008. "Ingle's endodontics" 6. BC Decker; Maidenhead: McGraw-Hill Education [distributor].
4. Estrela, C., Decurcio, D.D.A., Rossi-Fedele, G., Silva, J.A., Guedes, O.A. and Borges, Á.H., 2018. "Root perforations: a review of diagnosis, prognosis and materials". *Brazilian oral research*, 32.
5. Mozayeni, M.A., Asnaashari, M. and Modaresi, S.J., 2006. "Clinical and radiographic evaluation of procedural accidents and errors during root canal therapy". *Iranian endodontic journal*, 1(3), p.97.
6. Yousuf, W., Khan, M. and Mehdi, H., 2015. "Endodontic procedural errors: frequency, type of error, and the most frequently treated tooth". *International journal of dentistry*, 2015.
7. Neaverth, E.J., 1989. "Disabling complications following inadvertent overextension of a root canal filling material". *Journal of endodontics*, 15(3), pp.135-139.
8. HÜLSMANN, M., RÖDIG, T. and Nordmeyer, S., 2007. "Complications during root canal irrigation". *Endodontic Topics*, 16(1), pp.27-63.
9. Ciobanu, I.E., Rusu, D., Stratul, S.I., Didilescu, A.C. and Cristache, C.M., 2016. "Root Canal Stripping: Malpractice or Common Procedural Accident—An Ethical Dilemma in Endodontics". *Case reports in dentistry*, 2016.
10. Garg, N. and Garg, A., 2010. "Textbook of endodontics". Boydell & Brewer Ltd.

Volume 2 Issue 6 June 2021

©All rights reserved by Dr. Arwinder Kaur Sekhon. BDS