



Research Article

MISHAPS DURING BIOMECHANICAL PREPARATION OF ROOT CANAL SYSTEM- A REVIEW

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ABSTRACT

Root canal therapy consists of a series of scientifically-based technical procedures. Biomechanical preparation is the complex procedure, performed with different instruments and chemicals in a very restricted environment. The biomechanical preparation of the canal is done with two actions, cleaning and shaping. Specifically, cleaning of canal is debridement, whereas shaping is preparing the root canal system for obturation.

Lack of knowledge, its poor application, or a compromise or a break in the chain of proper procedures can lead to a number of accidental errors which are collectively called 'endodontic mishaps'.(8)

This article covers the basic knowledge of etiologic factors and methods of prevention as well as recognition, management and prognosis of mishaps during cleaning and shaping of root canal system.(1)

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INTRODUCTION

The reason in many cases teeth do not respond to root canal therapy is because of procedural errors that prevent the control of intracanal endodontic infection.(1)

Endodontic mishaps or procedural errors/accidents are those unfortunate occurrences that happen during the endodontic procedure, some of which owing to lack of attention to detail, others completely unpredictable. These procedural errors were termed as "Mishap" by Torabinejad (1990).(1)

Biggest challenge and first step in treating mishap is its detection. After detection, correction may be accomplished depending on the type and extent of the procedural accident. The next step is to re-evaluate the prognosis of the involved tooth. This is very essential as it may affect the entire treatment plan and may also require dentolegal consequences.

LEDGE

Definition

A ledge is an artificially created irregularity on the surface of the root canal that prevents the placement of instruments to the apex of an otherwise patent canal.(3)

Ledges in root canals can result from a inadequate access cavities that allow direct access to the apical part of the canals or from using straight or too-large instruments in canals with excessive curvatures.(3)

Recognition

Recognition of a ledge might be by clinical or radiographic observation. Ledge formation should be suspected when the root canal instrument gets a hard stop and can no longer be inserted into the canal to full working length.(2)

Correction/ Remedies of ledge Formation

Once ledge detected, a small file, no 10 or no 15 file is inserted into the canal with the tear shape silicone stops and canal is explored. Instrument is introduced in watch winding motion; whenever a resistance is felt, file is retracted, rotated an advanced further to bypass the ledges. If the instrument is introduced on to the full working length radiograph is taken to confirm the location of the file.(3)

A break through in ledge management is the use of Greater taper NiTi hand files. The D_o diameter of GT files are 0.02 mm, and their maximum flute diameter is 1.00, and their tapers are three to six times the conventional 0.02 tapered files.

Moreover, the concept of use of modified-tip files is that the rounded tip does not cut into the wall but will slip alongside it. The modified-tip files have been marketed as, Control Safe files (Dentsply/Maillefer, Tulsa, OK), Flex-R files (Moyco/Union Broach, Miller Dental, Bethpage, NY), Anti-

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Ledging Tip files (Brasseler, Savannah, GA), and Safety Hedström files (Sybron Endo/Kerr, Orange, CA).(4)

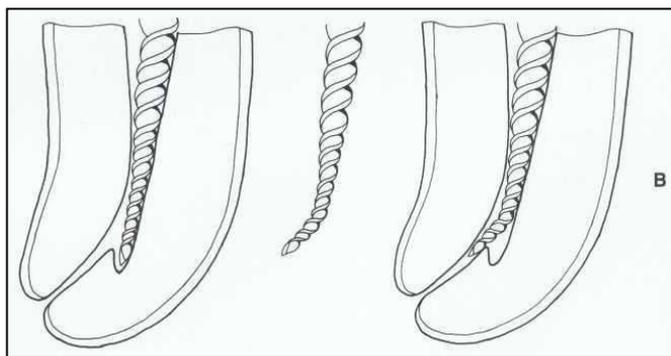


Fig.No.1 Correcting a ledge. A, Ledges or obstructions are occasionally bypassed by placing a small bend at the instrument tip. B, To negotiate the file past ledges, the tip is teased along the canal wall to attempt to locate the original canal.(2)

Perforations

Definition

It represent an artificial communication between the root canal space and the external root surface, causing irritation of the periradicular tissues.(5)

Root perforations may occur due to pathological processes or as a result of treatment consequences.

Etiology

1. Misaligned use of rotary burs during endodontic access preparation.(5)
2. Efforts to negotiate calcified and curved canal.(5)
3. Inappropriate post space preparation for permanent restoration.
4. Non-iatrogenic causes, including root resorption and caries.

Accidental canal Perforations are Categorized by Location.(1)

Should be written as

- ✓ Cervical,
- ✓ Mid,
- ✓ Apical perforations

Cervical Perforation

Etiology: The cervical portion of the canal is most often perforated during the process of locating and widening the canal orifice or inappropriate use of Gates-Glidden burs.(1)

Recognition: Sudden appearance of blood, which comes from the periodontal ligament. Rinsing and blotting may allow direct visualization of the perforation; magnification with either loupes, an endoscope, or a microscope is very useful in these situations.(1)

Correction: Correction may include both internal and external repair. A perforation if very small can be sealed from inside the tooth. If the perforation is large, it may be necessary to seal first from the inside and then surgically repair the damaged external tooth structure. Many materials have been used (amalgam, Cavit, glass ionomer), but the most promising material for almost all types of perforations is MTA(5) to provide a very excellent seal of perforated areas, and since it requires moisture for setting it is very useful in areas of

bleeding.(1)

Mid-root Perforation

Etiology: Lateral perforations at midroot level tend to occur mostly in curved canals, either as a result of

1. Perforating when a ledge has formed during initial instrumentation or stripping.
2. Endodontic files, Gates Glidden drills, or large, misdirected posts(1)

Recognition: Sudden appearance of hemorrhage in a previously dry canal, if there is tactile resistance of the confines of the canal space, or by a sudden complaint by the patient. A paper point placed in the canal can confirm the presence and location of the perforation. (1)

Correction: After initial 3-dimensional obturation of the canal apical to the perforation, the defect and the rest of the canal can be obturated with MTA.

Apical Perforation

Etiology: Perforations occurring in the apical one-third of roots primarily result from

1. File not negotiating a curved canal or not establishing accurate working length and (1)
2. Instrumenting beyond the apical confines.(1)

Recognition: Sudden complain of pain during treatment, the canal flooded with hemorrhage, or loss of tactile resistance of the confines of the canal space. It is important to confirm one's suspicions radiographically. A paper point inserted to the apex will confirm a suspected apical perforation (1)

Correction: Efforts to repair an apical perforation may be in two ways

1. Attempting to renegotiate the apical canal segmentor.
2. Considering the perforation site as the new apical opening and then decide what treatment the untreated apical root segment will require. Materials used, include dentin chips, calcium hydroxide powder, Proplast, hydroxyapatite and more recently, MTA.

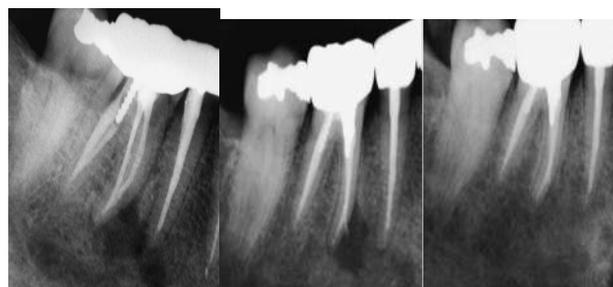


Fig. No 2 A, The patient presented with pain and localized swelling buccal to tooth #30. Endodontic treatment had been done 5 years previously. B, Mesial canals were re-treated, and the apical root perforation was sealed with calcium hydroxide. Later the root canals were obturated with gutta-percha and Roth's sealer. C, Two year post-treatment radiograph. (Courtesy of Dr. Steven Morrow, Loma Linda University, California.)(5)

TRANSPORTATIONS

Definition

According to the Glossary of Endodontic Terms of the American Association of Endodontists, canal transportation is defined as follows 'Removal of canal wall structure on the

outside curve in the middle third and apical third of the canal due to the files' tendency to restore themselves to their original linear form during biomechanical preparation; this may lead to ledge formation and possible perforation.'(6)

Etiology

Damage to the apical foramen – Deviation from the original curvature of the root canal system or dislocation of the original central long axis of the root canal may result in a loss of an apical stop.(6)

Zip formation – A transported root canal system with its over preparation along the outer curve of the root canal adopts an elliptical shape at the apical end. Zipping of a root canal influenced the apical seal adversely when these transported canals were obturated in vitro by lateral compaction technique.(7)

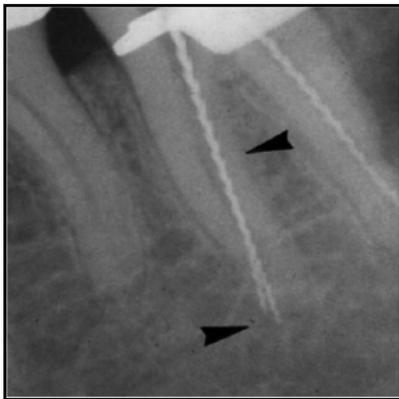


Fig 3 Transportation of the mesial roots of a lower molar after improper shaping

Elbow formation – Narrow apical portion of the root canal between the over removal of material along the outer aspect in the apical and the over enlargement of the inner aspect of the curvature more at coronal levels, which is usually localized at the maximum curvature point. This preparation outcome can result in insufficient taper and flow of materials and may affect proper cleaning and obturation of the apical third of the root canal system.(6)

If the transportation has occurred, the canal exhibits reverse architecture and fails to provide resistance form for the obturating material.

Correction/ Remedies

Proroot is mixed with anaesthetic solution or sterile water to a heavy, cake like consistency. A small amount of the material is picked and introduced into the canal with a microtube carrying device, such as customized spinal tap needle or on the side of West perforation repair instrument. Proroot is then tamped and coaxed down the canal to approximate length using a customized nonstandard guttapercha cone as a flexible plugger.(6)

SEPARATED INSTRUMENTS AND FOREIGN OBJECTS

Definition

An instrument will fracture if its ultimate strength is exceeded, or if a crack has extended to such a degree that the remaining intact cross-section of material is unable to bear the usual operating load.(1)

Etiology

1. When the instrument is advanced into the canal until it binds, and efforts to remove it then lead to breakage, leaving a segment of it in the canal.(1)
2. Using a "stressed" instrument, placing exaggerated bends on instruments to negotiate curved canals, and forcing a file down a canal before the canal has been prepared sufficiently with the previous, smaller file and then using it in a reaming motion.(1)
3. When the instrument tip is larger than the canal section to be shaped.
4. When the operator exerts excessive pressure on the handpiece.

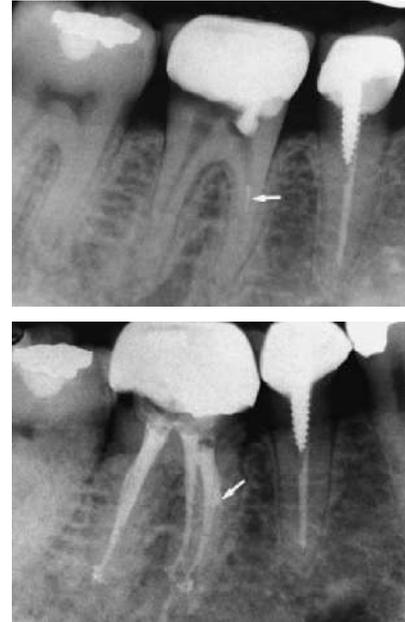


Fig. 4.No. A, Arrow showing to a separated rotary instrument in the ML canal of tooth **B**, Post-obturation radiograph with an **arrow** showing "tunneling" that was caused with an ultrasonic instrument used to remove the separated instrument. (Courtesy of Dr.MarshallGomes, Lodi, California.)

Correction/Remedies

The optimal correction of instrument separation or the presence of other foreign objects in a root canal system is to remove the blockage or obstruction. As a rule, attempts to remove instrument fragments should be made as the initial approach to corrective treatment.

Today, separated instruments can usually be removed due to enhancement in vision, ultrasonic instrumentation, and microtube delivery methods and dental operating microscope.(1)

CANAL BLOCKAGE

Definition

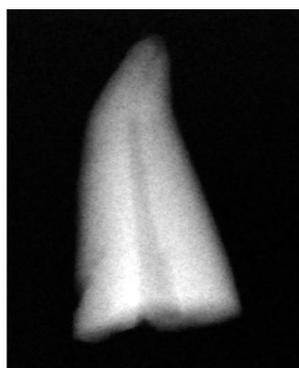
When a canal suddenly does not permit a working file to be advanced to the apical stop, a situation sometimes referred to as a blockout has occurred. (1,7)

Etiology

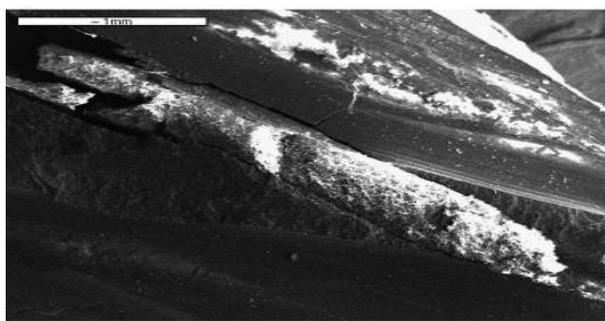
Canal Blockage is Caused When

- Pulpal tissue is packed apically and solidified in the apical constriction by the use of endodontic instruments;

- instrumentation without copious irrigation;or
- instruments are not cleaned before their reinsertion into the canal.(7)



(a)



(b)

Fig 5 (a) The discontinuation of canal space is due to its blockage by dentin chips after instrumentation.(b) SEM original magnification

Recognition

Recognition occurs when the estimated working length is not attained. Evaluating radiographically will demonstrate that the file is not near the apical constriction.(1)

Correction

Correction is accomplished by recapitulation. Starting with the smallest file, the quarter-turn technique is used; using a chelating agent can be helpful. If the blockout occurs at a curve or bend of the root, gently precurving the instruments to redirect it is also effective.(1)

CONCLUSION

Procedural mishaps can be prevented by paying proper attention. The literature provides much information and one can learn valuable lessons from prior experiences.

Today, patients expect to keep their teeth for a lifetime. With new knowledge and technology and advancements in dentistry and specifically endodontics have vastly improved the quality of care rendered to patients, we are able to keep many teeth that in the past would have been extracted and possibly replaced with an implant or a fixed or removal partial denture. When we encounter previously treated teeth that are not healing, we now have the knowledge and technology to disassemble and retreat them with a very high rate of success. Due to training, practice, experience and patience, clinicians can expand their capabilities alongside of these technologic advancements to perform endodontic treatments with increased success.(1)

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