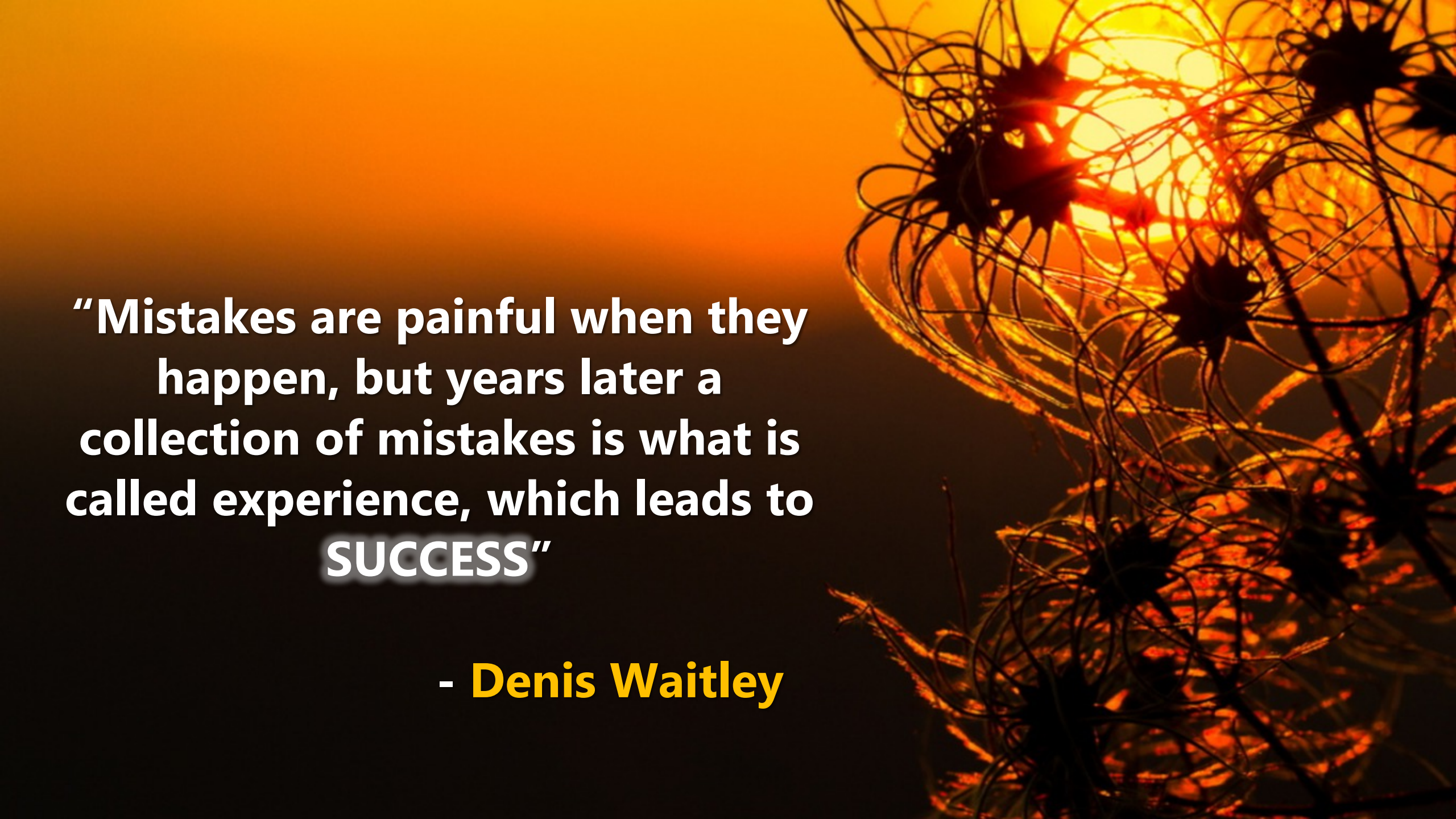

Good Morning


“Mistakes are painful when they happen, but years later a collection of mistakes is what is called experience, which leads to SUCCESS”
- Denis Waitley

Endodontic Mishaps

Dr. Nithin Mathew

Contents

Introduction

Endodontic mishaps or procedural accidents are those unfortunate occurrences that happen during treatment, some owing to inattention given to detail otherwise totally unpredictable.

INGLE :

Those unfortunate occurrences that happen during treatment, some owing to inattention to detail, others totally unpredictable.

WALTON & TORABINEJAD :

Unwanted or unforeseen circumstances during root canal therapy that can affect the prognosis.

Classification

According to Walton & Torabinejad

1. Procedural accidents during access preparation
2. Accidents during cleaning & shaping
    1. Ledge formation
    2. Creating an artificial canal
    3. Root perforations
    4. Separated instruments
    5. Other accidents
3. Accidents during obturation
    1. Underfilling
    2. Overfilling
    3. Vertical root fractures
4. Accidents during post space preparation

According to Ingle

I. Access related
   1. Treating the wrong tooth
   2. Missed canals
   3. Damage to existing restoration
   4. Access cavity perforations
   5. Crown fractures

II. Instrumentation related
   1. Ledge formation
   2. Cervical canal perforations
   3. Midroot perforations
   4. Apical perforations
   5. Separated instruments and foreign objects
   6. Canal blockage

III. Obturation related
   1. Over or underextended root canal fillings
   2. Nerve paresthesia
   3. Vertical root fractures

IV. Miscellaneous
   1. Post space perforation
   2. Irrigant related
   3. Tissue emphysema
   4. Instrument aspiration and ingestion

According to Leif Tronstad (Clinical Endodontics)

I. Incomplete Analgesia
II. Access cavity
III. Perforations from the pulp chamber
IV. Root Perforations
    1. Apical perforations
    2. Lateral perforation
    3. Post-perforations
V. Obliterated root canal
VI. Fracture of an instrument
VII. Adverse reactions to medicaments
    1. Local tissue irritation
    2. Neurotoxic reactions
    3. Allergic reactions
VIII. Overfilling of the root canal
IX. Vertical root fractures

Management of a Mishap

I. **Recognition** of a mishap

II. **Correction** of a mishap

III. **Re-evaluation of the prognosis** of the tooth involved

IV. How to **prevent** a mishap

Access Related Mishaps

Access Related Mishaps

Treating The Wrong Tooth

Cause

- Inattention on the part of the dentist
- Misdiagnosis

Recognition

- Patient continues to have symptoms after treatment
- Error may be detected after the rubber dam has been removed.

Correction

- Appropriate treatment of both teeth:
    - The one incorrectly opened
    - The one with the original pulpal problem

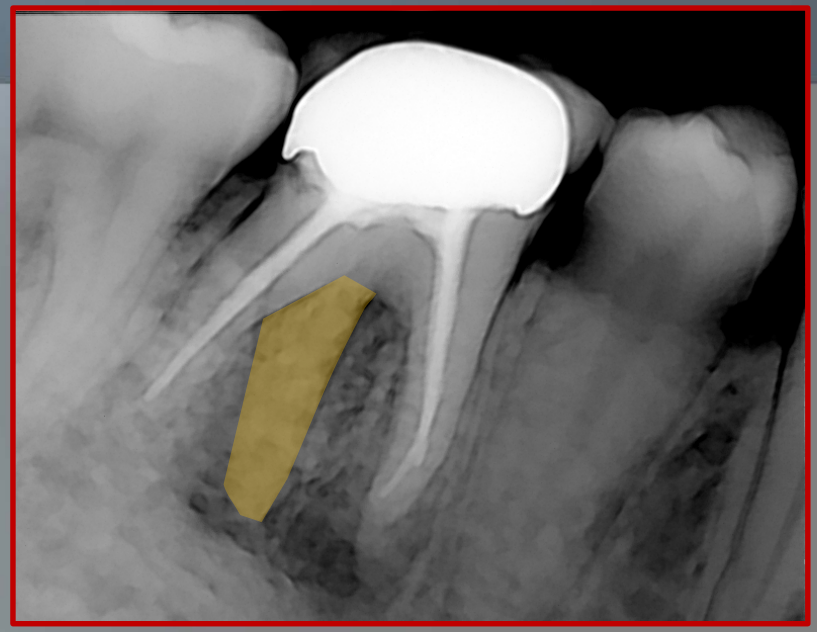
Prevention

- Mistakes in diagnosis can be avoided by obtaining at-least 3 good pieces of evidence supporting the diagnosis.
- Obtaining as much information as possible before making the diagnosis.
- Marking the tooth to be treated before isolating it with rubber dam.

Access Related Mishaps

Missed Canals

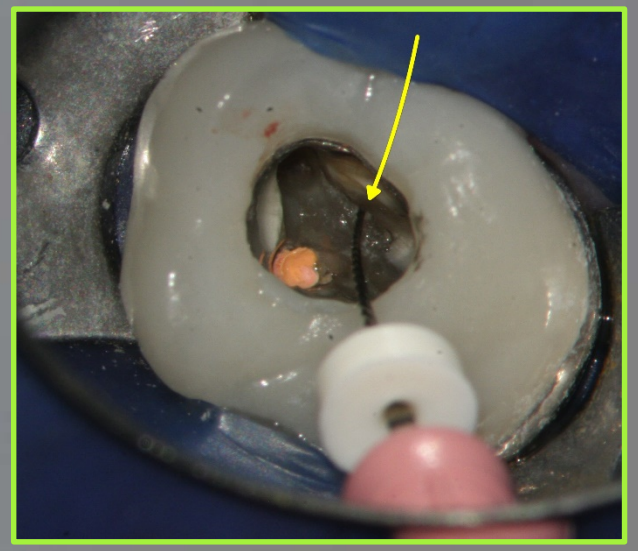
Cause



- **Anatomical**
  - Some root canals are not readily apparent or easily accessible
- **Dentist Related**:
  - Lack of knowledge about root canal anatomy.
  - Failure to adequately search for these additional canals.
  - Failure to remove cervical ledges - prevents straight line entry into the canal or cover up additional canals.

Recognition

- During treatment, an instrument or filling material may be noticed to be other than exactly centered in the root.
- Some cases, recognition may not occur until failure is detected.



- Mesial roots of maxillary molars and distal roots of mandibular molars - commonly missed canals.
- NaOCl can be used to detect canals – effervescence test

Correction

- Retreatment is appropriate and should be attempted before recommending surgical correction.

Prognosis

- Prognosis is reduced - most likely result in treatment failure.

Prevention

- Significant amount of failure are due to missed canals
- Thorough knowledge of the morphology of the tooth
- Interpretation of radiographs through mesial / distal angulation
- Computerized digital radiography, magnifying loupes, microscopes, endoscopes.
- Adequate coronal access - Follow principles of access cavity preparation
- DG-16 explorer / Micro openers

Access Related Mishaps

Damage To Existing Restorations

- Endo-treatment of a tooth with existing porcelain crown is challenging.

- Crown may chip off even with the most careful approach
  - While preparing access cavity
  - Placing rubber dam clamp on the margins

Correction

- Minor porcelain chips can be at times repaired by bonding composite resin to crown

Prevention

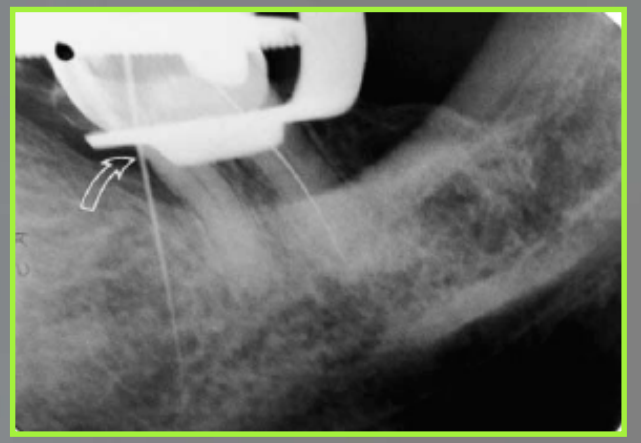
- Avoiding placing clamp directly on the margin
- Remove permanently cemented crown before treatment
- The rubber dam is released from the wings and positioned with the rubber between the jaws of the retainer and the restoration to provide a buffer.

- Specialized crown pliers can be used to remove restorations
- Remove crown with special device called Metalift crown and bridge system
- Ultrasonic Vibration

Access Related Mishaps

Access Cavity Perforations

- Happens during the search for canal orifices.
- Can occur either peripherally through the sides of the crown or through furcation.



Recognition

If the access cavity perforation is

- **Above PDL attachment**
  - Presence of leakage into the access cavity is often the first indication of an accidental perforation.

- **Into PDL**
  - Bleeding into the access cavity is often the first indication of an accidental perforation.

Cause

- Failure to identify the angle of the crown to the root and the angle of the tooth in the dental arch.
    - Ex:
        - Access through crowned teeth.
        - Maxillary lateral incisors and mandibular first premolars.

- Using a surgical length bur
- Misidentification of canals

Correction

- Coronal walls above the alveolar crest – can be repaired intracoronally without surgical intervention.
- Perforations into periodontal ligament – should be done as early as possible to minimize injury to the tooth's supporting tissues.
- Materials used for these perforations
  - - GIC, MTA, Super EBA, Tricalcium phosphate, Calcium hydroxide paste, amalgam or haemostatic agents such as gel foam.
- Study by **Alhadainy and Abdalla**
  - Calcium sulfate and hydroxyapatite, used as barriers, significantly improved sealing ability of vitrebond and provide successful barriers against its overextension.

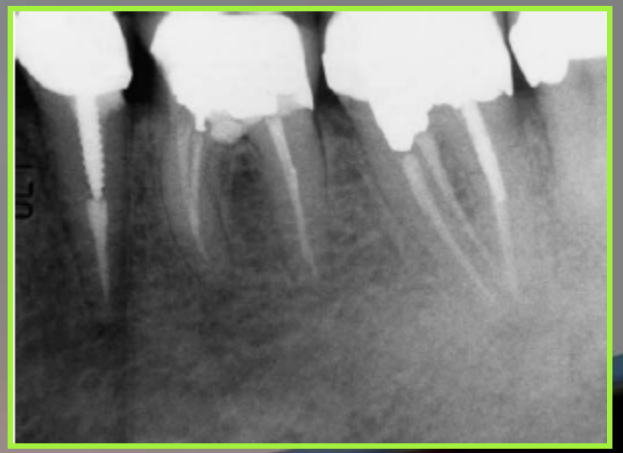
Correction

- **Mittal et al** reported highest amount of leakage was associated with amalgam followed glass-ionomer, composite, IRM and AH26.

- MTA showed better results, it can be placed in presence of blood since it require moisture to cure.

Prognosis

- Depends on:
  - **Location**
  - **Time**
  - **Adequacy of seal**
  - **Perforation size**
  - **Accessibility to main canals**



Prevention

- Proper bur alignment with the long axis of the tooth
- Bur penetration for both depth and angulation can be confirmed with radiographs
- Knowledge about the morphology
- Adequate access preparation

Access Related Mishaps

Crown Fractures

- A tooth with a preexisting infraction becomes a true pain when the patient chews on the tooth weakened additionally by an access preparation.

Recognition

- Observation : after removal of existing restoration by access preparation

- When infraction become true fractures, parts of the crown may be mobile

Treatment

- Extraction of the fracture fragment, if it is of a “chisel type“ in which only the cusp or part of the crown is involved.
- Crown with infraction - supported with a circumferential bands or temporary crowns.
- If the fracture is more extensive, the tooth may not be restorable and needs to be extracted.

Prognosis

- Less likely than for an intact tooth and the outcome is unpredictable.
- Crown infractions may lead to vertical root fractures

Prevention

- Reduce the occlusion.
- Bands and temporary crowns can be used.

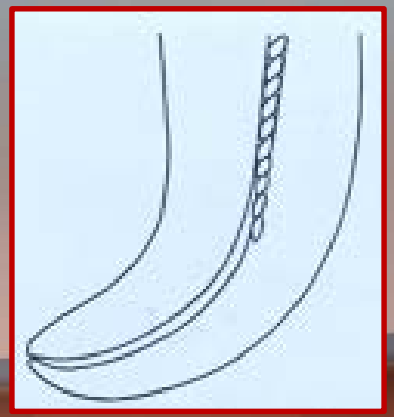
Instrumentation Related Mishaps

Instrumentation Related Mishaps

Ledge Formation

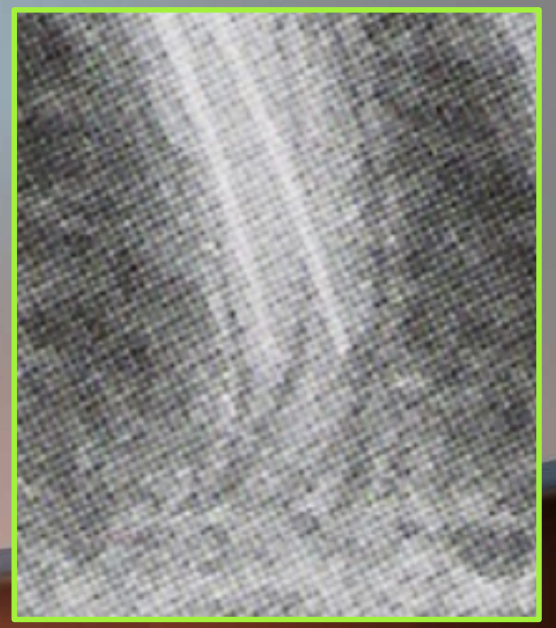
An artificially created irregularity on the surface of the root canal wall that prevents the placement of instruments to the apex of an otherwise patent canal.

A deviation from the original canal curvature without communication with the PDL, resulting in a procedural error is termed ledge formation or ledging. - JOE, 33, 2007



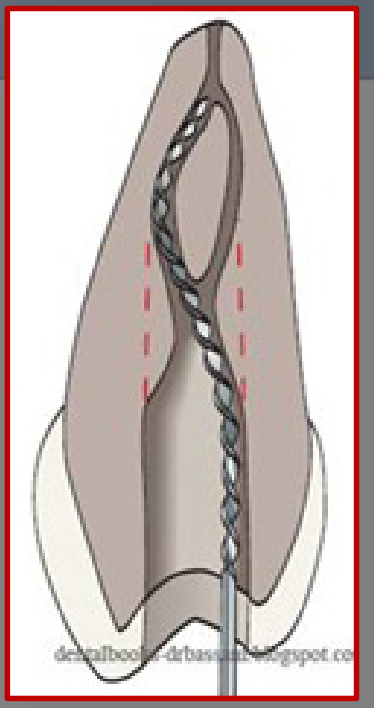
Recognition

- Root canal instrument can no longer be inserted into the canal to full working length.
- Loss of tactile sensation of the tip of the instrument binding in the lumen.
- Instrument point hitting against a solid wall
- Radiograph with instrument in place.



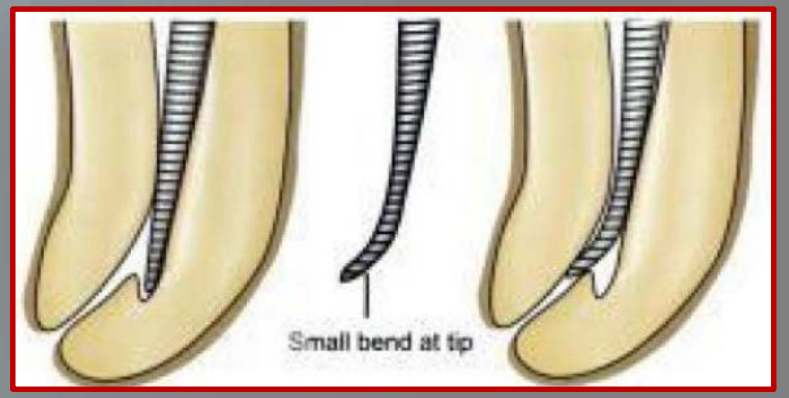
Cause

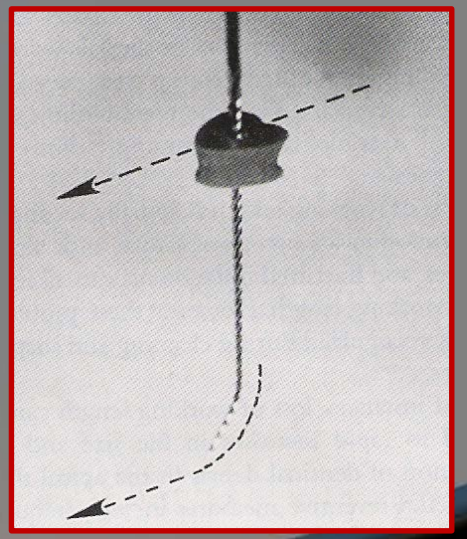
- Inadequate access preparation
- Inadequate irrigation / lubrication
- Excessive enlargement of curved canal with files
- Packing debris in the apical portion of the canal
- Anatomic complexities - roots curved towards the buccal or lingual side.
- Unsuspected canal aberrations in canal anatomy
- Forcing and driving the instrument into the canal
- Attempting to retrieve broken instruments
- Attempting to prepare calcified root canals



Correction

- Locating the ledge
- Irrigate, smaller instruments are preferred.
- No. 10 or 15 with a distal curve at the tip can be used
- Pointed towards the wall opposite to the ledge
- “Tear shaped” silicone stops can be used.
- Watch-winding motion
- If resistance is felt, retract slightly, rotate and advance again, until it bypasses and reach apically.
- Confirmed with a radiograph





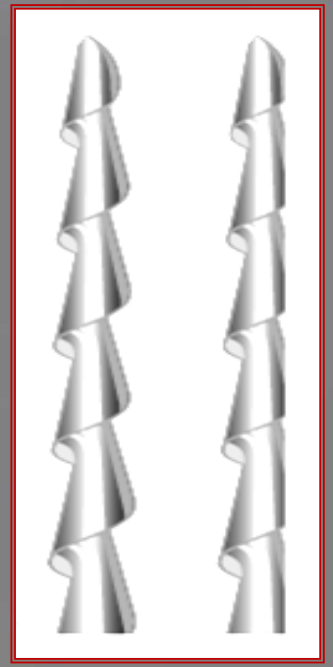
- If ledge cannot be bypassed, then clean, shape and obturate till obstruction.

Correction

- Alternate treatment procedures includes:
    - Retrograde filling through surgery
    - Hemisection / apisectomy
    - Intentional replantation
    - Extraction

Prevention

- Proper examination of the diagnostic radiographs.
- Awareness of canal morphology
- Frequent recapitulation and irrigation
- Precurving the instrument and not forcing it.
- Using instruments with not cutting tip
- Using NiTi files in case of curved canals
- Modified instruments:
    - Flex R files
    - Safety Hedstrom files
    - Flexofile



Prognosis

- Failure of root canal associated with ledging depends upon:
  - Amount of debris left in the uninstrumented canal
  - Unfilled portion of the canal

Instrumentation Related Mishaps

Root Perforations

Perforations in all locations can be caused by 2 main errors:

1. Creating a ledge in the canal wall during initial preparation and perforating through the side of the root at the point of obstructions / root curvature.

2. Using too large or too long an instrument and either perforating directly through the apical foramen or wearing a hole in the lateral surface of the root by over instrumentation.

Considerations influencing perforation repair:

1. Level
2. Location
3. Extend of perforation
4. Potential for successful management

- **Level**:
  - Coronal / furcation perforation : threaten sulcular epithelium
  - In general, more apical the perforation, more favourable the prognosis

- **Location**:
  - Can occur circumferentially on the buccal, lingual, mesial and distal aspects of roots.
  - Location of the perforation is not so important when non-surgical treatment is selected.
  - Position is critical and may preclude surgical access if this approach is considered.

- **Extend & Size of Perforation**:
  - Size greatly affects the clinician's ability to establish a hermetic seal.
  - The area of a circular shaped perforation can be mathematically described as πr^2.
  - Therefore doubling the perforation size with any bur or instrument increases the surface area to seal **four-fold**.

- **Time**:
  - Regardless of the cause, a perforation should be repaired as soon as possible to discourage further loss of attachment and prevent sulcular breakdown.
  - Chronic perforations exhibiting a loss of sulcular attachment pose treatment challenges that potentially escalate to surgical correction and effort directed toward guided tissue regeneration procedures.
- **Esthetics**:
  - Perforations in the anterior region can definitely impact esthetics.
  - Patients with high lip line - esthetically compromised by soft tissue defects such as cleft, ossious or discrepancies in the incisogingival dimensions of a crown when compared with the adjacent teeth

- Perforations can be either
    - Cervical
    - Middle
    - Apical

Cervical Canal Perforation

Cause

- Locating and widening the canal orifice.
- Inappropriate use of Gates-Glidden burs.

Recognition

- Sudden appearance of blood.
- Magnification with either loupes, an endoscope, or a microscope is very useful.
- Confirmed： place a small file and take a radiograph of the tooth.

Correction

- Hemostatics to control bleeding.
- Small area : sealed from inside the tooth
- Large area : seal from inside, then surgical repair
- Materials used:
    - Calcium Hydroxide, Collagen, Calcium Sulfate, Freeze-dried Bone, MTA

- Where esthetics is a concern, a calcium sulfate barrier along with composite restoration is generally used.
- Super EBA have been used when esthetics not an issue.

- Presently MTA is rapidly becoming the barrier/ restorative of choice for repairing non-esthetic coronal one-third defects because of its many desirable attributes.

Prognosis

- Usually Reduced
- Surgical correction is required if a lesion / symptoms develops.

- Depends on:
  - Size
  - Location
  - Length of time
  - Ability to seal
  - Accessibility to main canal
  - Existing periodontal condition

Prevention

- Reviewing each tooth's morphology prior to entering its pulp space.
- Thorough examination of pre-operative radiographs is the paramount step to avoid this mishap.
- Checking the long axis of the tooth and aligning the long axis of the access bur with the long axis of the tooth - tipped tooth.
- Following principles of access cavity preparation, adequate size and location, both permitting direct access to the root canals.

Mid-Root Perforation

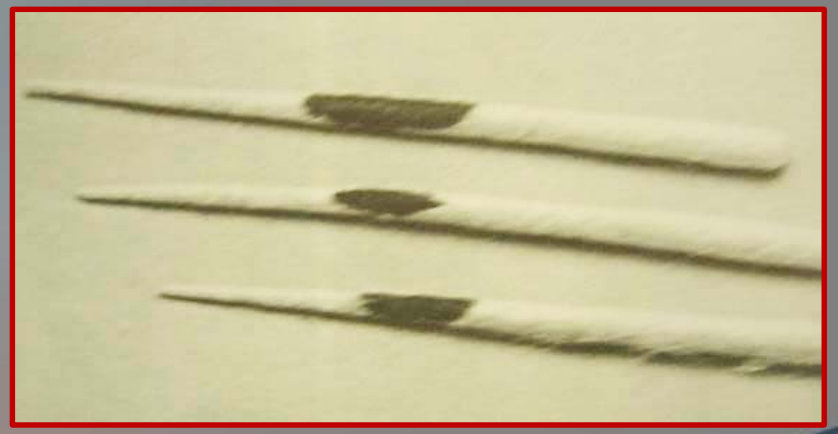
Cause

- Perforating when a **ledge** has formed
- Along the inside curvature of the root as the canal is straightened out - **"Canal Stripping"**

  (Ex: Distal wall of the mesial root of the mandibular first molar)
- Difficult access
- Limited visibility
- Uncertainity of moisture free environment

Recognition

- Stripping is easily detected by the sudden appearance of hemorrhage in a previously dry canal.
- Sudden complaint by the patient.
- Paper points placed into the canal
- Apex locators



Correction

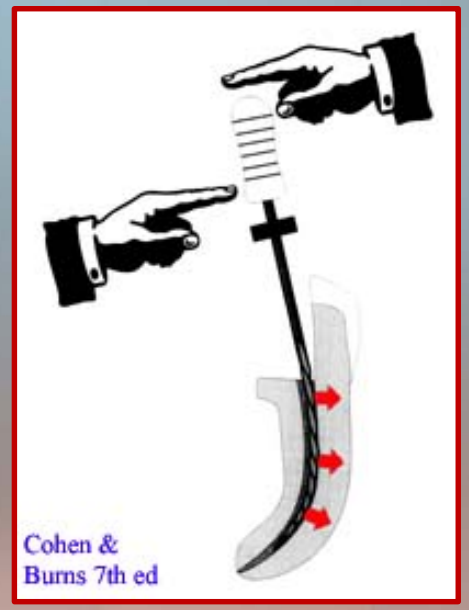
- By nature of occurrence, these defects are ovoid in shape and typically represent relatively large surface area to seal.
- Access to midroot perforation is most often difficult, and repair is not predictable.
- Successful repair depends upon the adequacy of the seal established by the repair material.
- The repair should be immediate, to protect the perforated site from saliva and other contaminants.
- **Barrier material of choice is MTA.**
- **Two-step method**: canals obturated and then defect is repaired surgically

Prognosis

- Usually Reduced
- Chances of micro-leakage / fracture.

Prevention

- Careful use of rotary instruments.
- Anticurvature filing



Apical Perforation

Cause

- **Straight canal** : Inaccurate WL & instrumenting beyond apex
- **Curved canal** : Ledging, Apical Transportation or Apical Zipping

Recognition

- Patient suddenly complains of pain during treatment.
- Canal becomes flooded with hemorrhage.
- If tactile resistance of the confines of the canal space is lost.
- Confirmation by radiograph.
- A paper point inserted to the apex will confirm a suspected apical perforation.

Zipping (Ellipticating)

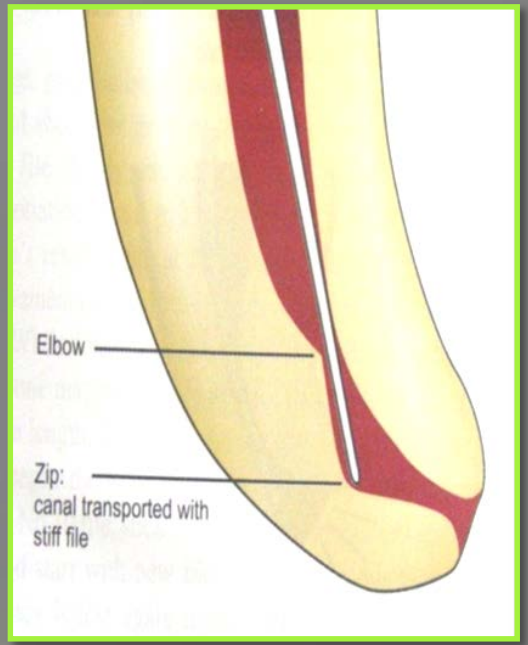
- Transportation of the apical portion of the canal

  ie. an elliptical shape formed in the apical foramen during preparation of curved canals.

- The terms ‘teardrop’ and ‘hour-glass shape’ are used similarly to describe the resulting shape of the zipped apical part of the root canal

- Creation of an ‘elbow’ is associated with zipping – at the narrow region of the root canal at the point of maximum curvature

  Ie. the irregular widening that occurs coronally along the inner aspect and apically along the outer aspect of the curve.



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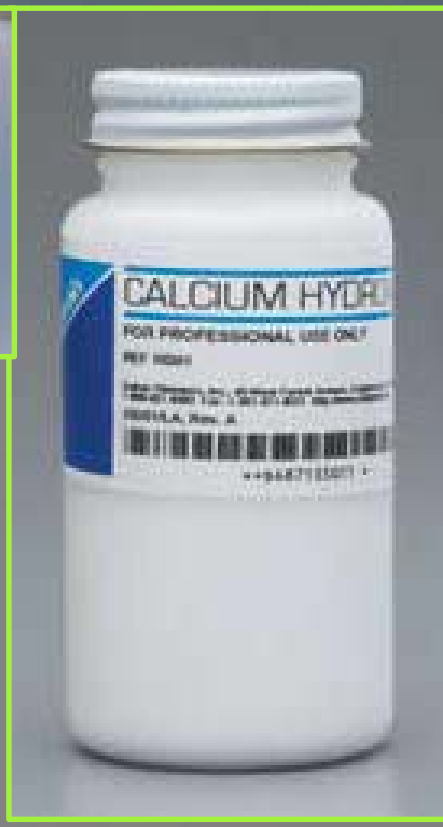


- **Overinstumentation :**
  - Re-establish the WL and enlarge with larger instrument.
  - Apical barrier: $Ca(OH)_2$, MTA, Dentin Chips, Hydroxyapatite

- **Apical Perforation :**
  - Negotiate
  - Perforation site as the new apical opening and obturation is done to seal of the foramen.
  - Surgery is necessary, if a lesion present apically.

Correction

- **Surgical Approach**:
  - A combined intracoronal and surgical approach involves repairing the defect intracoronally, then reflecting a surgical flap to remove the inevitable overextension of the repair material from the periodontal space.
  - In case of failing furcation repairs,
    - Bicuspidation
    - Hemi-Section
    - Intentional Replantation can be considered as treatment options.

Prognosis

- Less adverse effect than coronal perforations.

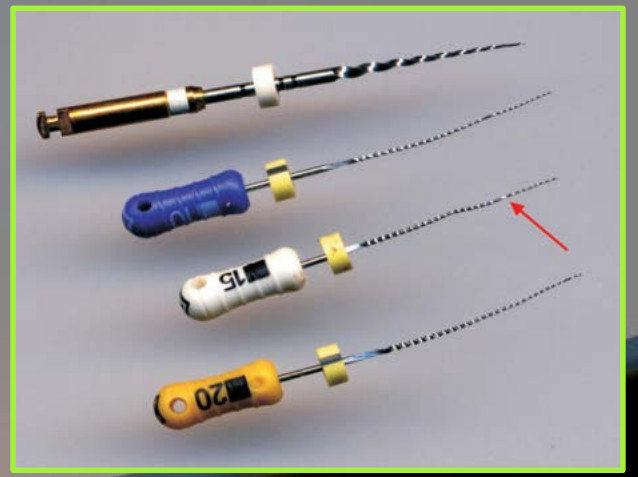
Instrumentation Related Mishaps

Instrument Separation

- Files & Reamers – most commonly involved

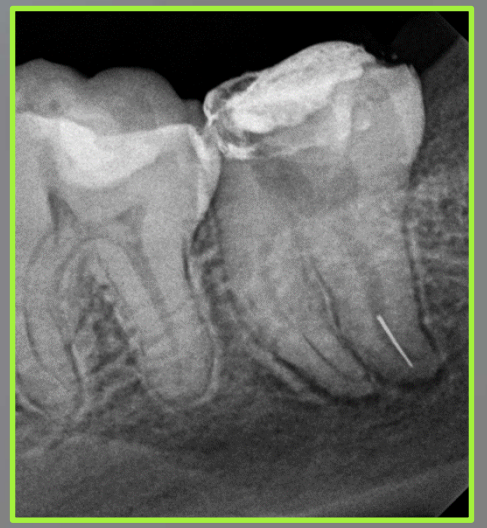
Cause

- Using a Stressed instrument
- Placing exaggerated bends
- Forcing a file before canal has been opened sufficiently.
- Inadequate access
- Anatomy of the canal
- Instrument is advanced into the canal until it binds, and efforts to remove it .
- Manufacturing defects



Recognition

- Loss of WL
- Shortened instrument
- Radiographic confirmation



Correction

There are three approaches to treatment.

1. Attempt to remove the instrument
2. Attempt to by pass it
3. Prepare and obturate up to the separated segment.

It will vary depending upon the location and nature of the broken instrument.

Factors influencing broken instrument removal

- C.S diameter of the canal
- Length of the canal
- Curvature of the canal
- Root morphology-thickness of dentin
- Depth of external concavities
- Area of breakage

- If one third of the overall length of an obstruction can be exposed and /or
  - Instrument that lie in the straight portion of the canal : **Retrieval Is Possible**.

- Instrument lies partially around the canal curvature and if access can be established to its most coronal extent : removal is **Difficult But Still Possible**.

- If the entire segment of the broken instrument is apical to the curvature if the canal and safe access cannot be accomplished : **Removal Impossible**.

Type of the material

- **SS files :**
  - Tend to be easier for removal because they do not further fracture during the removal process

- **NiTi instruments :**
  - May explode and break again deeper within the canal because of heat buildup caused by ultrasonic devices.

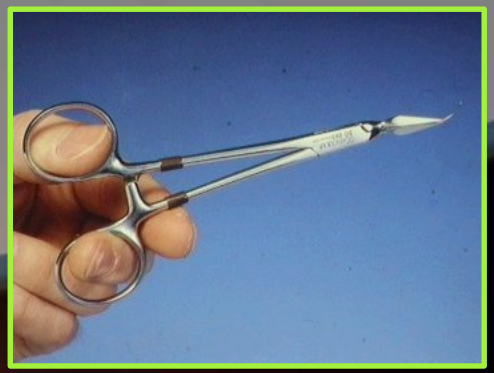
JOE – Vol 31, Sep 2004

Retrieval Techniques

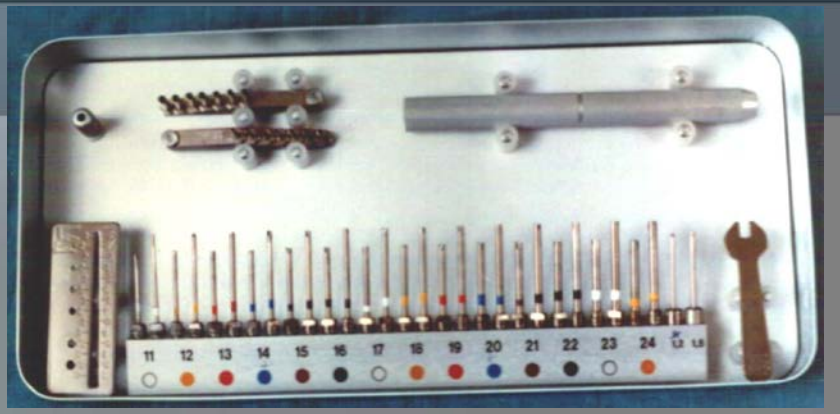
Checking for the mobility of the instrument

If lying loosely in the coronal third-

- Using microscopes, K files or H files are placed between the instrument and the dentinal wall, to bypass the obstacle.
- NaOCl and urea peroxide – **Effervescence Or Bubbling Effect** makes the instrument to float.
- Grasping the file - Micro Needle Forceps, Steiglitz or a Hemostat

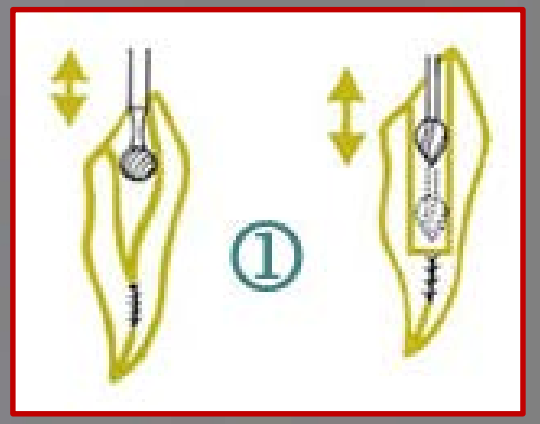


Retrieval Techniques

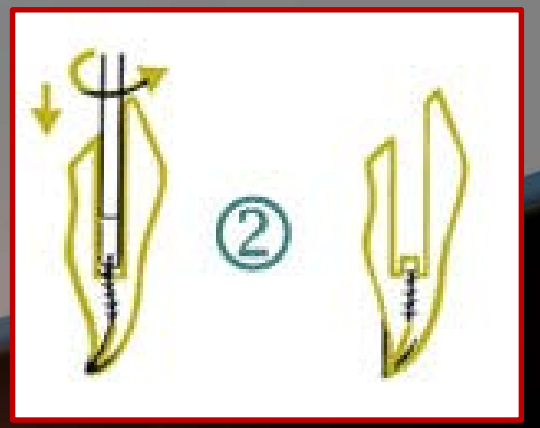


Wedged instruments in **Coronal Third**

- **Masseran KIT** :
  - Useful for removing metallic objects from root canals.
  - It contains a series of tubular trephine drills, and two sizes of tubular excavator.
  - Technique:
    - First creating a space in the root canal around the coronal 2 mm of the metallic object, so that the excavator tube will pass over it.



    - Then the excavator plugger, a locking rod in the tube is screened down, locking the metallic object against a knurled ring in the tube wall. This mechanism provides adequate retention for removal of most metallic object and instruments.

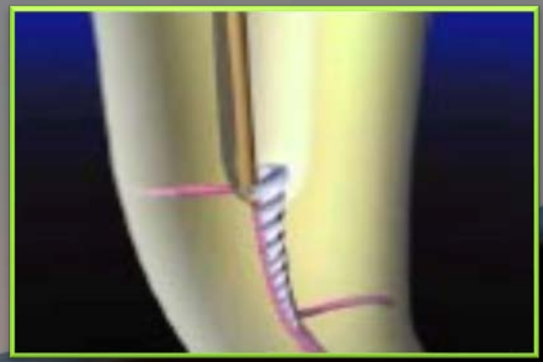


Retrieval Techniques

- **Instrument Retrieval System (IRS)**
- **Endo extractors** :
  - They grasp the instrument with cyanoacrylate and not by friction.
- **Endo safety system**:
  - Also uses trephine burs.
  - These trephines are smaller in diameter and the extractors use different mechanisms for grasping instruments

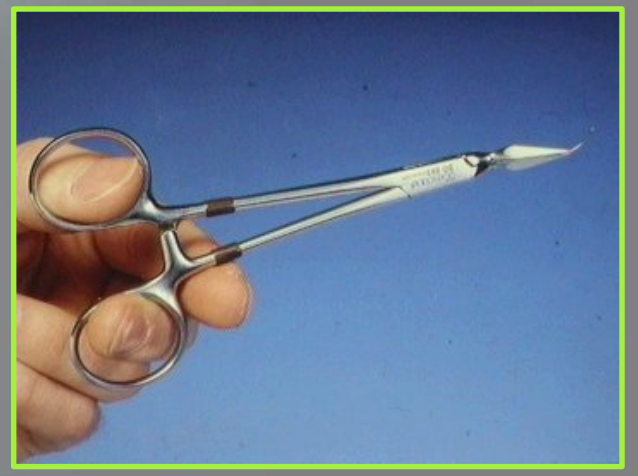
Retrieval Techniques

- **Ultrasonic instruments**
  - Different sizes and angles of ultrasonic tips are available for this purpose.
  - Ex: ProUltra Endo: 1,2,3 ; ProUltra Endo: 6, 7, 8
  - The tip is placed on the staging platform between the exposed end of the file and the canal wall.
  - Precisely removes dentin and progressively exposes the coronal aspect of the fractured file.
  - Vibration in CCW direction applies unscrewing force to the file that will aid in loosening the file.
  - Occasionally they will appear to jump out of the canal
  - It is wise to keep cotton or paper points in other canals to prevent the removed fragment from falling into them.



Retrieval Techniques

- **Middle 1/3 of the canal**
  - Micro needle forceps and H file
  - Ultrasonic tips such as Slim Jim ,CT4 and UT4 can be used.



- **Apical Third**
  - Instruments cannot be grasped directly.
  - Drilling with instruments remove excess dentin.
  - Use of RC prep /NaOCl
  - H file
  - Sonic instrumentation

Failing to retrieve the instrument :

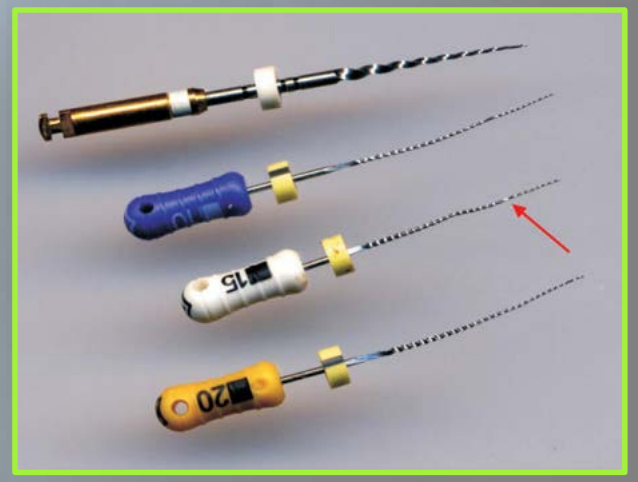
- Within the canal : Bypassed
    - Canal is filled
    - But risk of perforation
- Within the canal : Cannot be bypassed
    - Prepare and fill the canal till the level of separation
    - Instrument seals close to the apex and apical area is normal, then keep under evaluation.
    - If area of rarefaction persists, then apical surgery.
- If instrument extends pass the apex
    - Cleaning, shaping and filling
    - Apical surgery and retro-filling if indicated

Prognosis

- Depends on:
  - Stage of instrumentation
  - Preexisting pathology
  - Location
  - Type of material

- If bypassed, not much change in prognosis
- If surgical correction is required, prognosis is reduced

Prevention



- Examine new instruments - defects
- Careful handling
- Stressed instrument - DISCARD
- Adequate knowledge of physical characteristics of the instruments used.
- Instruments No. 6, 8 and 10 should be examined carefully to check for signs of stress and should be used only once.
- Use of canal lubricants
- Follow sequential instrumentation
- Major concern with NiTi instruments, tend to fracture without warning.

Classification of Instrument Breakage by SOTOKOWA

- Type I : Bent instruments
- Type II : Stretching or straightening of twist contour without bending
- Type III : Peeling or tearing off of metal at the edges without bending or straightening
- Type IV : Partial reverse twisting of instruments
- Type V : Cracking along the file axis
- Type VI : Fracture of the instrument

Instrumentation Related Mishaps

Canal Blockage / Blockout

Obstruction in a previously patent canal that prevents access to the apical stop

Cause

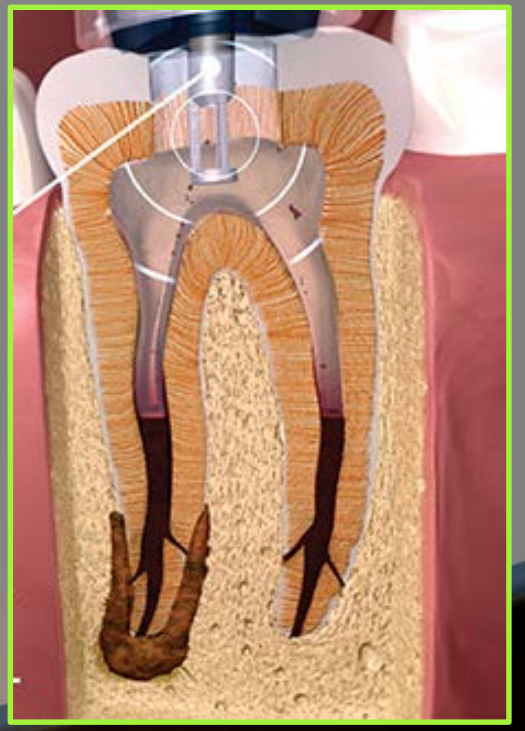
- Files compact apical debris (dentin chips)
- Fibrous blockage (tissue debris)
- Fractured instrument / restorative material / paper point / cotton

Recognition

- Working length no longer attained.
- Confirmed radiographically

Correction

- Recapitulation – quarter turn with EDTA
- Precurving and Redirecting the instrument
- Still if the block cannot be bypassed, endosonics can be used to dislodge dentin debris by acoustic streaming.
- Forcing any instrument may further compact the debris or may lead to perforation.



Prognosis

- Depends on the stage of instrumentation, disinfection and cleaning.
- Vitality of the pulp

Prevention

- Remove all caries and restorations before completion of the access cavity preparation.
- All instruments must be wiped clean before introducing it into the canals
- Frequent use of irrigation
- Instruments should not be used in dry canal
- Recapitulation
- Sequential instrumentation
- Excessive pressure and rotation should be avoided

Obturation Related Mishaps

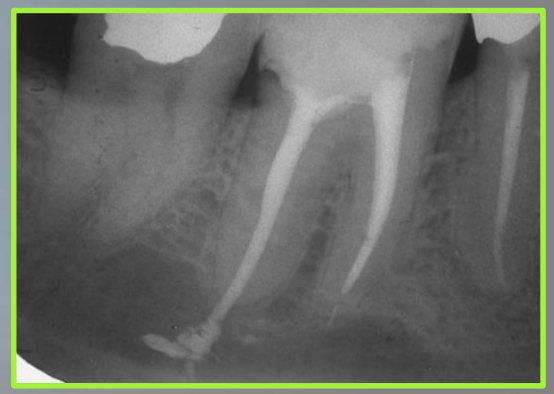
Obturation Related Mishaps

Over/Under Extended Root Canal Fillings

Cause

- **Under extension :**
  - Failure to fit mastercone accurately
  - Poorly prepared canal apically

- **Over extension :**
  - Apical perforation with loss of constriction



Recognition

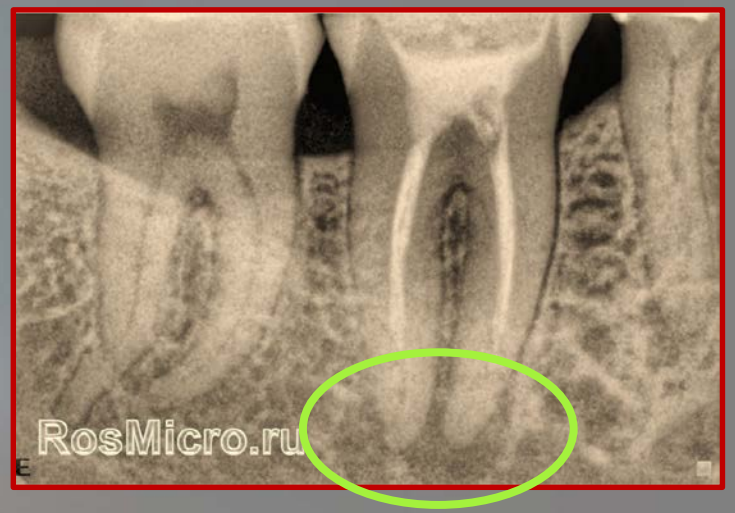
- Post-op radiographs

Correction

- **Under extension :**
  - Retreatment
- **Over extension :**
  - More difficult
  - Successful if the entire GP is removed in one tug
  - Gutta-percha and many sealers - generally well tolerated and do not automatically require surgical removal.
  - If symptoms persist - surgical removal

Prognosis

- **Under extension :**
  - If lesion is present / apical canal have necrotic debris – Reduced Prognosis
- **Over extension :**
  - If adequate seal - Successful



Prevention

- Confirmation & adherence to the working length
- Mastercone radiograph – if any corrections required, can be made.

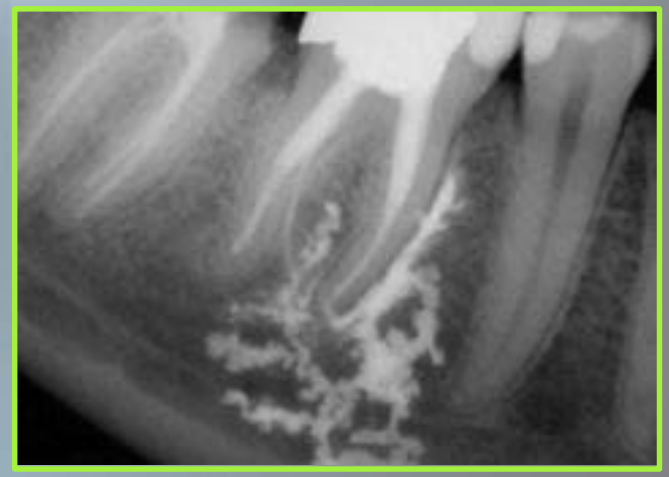
- **Techniques to remove Guttapercha**
  - Rotary files
  - Ultrasonic instruments
  - Heat
  - Chemical solvents
  - Paperpoint with chemical

Obturation Related Mishaps

Nerve Paresthesia

Cause

- Over extensions / over instrumentations
- Injury to inferior alveolar nerve
- Use of formaldehyde containing paste



- Loss of sensation / nerve damage can be transient / permanent

Correction

- Non-intervention and observation
- Systemic prednisolone
- Surgical decompression

Symptoms

- Loss of sensitivity of lips and gingiva
- Numbness
- Tingling sensation
- Dryness of the affected mucosa often preceded by intense pain in the affected area

- Inflammatory edema with resulting ischemia, that compresses and compromises blood supply to soft tissues and nerves in confined spaces such as the inferior alveolar canal.

- Compartment syndrome

Prevention

- Identify radiographically the neural structures and the sinuses in order to clearly understand the proximal risk.
- Use obturation materials that are well tolerated
- Careful shaping strategies and take serious precaution against over-instrumentation.
- When using thermoplastic techniques, it is important to respect the flow characteristics of the material.
- Caution in use of paste fillers and syringes for applying endodontic sealers.
- Creating a clean dentin plug or material barrier at the patent apical terminus when there is risk of extrusion.

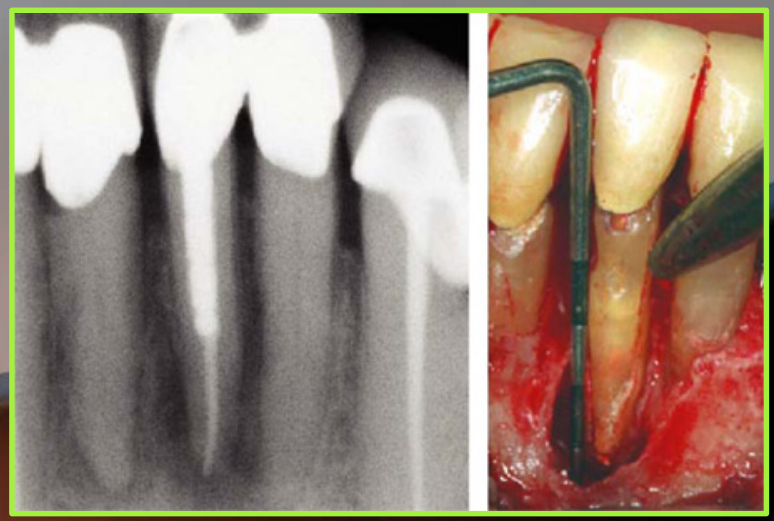
Obturation Related Mishaps

Vertical Root Fractures

- Can occur in any phase of therapy, while instrumentation, obturation or post placement

Recognition

- Sudden crunch sound
- Pain reaction
- A suggestive “tear drop” radiolucency
- Deep periodontal pocket of recent origin in a tooth with long present root canal filling
- Exploratory surgery is a good way to visualize fracture.



Management

- Most cases, extraction is the only option.
- Hemisection / Root Amputation of the fractured root may be considered.

Prevention

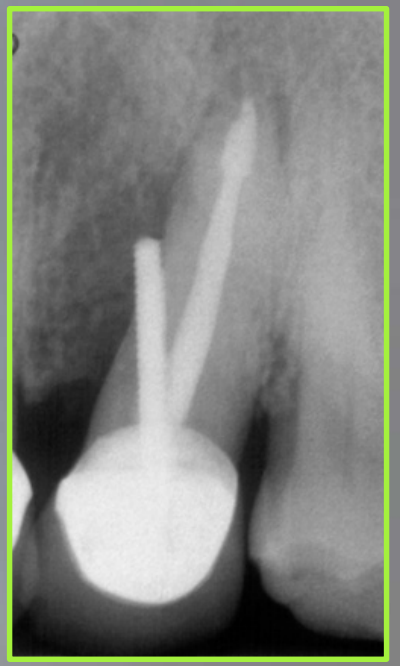
- Avoid weakening of canal wall. (Over-preparation of canals)
- Passive obturation and post placement
- Full cuspal coverage
- Minimize internal wedging forces

Obturation Related Mishaps

Post Space Perforation

Recognition

- Sudden presence of blood in the canal
- Radiographic evidence
- Presence of sinus tract stroma eluding to the base of a post.



Management

- Sealing of the perforation if possible

Prognosis

- Least effect if perforation is within bone
- If in gingival sulcus, then periodontal breakdown occurs
- There is a 15% failure rate in areas other than furcation. (Rud J et al)

Prevention

- Good knowledge of root canal anatomy
- Planning the post space preparation based on radiographic information
- Preparing the space at the time the root canal is obturated.
- GG drills / Peeso reamers can be used

Miscellaneous

Miscellaneous

Irrigant Related Mishaps

- Unfortunate sequence of events triggered after the solutions are injected into the root canal systems and forced into the periradicular tissues.

- Caused by any irrigant which has the potential to cause problems if extruded.

- **Sodium Hypchlorite** : Immediate inflammatory response followed by tissue destruction
- **Hydrogen Perxode** : Tissue emphysema

Recognition

- Pain & swelling
- Interstitial Haemorrhage & Ecchymosis
- Depends on solution concentration & amount.

Management

- Antibiotics, Analgesics & Antihistamines
- Ice packs, then warm saline soaks
- Intramuscular steroids
- Hospitalization and surgical intervention
- Constant Monitoring

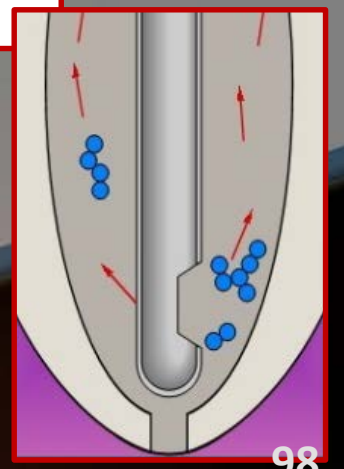
❖ Sodium hypochlorite injected into maxillary sinus - immediate lavage with sterile water or saline.

Prognosis

- Favourable : If immediate treatment & proper management
- Long term effects : Paresthesia, Scarring or Muscle weakness

Prevention

- Passive placement of needle.
- No attempt should be made to force the needle apically
- The needle must not be wedged into the canal
- The solution should be delivered slowly and without pressure.
- Special Endodontic irrigating needles :
  - Monoject Endodontic needle
  - Pro-rinse



Miscellaneous

Tissue Emphysema

- Abnormal presence of air in the tissue spaces.

Cause

- Compressed air being forced into the tissue spaces
- Canal preparation - blast of air to dry the canal
- Irrigation past the apex with H_2O_2
- Apical surgery - air from a high-speed drill.

Recognition

- Rapid swelling, erythema, and crepitus.
- Can be Subcutaneous or periradicular air emphysema
- Dysphagia and dyspnea

- Migration of air into the neck region could cause respiratory difficulty, and progression into the mediastinum could cause death.

Management

- Palliative care & observation to immediate medical attention
- Broad spectrum antibiotic therapy
- Recovers in a matter of few days
- Administration of 100% oxygen

Prognosis

- Good unless air spreads to the mediastinum

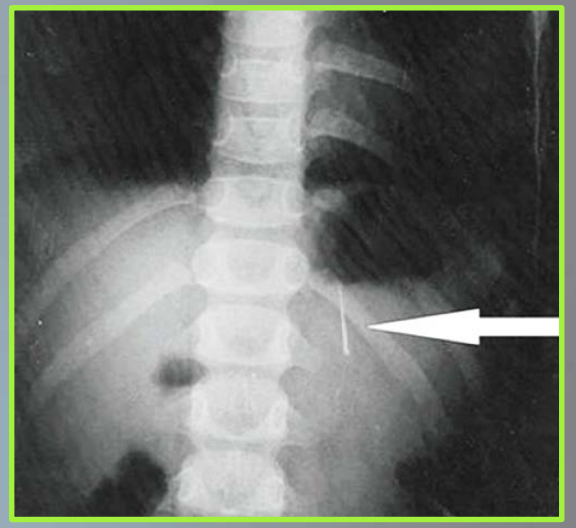
Prevention

- Using paper points to dry root canals.
- Air syringe - horizontal positioning over the access (Jerome et al)
- In surgical procedures – apical access – handpieces - do not direct jets of air into surgery sites.

Miscellaneous

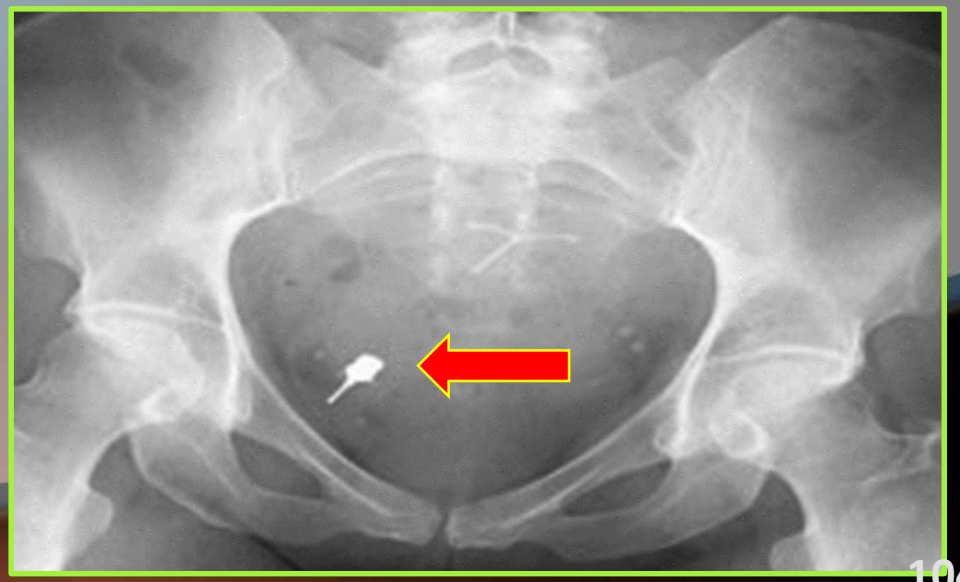
Instrument Aspiration & Ingestion

- When used in the absence of a rubber dam, instruments can accidentally be aspirated or dropped into the mouth.



Recognition

- Radiographs of the chest and abdomen.

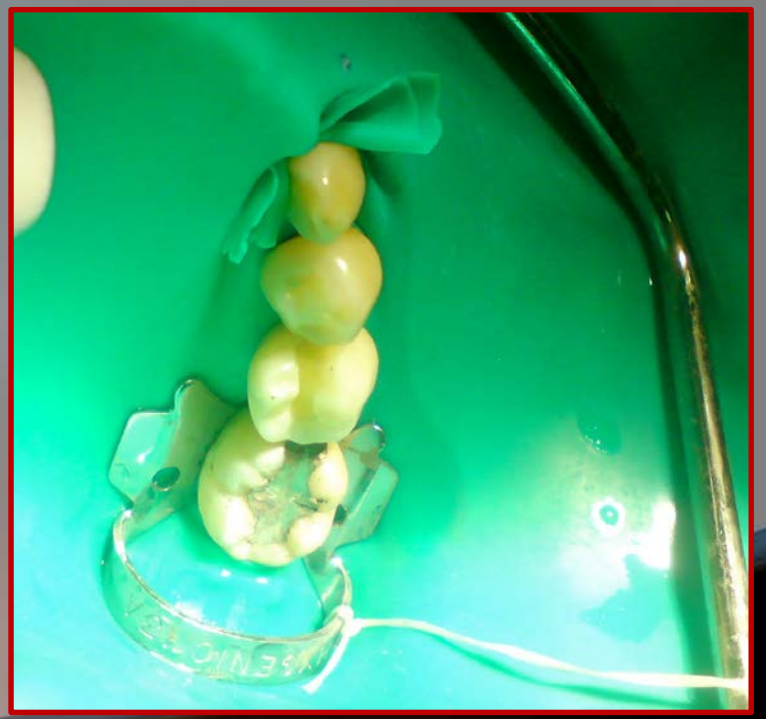


Management

- In the dental operatory –
  - Removal of accessible objects
  - High-volume suction
  - Hemostats and cotton pliers
- Once aspirated – **Emergency Medical Attention**

Prevention

- Proper tooth isolation with rubber dam
- Tying a floss to the rubber dam clamp and endodontic files before use.



Conclusion

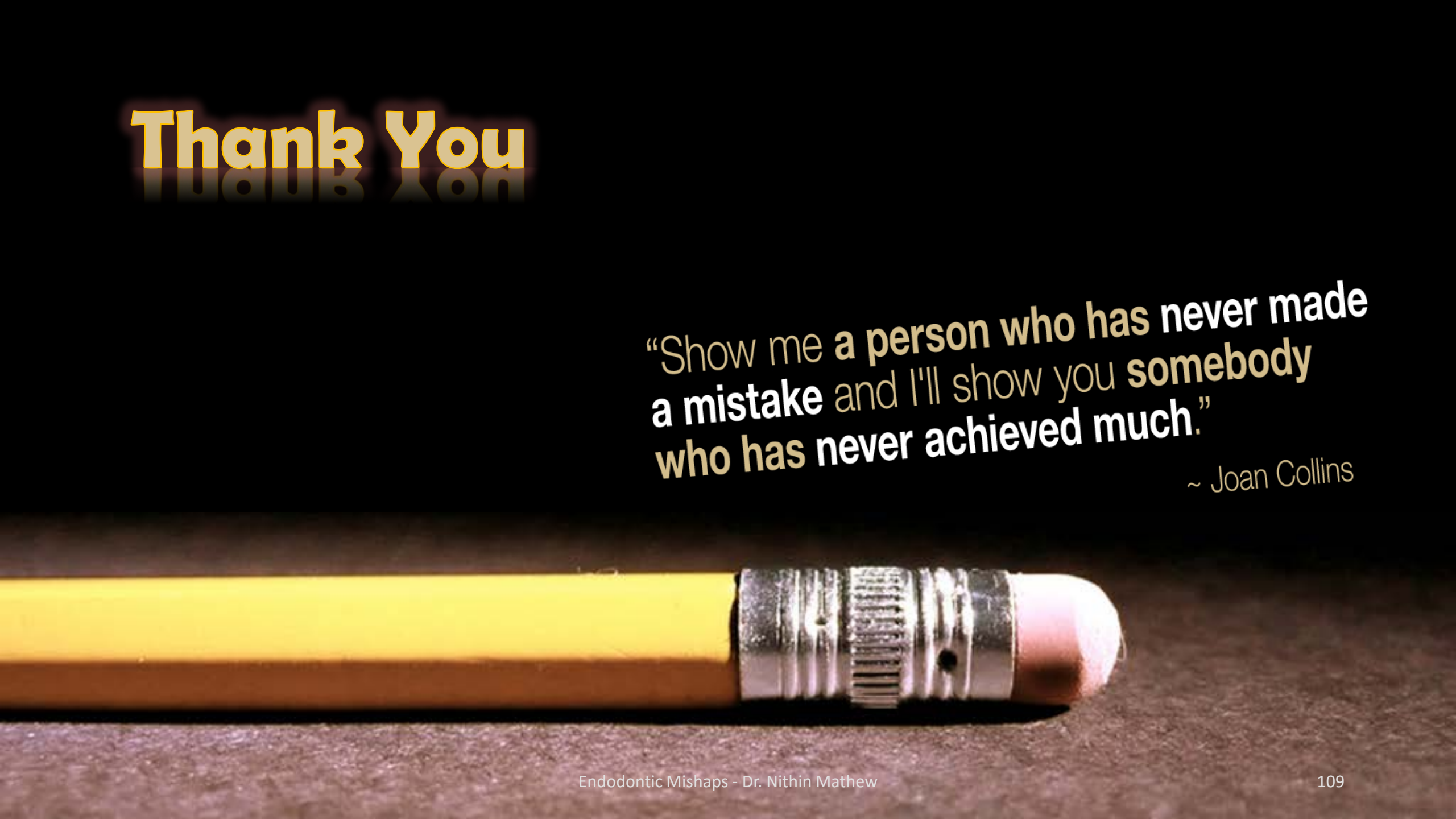
- Instrumentation during Root canal treatment is sometimes associated with unwanted or unforeseen circumstances.
- A good practitioner should use his or her knowledge, dexterity, intuition, patience, & awareness of his or her own limitations to minimize these procedural accidents.
- A knowledge of the etiologic factors involved in procedural accidents is essential.
- In addition, methods of recognition and treatment as well as the effects of such accidents on prognosis must be learned.

- A successful operator learns from the past experiences and applies them to future challenges.
- Ultimately the beneficiary will be the patient, who will receive the best care.
- Dental standard of care requires that patients be informed about any procedural accident.

References

- Textbook of Endodontics – Ingle
- Principles & Practice – Walton & Torabinejad
- Problem Solving in Endodontics - Guttmann
- Pathways of the Pulp – Cohen
- Textbook of Endodontics – Nisha Garg
- Endodontic practice - Grossman

Thank You


"Show me a person who has never made a mistake and I'll show you somebody who has never achieved much."
~ Joan Collins