PROCEDURAL ERRORS IN ENDODONTICS

- Procedural accidents are also called **endodontic mishaps** and are done by the dentist. They are classified into:

1. Inadequately cleaned RC systems

- Loss of WL:

Causes	Rapid increase in file size | accumulation of debris in apex | lack of attention to detail | changing reference points
Correction	Frequent recapitulation | Copious irrigation with NaOcl | WL verification | Prevent skipping sizes | Reliable reference points

- Canal blockage:

Prevention	Remove all unsupported tooth structure | Straight line access | Use instruments in wet canal | Place good temporary filling
Correction	Use EDTA with NaOcl | Use ultrasonic to dislodge dentinal debris | Otherwise, obturate to the level of blockage but patient must be asymptomatic with no endodontic/periodontal problems.

- Ledging: Internal transportation of the canal which prevents positioning of an instrument to the apex in an otherwise patent canal.

Correction	Bypass the ledge with smaller instrument | Maintain apical foramen patency | Use NiTi instruments

- Missed canal:

Prevention	Knowledge of the anatomy will prevent this mishap. Canals can be located by: Magnification | Surgical Microscopes | Correct access | Ultrasonic | Dyes | NaOcl | "Champagne Test"

2. Instrument breakage (separation)

- Broken instrument in a root filled tooth with necrotic pulp has a poor prognosis.
- If the instrument breaks in the later stages of debridement and closer to apex, prognosis is better than in undebrided canal short or beyond the apex.
- The real cause of failure is in the chance of instrument impeding mechanical debridement

Prevention	Use stainless steel, NiTi files | Small sizes should be used 1—2 times | Examine each file before use | Use files in sequence | Never force | work in wet canal | Do not excessively rotate the file
Correction	File bypass technique | Use Gates Glidden bur and endosonics to dislodge the instrument | If cannot be removed, incorporate in the filling.

3. Deviation from normal canal anatomy

- Zipping: Transportation of the apical portion of the canal

Causes	No pre-curving of files | forcing of instrument in a curved canal | large stiff instruments in a curved canal.

- Lateral wall perforation-stripping: due to over-instrumentation through a thin wall

Prevention	Pre-curve the files | modify the files – remove the flutes | anti-curvature filing
Correction	Very difficult & success rate and repair is not predictable | done surgically or non-surgically | $Ca(OH)_2$ can be used as a barrier against which to pack filling material

- Canal transportation: Moving the apical foramen to a new location on external root surface

Correction	Use a biocompatible material (like **MTA**) as a barrier against which obturation is packed

4. Inadequate canal preparation

- Over instrumentation
- Over preparation

Prevention	Avoid excessive removal of tooth structure as teeth become more weak and are subject to fracture during compaction

- Under preparation: failure to remove pulp tissue, dentinal debris, and micro-organism.

Prevention	Appropriate root canal shaping | Follow principles of WL determination and Biomechanical preparation

5. Obturation-Related

- Underfilling (under-obturated): Inadequate removal of infected necrotic tissue remains. ➔ In teeth with periapical pathosis, bacteria get colonized around the apex. ➔ constant infection in the root canal ➔ poor prognosis

- Overfilling (over-obturated):

Causes	Over-instrumentation | Wrong WL Determination | Incomplete root apex formation | Resorption | Improper reference points

  - Pushing the debris into PA spaces may cause a foreign giant cell reaction and act as a foreign body which supports formation of biofilm.
    - Biofilm is accumulation of micro-organisms embedded in self-produced extracellular polysaccharide matrix adherent to solid surface

6. Vertical Root Fracture

Prevention	Avoid weakening the wall | Minimize internal wedging forces | Reduce compaction forces while obturation
Correction	Extraction | Hemi-sections or root resections can be tried.

7. Instrument Aspiration

Prevention	Rubber dam | Tie instruments with floss
Correction	High evacuation suction tip | Haemostats or cotton pliers | Radiograph of chest and abdomen | Hiemlich manouver

8. Perforations: mechanical or pathologic communication between root canal and external tooth surface

- **Categories**
  - Coronal
  - Mid-root
  - Apical
  - Post space perforations – usually happens due to poor clinical judgment and improper orientation of the drill.
- **Recognized by**
  - Radiograph
  - Paper-point
  - Appearance of bleeding
  - Patient feels instrument touching periodontal tissue
- **Repair depends on**
  - Location of perforation

Coronal Root Perforation	Coronal to level of epithelial attachment and crestal bone	**Good prognosis**
Crestal Root Perforation (**Critical Zone**)	At level of epithelial and crestal bone At furcation	**Poorest prognosis** (epithelial migration and pocket formation)
Apical Root Perforation	Apical to crestal bone and epithelial attachment	**Good prognosis** (since effective chemo-mechanical preparation is possible)

  - Size
  - Visibility and accessibility
  - Time
  - Associated periodontal status and importance of teeth
- **Materials used**
  - Amalgam | IRM | SuperEBA | GIC | Hydroxy apatite
  - **Contains hemostatic**: $Ca(OH)_2$ | CaSO4 | Freeze dried bone | MTA

Material of Choice in Perforations: **MTA**	
Ingredients	Tricalcium Silicate | Dicalcium Silicate | Tricalcium Aluminate | Tetracalcium Aluminaferite | Calcium Sulfate | Bismuth Oxide
Properties	- **Setting**: Hydrophilic – requires moisture to set - **Consistency**: Brick hard - **Biocompatibility**: No inflammatory response, induce cementogenesis and bone deposition.
Procedure	Isolation perforation site by using rubber dam then drying the area ➔ mix and prepare MTA ➔ use a carrier to deposit MTA into site ➔ Condense ➔ While placing MTA, keep a file in canal to maintain patency, move the file up and down to prevent file from getting frozen in MTA ➔ Seal pulp chamber ➔ Next appointment, obturate the canal normally.