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:

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| **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:

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| **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.

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

* + - Missed canal:

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

* 1. **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

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| **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. |

* 1. **Deviation from normal canal anatomy**
     + Zipping: Transportation of the apical portion of the canal

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| **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

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| **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

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

* 1. **Inadequate canal preparation**
     + Over instrumentation
     + Over preparation

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| **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.

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

* 1. **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):

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| **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
  1. **Vertical Root Fracture**

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

* 1. **Instrument Aspiration**

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

* 1. **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

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| 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

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| 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. |