Endodontics

Lecture: 6 Cleaning and Shaping of Root Canal

The major biologic aim of endodontic therapy is to eliminate apical periodontitis by disinfection and sealing of root canal systems.

Endodontic treatment mainly consists of three steps:
1. Cleaning and shaping of the root canal system.
2. Disinfection of the canal system.
3. Obturation and 3D closure and seal of the complete canal space.

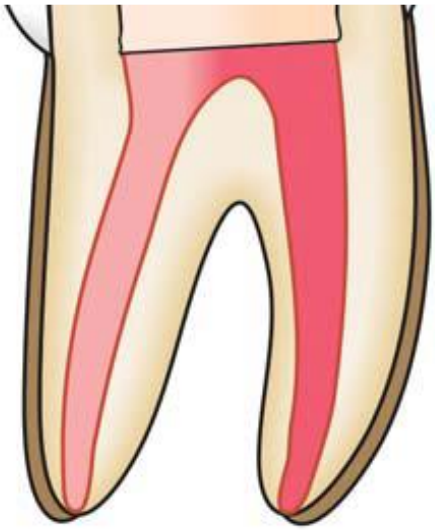
Cleaning and shaping is one of the most important step in the root canal therapy for obtaining success in the root canal treatment.

Cleaning

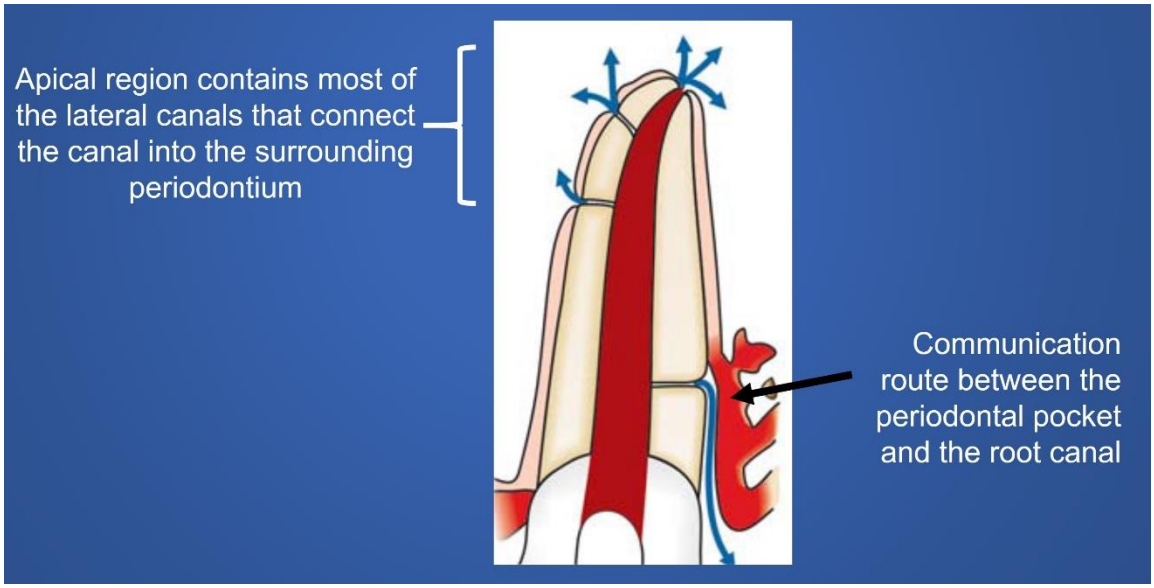
It comprises the removal of all potentially pathogenic contents from the root canal system including the necrotic pulp tissue, dentine debris and microbes.

Shaping

The establishment of a specifically shaped cavity which maintain the original shape and taper of the canal and allow three-dimensional progressive access into the apical part to permit the final obturation instruments and materials to fit easily.



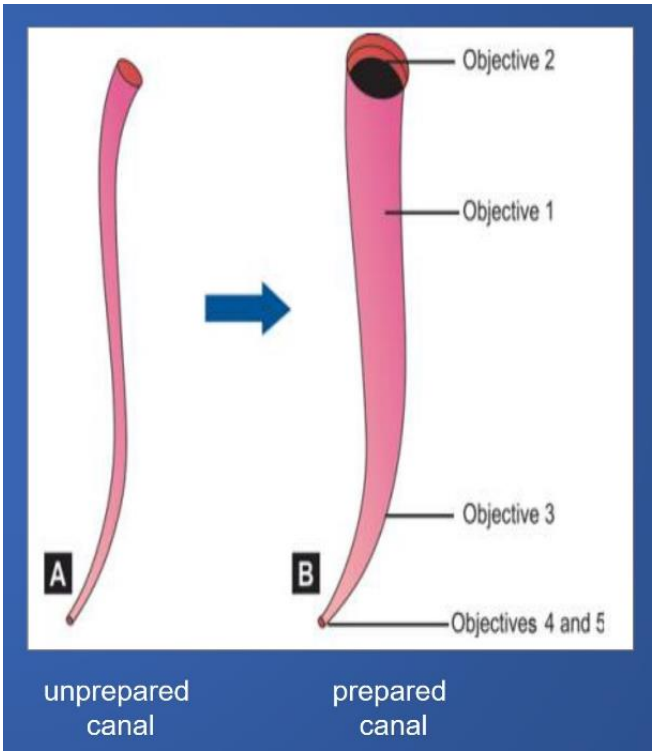
For the success of endodontic treatment the contents of the root canal must be completely removed, to prevent any communication from the root canal system and periodontal space that may act as a portal of exit and can lead to formation of periodontal lesions of endodontic origin.



Schilder in early 1960s described **5 mechanical** and **4 biological** objectives for successful root canal therapy.

Mechanical Objectives

1. The root canal preparation should develop a continuously tapering cone. This shape mimics the natural canal shape.
2. Making the preparation in multiple planes which introduces the concept of "flow". This objective preserves the natural curve of the canal.
3. Making the canal narrower apically and widest coronally. To create a continuous taper up to apical third which creates the resistance form to hold gutta-percha in the canal.
4. Avoid transportation of the foramen. There should be gentle enlargement of the foramen while maintaining its position.
5. Keep the apical opening as small as possible to prevent any extrusion of filling material outside the tooth.



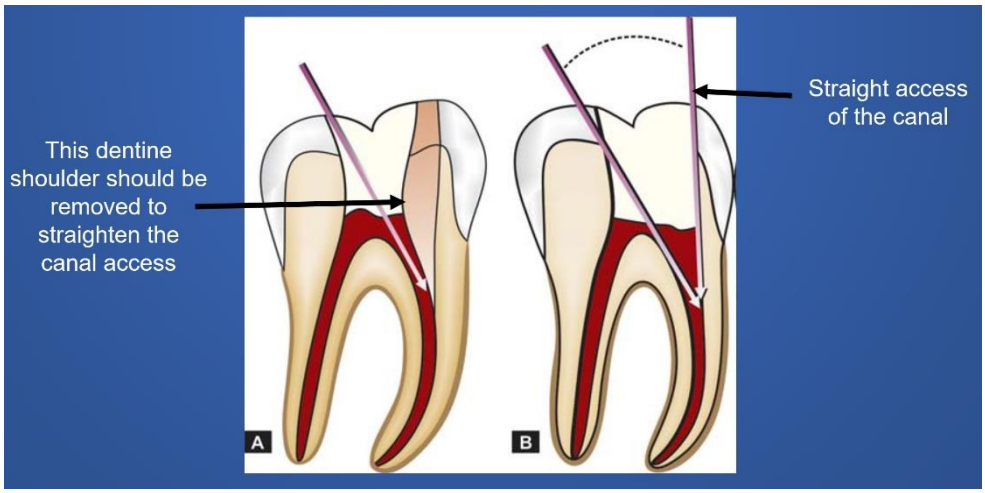
Biological Objectives

1- Confinement of instrumentation within the root canals only.
2- Ensure not to force necrotic or instrumentation debris beyond the apical foramen.
3- Optimum debridement of the root canal space.
4- Creation of sufficient space for intra-canal medicaments.

Basic principles in root canal instrumentation

1- Before starting the endodontic treatment, proper diagnosis and evaluation of the tooth has to be perform to ensure that the tooth has favourable treatment prognosis.

2- During preparation of the access cavity, a straight line access from the coronal to the apical regions of the canal must be obtained. This can be performed by removing the overlying dentine to ensure flaring and smooth internal walls of the cavity with straight line access to the root.



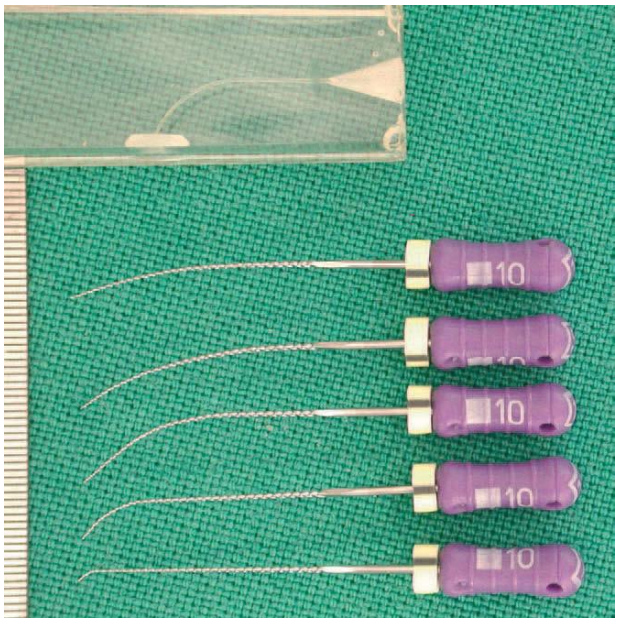
3- Ensure glide path of the canal and apical patency before starting canal preparation. This can be performed by passing a small size K-file (usually a size #8 or #10) beyond the apex. The glide path file can help to ensure complete opening of the canal and facilitate working length estimation.

4- Precurved instrument: In case of a curved canal, the instrument should be precurved to estimate the curvature of the canal. This is true only in case of stainless steel instrument, but nickel titanium instrument is flexible and cannot be curved.

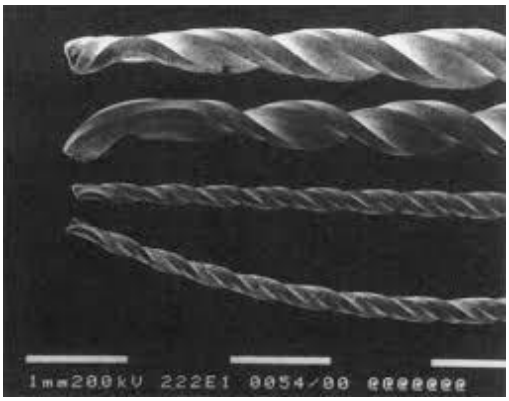
5- The use of intracanal irrigation solutions that serve many advantages:

- Dissolving and flushing out of the debris from the root canal,
- Lubrication for the cutting motion of the files within the canal,
- Antimicrobial activities.

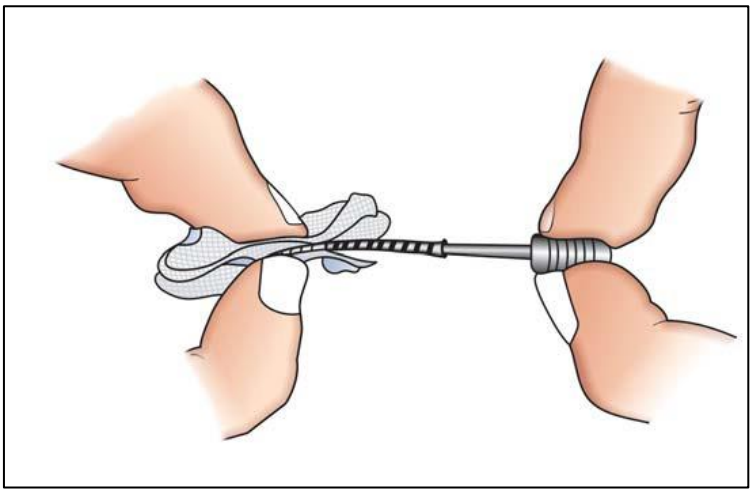
The most popular intra-canal irrigation solution is Sodium hypochlorite (NaOCl) 2.5-5.25%.
The irrigation solution can be delivered inside the canal by using hypodermic syringe.



6- Instrument examination: each instrument should be examined each time before insertion inside the root canal to verify the presence of any sign of fatigue, stress or damage, so any instrument showing such a sign should be discarded.



7- After each insertion and removal of the file, its flutes should be cleaned regularly, to ensure efficient cutting action of the file and prevent debris accumulation, canal blockage or extrusion of debris beyond the apical foramen.



8- Never force the instrument in the canal. Forcing or continuing to rotate an instrument while its bind to the canal wall may break the instrument.

9- Use of instruments in sequential order. Root canal preparation is done gradually by using successively larger files (never skip any size of instrument) e.g. size 20 followed by size 25 then 30 and so on, but not size 20 then size 30.

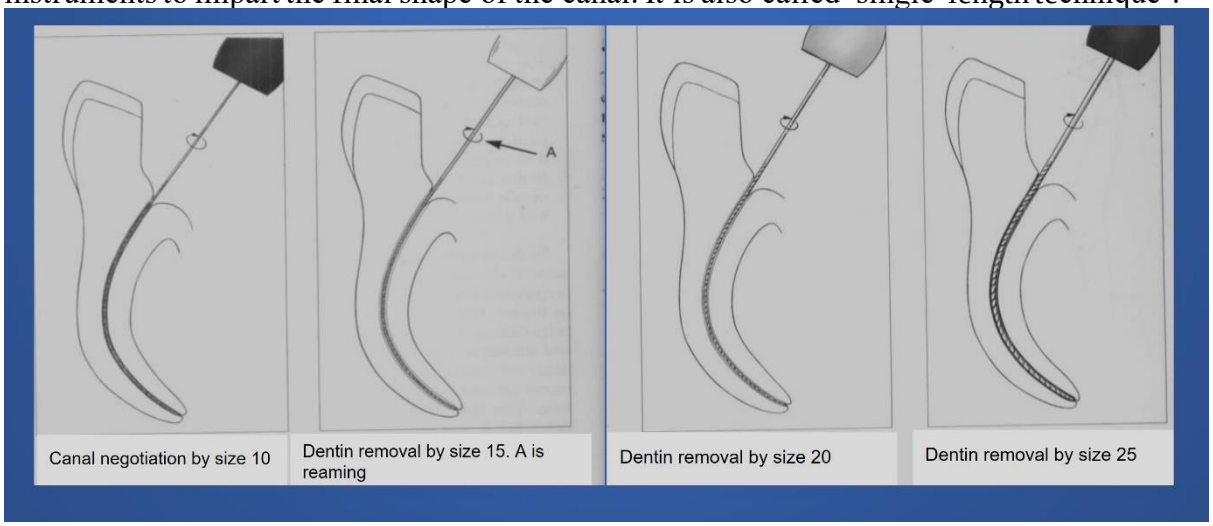
10- Over preparation and too aggressive over enlargement of the curved canals should be avoided.

11- Creation of an apical stop should be maintained during instrumentation procedures by maintaining the apical size as clean and small as possible. Over enlarging of the apical foramen should be avoided because it destroy the apical stop and cause apical extrusion of the irrigation and obturation material and cause failure of endodontic treatment.

Manual or Hand instrumentation techniques

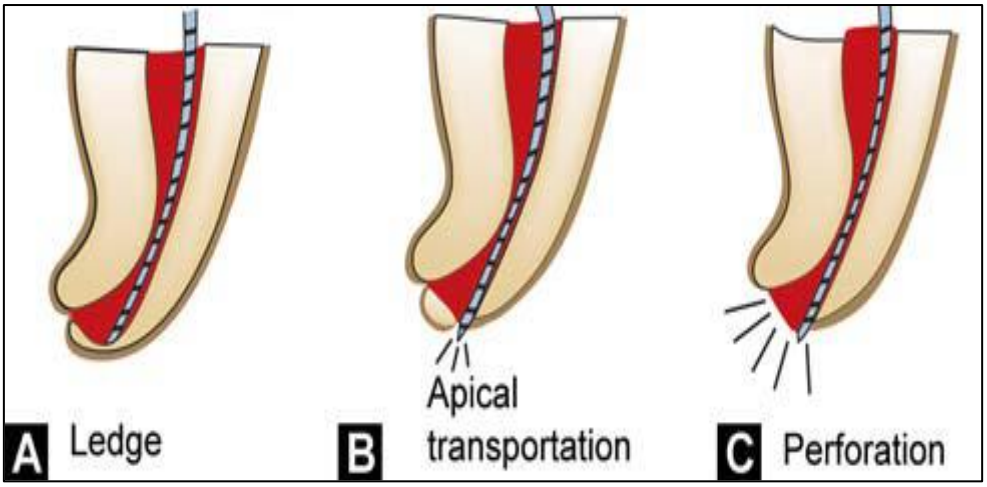
Standardized Technique

This technique is developed by Ingle and uses the same working length (WL) definition for all instruments introduced into a root canal. Therefore, relies on the inherent shape of the instruments to impart the final shape of the canal. It is also called 'single-length technique'.



Disadvantages of Standardized technique:

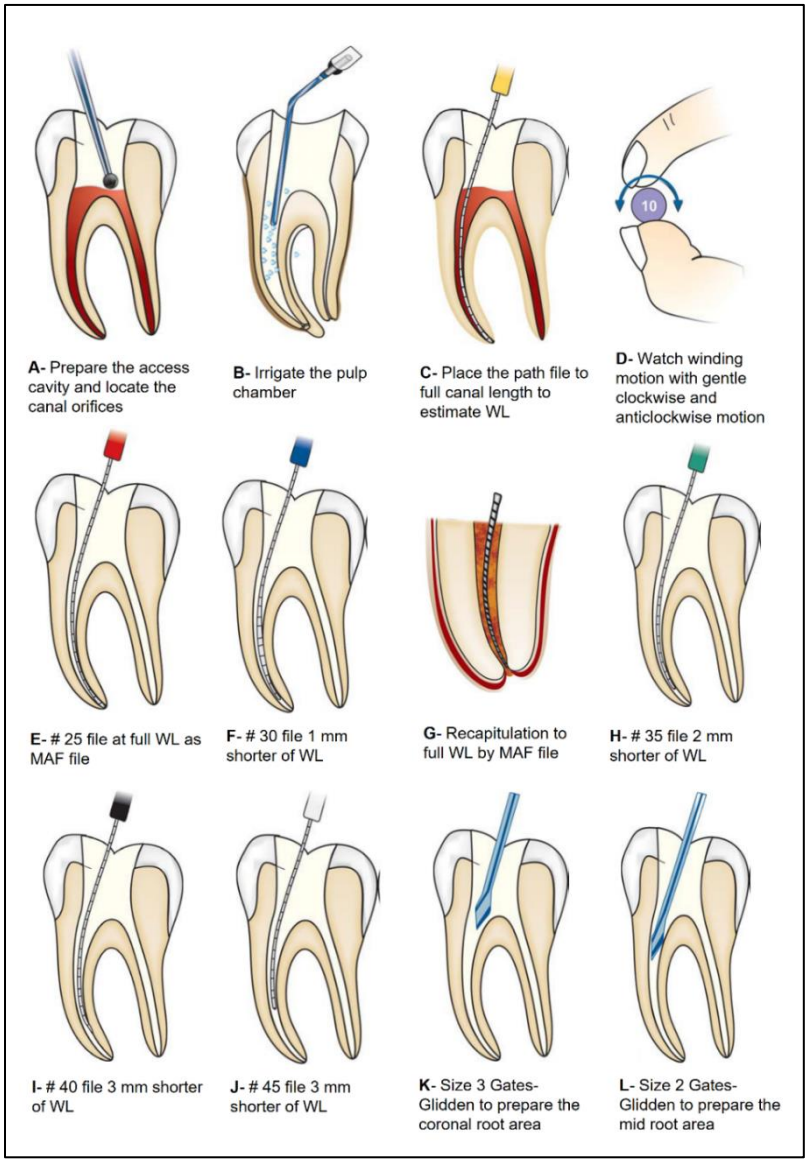
1- Chances of loss of working length due to accumulation of dentin debris.
2- Possibility of uncompleted debridement of the wider part of the canal (coronal part)
3- Difficult to irrigate apical region.
4- More chances of pushing debris periapically.
5- Increased incidences of ledging, zipping and perforation in curved canals.
6- Increased incidences of file fracture due to heavy contact and friction with canal walls.

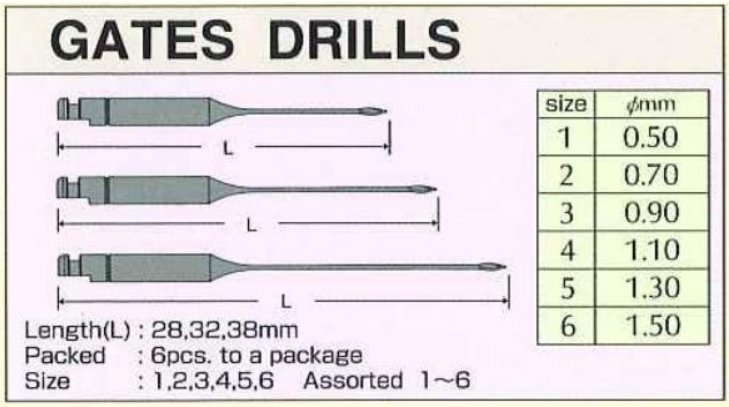


Step-back Technique

- Realizing the importance of a canal shape larger than that produced with the standardized approach, the step-back technique was introduced by Clem and Weine in 1960.

- This technique relies on stepwise reduction of WL for larger files, typically in 1- or 0.5-mm steps, resulting in flared shapes with 0.05 and 0.10 taper, respectively. The final result is a preparation with small apical enlargement and marked taper from apical to coronal.

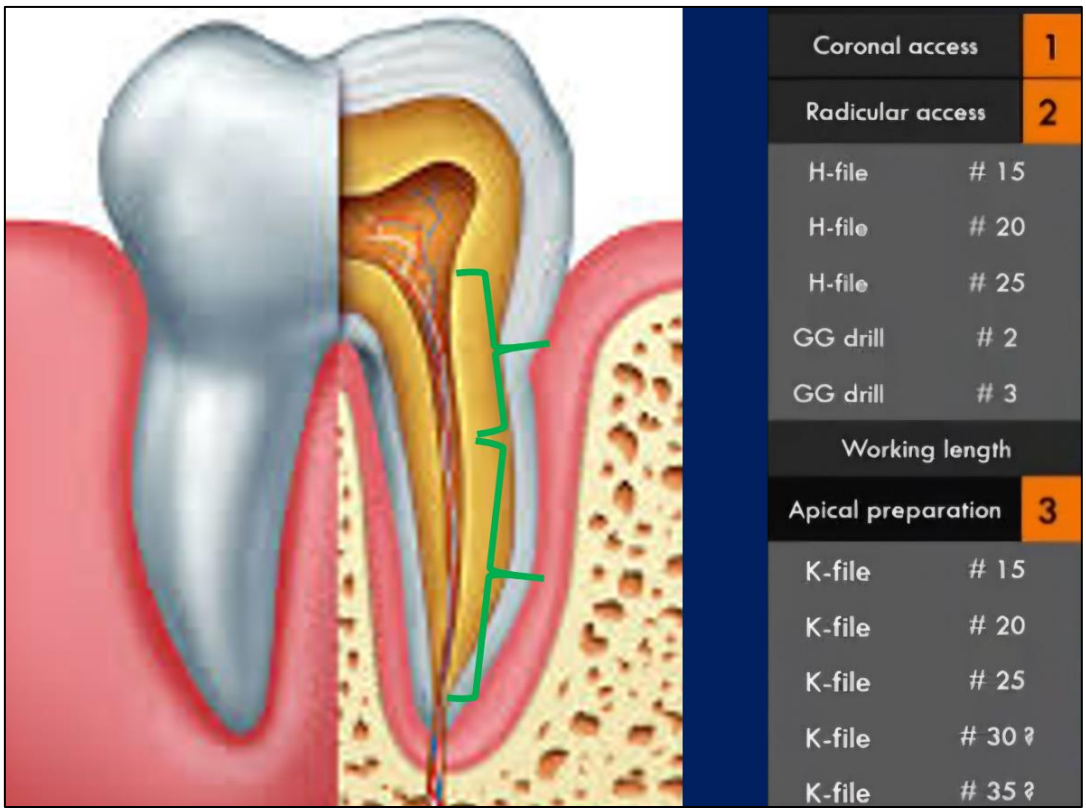




Advantages of step-back technique:
More flare at coronal part of root canal with proper apical stop.

Disadvantages of step-back technique:
1. Difficult to irrigate apical region.
2. More chances of pushing debris periapically.
3. Time consuming.
4. Increased chances of iatrogenic errors for example ledge formation in curved canals.
5. Difficult to penetrate instruments in the canal.
6. More chances of instrument fracture.
7. More chance of change in WL after finishing of coronal flaring especially in the curved canal

<u>Step-down Technique</u>



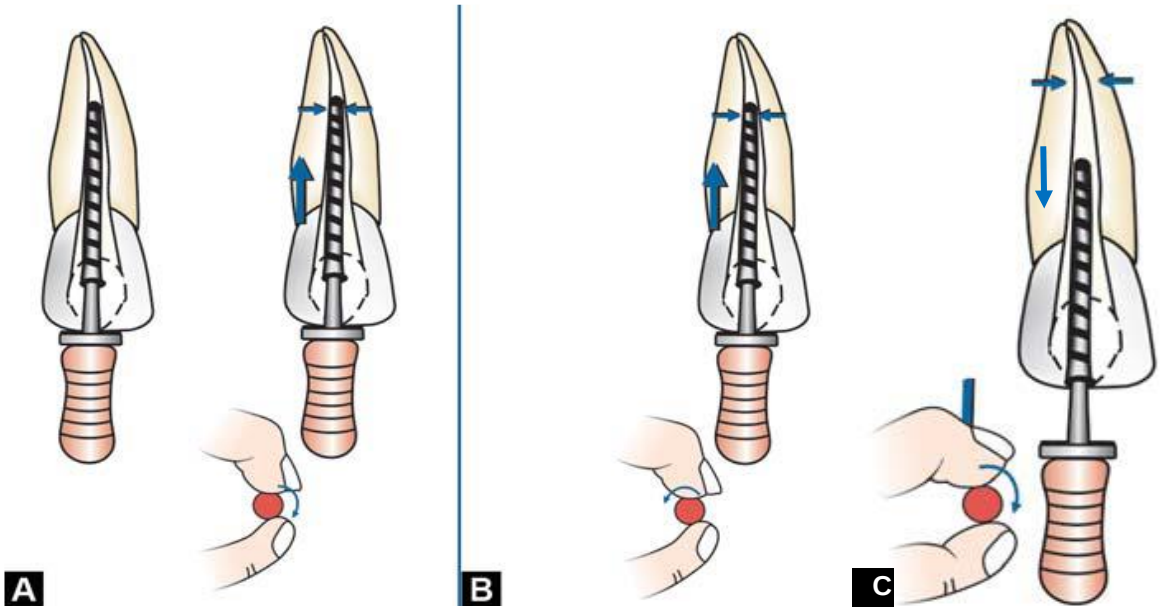
Objectives
1- To permit straight access to the apical region of the canal.
2- To remove the bulk of necrotic tissue and microorganisms before apical shaping.
3- To allow deeper penetration of irrigant into the apical part of the canal.
4- The WL is less likely to change with less chance of zipping near the apical constriction.

Procedure
1- Coronal Access. The access opening is performed to show all the orifices.
2- Radicular Access. The coronal part of the root canal in shaped by files #15-25 and then Gates Glidden burs #2 and 3 to widen the orifice and clean this part.
3- Establishment of the working length.
4- Apical preparation. The apical part of the root canal is shaped in sequential order with files #15-35.

Balanced Force technique

- This technique uses the Flex-R file.
- This file has "safe tip design" with a guiding land area behind the tip.
- This technique can be described as positioning and preloading an instrument through a clockwise rotation and then shaping the canal with a counterclockwise rotation.

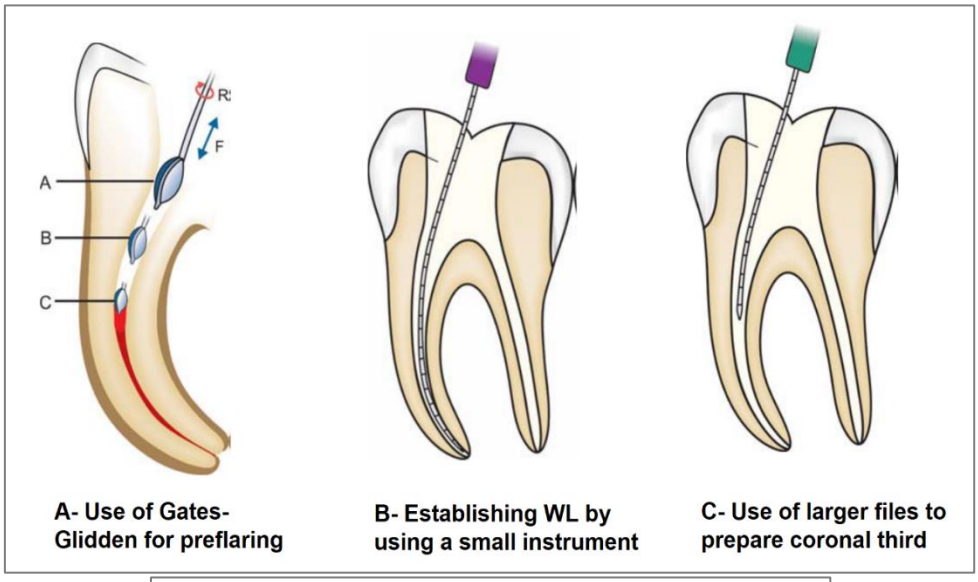
Procedure
- Placement of the file (apical pushing with 1/4 clockwise rotation) (A)
- Cutting (repeated 3/4 counter clockwise rotation) (B)
- Removal (1/4 clockwise rotation with pulling for removing debris) C.

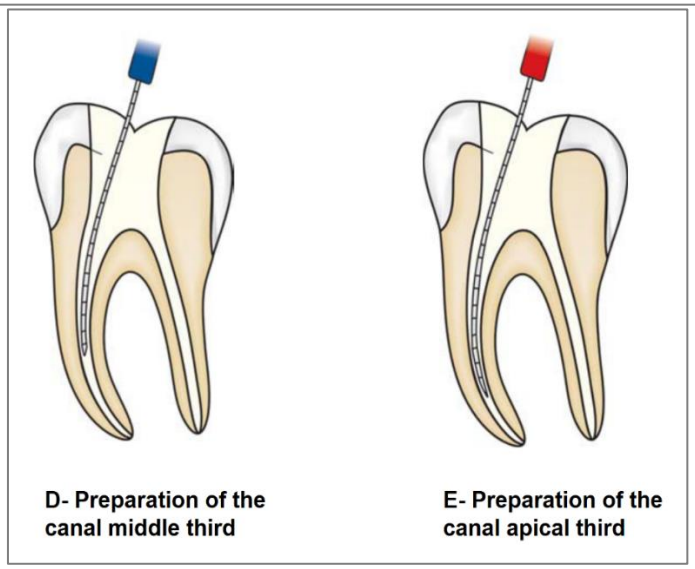


Crown Down Pressure-less Technique

This technique starts from the orifice and ends in the apex.
Procedure
1- Coronal flaring with Gates Glidden burs to widen the orifice and clean the coronal third of the root canal.
2- Establish the working length.

3- Progressive entrance to the middle and apical third of the root canal until reaching the CDJ.





Biological Advantages

1. Removal of tissue debris coronally.
2. Reduction of postoperative sensitivity.
3. Greater volumes of irrigants can reach in canal irregularities.
4. Better dissolution of tissue with increased penetration of the irrigants.

Clinical advantages

1. Enhanced tactile sensation with instruments because of removal of coronal interferences.
2. Flexible (smaller) files are used in apical portion of the canal; whereas larger (stiffer) files in coronal portion.
3. Less chance for canal ledging, transportation and perforation.
3. Straight line access to root curves and canal junctions.
4. Provides more space for irrigants for debridement.
5. Final shape of canal obtained is narrow apically and wider coronally.