

Resource view

Resource name	ENDODONTICS IN DENTISTRY
Resource description	This is a lecture on endodontics in dentistry.
Resource content	<u>Endodontics</u> <u>Contents:</u> 1. Diagnosis 2. Causes of Pulpal Damage 3. Conventional Root canal Therapy 4. Access cavity preparation 5. Isolation 6. Instruments 7. WORKING  length determination 8. Techniques for canal preparation 9. Root canal CLEANERS  10. Root canal filling material 11. Complication of Root canal Treatment <u>Diagnosis</u> • patients pain history • intra and extra oral examination • palpation - to assess any swelling + tenderness around tooth apex • percussion- to assess periodontal integrity • mobility - to assess bone support

- Radiography- Radiography is the most reliable of all the diagnostic tests and provides the most valuable information.
- Pulp testing:
 - normal response - vital pulp
 - readings above 80 - necrosis
 - quick response - usually pulpitis (need to confirm with other tests)
 - cold test- if positive means pulp is vital , however if there is lingering pain then it suggests irreversible pulpitis
 - heat test -if positive means irreversible pulpitis
- Cutting a test cavity- used as a last method

Causes of Pulpal Damage

- Dental caries
- Trauma
- Periodontal disease
- Damage during operative procedure

Conventional Root Canal Therapy

Aims:

- ♦ To cleanse the pulp cavity of infected debris, toxic materials and pulpal remnants.
- ♦ To seal the pulp cavity apically, periodontally and coronally.
- ♦ To maintain tooth in function.

INDICATION OF RCT

- pulpal and periradicular disease
- restorative requirements
- coronal fracture at gingival level/ over denture
- re root treatment
- discoloured tooth due to trauma





CONTRAINDICATION

- general factors- lack of patient interest and access
- restorative factors (poor periodontal prognosis)
- trauma (horizontal fracture involving the gingiva, vertical , oblique fracture)
- complex internal and external anatomy

NUMBER OF ROOT CANALS and ESTIMATED WORKING LENGTHS

Tooth	Average Length	No. of roots	No. of canals
Maxillary anteriors			
Central incisor	22.5 mm	1	1
Lateral incisor	22.0 mm	1	1
Canine	26.5 mm	1	1
Maxillary premolar			
First premolar	20.6 mm	2-3	1 (6%) 2 (95%) 3 (1%)
Second premolar	21.5 mm	1-3	1 (75%) 2 (24%) 3 (1%)
Maxillary molars			
First molar	20.8 mm	3	4 (93%) 3 (7%)
Second molar	20.0 mm	3	4 (37%) 3 (63%)
Third molar	17.0 mm	1-3	

Mandibular anteriors			
Central incisor	20.7 mm	1	1 (58%) 2 (42%)
Lateral incisor	20.7 mm	1-2	1 (58%) 2 (42%)
Canine	25.6 mm	1	1 (94%) 2 (6%)

Mandibular premolars			
First premolar	21.6 mm	1	1 (73%) 2 (27%)
Second premolar	22.3 mm	1	1 (85%) 2 (15%)
Mandibular molars			
First molar	21.0 mm	2-3	3 (67%) 4 (33%)
Second molar	19.8 mm	2	2 (13%) 3 (79%) 4 (8%)
Third molar	18.5 mm	1-2	

Access Cavity Preparation

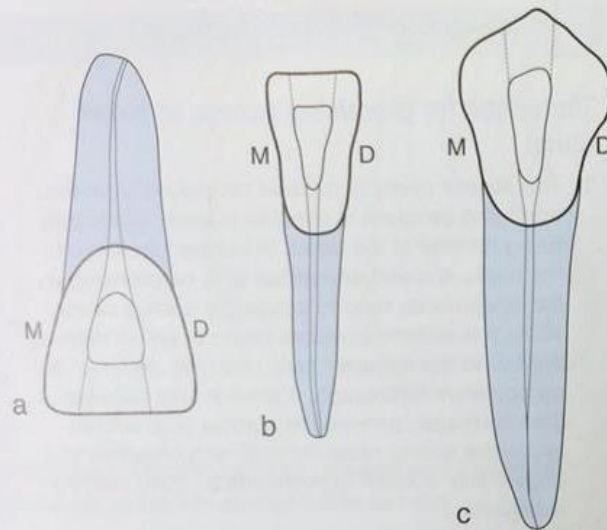


Fig. 2.2 • Access cavity outline for the anterior teeth. • (a) Upper incisor. (b) Lower incisor. (c) Canine teeth. M = mesial; D = distal.

- the angle of exit of root canals from the floor of the pulp chamber; this provides an indication of the amount of coronal third root canal modification required to obtain straight-line access
- the number of roots, degree of root curvature and canal patency.

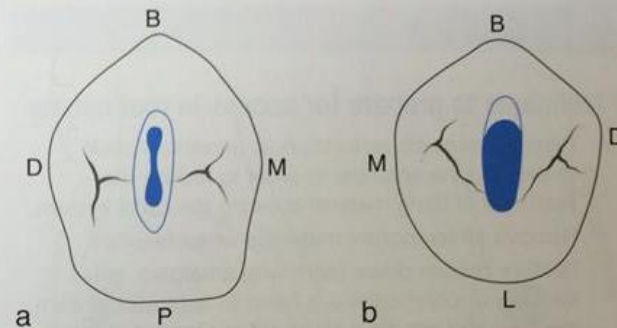


Fig. 2.3 • Access cavity outline for (a) upper and (b) lower premolar teeth. • M = mesial; D = distal; P = palatal; B = buccal.

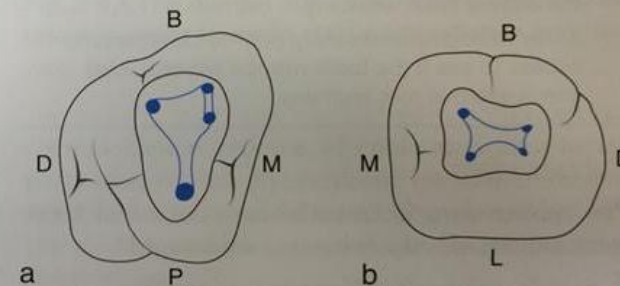


Fig. 2.4 • Access cavity outline for (a) upper and (b) lower molar teeth. • M = mesial; D = distal; P = palatal; B = buccal.

For maxillary and Mandibular Canines and Incisors

- Access cavity should permit straight-line access.
- Ideally access cavity is close to incisal edge on palatal or lingual surface of tooth second canal may be present in 40%.
- For maxillary central incisors and lateral incisors, access is triangular in shape.
- Access cavities for maxillary and mandibular canines are ovoid in shape.

Maxillary and Mandibular Premolars

Access cavity should be ovoid buccolingually and through occlusal surface.

Maxillary Molars

- Access cavities through occlusal surface
- Triangular in shape This tooth has three roots.
- The palatal root is the longest. with an average length of 22 mm; the mesio- buccal and distobuccal roots are slightly shorter, at 21 mm average length.
- The canals of the mesiobuccal root are often very fine and difficult to negotiate .The curvature of the roots can be difficult to visualize from radiographs, and the second mesiobuccal canal is nearly always superimposed on the primary mesio-buccal canal.
- The palatal root has a tendency to curve towards the buccal and the apparent length on a radiograph will be shorter than its actual length.

Mandibular Molars

-  Triangular in shape (more trapezoid in shape) with its base to mesial and apex to distal.
- Generally there are two roots and three canals: two canals in the mesial root and one large oval canal distally.
- According to Skidmore and Biorndal,⁹ one third of these molars have four canals.
- The mesiobuccal canal tends to exhibit the greatest degree of curvature.

Canal Preparation

Isolation

Rubber Dam is essential to:

- ? To protect oro-pharynx from any inhalation or swallowing of instruments
- ? Minimise contamination of open root canal
- ? Retract soft tissues
- ? Improved visibility
- ? Confinement of excess irrigant

Instruments

Files/ reamers:

Used to widen the root canal. E.g. K Flex Files, K Files and Hedstrom (H) files. These are hand held or operated in a hand piece or ultrasonic hand piece.

K FILES :

These instruments were originally made from a square or triangular blank, machine twisted to form a tight spiral. The angle of the blades or flutes is consequently near a right-angle to the shank making it effective in cutting. the balanced-force technique is now considered the manipulation method of choice.

H FILE:

Only a true filing action should be used with this instrument because of the angle of the blade. There is a strong possibility of fracture if a reaming action is used and the blades are engaged in the dentine.

REAMERS:

The reamer is constructed from a square or triangular blank, machine twisted into a spiral but with fewer cutting flutes than a file. The reamer will only cut dentine when it is rotated in the canal. Considerable damage may be caused to a root canal by the incorrect use of a reamer, and their routine use is no longer recommended. Power-assisted instrument

Rotary Files:

Used to widen the RC especially the coronal part.

Broaches:

Barbed broaches are used for vital tissue removal. However should not be used in narrow canals as that may cause the broach to fracture

Gates Glidden:

Used for preparation of coronal 2/3rd of root canal.

Working Length Determination

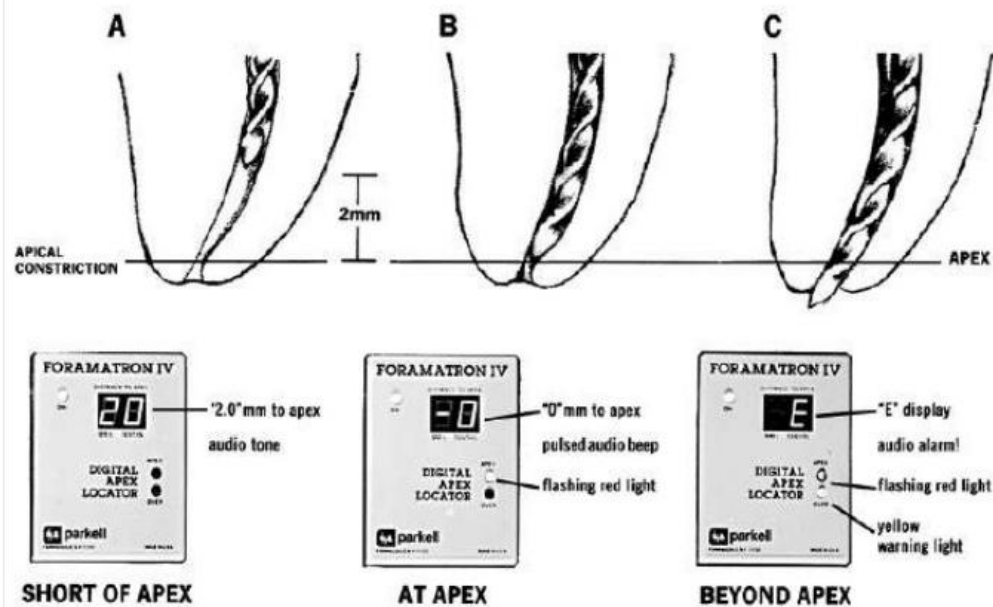
It is usually determined by estimating a length from a preoperative radiograph.

Working Length Radiograph

Using files of known length to a stable reference point, the reference point can be marked with the help of a rubber stopper placed on the file.

Electronic Apex Locators

Used to access working length in both wet and dry canals. Used in conjunction working length radiograph.



Technique for Canal Preparation

- Manual preparation with ISO instruments.
- Manual preparation with taper instruments
- Rotary Preparation.
- Regardless of technique, open the canal system using 15-35 K file then irrigate and check patency.

Manual preparation with ISO Instruments

Techniques

Step-Back Technique

- In this technique apical portion is instrumented first and then progress toward coronal. Access coronal portion and middle third with a gates glidden drill.
- Establish working length using small flexible file and locate the apex
- Step back from the apex, while increasing file size
- Your goal is to achieve a funnel shape
- This technique is time consuming because repeated irrigation and recapitulation is necessary, failing which apical blockage can occur with debris
- For instance,
If MAF size 030 at 21mm

File sequence will be:

030 21mm
035 20mm
030 21mm
040 19mm
030 21mm
045 18mm

The working distance must be re-established at each progression by original apical step size File known as recapitulation.

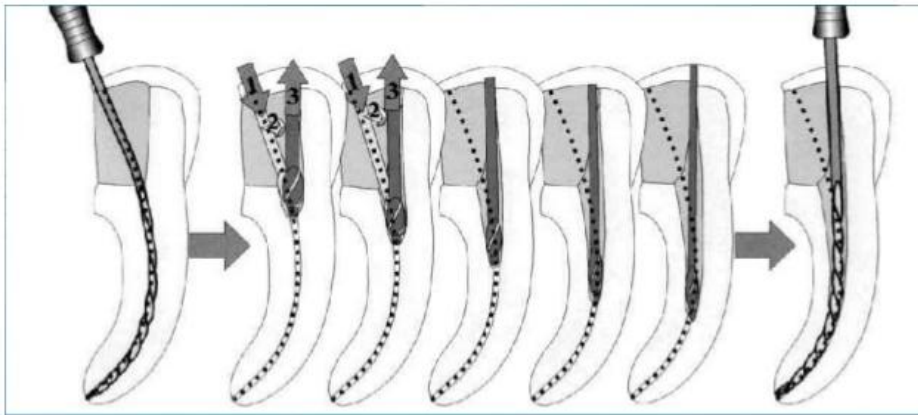




Step-Down Technique

Here Principal is:

- Gates-Glidden burs are introduced into the canal, directed apically and laterally away from the furcation.
- The larger sizes are introduced first, working sequentially further down the canal with smaller sizes.
- In a relatively straight canal, the No. 2 bur is inserted 10-12 mm into the canal from the occlusal reference point.
- In a curved canal the pre-operative radiograph should be checked for the maximum straight line penetration of the bur.
- A size appropriate to the particular canal and the final size Gates-Glidden drill is selected, perhaps a size 60 and then the root canal is prepared till the apex with subsequent smaller number hand files



Advantages

- Straight access to apex
- Bulk of coronal bacteria removed before apical instrumentation thus reducing extrusion of debris through the apex
- Removal of dentinal interferences



- The enlargement of the coronal portion first has several benefits. It allows better penetration of the irrigating solution to the entire root canal system and forms a reservoir of irrigant which is more readily replenished in the canal system. It also reduces the risk of compacting debris apically which may block the canal.

The stepdown technique is now the most widely used technique for canal preparation

Nickel-titanium

- The development of nickel-titanium alloys has revolutionised automated root canal preparation.
- The remarkable ability of these alloys to alter their crystalline state gives instruments manufactured from nickel-titanium profound flexibility.
- A controlled high-torque, low-speed motor is required for efficient use of the instruments.

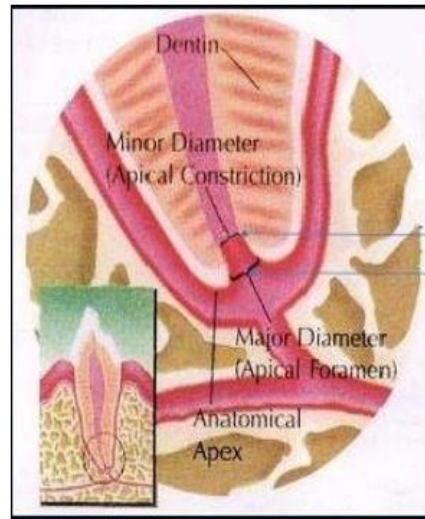


There are a number of rotatory Niti systems available, make sure;

- Access must be straight
- Speed of rotation is critical
- No instruments should be in canal for more than 5 seconds before being removed and inspected
- Instruments should be kept constantly moving.

Apical Anatomy

- Apical Foramen is not usually at anatomical apex of the root and is likely to be on the side of end of root. It may be single or multiple and can lie in confluence of two root canals.
- Mature root shows an apical constriction where canal narrows dramatically at the apex. It is upper limit of ideal canal preparation and is 0.5-1 mm from anatomical apex.



Instrument manipulation

In addition to the method of approach to the root canal, there have been numerous techniques for the manipulation of endodontic shaping instruments.

Balanced Forced Technique

- The balanced force technique. is now the most widely taught technique for manipulating handfiles. It is particularly good when negotiating the curved root canal.
- The technique requires flexible files with non-cutting tips
- K files into canal system using clockwise motion with no apical pressure at 60 degrees
- File rotated anticlockwise(360°) with downward pressure (cutting stroke). This balances force with which file wants to back out of the canal.
- File then turned quarter turn clockwise with no pressure to remove debris.
- The balanced force cycle of movement should be made no more than three times before the file is

withdrawn to be cleaned

Advantages

- Circular preparation in centre of tooth
- Efficient cutting especially in curved canals

Watchwinding and circumferential filing

- Watchwinding, or a continuous back and forth rotation with slight apical pressure,
- Each slight turn engages the flutes of the file in the canal wall and removes dentine.
- Once the file has reached the desired length, a push-pull filing action is used, moving the file circumferentially around the canal walls with a k file

DISADVANTAGE OF THIS TECHNIQUE:

A tendency to preferentially file the inside wall of a curved canal.

SOLUTION:

- a **Anticurvature filing** :involves filing predominantly away from the inner curve of root to reduce the risk of a strip perforation.
filling ratio used is 3:1 (outer wall:inner wall)

The mesiobuccal roots of maxillary molars and the mesial roots of mandibular molars are the teeth most frequently at risk. The method is used only in canals with a moderate-to-severe curve.

Patency filing:

The use of recaptulation, in order to avoid blockage of apical area with debris.
Smaller number file is used subsequently to keep the apical area patent.

Disadvantage:

- Risk of pushing debris through the apex
- Time consuming

Root Canal Cleaners



Primary role of material is to debride and clean out dentine debris from canal

- ◆ Cleansing achieved by irrigating solutions into root canal either endoscopically or using syringe with 27 gauge needle.

Solutions Used Are:

- 1) Saline
- 2) 17% EDTA (chelating agent which dissolved inorganic component of smear layer, this smear layer occludes the dentinal tubules, and may protect microorganisms from the effects of the sodium hypochlorite irrigation.
- 3) 20% citric acid
- 4) 2.5 ◆ 5% sodium hypochlorite (sodium hypochlorite is considered the most effective irrigant, as it is bactericidal, dissolves organic debris and is only a mild irritant.)

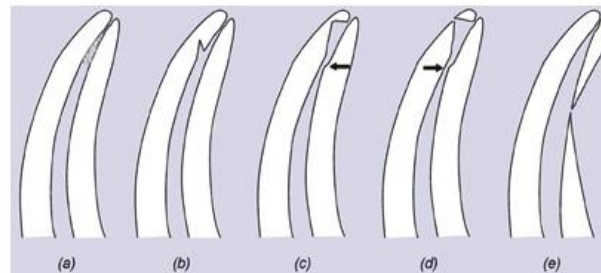
Root canal filling material

Material Type	Principal Component	Technique	Advantage	Disadvantage
Semi-solid	Gutta-Percha 2% taper 60% crystalline 40% Amorphous	1) lateral condensation with sealer 2) Thermomechanical compaction GP melted by friction of compacting instrument 3) Warm vertical condensation with heated spreaders, no sealer. 4) Thermoplasticised	1) Compressible control insertion 2) Good condensation 3) Good condensation	Difficult to use in fine curved canals Excessive heat generated shrinkage on cooling. Time consuming soft GP can pass through apex. Shrinkage on cooling.

		injection with vertical compaction.	4) Time saving due to extraoral softening.	
Solid	Silver Titanium	Solid cone with sealer	Easy to use in curved canals due to rigidity	- Poor adaptation - Canal space block with metal - Corrosion of silver
Hybrid	GP coated steel	Cone heated to softened GP, then warm vertical condensation	Good condensation	Canal space blocked with metal cone difficult to remove.
Root canal therapy material	non setting CAOH (Hypocal) ledermix (antibiotic/steroid)	can be placed with an H file or lentulo spiral .	used as inter appointment medicament (effective in cases where persistent inflammatory exudate from the periapical tissue is seen) useful in cases that are unable to anaesthesia a hyperaemic pulp. Use of ledermix can help allow pulp removal in next appt	not a permanent solution Can not be used for long delays in btw appointments, as it can leach out of canal and cause inflammation.
Root Canal	1) ZnO/ Eugenol (comes in 2	All used with gp cones	1) Biocompatible	1) Solubility 2) Solubility

Sealers	pastes called tubliseal) 2) CaOH (sealapex, apexit) 3) Epoxy Resin(AH Plus, realseal) 4) GIC 5) MTA 6) Silicone based		2) Biocompatible 3) Slow setting 4) Biocompatible 5) Biocompatible	3) Apical irritation reported 4) Vulnerable to water contamination rapid set 5) Expensive handling difficult.
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Problems in Conventional Root Canal Therapy



a) Dentine debris and pulp remnants packed into the apical part of the canal resulting in loss of working length. This may be avoided by recapitulation with fine files and copious irrigation.

b) Ledging either due to not precurving the instrument, or forcing it into the canal.

c) Apical zip caused by rotating the file excessively.

d) Perforation either due to persistent filing with too large an instrument, or continual zipping. Note the narrower part of the canal in c) and d) is termed an elbow. This makes obturation of the root canal very difficult in the widened apical area.

e) Strip perforation caused by overpreparing and straightening the curved canal

Fracture Instrument

- With incorrect filing techniques (e.g. watch winding)
- Instruments autoclaved too many times.
- (A masseran kit is used to retrieve a broken file within a canal)



Perforations

- Due to over instrumentation of apex
- Strip perforation caused by over preparing and straightening the curved canal.
- Perforation either due to persistent filing with too large an instrument, or continual zipping.

- Ledge formation

Ledging either due to not precurving the instrument, or forcing it into the canal.

Zipping (transportation)

- Occurs by using straight large files in curved canals
- Can be minimised by instrument pre-curving and use of files with blunt tip.
- Apical zip caused by rotating the file excessively.

Elbow Formation

- When apical zip happens, a narrowing often occurs coronal to this in the canal, which is hourglass in shape.

(Note the narrower part of the canal in c) and d) is termed an elbow

After completion of RCT , the treated tooth should be reviewed after a year radiographically. If the tooth already has a periapical lesion, healing should usually take place within 2 years, However if the xray assessment shows no change or no signs of healing then it should be followed up to 4 years before further treatment is planned.

PRINCIPAL SOURCES AND FUTURE READING:

- OXFORD HANDBOOK OF CLINICAL DENTISTRY 5th Edition :Restorative dentistry pg :276
- Problem Solving in Endodontics J.L.Gutmann et al 1997
- J.M Whitworth 2002 Rational Root canal treatment in Practice

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