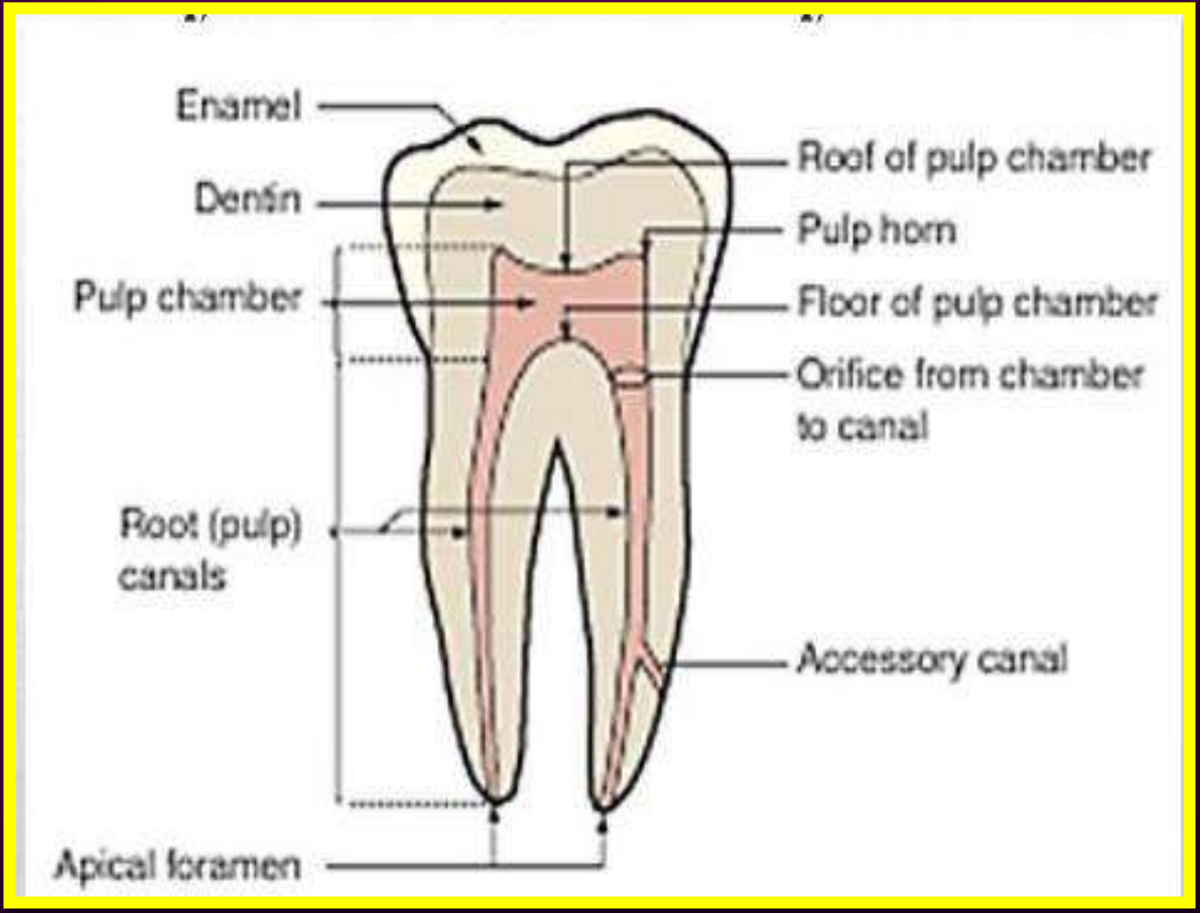
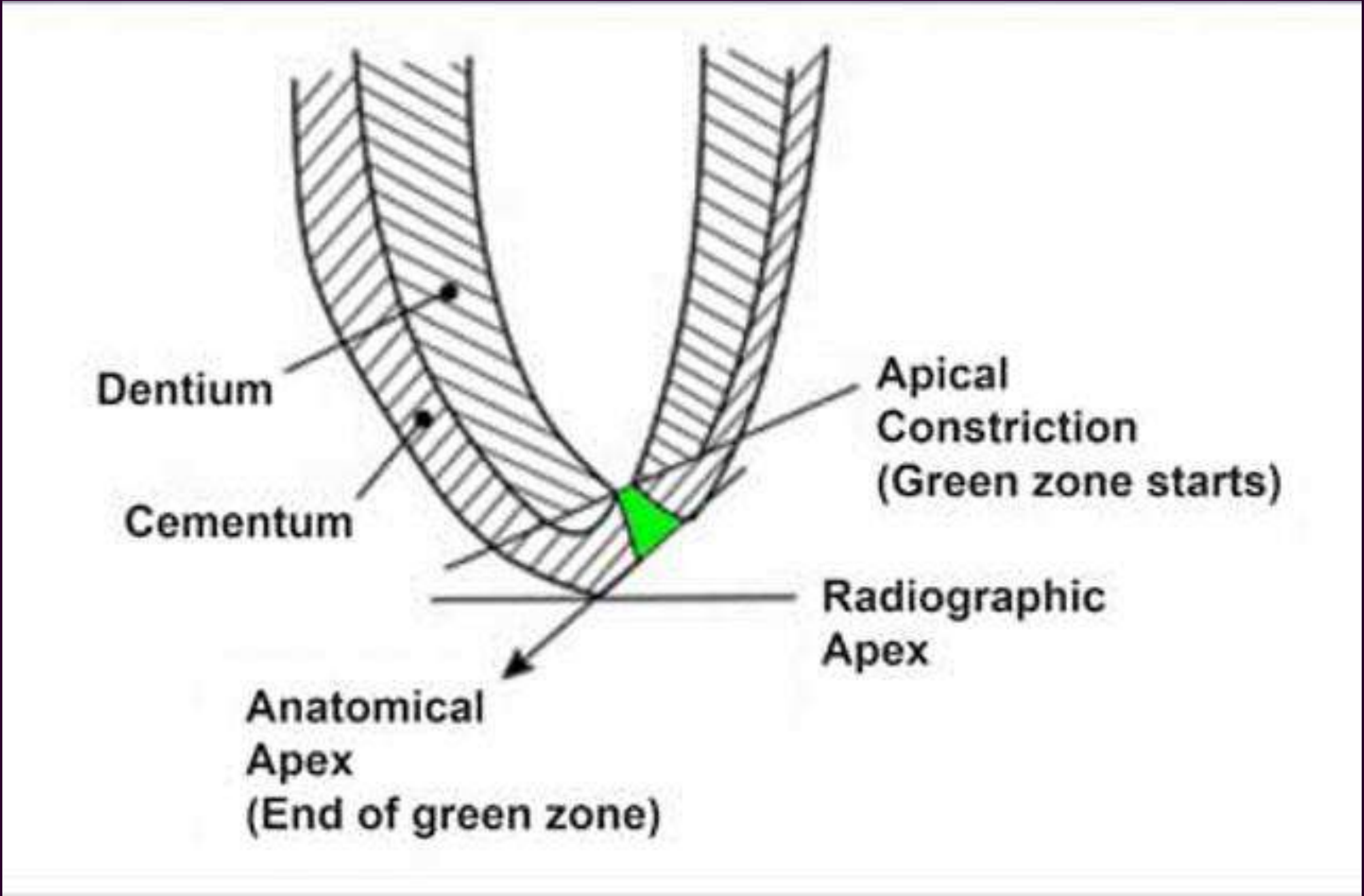
ACCESS OPENINGS

IMPORTANT LANDMARKS




Dentium
Cementum
Apical
Constriction
(Green zone starts)
Radiographic
Apex
Anatomical
Apex
(End of green zone)

CONCEPT OF TOTAL ENDODONTIC CAVITY PREPARATION,

Black's principles beginning at apex:

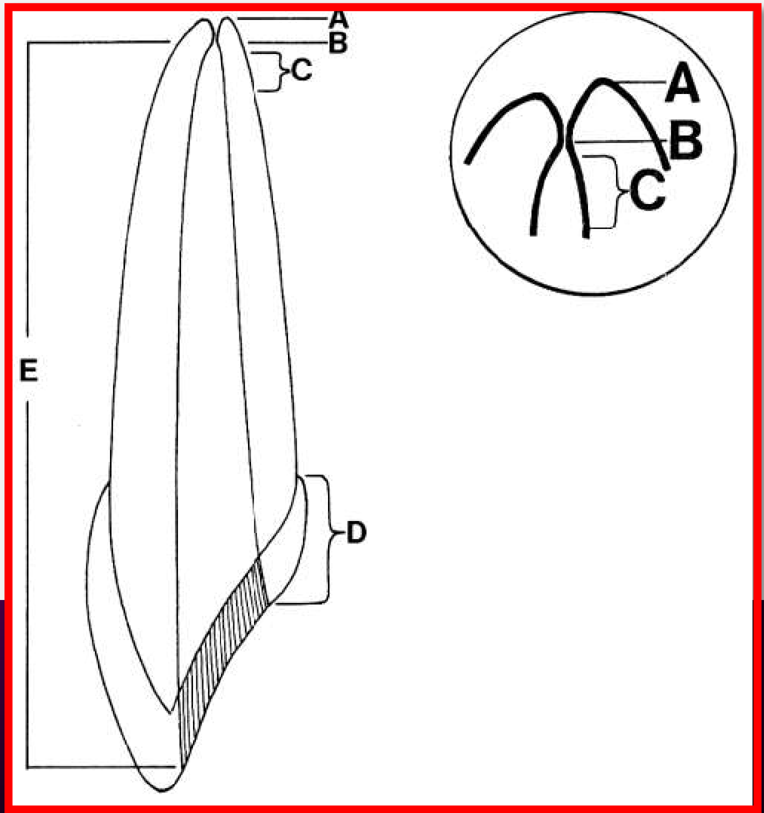
A, Radiographic apex.

B, Resistance Form.

C, Retention Form

D, Convenience Form.

E, Outline Form.



OBJECTIVES OF ACCESS CAVITY PREPARATION

1 Straight line access to apical foramen or to the initial curvature of the canal.

2 To locate all root canal orifices.

3 To conserve sound tooth structure.

PRINCIPLES OF ENDODONTIC ACCESS PREPARATION -

Endodontic Coronal Cavity Preparation

I. Outline Form

II. Convenience Form

III. Removal of the remaining carious dentin

(and defective restorations)

IV. Toilet of the cavity

Endodontic Radicular Cavity Preparation

I and II. Outline Form and Convenience Form (continued)

IV. Toilet of the cavity (continued)

V. Retention Form

VI. Resistance Form

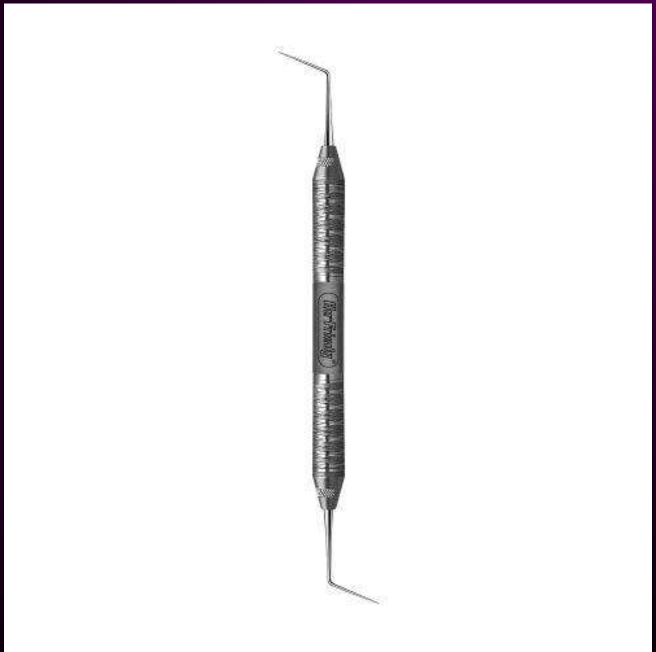
Armamentarium

<u>Common armamentarium required</u>

is bur and Gates. Burs used for access cavity preparation : <u>Diamond Round Bur, Transmetal Bur, Carbide Round Burs, Endo Z Bur, Tapered Diamond Bur.</u> One X-Gates is comprised of four Gates Glidden (GG) drills.

Armamentarium

Aids used for access cavity: Dyes, Sodium hypochlorite Champagne bubble test, Transillumination, DG-16 endodontic explorer , Endodontic spoon excavators



Armamentarium

Modern aids in access cavity preparation

Dental loupes

Dental operating microscope

Ultrasonics tips

Radiographs

LAWS

- Law of Centrality
- Law of Concentricity
- Law of the CEJ
- Law of Symmetry
- Law of Color Change
- Law of Orifice Location

LAWS

- **The studies conducted by Krasner & Rankow have provided the following Laws**

- **<u>Law of Centrality:</u> The floor of the pulp chamber is always located in the center of the tooth at the level of the CEJ.**

LAWS

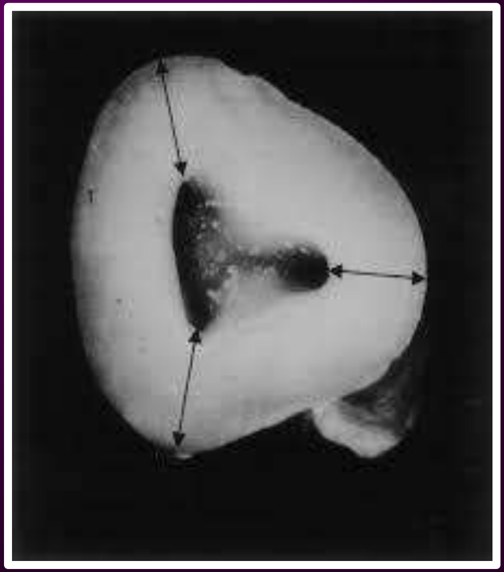
- <u>**Law of Concentricity:**</u> **The walls of the pulp chamber are always <u>concentric</u> to the <u>external surface</u> of the tooth at the level of the CEJ, that is, the external root surface anatomy reflects the internal pulp chamber anatomy.**

LAWS

- **Law of Color Change: The color of the pulp chamber floor is always darker than the walls.**

LAWS

- **Law of the CEJ:** **The distance from the external surface of the clinical crown to the wall of the pulp chamber is the same throughout the circumference of the tooth at the level of the CEJ—the CEJ is the most consistent repeatable landmark for locating the position of the pulp chamber.**



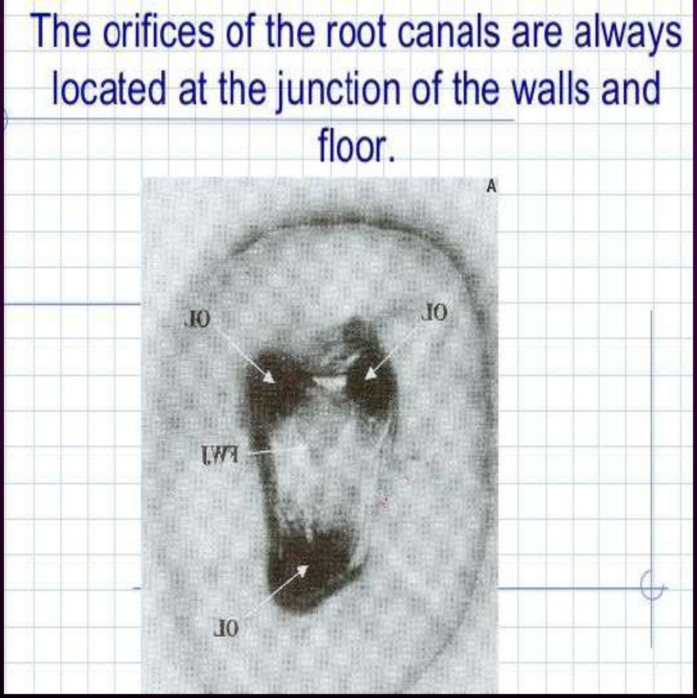
LAWS

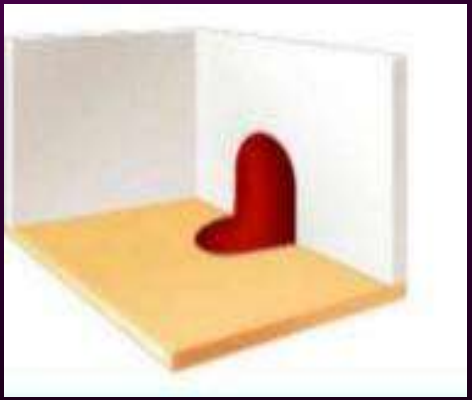
Law of Symmetry 1: Except for the maxillary molars, the orifices of the canals are equidistant from a line drawn in a mesial–distal direction, through the pulp chamber floor.

Law of Symmetry 2: Except for the maxillary molars, the orifices of the canals lie on a line perpendicular to a line drawn in a mesial–distal direction across the center of the floor of the pulp chamber.

LAWS

- **Law of Orifice Location :** **The orifices of the root canals are always located at the junction of the walls and the floor.**





ACCESS CAVITY OBJECTIVES

1ST objective is to penetrate through the occlusal surface. Penetrating enamel or precious metal can be done using a high-speed handpiece with a tungsten carbide bur.

2ND objective is to find the pulp chamber. A narrow opening is maintained initially and the penetrating bur is taken to a premeasured depth. If the pulp chamber is large and the angulation is correct, the bur can be felt to "drop" through into the chamber.

However, relying on this feeling is dangerous for it is unpredictable. If the chamber is calcified or deep, the "drop" is often not discernable

ACCESS CAVITY OBJECTIVES

The 3RD objective is to "unroof" the dentin that covers the pulp chamber, Round burs should be avoided during access preparation other than perhaps for initial penetration as they cause indiscriminate gouging of the walls. Safe-ended cutting burs can be used

The 4TH objective is to obtain uniform contact of the file with the access cavity wall.

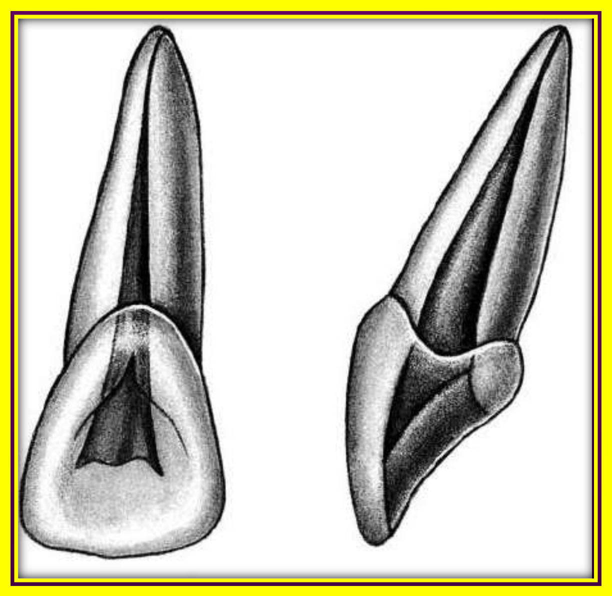
ACCESS CAVITY OBJECTIVES

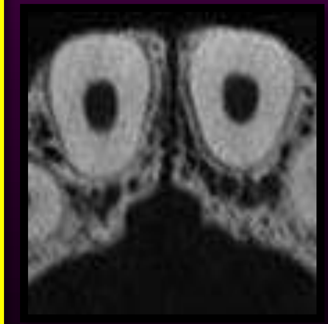
The 5TH objective is to obtain STRAIGHT LINE ACCESS..

This single "slice" of dentin is then flared out to an obtuse angle relative to the pulp chamber floor, creating a slot-like extension.

MAXILLARY CENTRAL INCISOR

ACCESS OPENING

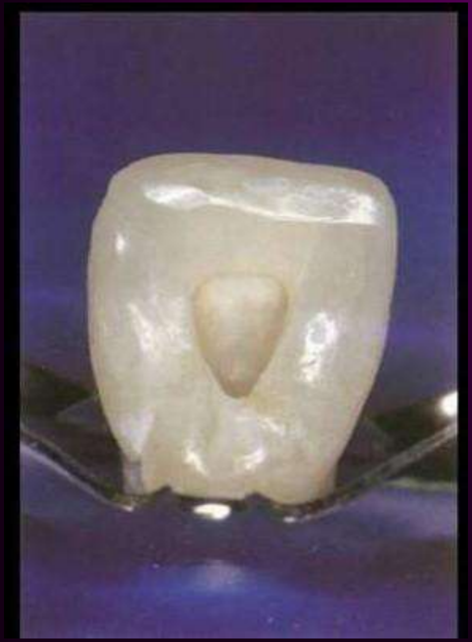


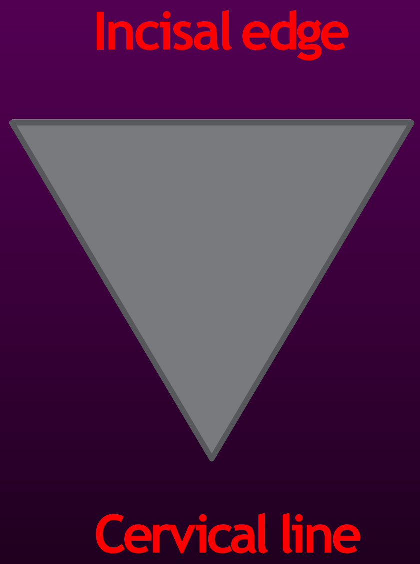


CORONAL MIDDLE APICAL

ACCESS CAVITY PREPARATION IN ANTERIOR TEETH

Outline form of central and lateral incisors are triangular with the base of the triangle towards the incisal edge and the apex towards the cingulum.

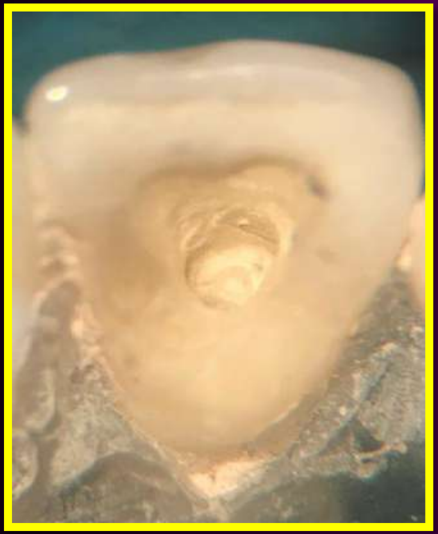




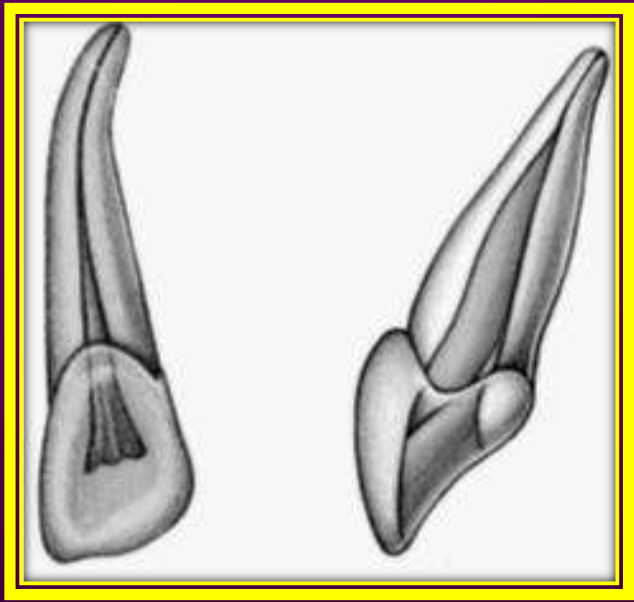
Maxillary Central Incisor

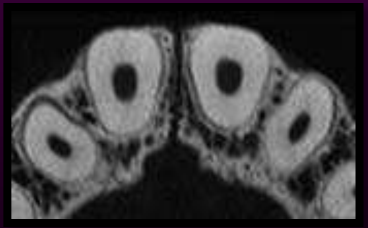
- Average Length – 21.8 mm.
- Pulp chamber is located in the center of the tooth.
- Broad mesio distally with widest incisally.
- One root and One root canal.
- Enamel is penetrated in the centre of the lingual surface.
- Use No.4 high speed bur to penetrate enamel.
- Angulation should be perpendicular to long axis.
- Penetrate dentin with No. 4 round carbide bur in slow speed.
- Angulation should be parallel to long axis.
- Penetrate pulp chamber.
- Remove the overhanging enamel and dentin of the lingual roof.
- Remove lingual shoulder with gates glidden drill.

MAXILLARY LATERAL INCISOR



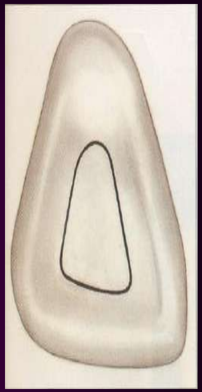
ACCESS OPENING





CORONAL MIDDLE APICAL

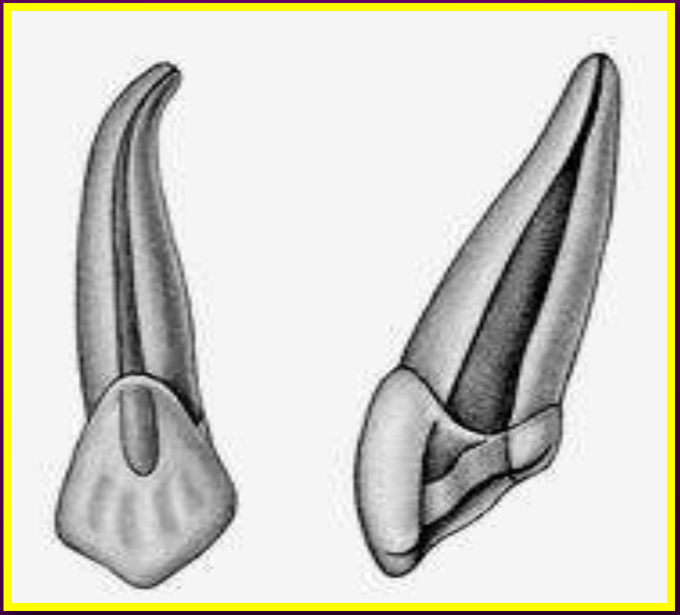
Maxillary lateral Incisor

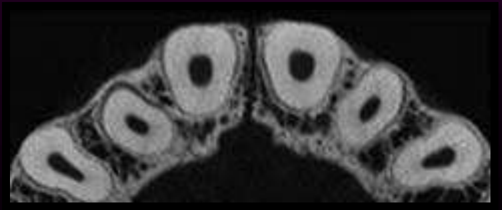


- Average Length – 23.1 mm.
- Pulp chamber is similar to central incisor but smaller.
- Only two pulp horns.
- One root and One root canal.
- Access opening is same as for C I but smaller and ovoid.
- Enamel is penetrated in the centre of the lingual surface.
- Use No.2 high speed bur to penetrate enamel.
- Angulation should be perpendicular to long axis.
- Penetrate dentin with No. 2 round carbide bur in slow speed.
- Angulation should be parallel to long axis.
- Penetrate pulp chamber.
- Remove the overhanging enamel and dentin of the lingual roof.
- Remove lingual shoulder with gates glidden drill.

MAXILLARY CANINE

ACCESS OPENING



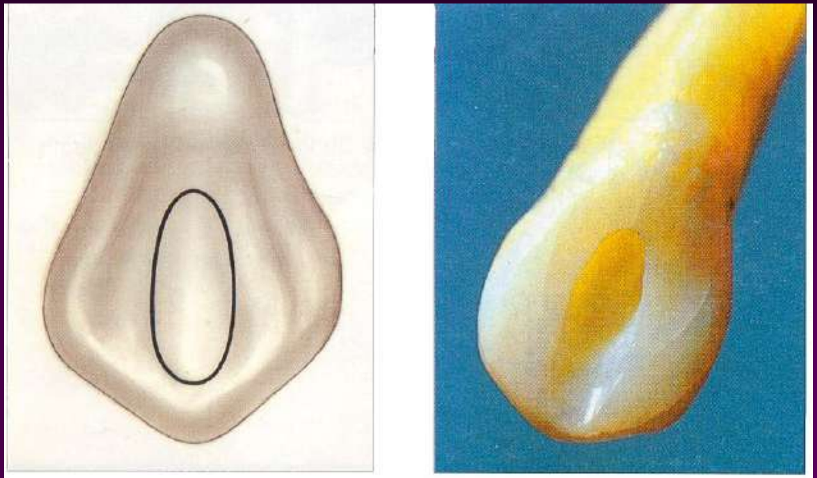


CORONAL

MIDDLE

APICAL

Maxillary Canine



7.21, 7.22 Maxillary canine

- Average Length – 26 mm.
- Pulp chamber is ovoid in shape, wider labio palatally.
- Only one pulp horn, largest pulp chamber from any single rooted teeth.
- One root and One root canal.
- Access opening is same as for C I but ovoid.

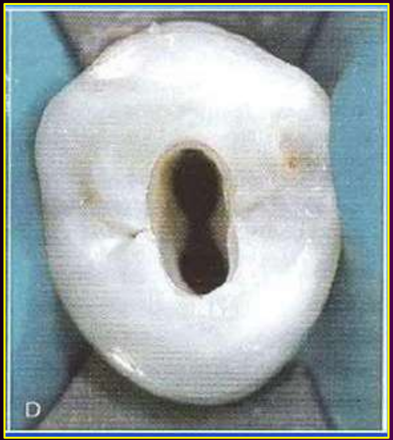
Endodontic treatment of a 36-mm long upper cuspid

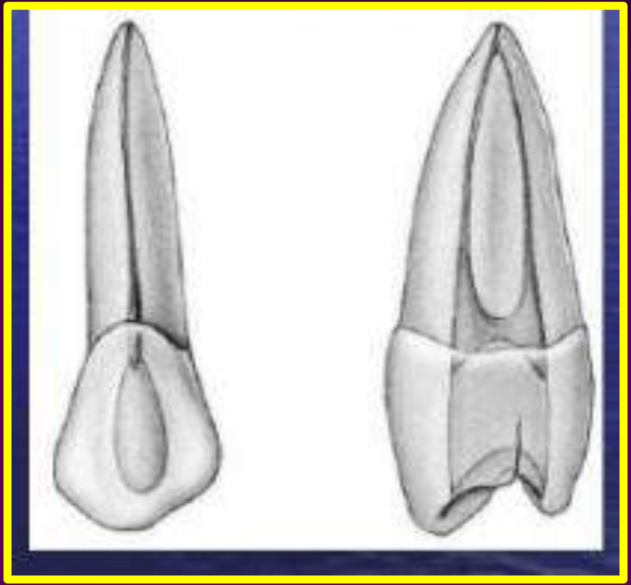
a} preoperative

b}working length

c}post operative

MAXILLARY FIRST PREMOLAR

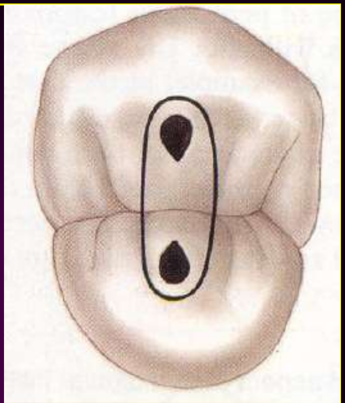




ACCESS OPENING

CORONAL | MIDDLE | APICAL

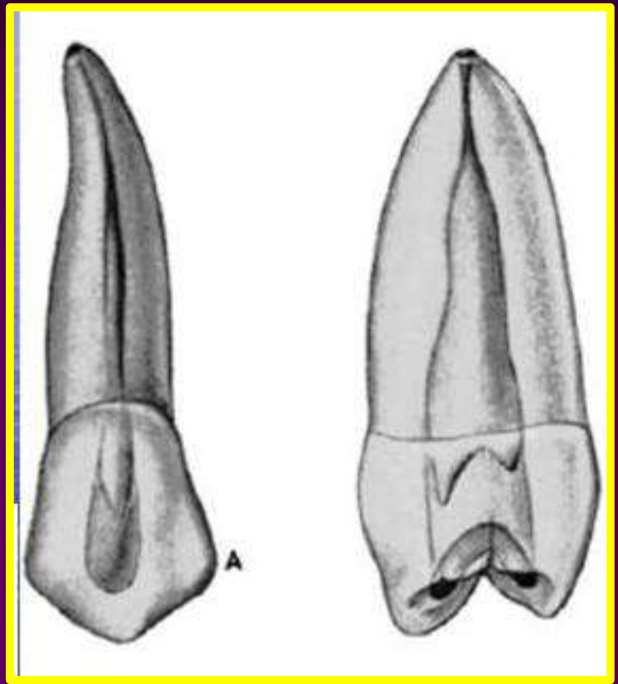
Maxillary first premolar



- Average Length – 21.5 mm.
- Pulp chamber is narrow mesiodistally.
- Pulp horn under each cusp.
- Roof of the pulp chamber is coronal to cervical line.
- Floor of the chamber is convex.
- Two roots and root canals.
- Penetrate deep to remove the roof of the chamber.
- Avoid shallow openings, as they expose only orifices.
- Use No. 2 round bur in high speed contra angle, penetrate enamel in the centre of the buccal and palatal cusps.
- Bur should be held parallel to long axis of the tooth.
- Endodontic preparation should be ovoid in bucco lingual direction.

MAXILLARY SECOND PREMOLAR

ACCESS OPENING



CORONAL

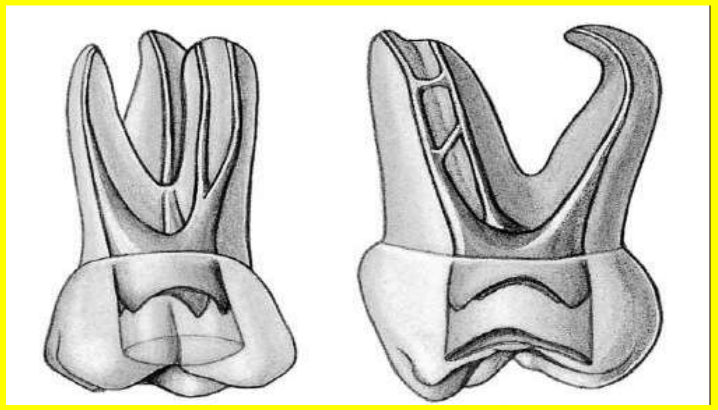
MIDDLE

APICAL

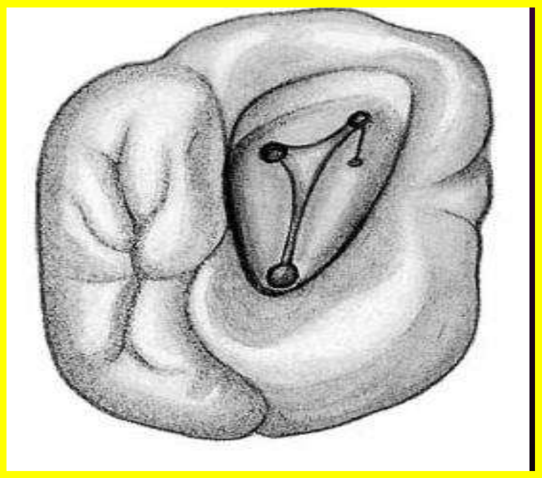
Maxillary Second premolar

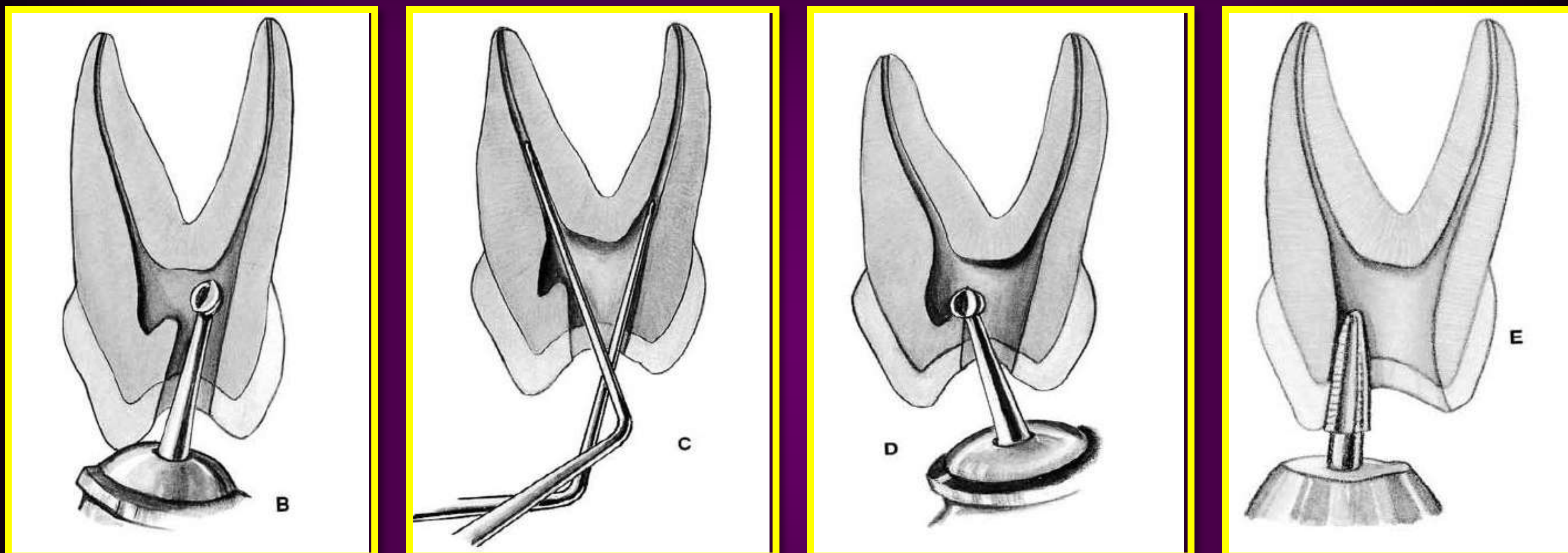
- Average Length – 21.6 mm.
- Pulp chamber is narrow mesiodistally.
- Wider bucco palatally than 1^{st} premolar.
- One root in 90% of cases, two roots in 2% and partially fused two roots in 7-8% of cases.
- Access opening is same as for maxillary first premolar.
- Variations as dictated by anatomy.

MAXILLARY FIRST MOLAR



ACCESS OPENING



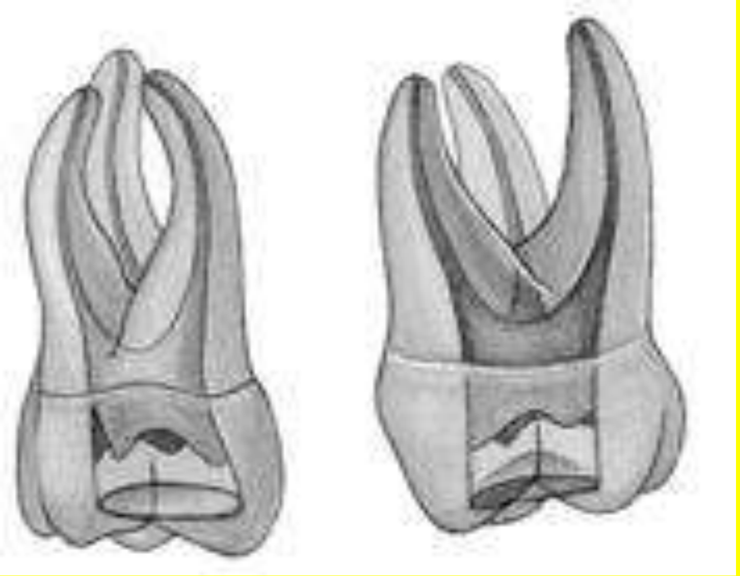

B
C
D
E

Maxillary first molar

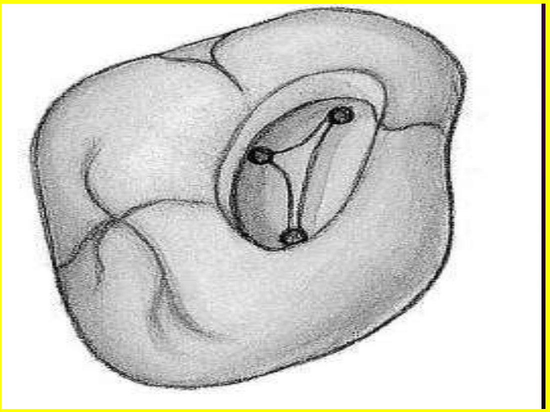
- Average Length – 21.3 mm.
- Pulp chamber is largest in the dental arch, with four pulp horns.
- Mesiobuccal, Distobuccal, Mesiopalatal and Distopalatal.
- Pulpal roof is rhomboidal in shape.
- Floor has triangular form in cross section.
- Orifices are located in the three angles of the floor.
- Palatal orifice is the largest.
- The mesiobuccal orifice is under the mesiobuccal cusp.
- Distobuccal is slightly palatal and distal to the mesiobuccal cusp.
- Three roots namely – Mesiobuccal, Distobuccal and palatal.
- Mesiobuccal root is broad in bucco palatal direction, narrowest of three canals, shows distal curve in 78% of cases.
- Distobuccal root is small and round in shape and straight in 54% cases.

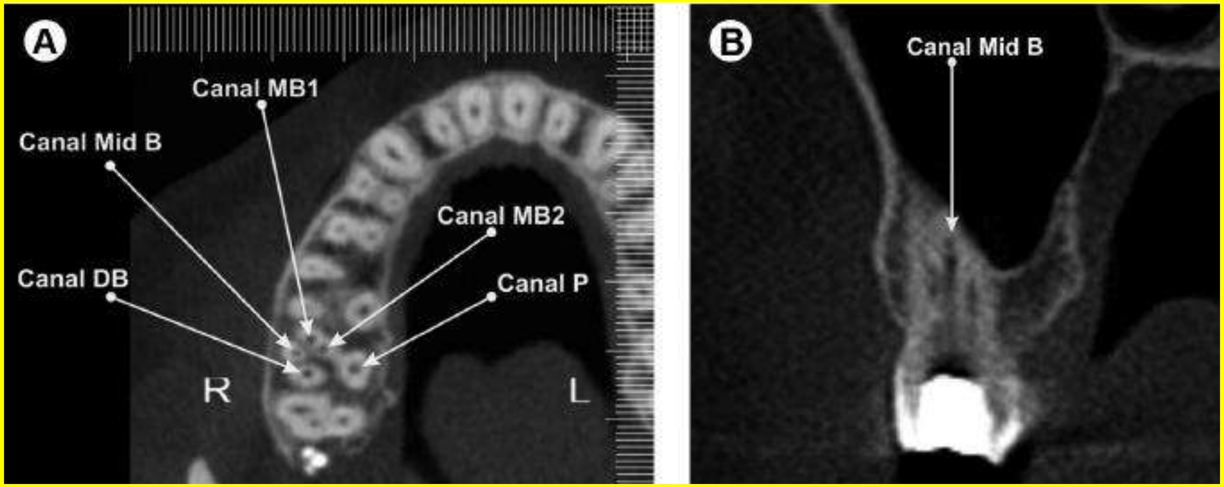
- Palatal root has the largest diameter and is the longest root.
- The enamel is perforated with a No 9 round carbide bur in a high speed contra angle.
- The bur is directed toward the palatal canal, where the chamber is largest.
- Use No. 4 carbide in slow speed to penetrate dentin till a drop is felt.
- A tapered cylinder, diamond is used to remove the remaining roof.
- Internal anatomy dictates the shape of access opening.
- Walls are made divergent occllusaly.
- The access opening is usually triangular with rounded corners extending towards but not including, the mesiobuccal cusp tip, the marginal ridge and the oblique ridge.
- **Check out for fourth orifice and canal that may be present in mesio buccal root.**

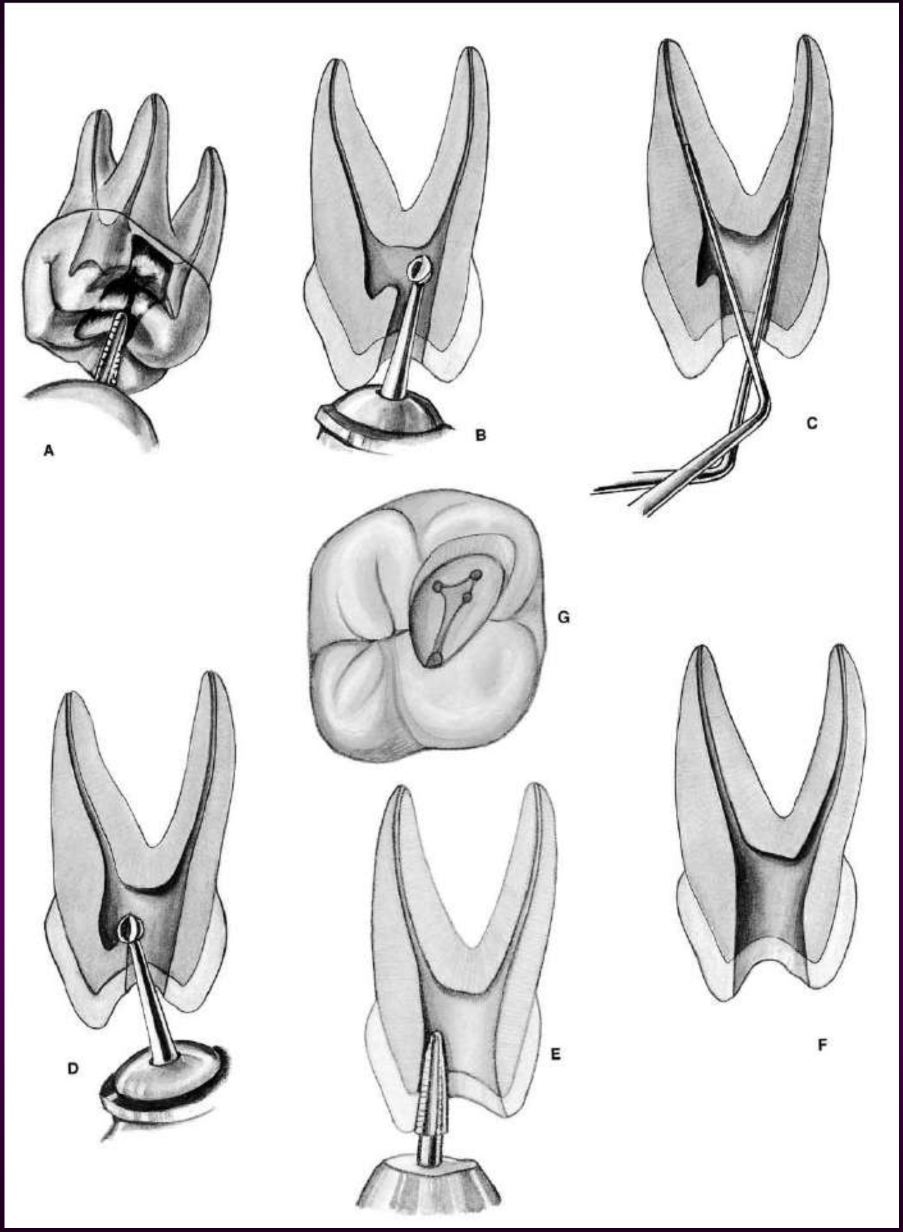
MAXILLARY SECOND MOLAR



ACCESS OPENING

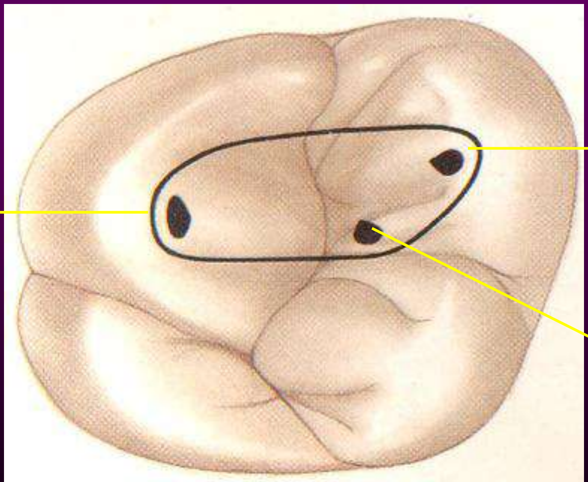





A
B
C
G
D
E
F

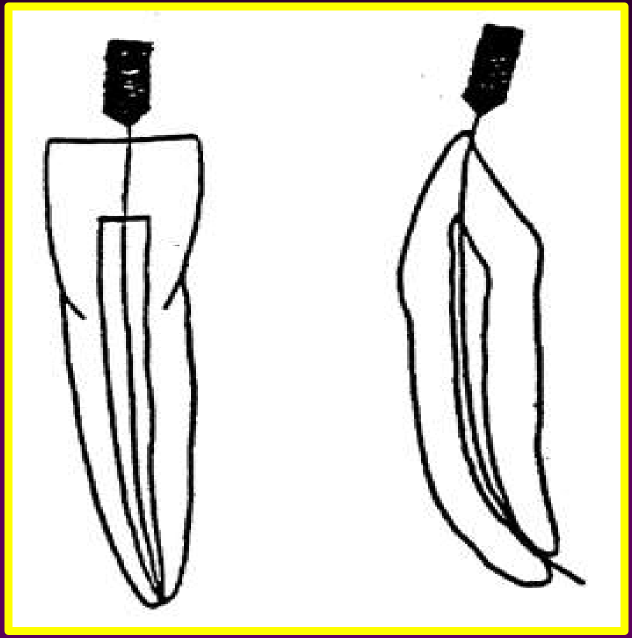
Maxillary Second molar

- Average Length – 21.7 mm.
- Pulp chamber is similar to that of maxillary first molar except that it is narrower mesio distally.
- Pulpal roof is more rhomboidal in shape.
- The mesiobuccal and distobuccal are close to each other.
- They might fuse to form a single root.
- In 46% cases all three fuse to form a single conical root.



MANDIBULAR CENTRAL INCISOR

ACCESS OPENING



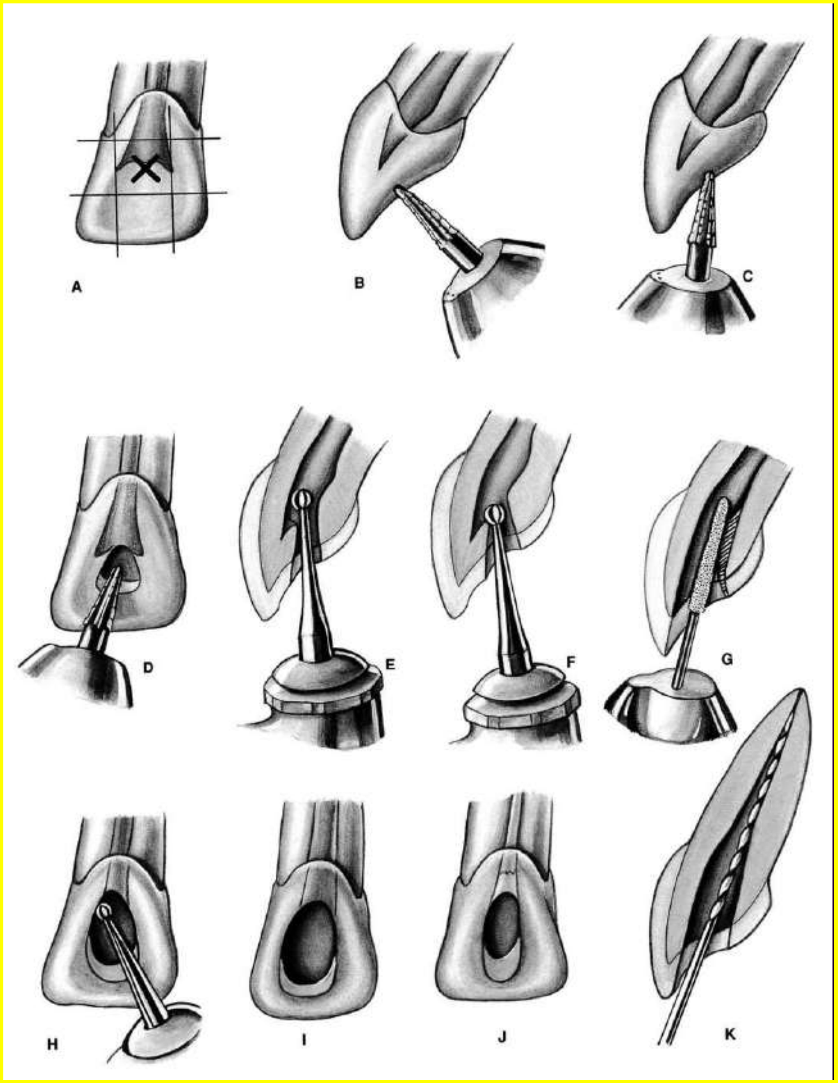
PULPAL TISSUE

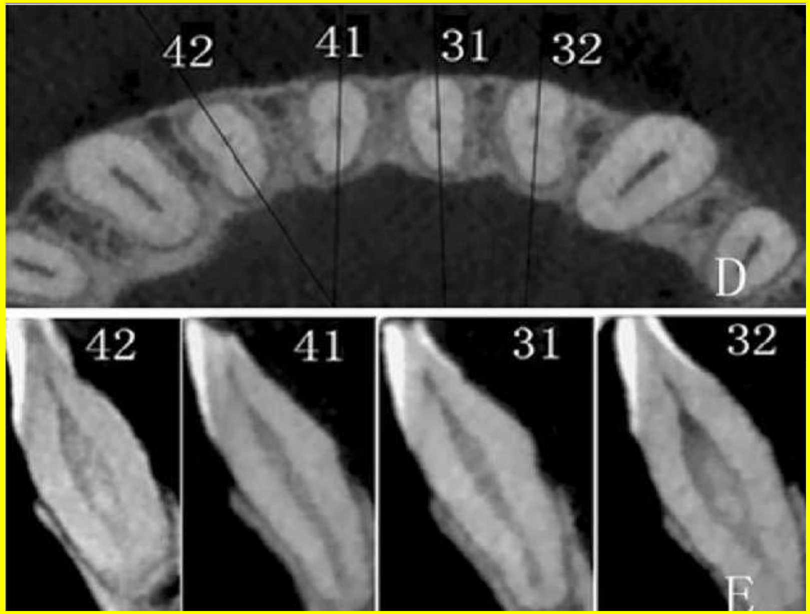
VERTICAL SECTION & HORIZONTAL SECTION

CORONAL

MIDDLE

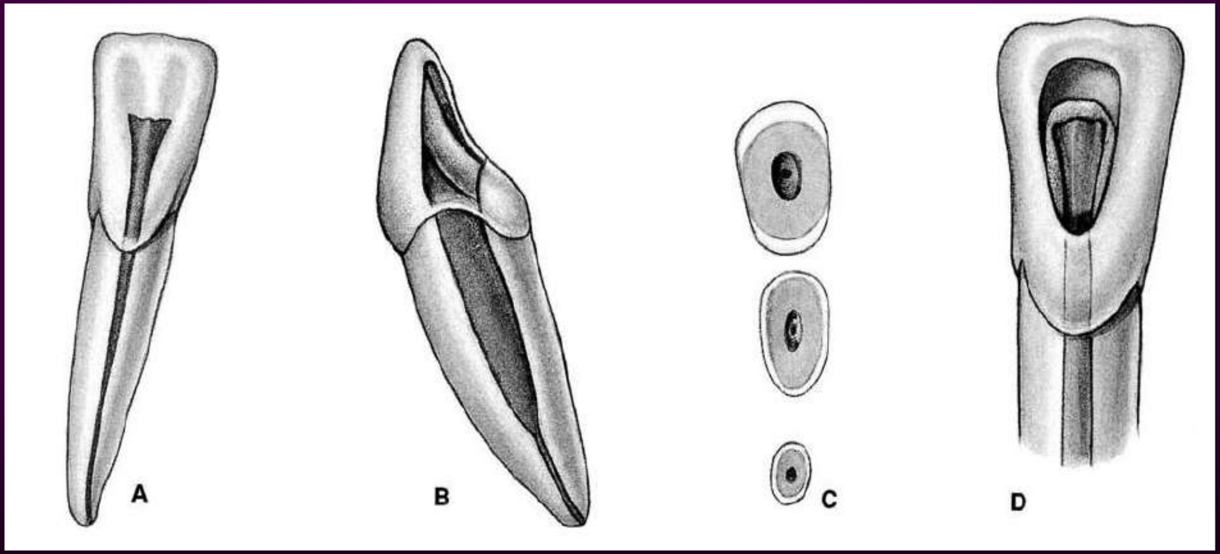
APICAL


A
B
C
D
E
F
G
H
I
J
K


42
41
31
32
D
42
41
31
32
E

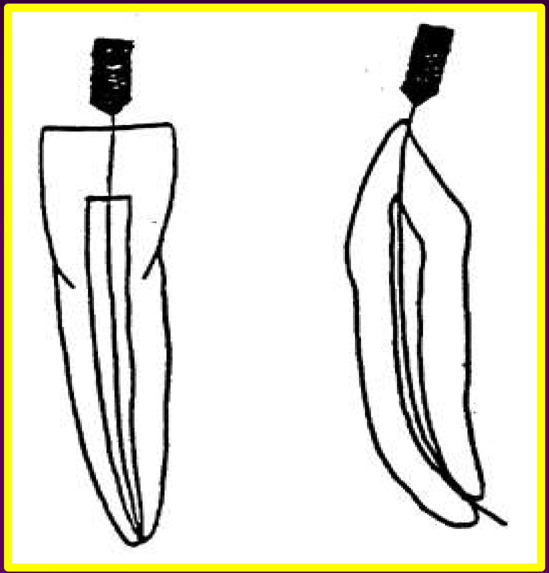
Mandibular Central Incisor –

- Average Length is 20.8 mm.
- The pulp chamber is small and flat mesio distally.
- It has one root wide labio lingually.
- Access opening is same as for maxillary central incisor.
- Long oval opening.
- Check for second canal.



MANDIBULAR LATERAL INCISOR

ACCESS OPENING



PULPAL TISSUE

VERTICAL SECTION & HORIZONTAL SECTION

CORONAL

MIDDLE

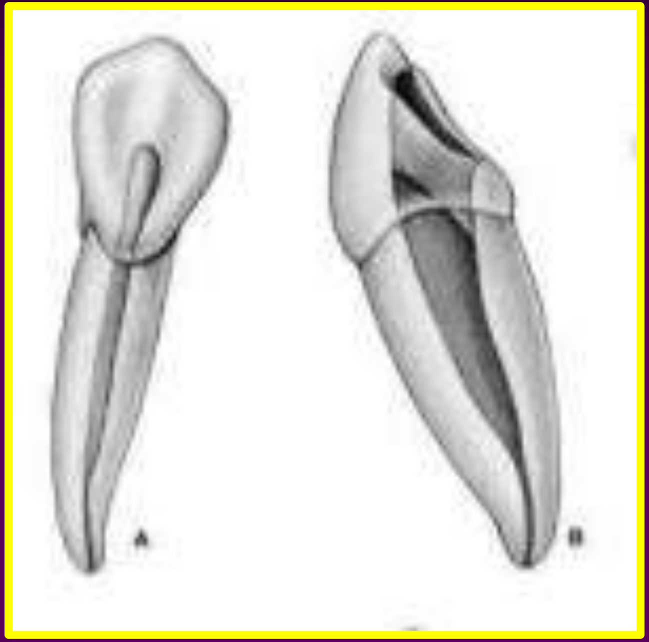
APICAL

Mandibular Lateral Incisor –

- Average Length is 22.6 mm.
- The pulp chamber is small and flat mesio distally.
- Root is larger than mandibular central incisor.
- Root shows sharp distal curve.
- Access opening is same as for mandibular central incisor.

MANDIBULAR CANINE

ACCESS OPENING

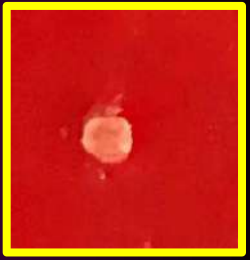


PULPAL TISSUE

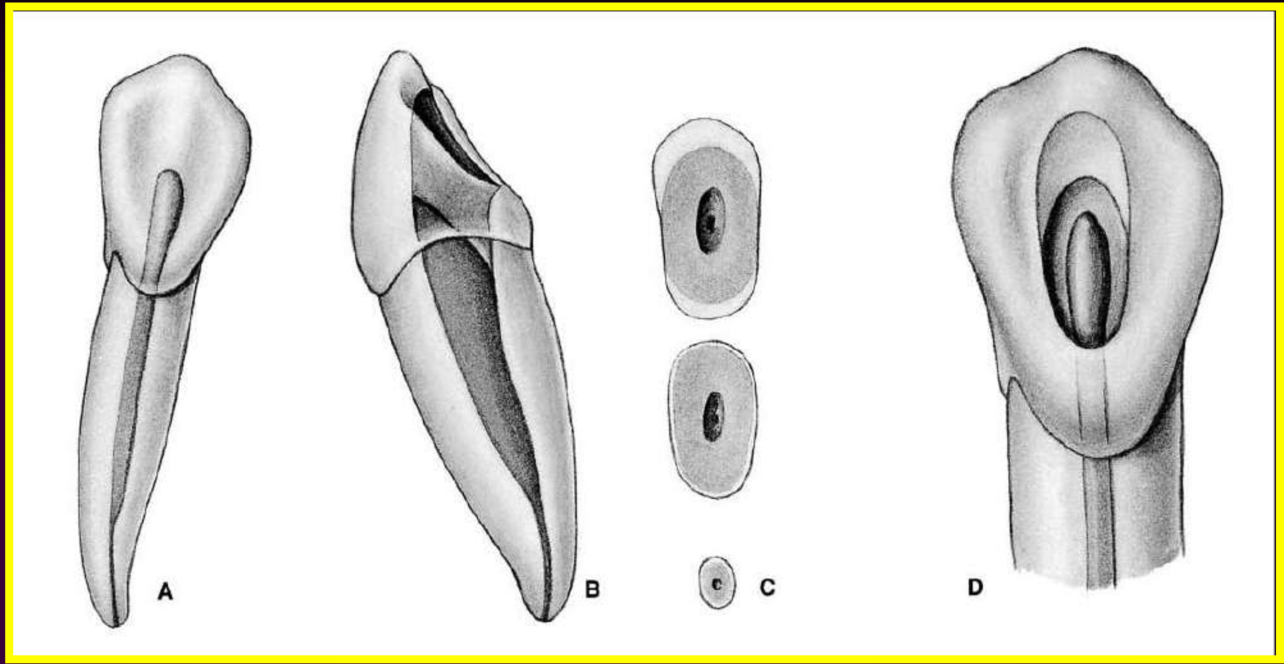
VERTICAL SECTION & HORIZONTAL SECTION

CORONAL

MIDDLE



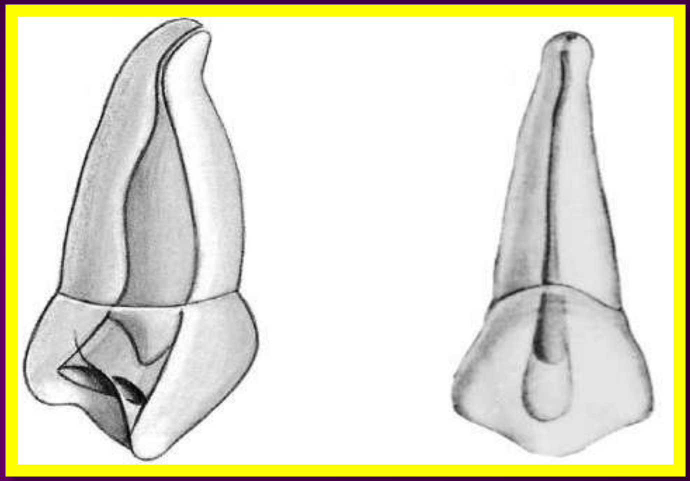
APICAL


A
B
C
D

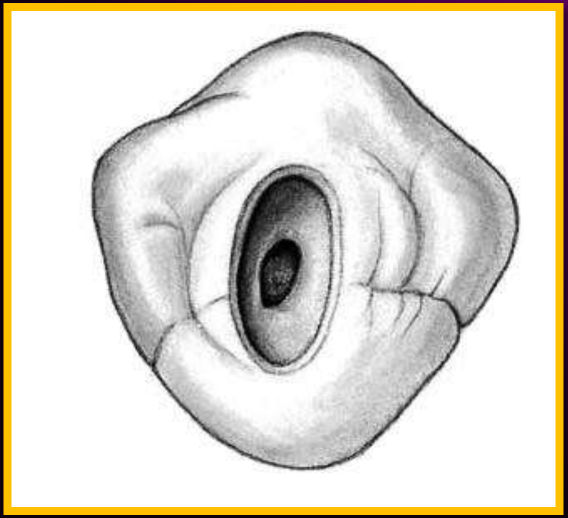
Mandibular Canine –

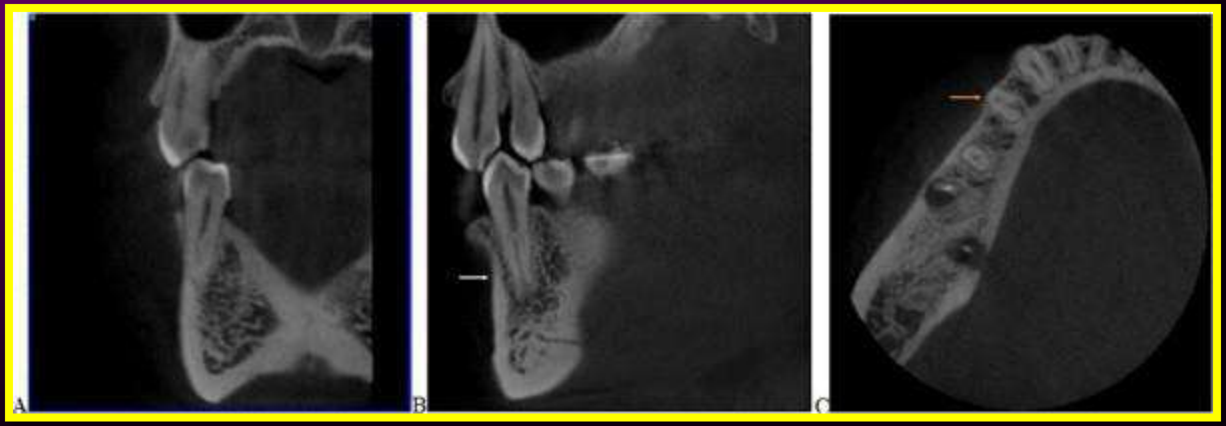
- Average Length is 25 mm.
- Resembles maxillary cuspid but smaller in dimension.
- Pulp chamber is narrow mesio distally.
- Single root, but it might have two.
- Access opening is same as for mandibular central incisor.

MANDIBULAR FIRST PREMOLAR

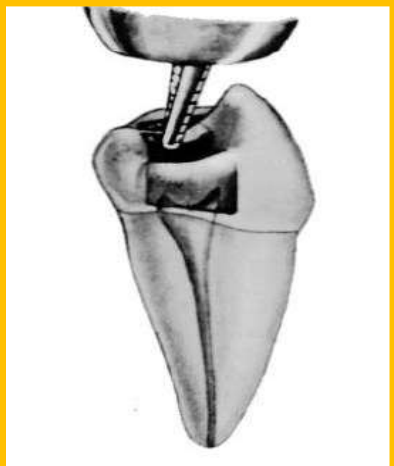


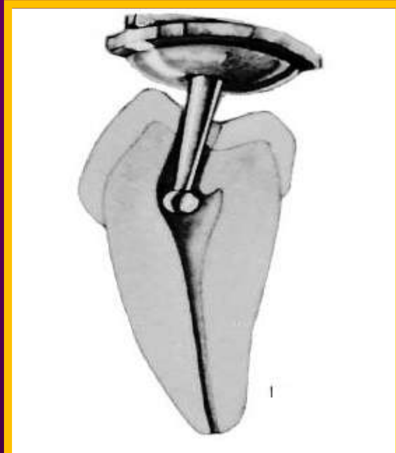
ACCESS OPENING

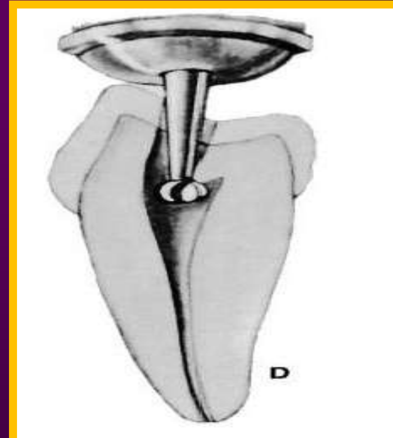


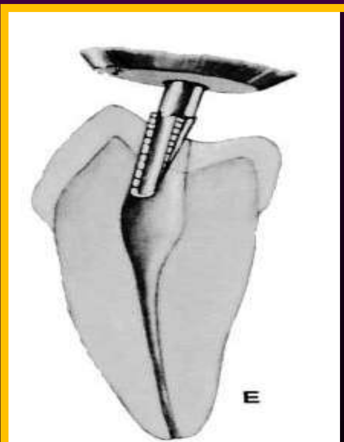


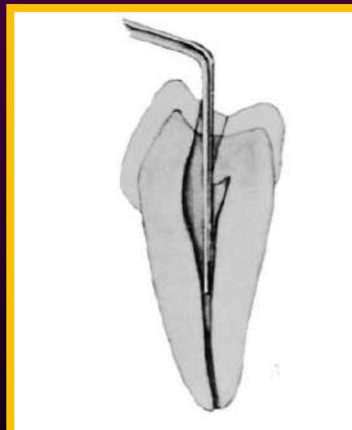
ACCESS OPENING

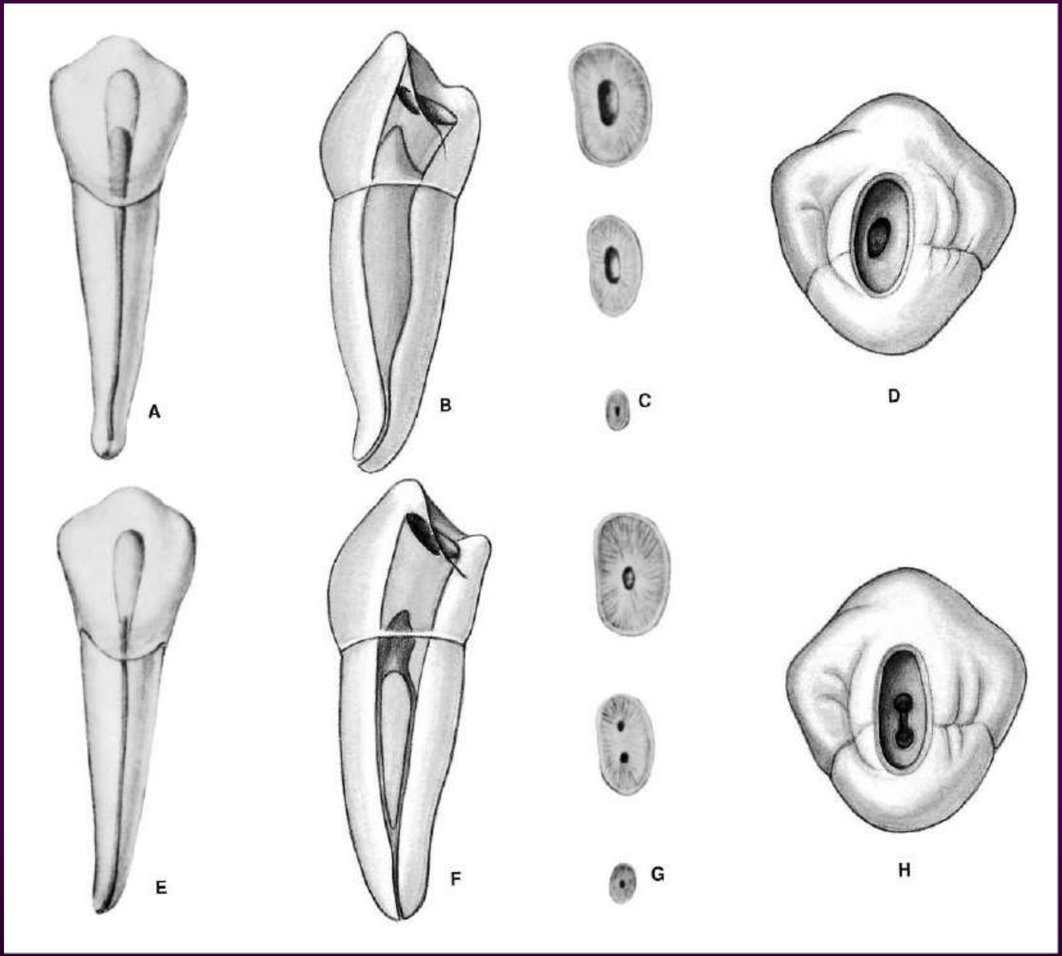








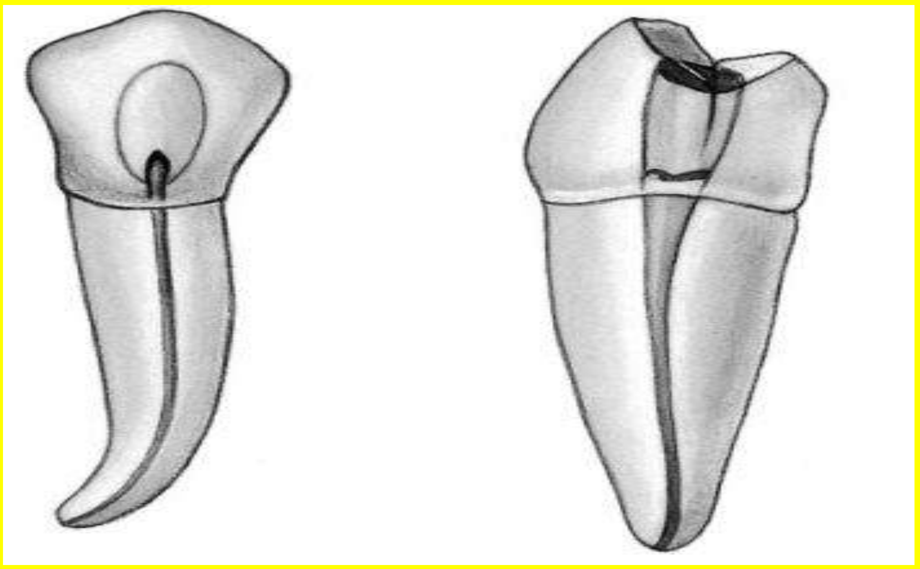



A
B
C
D
E
F
G
H

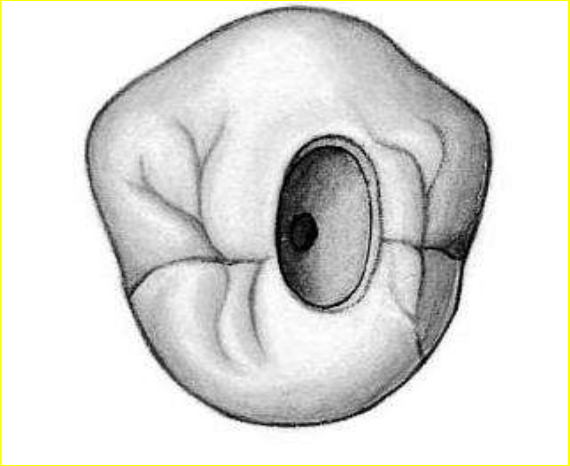
Mandibular first premolar –

- Average Length is 21.9 mm.
- Transitional tooth between anterior and posterior teeth.
- Pulp chamber is narrow mesio distally.
- Prominent buccal horn, small lingual horn.
- Crown of mandibular premolar has 30 degree lingual tilt.
- It usually has short, conical root.
- To compensate for the 30 degree tilt, enamel is penetrated at the upper third of the lingual incline of the facial cusp with a No. 2 carbide bur.
- Access cavity is ovoid.
- Should be extended enough buccally and lingually.

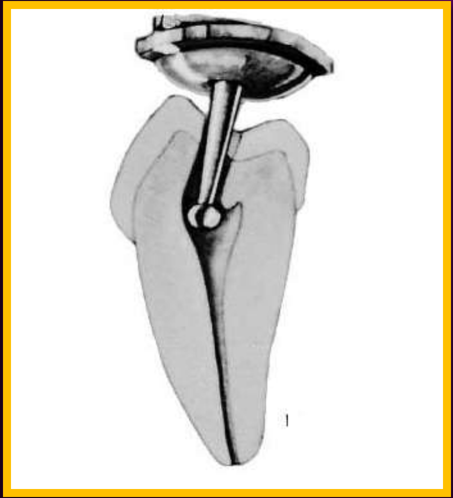
MANDIBULAR SECOND PREMOLAR

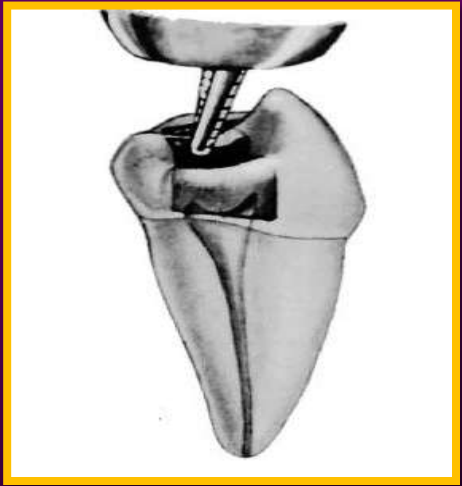


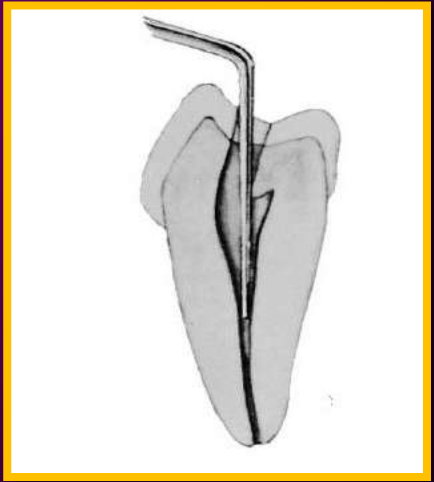
ACCESS OPENING



ACCESS CAVITY PREPERATION

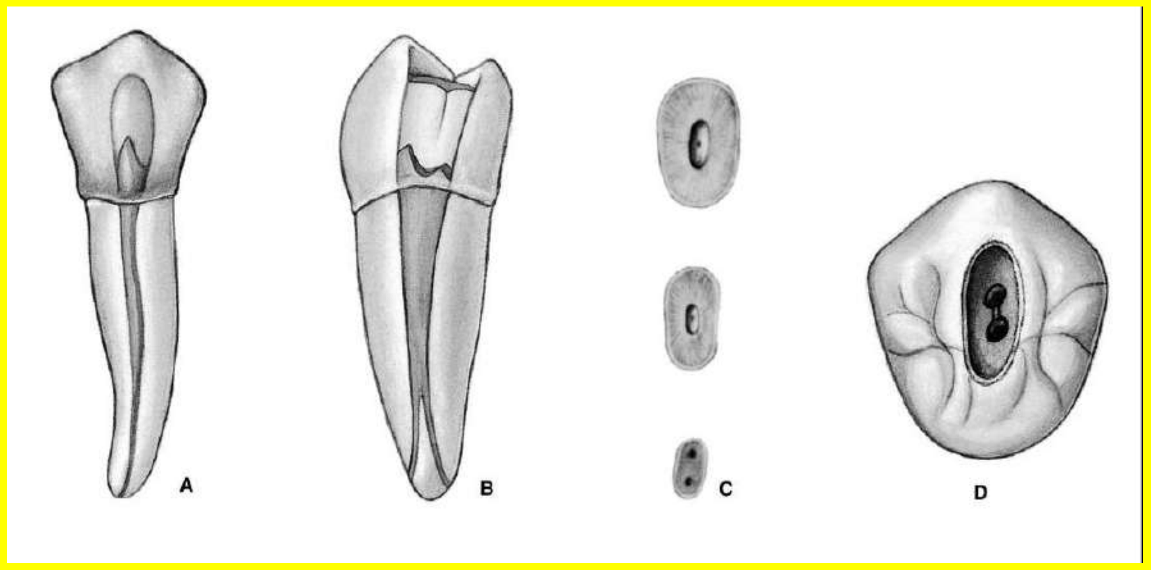




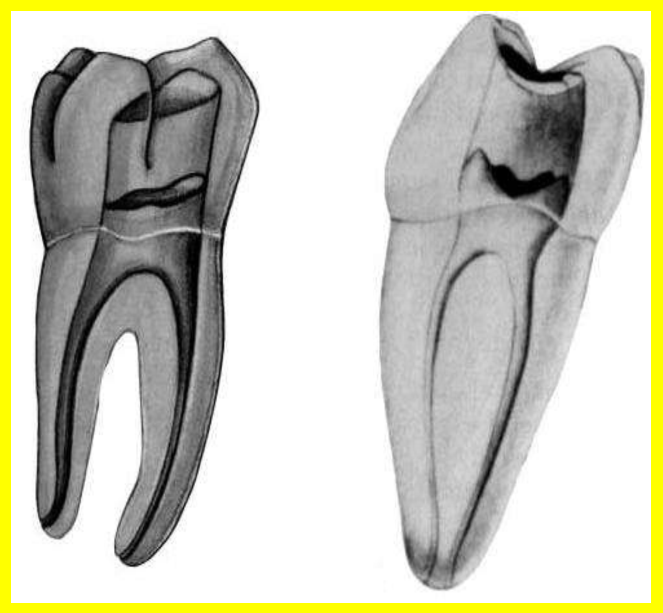


Mandibular Second premolar –

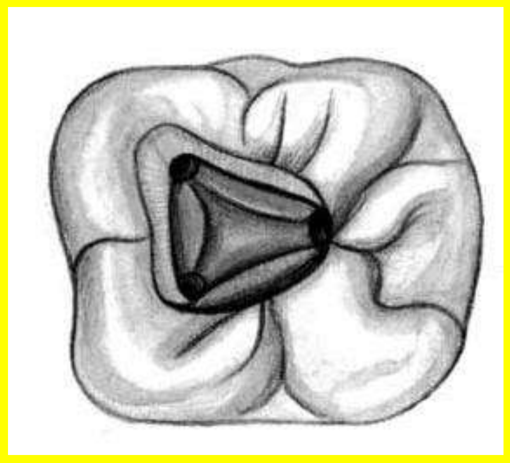
- Average Length is 22.3 mm.
- It is similar to that of premolar except that lingual horn is more prominent.
- Enamel penetration is initiated in the central fossa.
- Ovoid access opening is wider mesio distally.
- It can have two roots in rare cases.

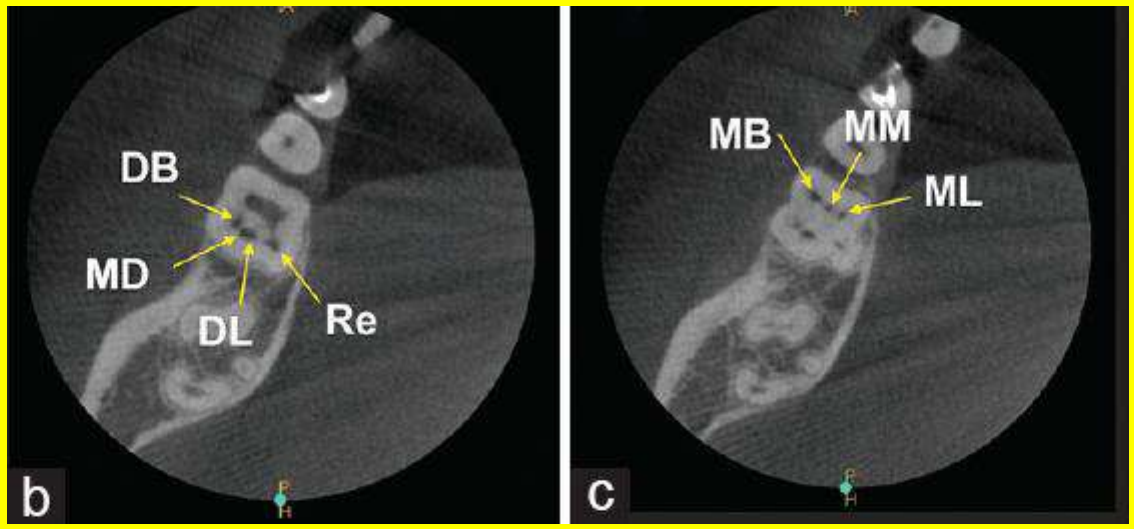


MANDIBULAR FIRST MOLAR

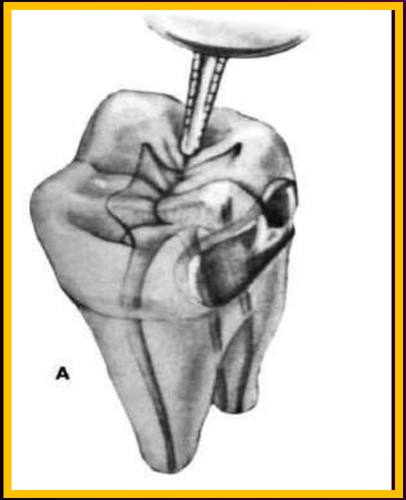


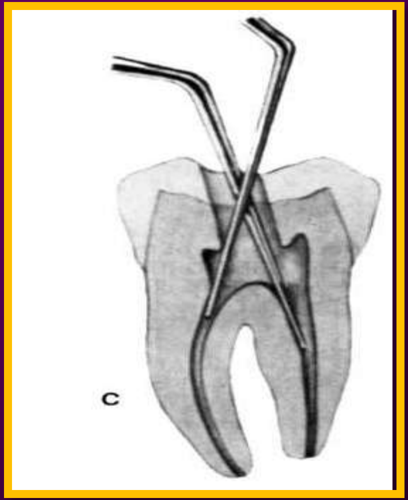
ACCESS OPENING

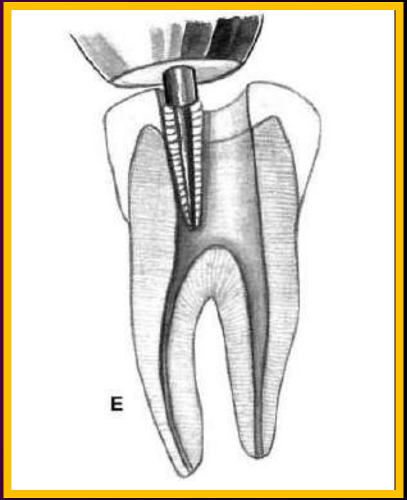


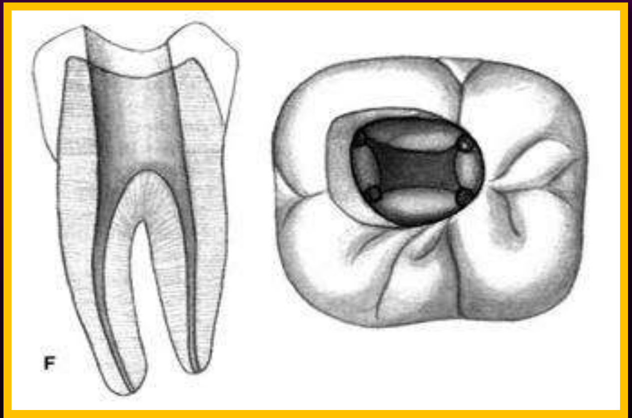


ACCESS OPENING







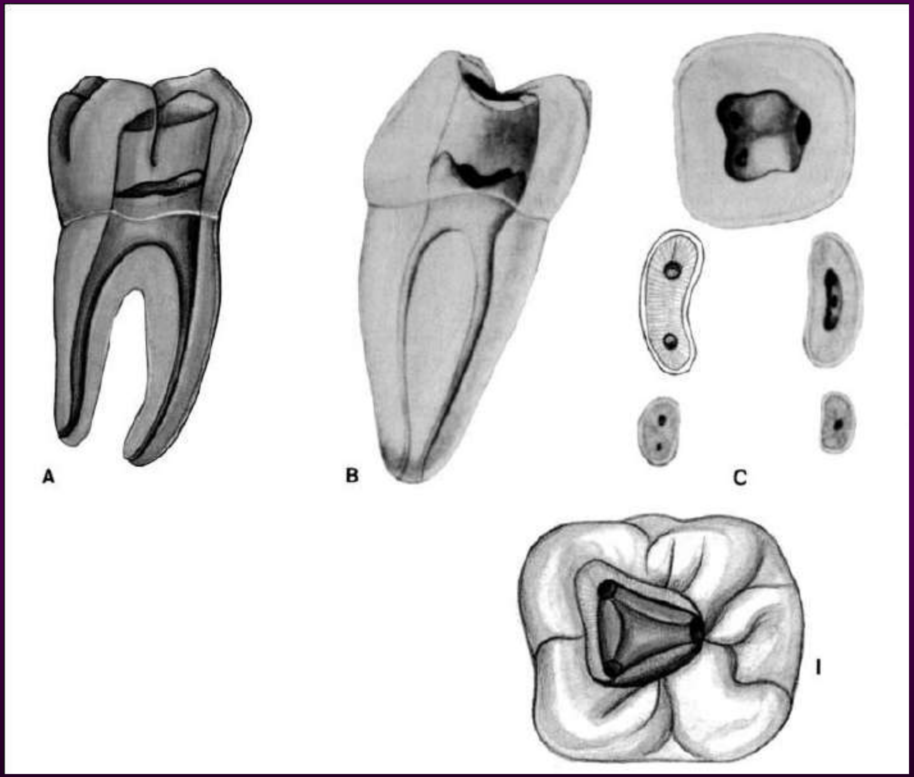


Mandibular First Molar –

- Average Length is 21.9 mm.
- Roof of pulp chamber is rectangular.
- Floor is rhomboidal.
- Four pulp horns.
- Three distinct orifices in the pulpal floor – mesiobuccal, mesiolingual and distal.
- Mesiobuccal orifice is under the mesiobuccal cusp.
- Mesiolingual orifice is located in depression formed by the mesial and lingual walls.
- Distal orifice is widest and oval in shape.
- Enamel and Dentin are penetrated in the central fossa with the bur angled toward the distal root.
- Trapezoidal opening with round corners or rectangular if second distal

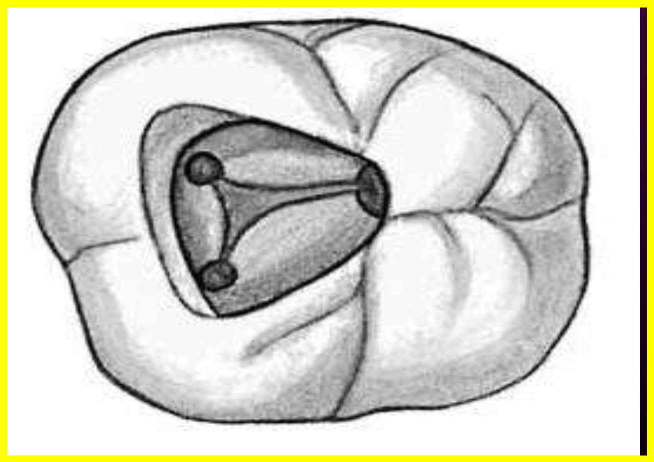
• canal is present.

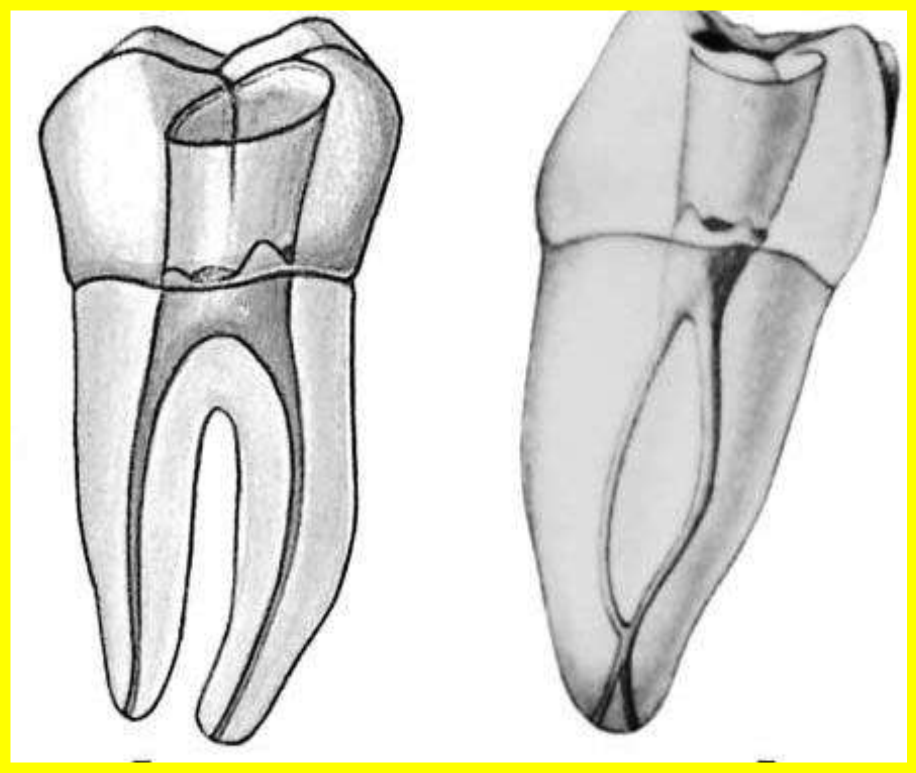
• The access opening extends towards the mesiobuccal cusp to uncover the mesiobuccal canal, lingually slightly beyond the central groove and distally beyond the buccal groove.



MANDIBULAR SECOND MOLAR

ACCESS OPENING





BIOMECHANICAL PREPARATION

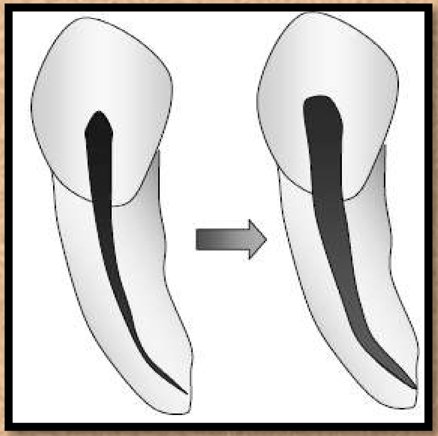
INTRODUCTION

Preparation of the root canal system is one of the most important stages in root canal treatment. It includes:-

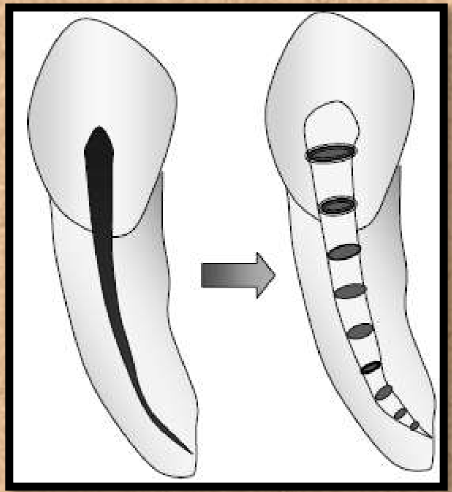
- ***Removal of vital and necrotic tissues.***
- ***Removal of infected root dentine.***
- ***Disinfection by irrigants and medicaments.***

OBJECTIVES FOR CLEANING AND SHAPING

(SCHILDER)

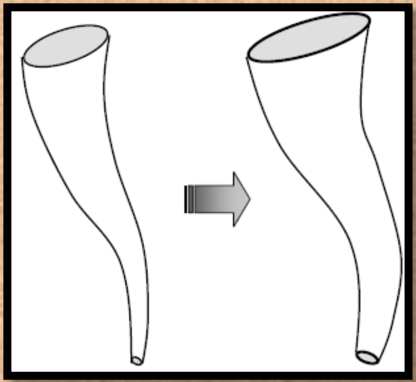


•Continuously ***tapering*** funnel from the root apex to the coronal access cavity.

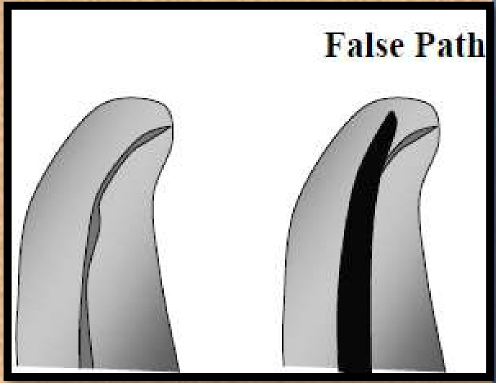


•Cross-sectional diameter of the preparation should be ***narrower at every point apically and wider at each point as the access cavity is approached.***

•***The preparation should flow with the shape of the original canal.***



•The ***apical foramen should remain in its original spatial relationship*** both to the bone and to the root surface.



GUIDELINES

Pre-instrumentation guidelines:-

-***Direct access*** into the root canals should be obtained along straight lines.

-***Working length*** of the root canal should be ***accurately*** determined.

Instrumentation guidelines:-

-Instruments should be ***fitted with instrument stops***.

-Instrument should be used in a ***sequence of sizes***.

-All instrumentation should be done using sterile instruments in ***wet canal***.

Cleaning and shaping guidelines:-

- Instrument should be confined to root canal.

-One must *not force the instrument* if it binds.

- ***Recapitulation*** helps to prevent the packing of dentin filings

- ***Coronal portion*** of a root canal, 3-4mm should be *enlarged to facilitate the flow of irrigants*

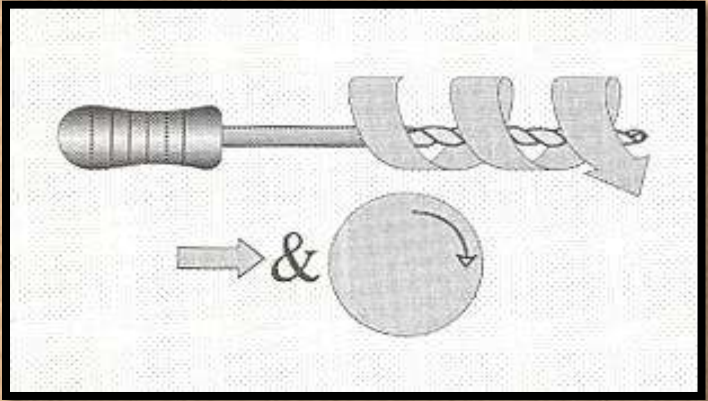
- The remainder of the canal should be enlarged to maintain the *original tapered canal* configuration.

- *Debris should not be forced* through the apical foramen.

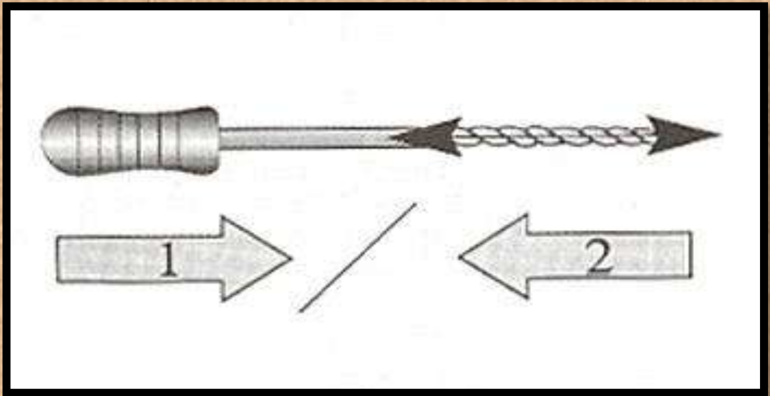
- *Pre-curving* the instrument in case of curved canals.

FUNCTIONAL MOTIONS OF INSTRUMENTATION

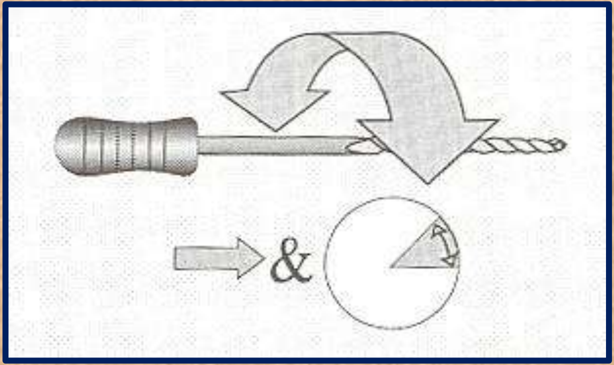
REAMING – clockwise rotating-pushing motion limited to quarter to half turn and disengaged with a mild pulling motion when bound.



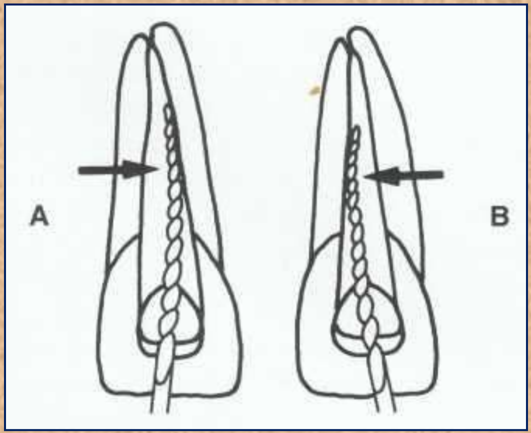
FILING- push-pull motion



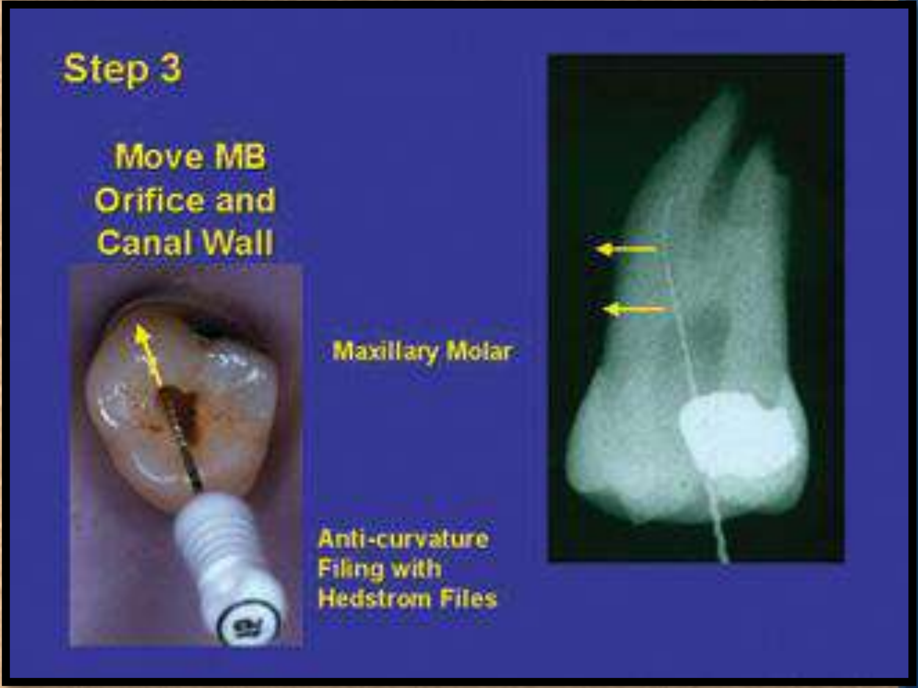
WATCH WINDING – gentle right and left rocking motion that causes the instrument to cut while light inward pressure (straight arrow) keeps the tip engaged and progressing towards the apex.



CIRCUMFERENTIAL FILING- file inserted into the canal to the apex, laterally pressed against one side of canal and then withdrawn.



ANTI CURVATURE FILING- Direct the blade of the Hedstrom files (Nos. 15, 20, and 25, in that sequence) against the canal orifice and coronal canal walls (arrows) in the direction away from the furcation (mesio-buccally).



TECHNIQUES OF BIOMECHANICAL PREPARATION

-Manual

- ***Standardized technique***
- ***Step back preparation***
- ***Modified step-back technique***
- *Passive step back*
- ***Step-down technique***
- ***Balanced force technique***
- ***Crown down pressure less technique***

•*hybrid/double flared technique*

•*Alternated Rotary Motion (ARM) technique*

•*Anticurvature filing technique*

•*Incremental Technique*

-***Ultrasonic and sonic preparation***

-Automated or rotary

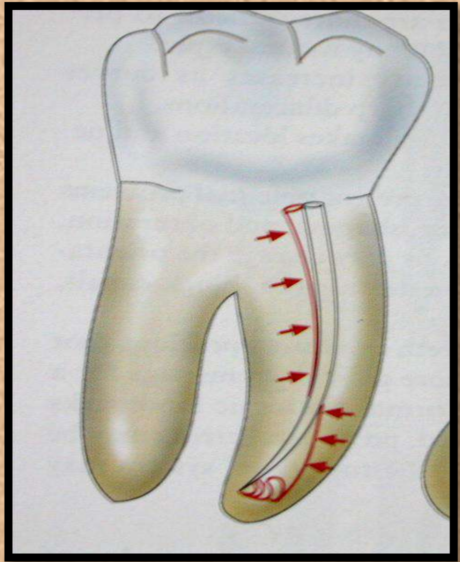
-LASER preparation

-Non Instrumentation Technique (NIT)

STANDARDIZED TECHNIQUE

- Ingle (1961) described first formal canal technique. In this technique each instrument was introduced to working length resulting in a canal shape that matched the taper and size of the final instrument.

Disadvantages:
Ledging, zipping, elbow formation, perforation and loss of working length owing to compaction of dentin debris.

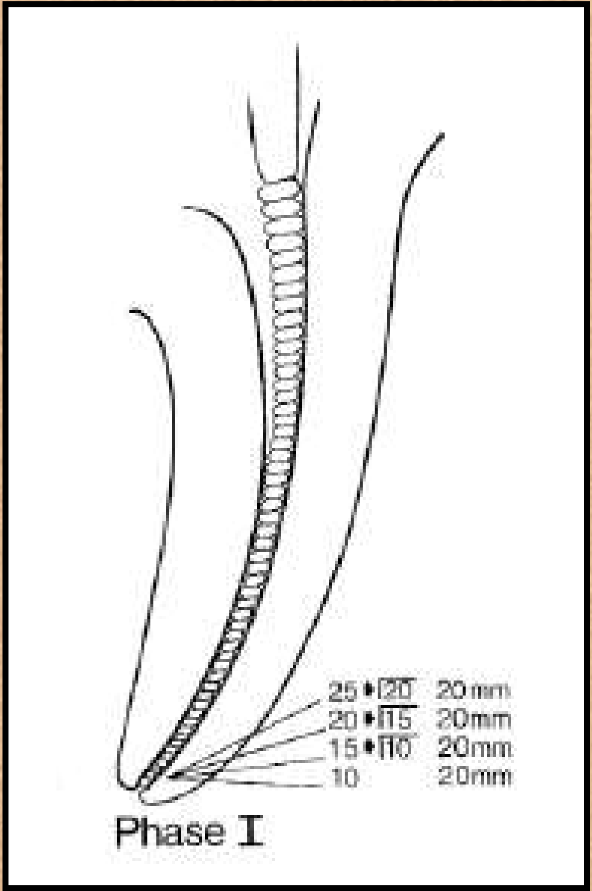


Hourglass preparation

STEP BACK/TELESCOPIC PREPARATION

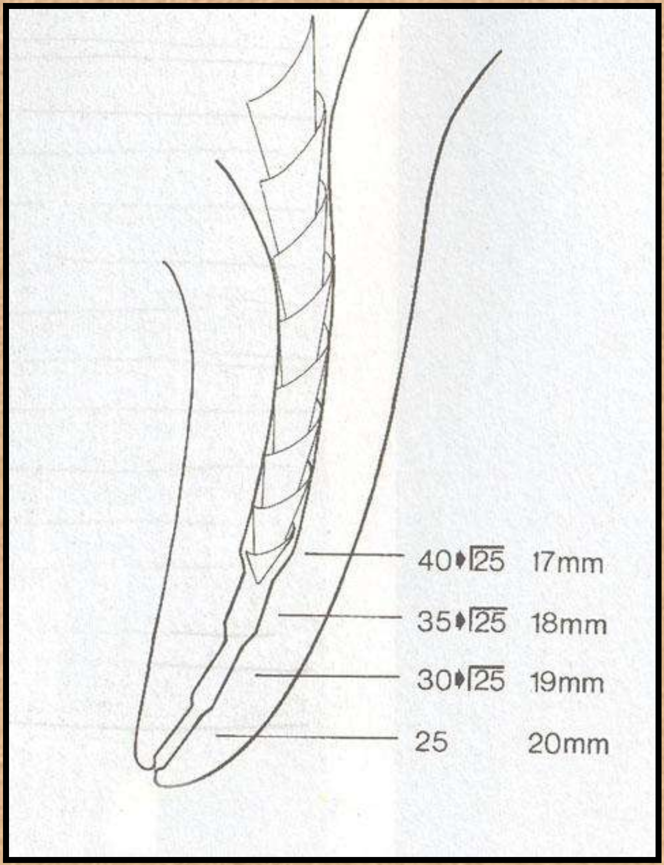
- Introduced by ***Mullaney et al in 1979***
- **PHASES**
- Phase I
- Phase II
    - -Phase IIA
    - -Phase IIB

PHASE I



- Pathfinder instrument –no. 8,10,15 0.02 taper ISO
- Motion- watch winding – Two/Three quarter-turns clockwise or counter clockwise and then retraction.
- Apical preparation upto the file #25(MAF)to full WL
- With recapitulation using prior size

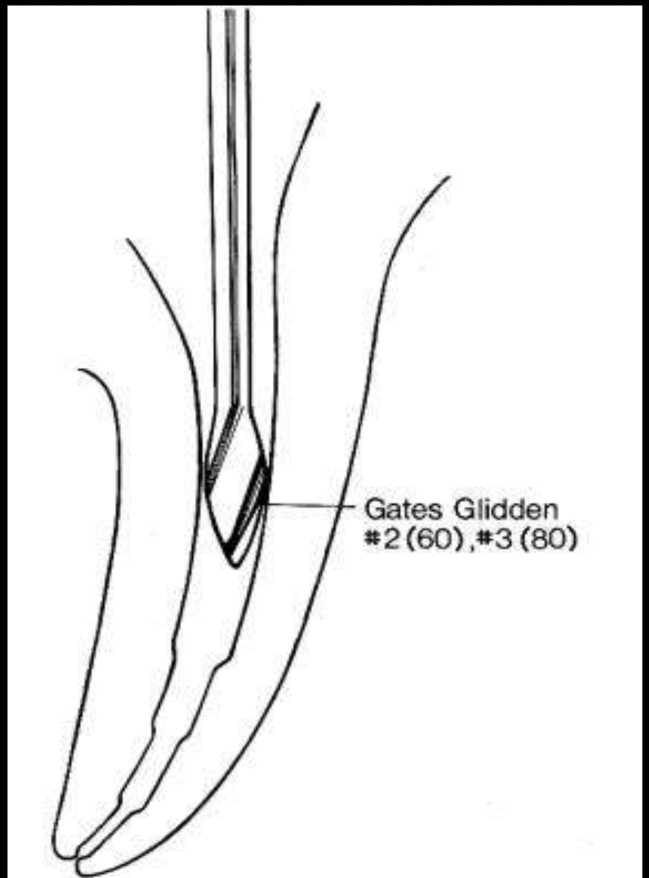
PHASE II



•Stepping back in increments with recapitulation using # 25 file to ensure patency to the constriction with irrigation

(step back up the canal 1mm and 1larger instrument at a time)

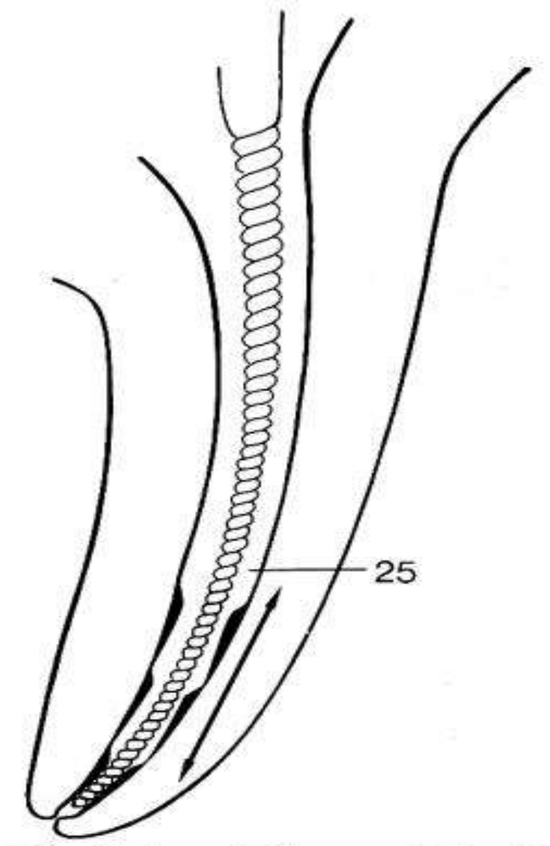
PHASE II A



Refining Phase II - A

Refining Phase II-A—Gates-Glidden drills Nos. 2, 3, and 4 used to create coronal and midroot preparations

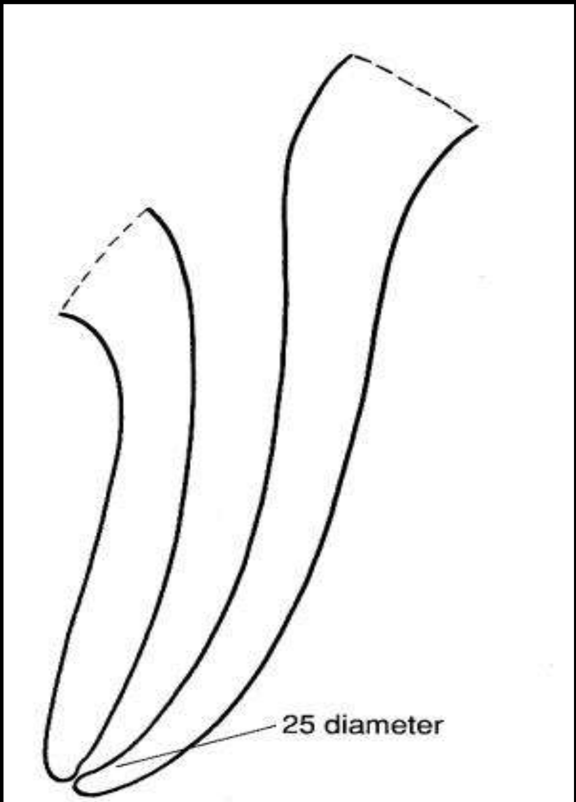
PHASE II B



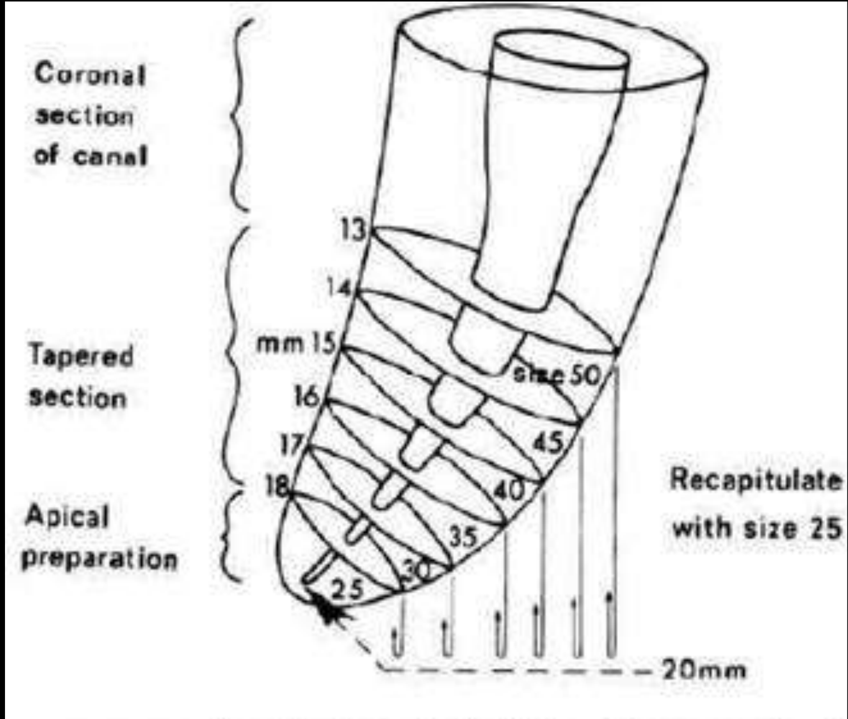
Refining Phase II - B

Refining Phase *II-B—No. 25 file, circumferential filing* smoothens step-back. H files used.

COMPLETED PREPARATION



Completed Preparation



A stylized step-back (telescopic) preparation. A

Advantages

-Better tactile awareness

-Keeps apical prep small in its original position

-Greater taper coronally compared to standard prep

-Early removal of pulp tissue, infected necrotic debris from coronal 3rd

-Avoids zipping

Disadvantages

-Chances of pushing debris into peri-radicular tissues

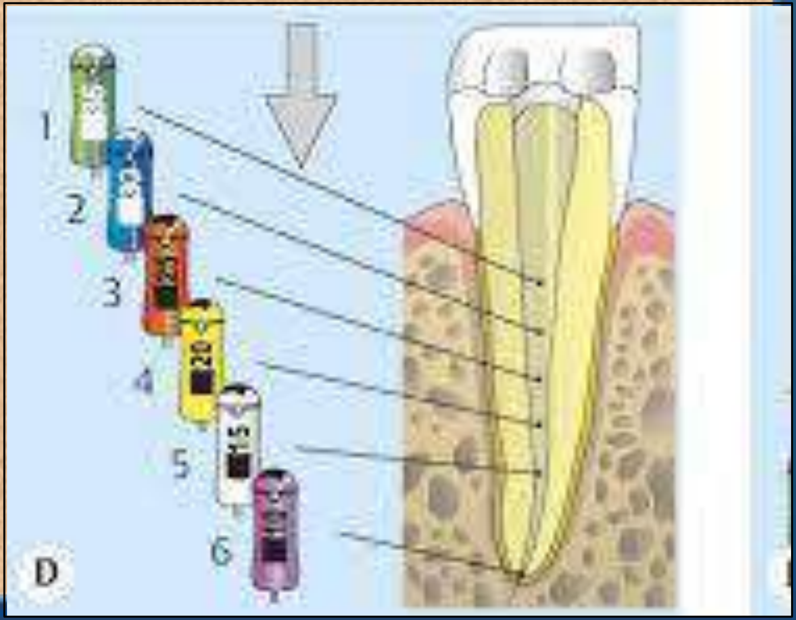
-Working Length likely to change as canal curvatures are eliminated

STEP-DOWN TECHNIQUE/CROWN DOWN TECHNIQUE

- Advocated by ***Goerig et al.***
- Patency of canal # 8 or10 k file
- Preparation of Coronal 2/3 by H-file no 15,20,25 to 16-18 mm or where the file start binding
- Coronal flaring GG- 2,3 sometimes 4 with sequential shorter WL
- WL determination with 10 or 15 k file

•A large file is then placed to the level of binding and canal is prepared using watch winding motion until resistance is encountered

•Process is repeated with sequential smaller files until WL is reached



- Recapitulation and irrigation
- Apical portion enlarged to the appropriate master apical file
- Final canal taper is accomplished by filing circumferentially with master apical file.

Advantages

•Shaping subjectively easier then step back.

•Removal of coronal obstructions

•Minimizes apical extrusion of debris

•Better access

•Allows better penetration of irrigants

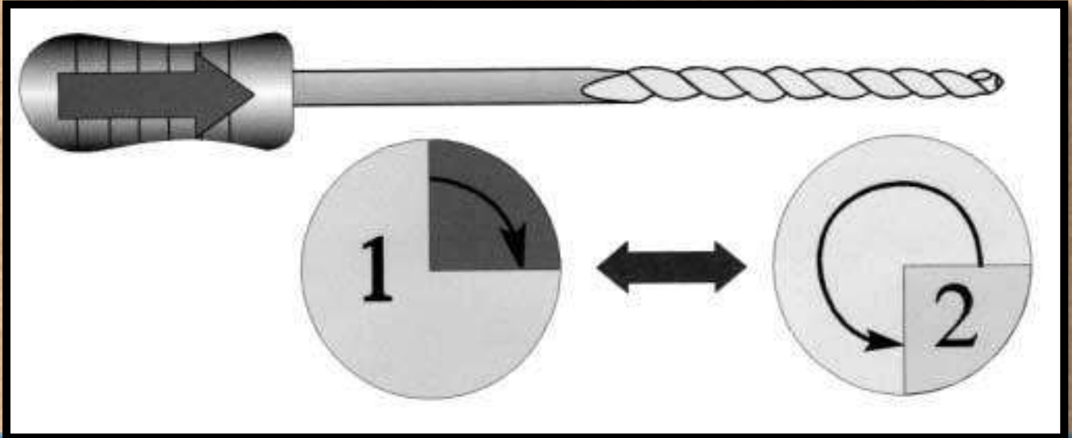
•Working length is less likely to change while employing this technique

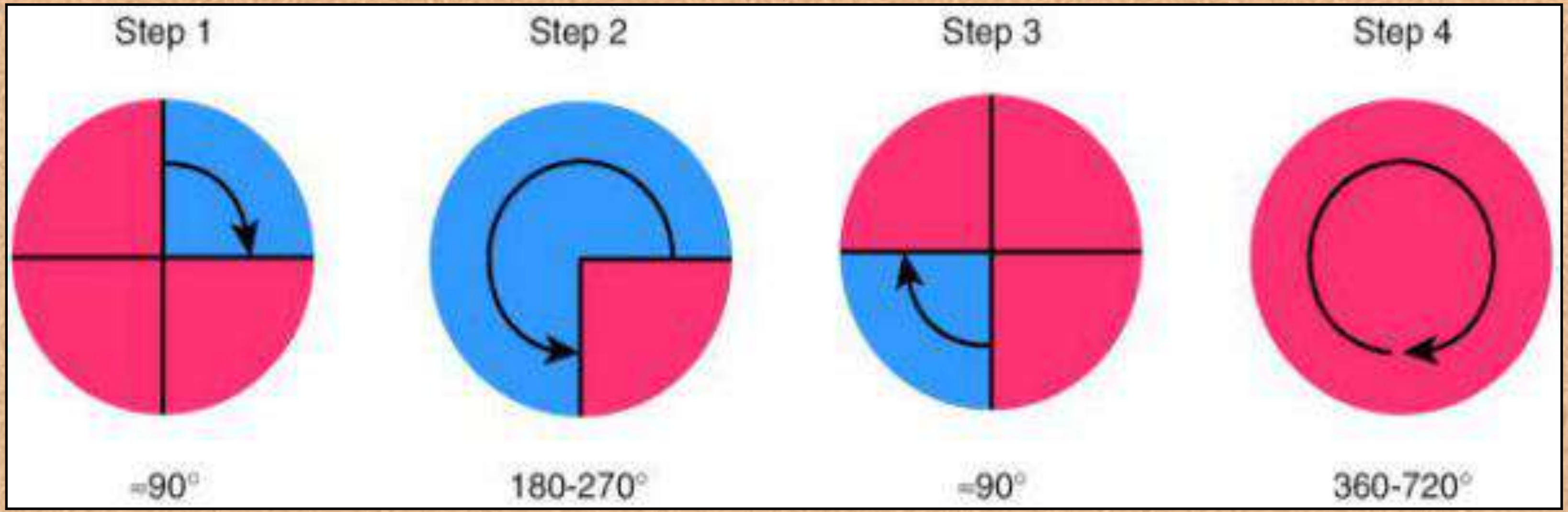
BALANCED FORCE TECHNIQUE

- Roane et.al (1985)

- Establish radicular access by step-down or crown-down techniques before preparing the apical one third of the canal.

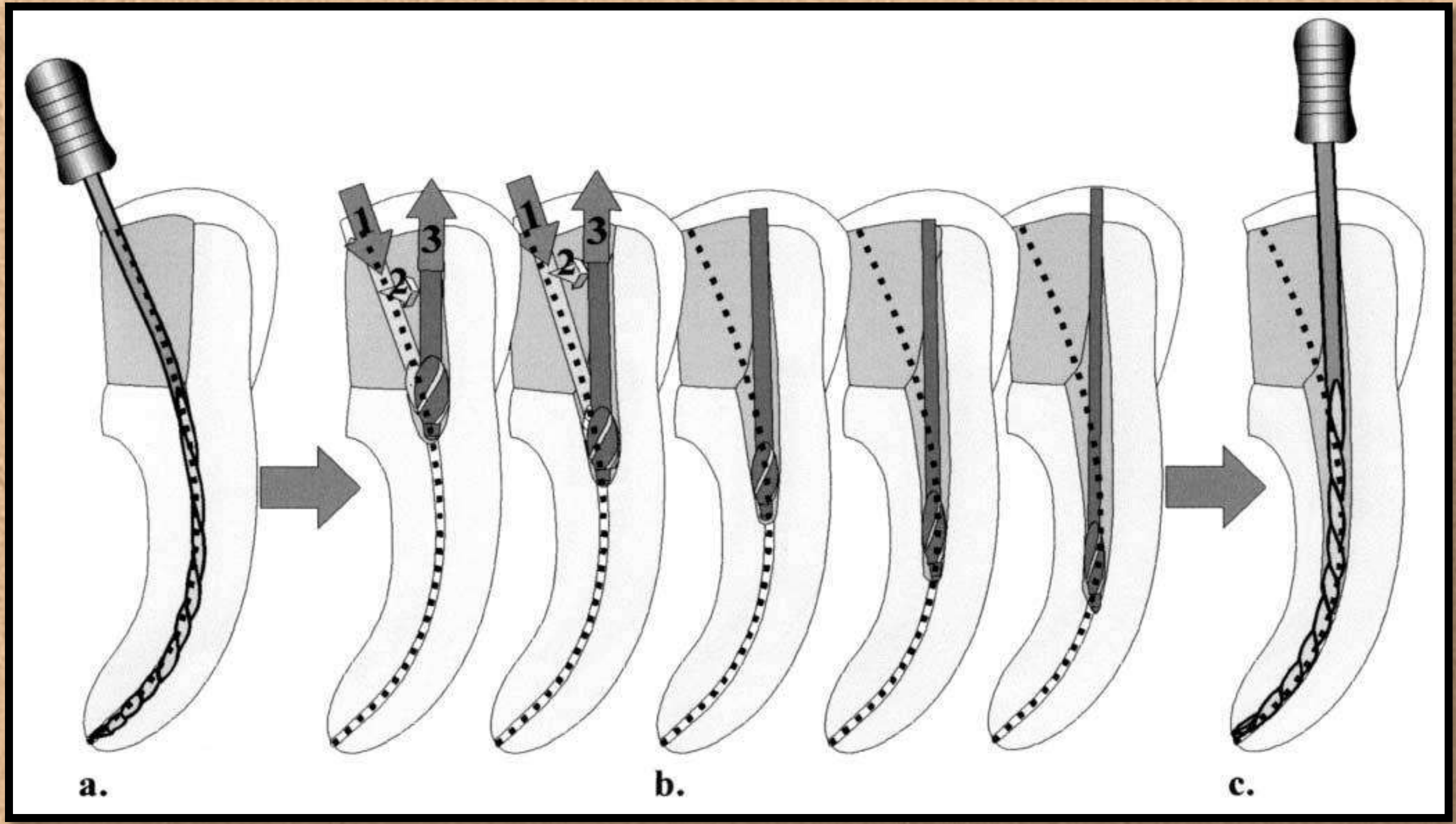
- Described as *"positioning and pre-loading an instrument through a clockwise rotation and then shaping the canal with a counterclockwise rotation."*





Step 1: After pressureless insertion of a Flex-R or NiTiFlex K-file, the instrument is rotated clockwise 90 degrees using only light apical pressure.
Step 2: The instrument is rotated counterclockwise 180 to 270 degrees; sufficient apical pressure is used to keep the file at the same insertion depth during this step.
Step 3: This step is similar to step 1 and advances the instrument more apically.
Step 4: After two or three cycles, the file is loaded with dentin shavings and is removed from the canal with a prolonged clockwise rotation.

•The coronal and mid-thirds of a canal are flared with Gates-Glidden drills, sizes 2 through 6, and then instrument shaping is carried into the apical areas.



Advantages-

- Good apical control of the file tip as the instrument does not cut over the complete length,
- Good centring of the instrument because of the non-cutting safety tip, and
- No need to pre-curve the instrument
- Reduce transportation and ledging.

CROWN DOWN PRESSURELESS TECHNIQUE

- Advocated by **Marshall and Pappin**
- ***Rotate straight k-files two times in a clockwise direction from a larger to a smaller sequence, without apical pressure, until a depth of 16 mm is reached.***
- Use NO.2 and NO.3 Gates-Glidden burs passively.
- Establish a provisional working length 3 mm short of radiographic apex by rotating successively smaller files.

- Take a radiograph to **establish working length**.
- Rotate straight files two times in a clockwise direction, from larger to smaller, without apical pressure ***until working length is achieved.***
- Complete crown-down preparation with a file two times larger than first file to reach working length.

ADVANTAGES-

- Increased space for irrigant penetration and debridement
- Rapid removal of the bulk of dental pulp tissue located in the coronal one third
- Straight-line access to root curves and uniting canal junctions
- Easy removal of obstacles, which prevents access to the root apex (e.g., pulp stones)

HYBRID/DOUBLE FLARED TECHNIQUE

In this technique a combination of step-back and crown down preparation is used.

- A small k-file is used to explore the canal and prepared in a crown down approach using k files, until apical third is reached.

- Irrigate+ working length determination

- Apical third is enlarged using larger to smaller files until the working length is reached

- Apical enlargement till master apical file

•Then stepping back with descending files with frequent recapitulation (master file)

•**No use of rotary instruments**

Advantages

•Less chances of ledge formation.

•Maintains integrity of dentin by avoiding removal

of excessive radicular dentin.

PROBLEMS RELATED TO ROOT CANAL PREPARATION

Loss of Working Length

- Sound reproducible reference points should be used.
- Firm or secure rubber stops should be placed at right angles to the shaft of the instruments.

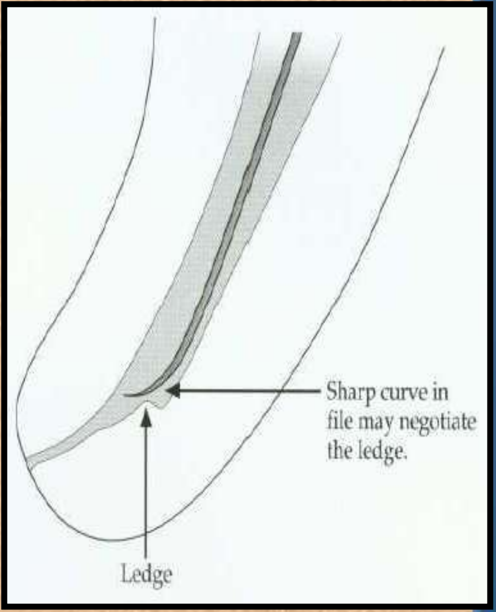
Blockage of the Canal System

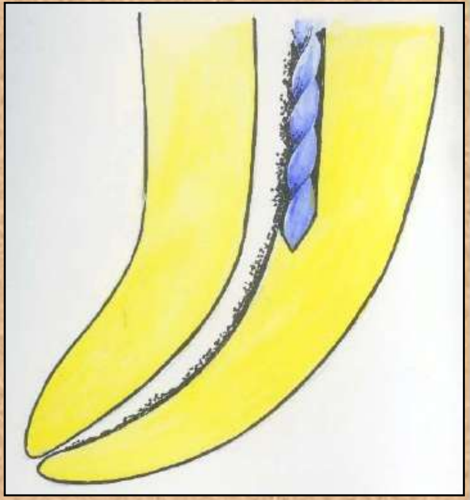
•The packing of dentin chips, tissue debris, restorative materials, cotton pellets, paper points, or a fractured instrument in the canal are common causes of blockages.

Ledging

- 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.

- Caused by the insertion of uncurved instruments short of the working length with excessive amounts of apical pressure.





Breakage of Instruments in the Canal

- The possibility of instrument separation is enhanced remarkably when the instrument is used incorrectly.

- In most clinical situations, the instrument fractures that occur in the apical one third of the canal are almost impossible to remove or bypass, especially in cases of small, tight canals.

DEVIATIONS FROM THE NORMAL CANAL ANATOMY

Zipping refers to transposition or transportation of the apical portion of the canal. A normally curved canal that has been straightened, especially in the apical one third.

.

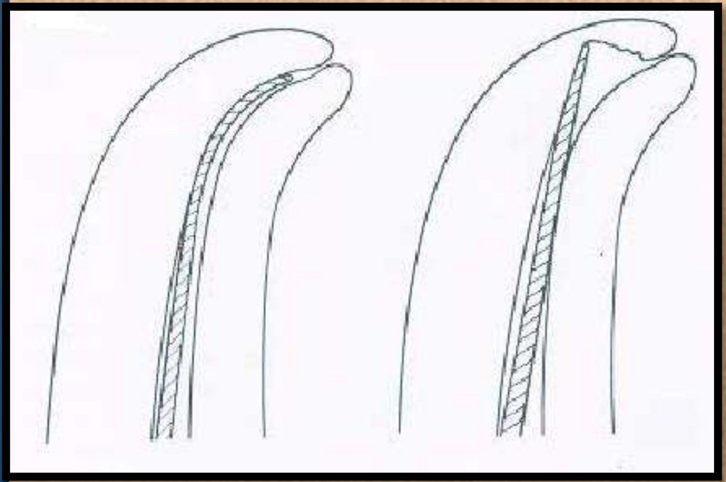
DEVIATIONS FROM THE NORMAL CANAL ANATOMY

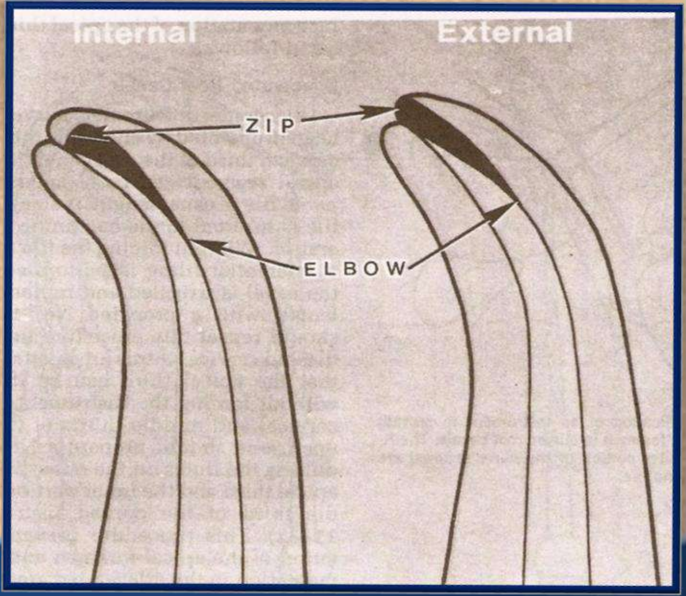
The main reasons for **zipping** are

(1) a failure to precurve files,

(2) rotation of instruments in curved canals, and

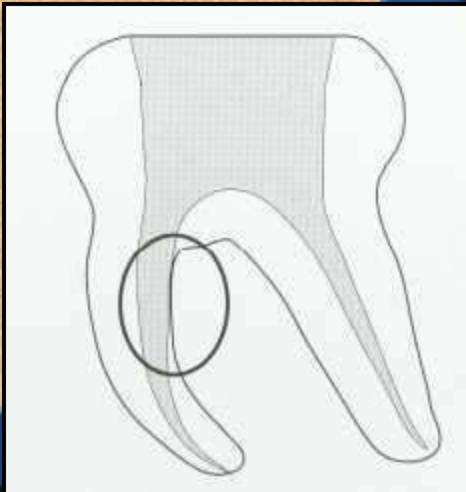
(3) the use of large, stiff instruments to bore out a curved canal.





Stripping or lateral perforation

- **Stripping** refers to a thinning of the lateral root wall with eventual perforation.
- **Stripping** is primarily caused by overzealous instrumentation in the midroot areas of certain teeth, usually molars that have curved roots and canals.




THANK
YOU ☺

BLEACHING

BLEACHING:

Whitening of a tooth through the application of chemical agents to oxidize / reduce the organic pigmentation in the tooth.

- Most commonly followed classification which was given by Dayan et al 1983, Hayes et al 1989 is based on location of discolouration.

EXTRINSIC STAINS	INTRINSIC STAINS
• These are located on the outer surfaces of the teeth. • These are common and it may be result of various causes: i. Remnants of Nasmyth membrane ii. Poor oral hygiene iii. Existing restoration iv. Gingival bleeding v. Plaque and calculus accumulation. vi. Eating habits: tea, coffee stains,etc. vii. Tobacco chewing habit viii. Chromogenic bacteria ix. Mouthwashes- Chlorhexidine	• These are located on internal surfaces of teeth. • These are caused by deeper internal stains or enamels defects. • Teeth with vital or non-vital pulp or endo treated can be affected. • Causes: i. Hereditary disorders ii. Medications iii. Excess fluoride iv. High fevers associated with early childhood illness, and other types of trauma. v. Staining may be located in enamel or in dentin.



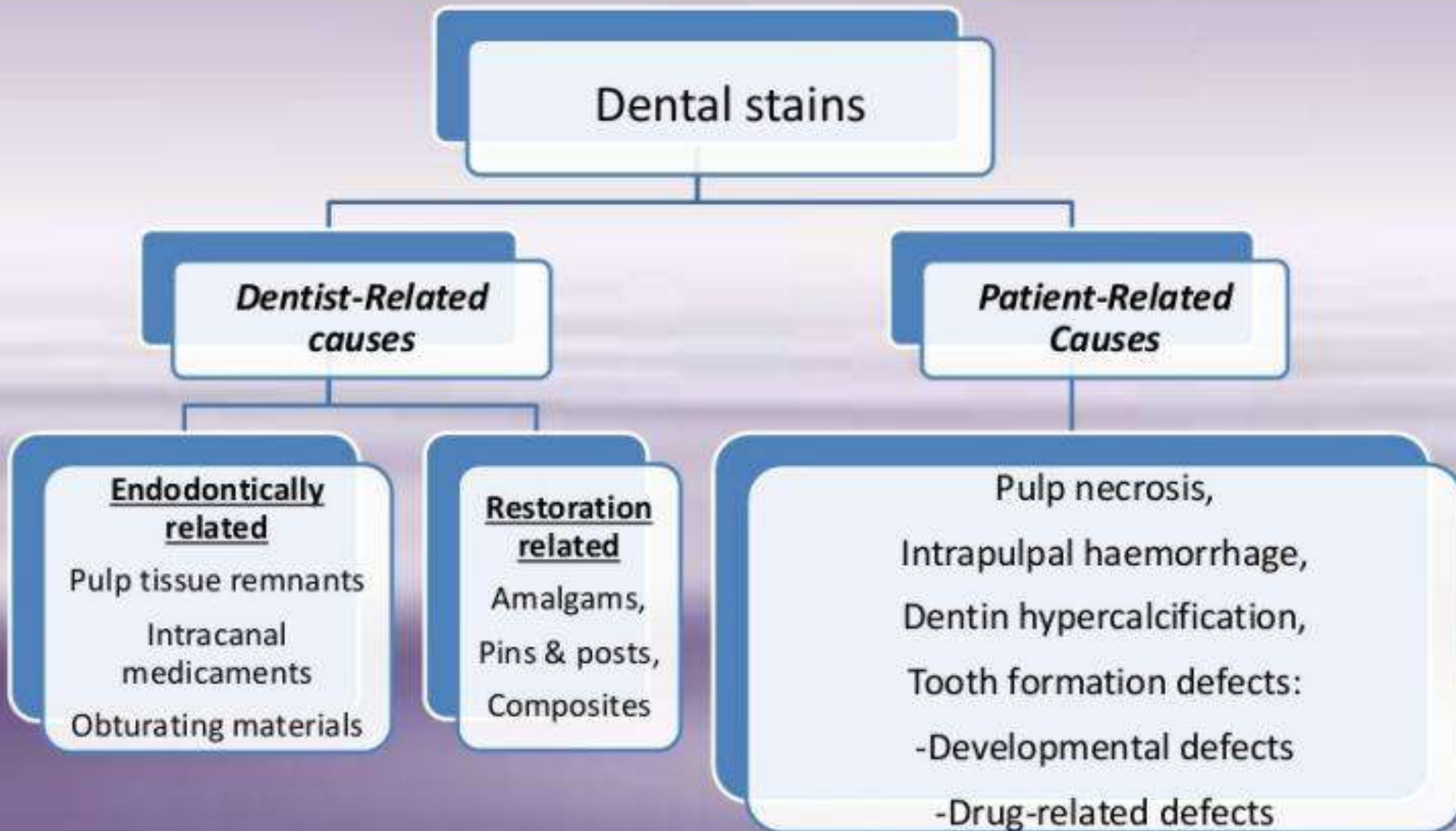
May be due to systemic conditions like

Red or Purple –	Congenital porphyria
Violaceous –	hereditary opalescent dentin
Mottled brown –	Endemic fluorosis
Grayish brown –	Erythroblastosis foetalis
Brown -	Jaundice.

Yellow – brown Gray – Tetracycline

group of Antibiotics

Based on cause; Tooth discoloration usually occurs owing to patient- or dentist-related causes.- [INGLE]



Tetracycline stains

Decalcification

Turner's hypoplasia

Fluorosis

- Prevention:
- Scaling: Most of the surface stains can be removed by routine prophylactic procedures.
- Microabrasion
- Macroabrasion
- Veneers:
  - Direct veneers
  - Indirect veneers
- Ceramic crowns
- Bleaching:
  - Non-vital bleaching
  - Vital tooth bleaching

Pulp Succumbs to trauma

Hemoglobin

Breaks down

↓

Hemin

Hematin

Hematoidin

Hematoporphyrin

Hemosiderin

↓

Hydrogen sulfide (Bacteria)

↓

Darkens The Tooth

Bleaching Agents:

Superoxol

- 30% solution of hydrogen peroxide by weight and 100% volume in pure distilled water.
- It is clear, colorless, odorless liquid stored in light-proof amber bottles.

- It is unstable and should be kept away from heat

Care to be taken during handling as it has its chemical

effect on skin and mucous membrane.

- Superoxol can be used alone or mixed with Na

Perborate into a paste for use in walking bleach.

Sodium Perborate:

It is a stable, white powder supplied in a granular form. It is water soluble and decomposes into Na metaborate and hydrogen peroxide releasing O_2

$$\text{Na P} + H_2O_2 \longrightarrow H_2O + \text{Na. M} + O_2$$

When sealed into pulp chamber it oxidizes and discolors the stain slowly continuing its activity over a longer period of time –Walking bleach

Indications:

Discolored Teeth

Contra Indications:

1. Too much sensitivity because of erosion of enamel, extremely large pulp, exposed root surface etc.
2. Teeth with white or opaque spots.
3. Extremely dark stains especially those with banding or with uneven distribution.

   Eg: dark tetracycline stains.

Techniques for Bleaching:

The goal of bleaching procedures is to restore the normal color to a tooth by decolorizing the stain with powerful oxidizing or reducing agent.

- The oxidizing agents used are superoxol [30% H_2O_2] and sodium perborate.
- The technique differs in the method used to activate the superoxol to liberate O_2
- Whereas walking bleach uses reaction of Na Perborate with superoxol
- The other technique uses heat and light.

BLEACHING TECHNIQUES

For non vital tooth –

In office bleach (Thermo catalytic)

- Walking bleach

For vital tooth –

In office bleaching :- Mc Innes

Modified Mc Innes

Night guard / Matrix bleaching

‘WALKING BLEACH’ OR NON VITAL BLEACHING

Steps:

1. Prepare the tooth – polishing, remove surface debris
2. Apply petroleum jelly to gingival tissues
3. Adapt the rubber dam
4. Re-establish the access cavity
5. Remove any GP that extends into the pulp chamber to the level of alveolar bone.

6. Seal the orifice of the root canal with at least 1mm glass ionomer cement to prevent percolation of the bleaching agent into the apical area.

7. Remove the smear layer with 30% orthophosphoric acid

8. Flush Naocl and water to remove acid.

   also EDTA and Naocl may be used

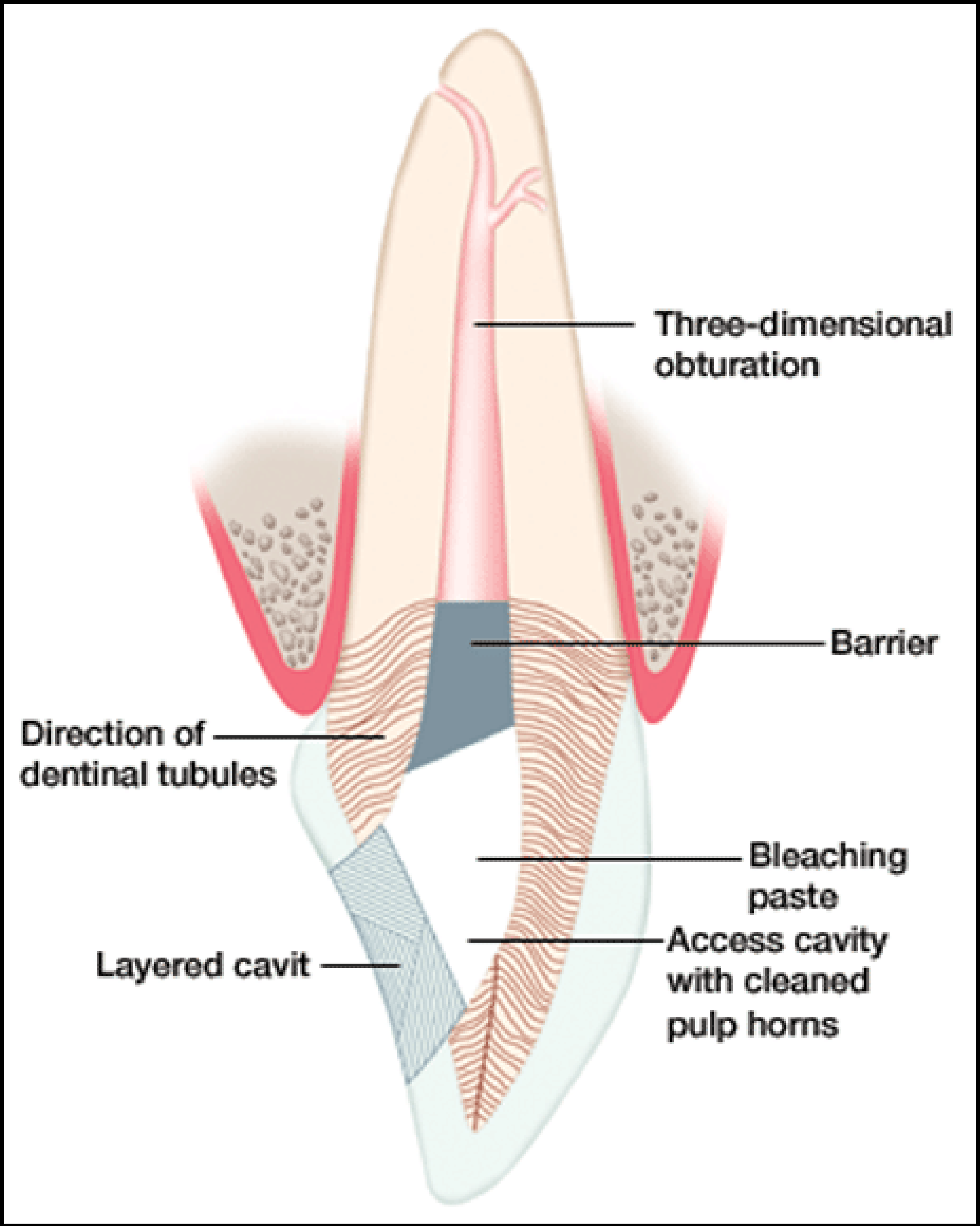
9. Protect the patients face.

10. Mix sodium per borate and superoxol and carry the thick paste into pulp chamber and cover the facial surface of the pulp chamber with paste.

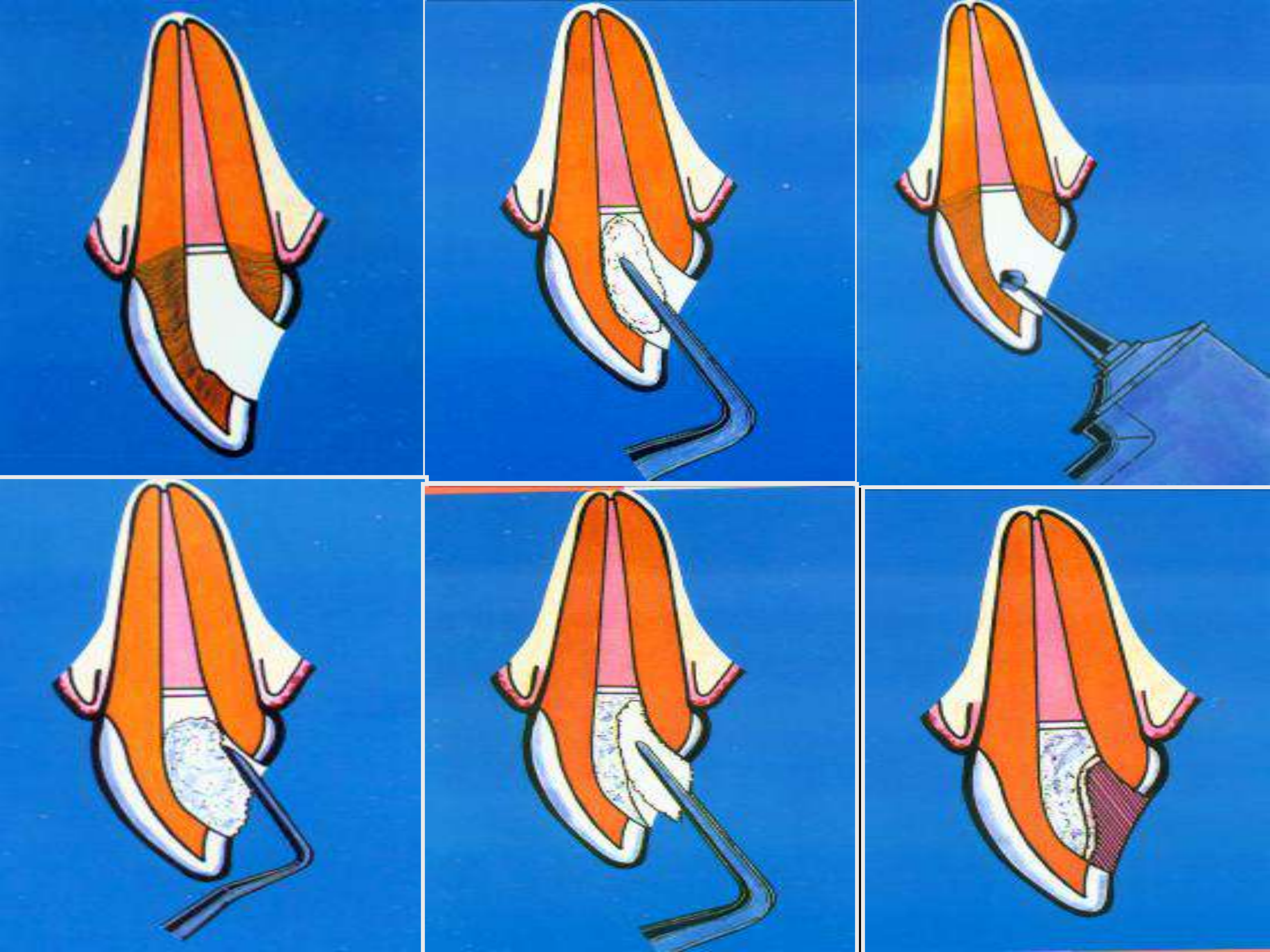
11. Place a cotton pledget over the bleaching paste.

12. Seal the cavity with IRM.

- Maximum bleaching effect is attained after 24 hrs
- To be recalled with in 3 –7 days for evaluation
- If the shade is not proper it has to be repeated
- Generally 2 sittings have to be performed to restore the normal color.



Three-dimensional obturation
Barrier
Direction of dentinal tubules
Bleaching paste
Access cavity with cleaned pulp horns
Layered cavit



Microabrasion:

- In 1984, McCloskly reported the use of 18% HCl acid swabbed on teeth for removal of superficial fluorosis stains.
- In 1986, Croll modified the technique to include the use of pumice with HCl acid to form a paste applied with a tongue blade. This technique is called as microabrasion and it involves the surface dissolution of the enamel by acid along with abrasiveness of pumice to remove superficial stains or defects.
- Since that time, Croll further modified the technique reducing the concentration of the acid to approx 11% and increasing the abrasiveness of the paste using silicon carbide particles, instead of pumice.

McInne's technique:

- This technique uses a combination of 5 parts of 30% H_2O_2, 5 parts of 36% HCl and 1 part of diethyl ether. The solution is applied directly to the stained areas for 1 to 2 minutes with cotton applicators. While the surface is wet, a fine cuttle disc is run over the stained surfaces for 15 seconds. This process is repeated until the desirable results are achieved, during subsequent appointments.
- Modified McInn soln: 18% HCl & 20% hydrogen peroxide.

Macroabrasion:

- An alternative for removal of localized superficial white spots and other surface stains or defects is called macroabrasion.
- It uses a 12- fluted composite finishing bur or a fine grit finishing diamond in a high-speed handpiece to remove the defect.
- Air-water spray is recommended as coolant and also to maintain the tooth in hydrated state to facilitate assessment of defect removal.

Heat and light bleaching (Thermocatalytic):

- Tooth preparation is the same.
- Later, a loose material of cotton is placed on labial surface and another is placed in the pulp chamber of the tooth and the cotton is saturated with superoxol.
- This solution is activated by exposing it to light and heat from a powerful light

  i.e Heat and light from photo flood lamp is aimed directly on the tooth from a distance of 2ft and temperature ranges from 115°-140°F.

- Superoxol is added to the cotton every 5 min.
- The tooth is subject to several six,5 min exposures.
- On completion, a cotton pellet moistened with superoxol or superoxol + Na Perborate is sealed in the pulp chamber until the next appointment.
- Walking bleach is preferred to Heat and light method as it is -
    - Easy to perform.
    - Consumes less time
    - Requires no special equipment.

Thermocatalytic Method:

An alternative method, to activate superoxol is the application of a thermostatically controlled electric heating instrument or a stainless steel instrument such as woodson No.2, heated over a flame.

- *When heat is used the temperature is* ***46°-60°C.***

Vital Teeth Bleaching:

Mc Innes Method:

Solution consists of 1 part anesthetic ether - 0.2ml

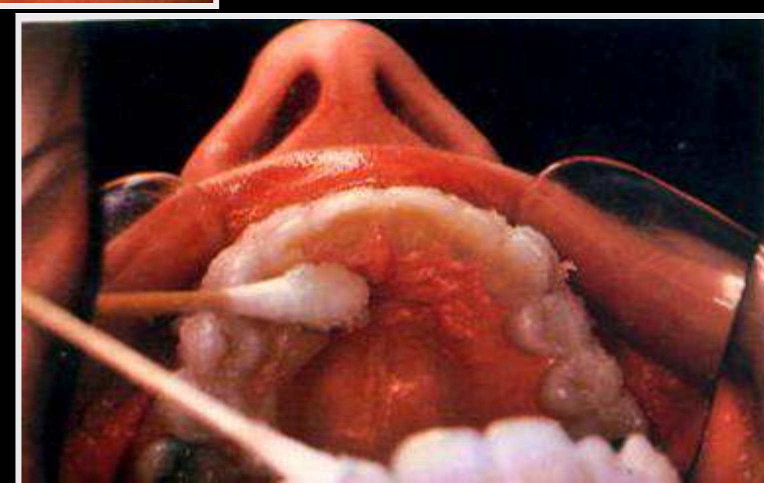
5 Parts 36% HCl - 1ml

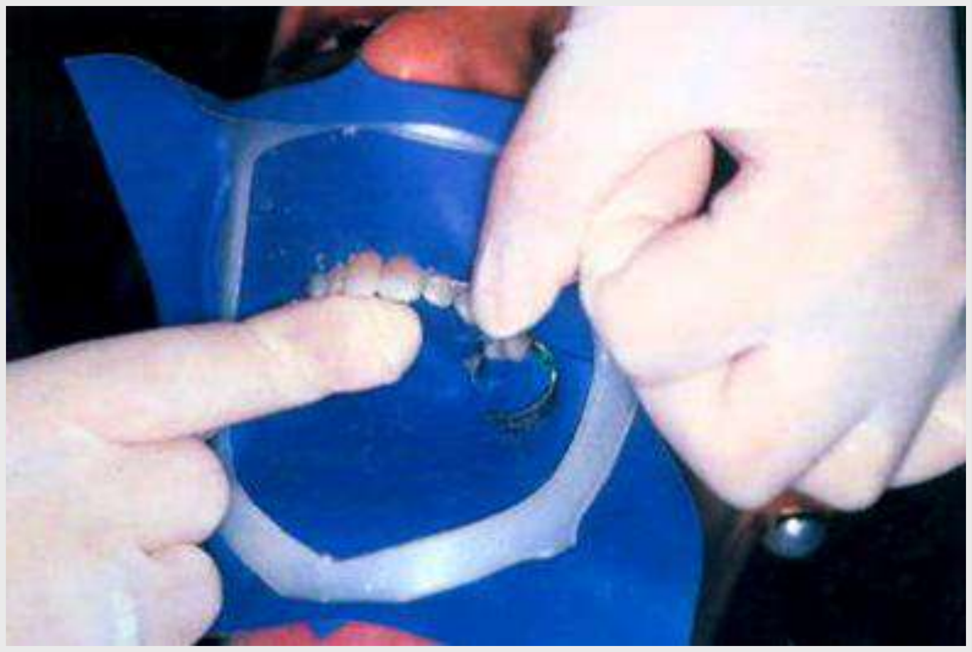
5 parts 30% H_2O_2 - 1ml

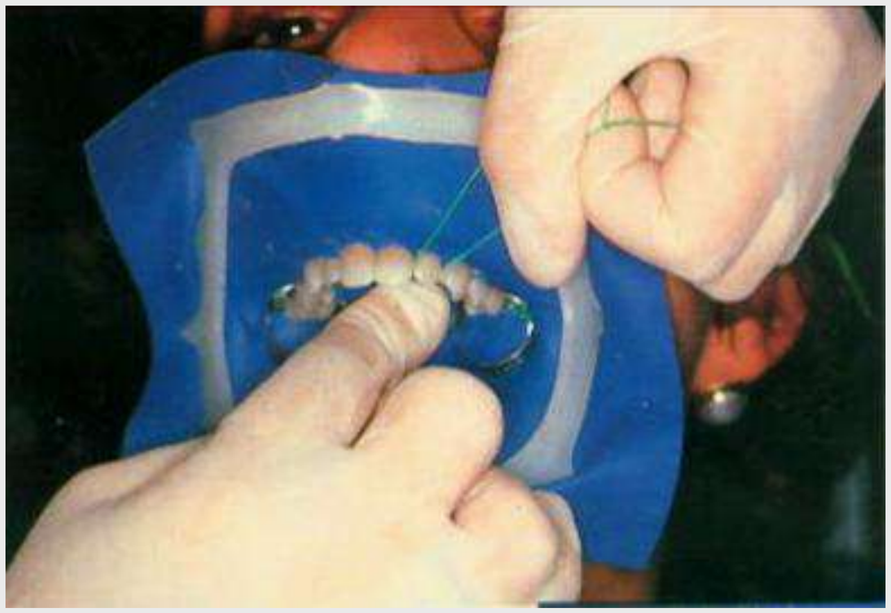
- Ether removes surface debris
- HCl etches the enamel
- H_2O_2- bleaching agent

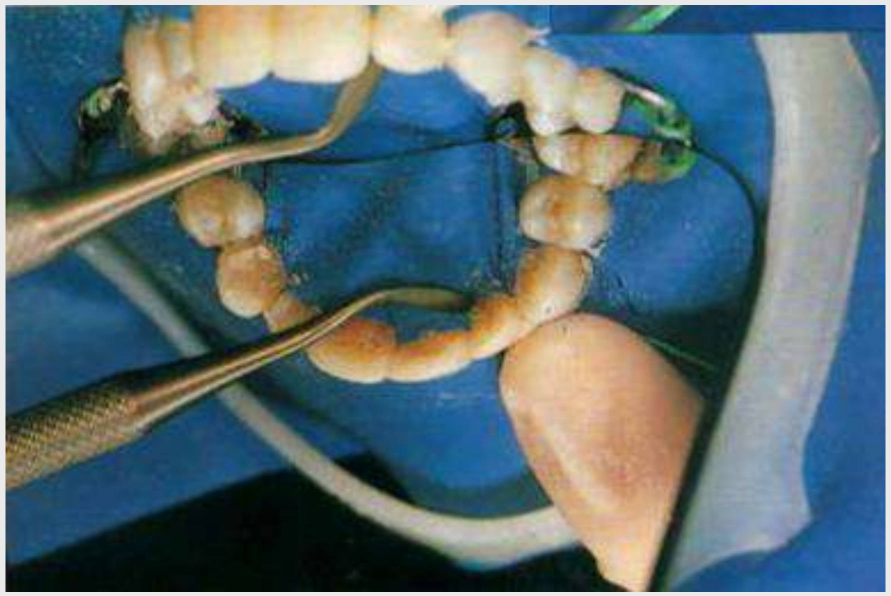
Technique:

- Polish the crown.
- Apply petroleum jelly onto the gingiva.
- Isolate teeth with rubber dam.
- Always solution is freshly mixed and applied to the enamel surface for 5mins at 1 min intervals.
- On completion, the solution is neutralized with NaOCl irrigation and water.
- Again the bleached surface is polished.
- This is repeated 2-3 times until the shade is obtained.











0
10
20
30
40
60

Disadvantages of old McInnes solution

1) Loss of contour

2) Sensitivity

3) Irritation to gingiva

Modified Mc Innes solution:

- HCl Acid is replaced by 20% NaOH
- In this technique, the teeth are etched with HCl and then bleaching procedure is continued

Night Guard / Matrix Bleaching:

This uses a vacuum formed soft mouth guard and10% carbamide peroxide to bleach the teeth

There are 2 basic regimens for application of this solution

a) Over night use of night guard filled with bleaching material .

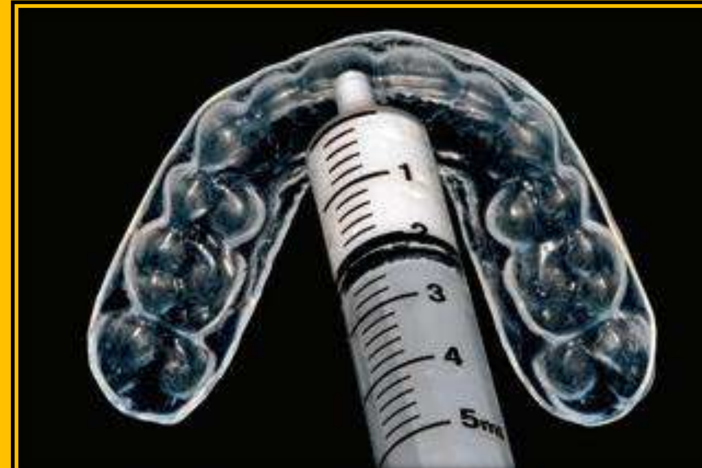
b) Use of loaded night guard during the day

- Solution is changed every 1½ - 2 hrs
- Rx time is usually 4-6 wks for night time bleaching
  1-3 wks for day time with multiple application.

- ✓ Make primary impression and pour a cast.
- ✓ Make reservoirs on the cast on the labial aspect.
- ✓ Prepare the poly resin tray with the help of vacuum form machine.
- ✓ The tray is trimmed and extended 1mm short of the gingival margin on the labial aspect to avoid irritation of gingiva by the bleaching material.
- ✓ Tray is then tried on the patient’s mouth to check for fit.

BLEACHING INSTRUCTIONS

a) syringe with peroxide/MI Paste



(b) being taken to the tray

(c) a small quantity was spread on the buccal aspect of the tray edentations

(d) tray in position

Disadvantages

1. The solution may initially cause tissue irritation on gingival papilla – in 1st week of Rx
2. Some teeth may become more sensitive to temperature change.

- More lab procedures
- Patient complains of gag reflex while using tray

White strips:

Which is a thin flexible polyethylene strips which contains 5.3% hydrogen peroxide in gel form. The strips are used for 30 minutes twice daily for 14 days.


3D WHITE
TEETH WHITENING STRIPS
3 Days Significant whitening
Enamel safe
14pcs

Prevention of tooth discoloration:

- Proper access cavity preparation that permit complete removal of pulp tissue including pulp horm.
- All traces of blood should be removed by through irrigation.
- Any defective restoration should be removed.
- Non staining medicaments and materials to be used
- During bleaching procedure root canal sealer and obturating material should be removed from pulp chamber beyond a level of 1- 3mm apical to free gingival margin.

COMPOSITE RESTORATIVE MATERIALS

- Acrylic resins (polymethylmethacrylate) replaced the silicates during the late 1940s and the early 1950s

✓ Tooth like appearance,
✓ Insolubility in oral fluids,
✓ Ease of manipulation, and
✓ Low cost.

LIMITATIONS OF METHACRYLATE RESINS

- Poor wear resistance
- Shrink severely during curing, which causes them to pull away from the cavity walls and produce leakage along the margins.
- Excessive thermal expansion and contraction cause further stresses to develop at the cavity margins

DENTAL COMPOSITES

Dr. Ray L. Bowen (1962) developed a new type of composite material.

Dental composites are highly cross-linked polymeric materials reinforced by a dispersion of glass, crystalline or resin filler particles and /or short fibers bound to the matrix by silane coupling agents

RESIN

+

QUARTZ POWDER

→

COMPOSITE STRUCTURE

Three structural components in dental resin - based composites

- MATRIX

a plastic resin material that forms a continuous phase and binds the filler particles

- FILLER

reinforcing particles and /or fibers that are dispersed in the matrix

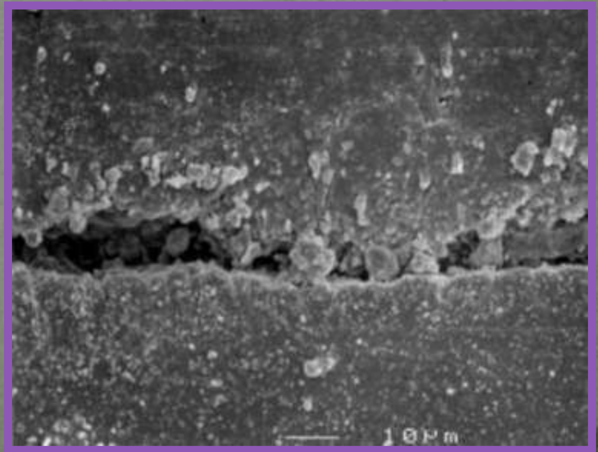
- COUPLING AGENT

bonding agent that promotes adhesion between filler and resin matrix.

1. RESIN MATRIX

Most dental composites use a blend of aromatic and/or aliphatic dimethacrylate monomers such as

- Bis-GMA,
- Triethylene glycol dimethacrylate (TEGDMA),
- Urethane dimethacrylate (UDMA).



2. FILLER PARTICLES

The primary purpose of a filler particle is to

- ✓ Strengthen a composite and
- ✓ To reduce the amount of matrix material.

- Increased hardness, strength, and decreased wear
- Reduction in polymerization shrinkage
- Reduction in thermal expansion and contraction
- Improved workability by increasing viscosity
- Increased radiopacity and diagnostic sensitivity

- Less water sorption and less softening of composites compared with unfilled resins
- Mechanical properties such as compressive strength , tensile strength modulus of elasticity , abrasion resistance are increased
- Coefficient of thermal expansion is decreased.

3. COUPLING AGENTS

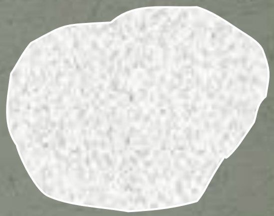
- Allows the more flexible polymer matrix to transfer stresses to the filler particles.
- Result in improved physical and mechanical properties.
- Titanates , zirconates and organosilanes can be used as coupling agents.
- Organosilanes such as ϒ-methacryloxypropyl trimethoxysilane are used most commonly

- In the presence of water, the methoxy groups are hydrolyzed to silanol groups that can bond with the other silanols on the filler surfaces by formation of a siloxane bond.
- The organosilane methacrylate groups form covalent bonds with the resin
- when it is polymerized , thereby completing the coupling process.

Bis-GMA ⇐ Bonds with resin

$$CH_3\text{-}\underset{\overset{\|}{}}{\overset{\overset{CH_2}{\|}}{C}}\text{-}\underset{\underset{O}{\|}}{C}\text{-}O\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}\underset{\underset{OH}{|}}{\overset{\overset{OH}{|}}{Si}}\text{-}OH$$

Silane

Bonds with filler ⇒ 

4. ACTIVATOR –INITIATOR SYSTEM

- Both monomethacrylate and dimethacrylate monomers polymerize by the addition polymerization mechanism initiated by free radicals.

- Free radicals can be generated by chemical activation or by external energy activation (heat, light, or microwave)

- **Chemically activated resins-**

- Base paste –

  Benzoyl peroxide initiator

- Accelerator paste –

  An aromatic tertiary amine activator(eg,N,N-dimethyl-*p*-toluidine)

- when the two pastes are mixed together, the amine reacts with the benzoyl peroxide to form free radicals, and the additional polymerization is initiated.

- **Visible light –curable dental composites**

Supplied as a single paste

- Initiator -

Camphoroquinone

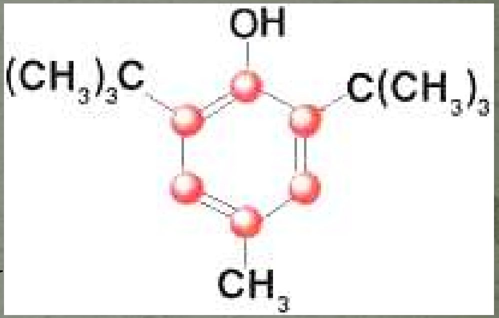
- Activator -

Diethyl –amino- ethyl methacrylate (amine)

- Exposure to light in the blue region(wavelength of ~468nm) produces an excited state of the photosensitizer, which then interacts with the amine to form free radicals that initiate addition polymerization.

5. INHIBITORS

- To prevent spontaneous or accidental polymerization of monomers.



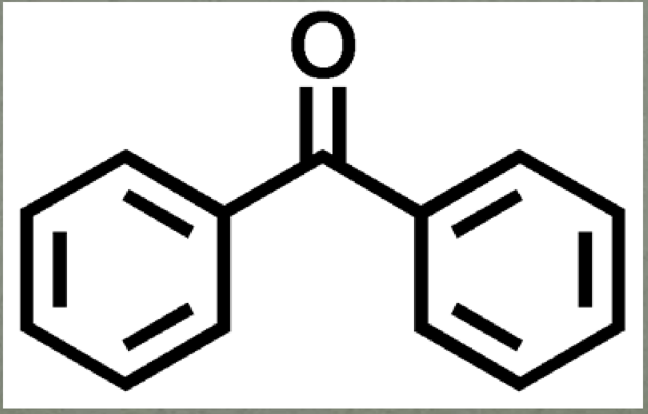
- Inhibitors have a strong reactivity potential with free radicals

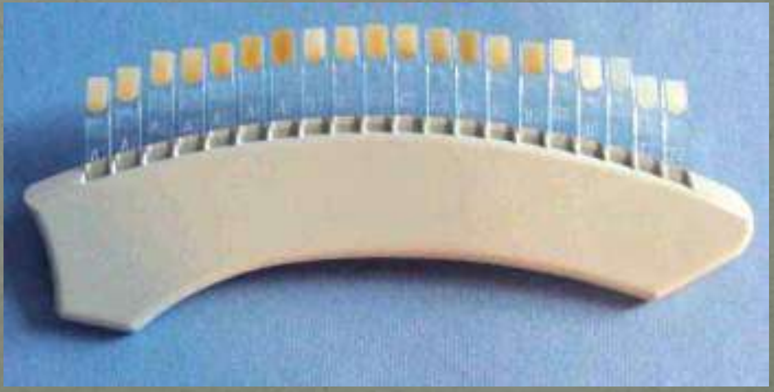
- The inhibitor reacts with the free radical faster than the free radical can react with the monomer.

- This prevents chain propagation by terminating the reaction before the free radical is able to initiate polymerization
- Butylated hydroxytoluene (BHT)
- Used in concentrations on the order of 0.01 wt%.

- # 6.OPTICAL MODIFIERS
- For natural appearance, dental composites must have visual shading and translucency that are similar to the corresponding properties of tooth structure

- Titanium dioxide and aluminium oxide (0.001 to 0.007 wt%)





- All optical modifiers affect light transmission through the composite.

- Thus darker shades and greater opacities have a decreased depth of light curing ability and require either an increased exposure time or a thinner layer when cured.

POLYMERIZATION

Chemical activation

- Cold curing or self curing
- Initiated by mixing two pastes just before use.

o

- Impossible to avoid incorporation of air into the mix,Thereby forming pores that weaken the structure and trap oxygen inhibits polymerization during curing.

- Operator has no control over the working time after the two components have been mixed. Therefore both insertion and contouring must be completed quickly once the resin components are mixed.

Light activation

- Allow the operator to complete insertion and contouring before curing is initiated
- Once curing is initiated, an exposure time of 40 sec or less is required to light cure a 2mm thick layer
- They are not as sensitive to oxygen inhibition

Limitations of light cured composites

- They must be placed incrementally when the bulk exceeds approximately 2 to 3 mm
- Variable exposure times because of shade differences, resulting in longer exposure time for darker shades and/ or increased opacity.
- Sensitivity to room illumination
- Cost of light curing unit

Types of lamps used for photo initiator curing

In order of lowest intensity to highest

- LED lamps
- QTH lamps
- Argon laser lamps

Depth of cure and exposure time

- Curing depth is limited to 2 to 3 mm unless excessively long exposure times are used , regardless of lamp intensity.

- Darker shades and /or more opaque resins require longer curing times

INDICATIONS

- Class I,II,III.IV and VI restorations
- Foundations or core buildups
- Sealants and preventive resin restorations (conservative composites restorstions)
- Esthetic enhancement procedures

- Partial veneers
- Full veneers
- Tooth contour modifications
- Diastema closures
- Cements (for indirect restorations)
- Temporary restorations
- Periodontal splinting

CONTRAINDICATIONS

- Large posterior restorations
- Bruxism
- Poor isolation

ADVANTAGES

- Esthetics
- Conservative of tooth structure removal(less extension, uniform depth not necessary, mechanical retention usually not necessary)
- Less complex when preparing the tooth


- Insulative ,having low thermal conductivity
- Used almost universally
- Bonded to tooth structure, resulting in good retention, low microleakage, minimal interfacial staining and increased strength of remaining tooth structure
- Repairable

DISADVANTAGES

- Technique sensitivity
- Polymerization shrinkage
  - marginal leakage
  - secondary caries
  - postoperative sensitivity
- Decreased wear resistance

CLASSIFICITION

Traditional composites

- These composites are referred to as conventional or macrofilled composites.
- The most commomnly used filler for these materials is finely ground amorphous silica and quartz.
- Average size of the filler particles ranges from 8-12um,
- Filler loading generally is 70-80wt%. or 60 -70vol%

Diadvantage of traditional composites

- Rough surface that develops during abrasive wear of the soft resin matrix ,thus exposing the more wear resistant filler particles ,which protrude from the surface.

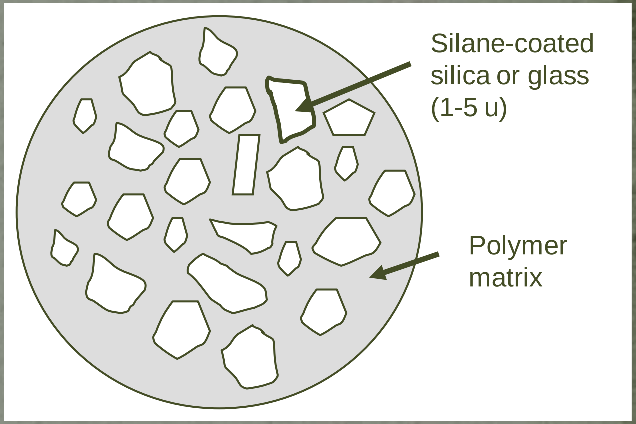
- **Small particle-filled composites**

- To improve the surface smoothness and to retain or improve physical and mechanical properties of traditional composites ,inorganic fillers are ground to a size range of 0.5 to 3um but with a fairly broad size range distribution

- The use of small and highly packed filler imparts a surface smoothness

- Some SPF composites use amorphous silica as filler,but most incorporate glasses that contain heavy metals for radio-opacity.

- Colloidal silica is usually added in amounts of approximately 5wt% to adjust the viscosity

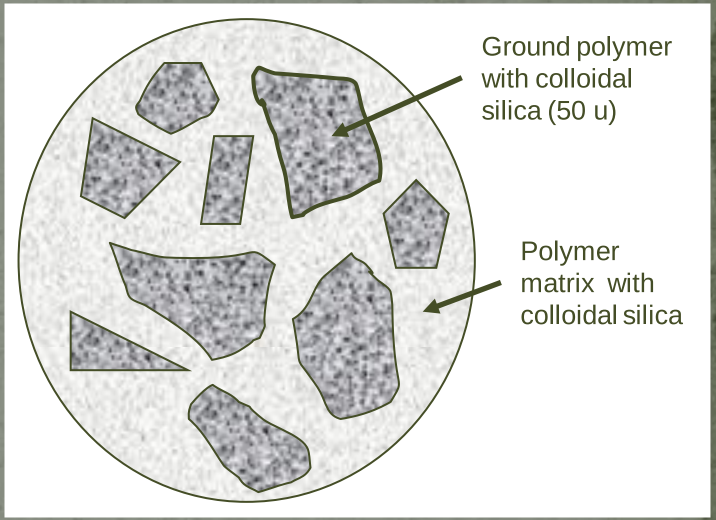


Clinical considerations of SPF composites

- SPF composites are indicated for high–stress and abrasion–prone applications, such as in class IV sitesbecause of their higher filler loading

Microfilled composites

- The problems of surface roughening and low translucency associated with traditional and small-particle composites can be overcome through the use of colloidal silica particles as the inorganic filler.



- The individual particles are approximately 0.04 um in size

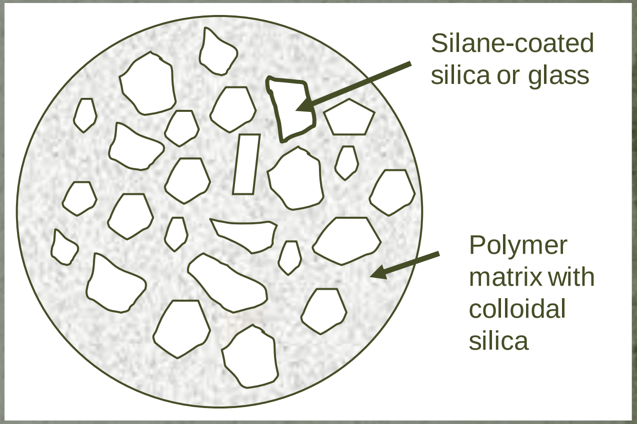
Clinical considerations

- In stress bearing situations ,such as class II and class IV sites,the potential for fracture is greater
- The larger amount of resin compared with inorganic filler results in greater water sorption,a higher coefficient of thermal expansion,and decreased elastic modulus

- The inorganic filler particles are smaller than the abrasive particles used for finishing the restoration thus the silica filler is removed along with the resin in which it is embedded, leaving a very smooth, polished surface that is retained for the life of restoration

Hybrid composites

- This category of composite materials was developed in an effort to obtain even better surface smoothness than that provided by small particle composites,while still maintaining the desirable properties of the latter.



- Hybrid composites contain two kinds of filler particles. Most modern hybrid fillers consist of colloidal silica and ground particles of glasses containing heavy metals,constituting a filler content of approximately 75 to 80 wt%

- The glasses have an average particle size of about 0.4 to 1 um.

Clinical considerations of hybrid composites

- Because of their surface smoothness and reasonably good strength,these composites are widely used for anterior restorations, including class IV sites.

- Although the mechanical properties of hybrid composites generally are somewhat inferior to those of SPF composites,the hybrid composites are widely employed for stress-bearing, posterior restorations

Flowable composites

- A modification of the SPF and hybrid composites results in the so – called flowable composites.

- These composites resins have a reduced filler level so as to provide a consistency that enables the material to flow readily,spread uniformly,and intimately adapt to a cavity form to produce a desired dental anatomy.

- Because of their greater ease of adaptation and a greater flexibility as a cured material, flowable composites are useful in class I restorations in gingival areas.

- Flowable composites can also be used in minimal class I restorations to prevent caries, used in a manner similar to the use of fissure sealant.

COMPOSITES FOR POSTERIOR RESTORATIONS

- **Packable composites**
- These materials were introduced in the late 1990s
- Compared with the amalgam ,the technique of composite placement is far more time-consuming and demanding
- A solution to this problem is offered by resin composites with filler characteristics that increase the strength and stiffness of the uncured material

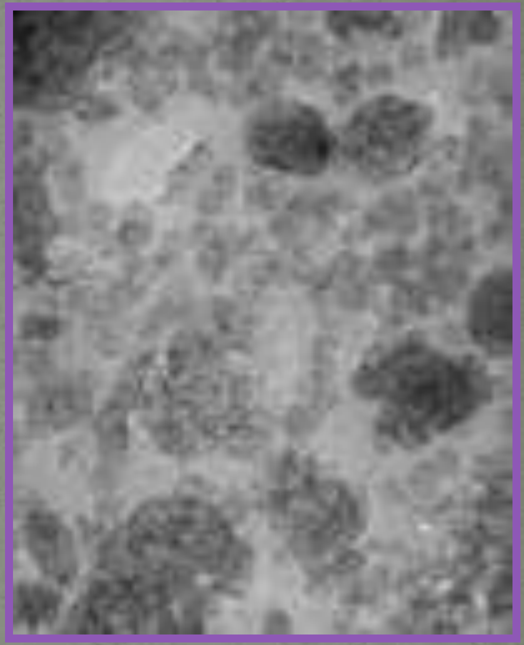
- The packable and condensable characteristics derive from inclusion of elongated,fibrous,filler particles of about 100um in length,and /or textured surfaces that tend to interlock and resist flow.

Indirect Posterior Composites

- Indirect composites for fabrication of onlays are prepolymerised outside the oral cavity and luted to the tooth with a compatible resin cement.
- Indirect composite inlays and onlays reduce wear and leakage.

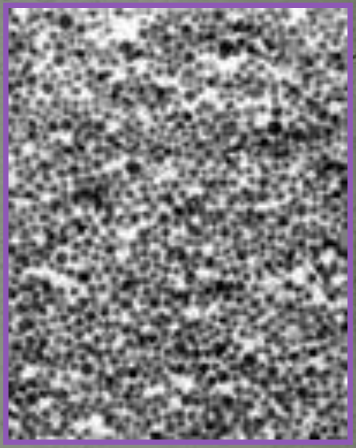
Nanofill composites

- Nanofill composites contain filler particles that are extremely small (0.005 -0.01 um).
- Because these small primary particles can be easily agglomerated , a full range of filler sizes is possible.
- .



- Consequently, high filler levels can be generated in the restorative material, resulting in good physical properties and esthetics

- The small primary particle size also makes nanofills highly polishable

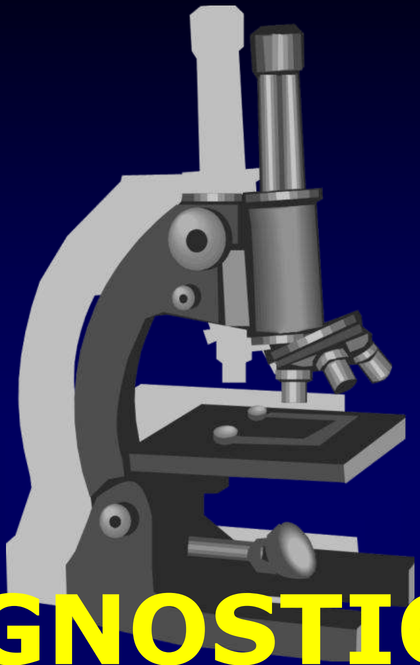


WELCOME TO THE FINAL YEAR BDS

DEFINITION OF ENDODONTICS

Endodontics is that branch of dentistry that deals with the etiology ,diagnosis, prevention, and treatment of diseases of the pulp and periapical tissues compatible with good health .

Its scope encompasses those disturbances or diseases of the pulp requiring pulpotomy or pulp extirpation; treatment and filling of infected root canals by conservative means ;surgical removal of pathologic periapical tissue when indicated ;restoration of the natural appearance of the crown when discoloured ;replantation of teeth when avulsed or luxated ;intentional replantation of teeth ;transplantation of teeth ,hemisection or radisectomy; and endodontic implants



DIAGNOSTIC AIDS

- Correct Diagnosis → Knowledge, Skill, Art
- Symptoms → Subjective, Objective
- Differential Diagnosis
- Diagnosis by Exclusion

- Chief Complaint
  - Questionnaire
  - Own words
  - Do not lead

- Subjective Symptoms
  - **Pain**
    - **Type**
    - **Location**
    - **Duration**
    - **Rel/Agg factors**

Objective Symptoms

- Visual and Tactile inspection.
- Percussion.
- Palpation.
- Mobility and Depressibility.
- Radiograph.
- Electric pulp test.
- Thermal tests (hot and cold).
- Anesthetic test.
- Test cavity.

Objective Symptoms

1. <u>Visual and Tactile inspection</u> –

- Check for three C's – Soft tissues and hard tissues.
- <u>Soft tissues</u> – Check for colour, contour and consistency.
- Colour – Any deviation from normal pink of healthy gingiva indicates inflammation.
- Contour – Swelling disturbs contour.
- Consistency – Spongy gums are different from normal ones.

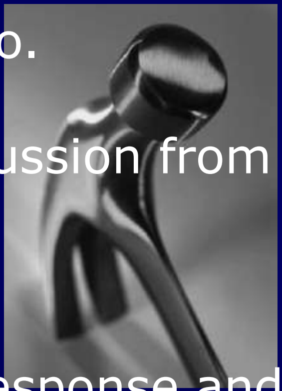
Hard tissues –

Check for colour, contour and consistency.

- Colour – Normal teeth have a life like sparkle and translucency which is missing in pulpless teeth.
- Contour – Fractures and wear facets change the contours
- Consistency – Relates to presence of caries, internal resorption.
- Dry field, Mouth mirror, periodontal probe, good illumination are required for a thorough examination.

2. **Percussion** –

- Evaluates the periodontium.
- Quick moderate blow with finger first and then with mirror handle.
- Change the sequence of teeth to be percussed.
- Check adjacent teeth also.
- Change direction of percussion from bucco – lingual to vertico – occlusal.



- Check out for patient's response and his body movements.
- Dont jump to conclusions try to correlate with other findings.
- Is it periodontal abscess ?

3. **Palpation** –

- Use fingertip, light pressure to check consistency and pain.
- Check for fluctuant tissue, presence of pain .
- Presence and location of adenopathy (Be careful) .
- Presence of bone crepitus.
- Not diagnostic when the infection is limited to pulp.

4. **Mobility and Depressibility** –

- Evaluates the integrity of the attachment apparatus.
- Move tooth laterally in the socket using mirror handles.
- Greater the movement poorer the periodontal status.
- Depressibility consists of vertical movement of tooth in socket.

- If the tooth is depressible prognosis is poor.
- Grade I mobile – Noticeable mobility in socket.
- Grade II mobile – Movement of tooth within 1mm.
- Grade III mobile – Movement > 1mm, depressible.

5. <u>Radiography –</u>

- Very critical in endodontics.
- One should have knowledge of anatomy and normal landmarks.
- " **An excellent radiograph may be difficult to interpret but a poor radiograph is impossible to read."**
- Gives information on presence of caries, number, shape and anatomy of canals, calcifications, resorption, thickening of periodontium.

- Presence of periapical radiolucency can be misleading.
- Periapical osteofibrosis shows a radiolucent area around root whereas responds normally.
- Periapical lesion is usually larger than seen on radiograph.
- 6.6% mineral loss is visible on radiograph.

6. Electric pulp testing –

- Uses nerve stimulation.
- Stimulates a pulpal response by subjecting it to increasing level of electric current.
- No response indicates pulpal necrosis.

Technique –

- Describe it to patient.
- Isolate with cotton rolls and saliva ejector and air dry all teeth.
- Check the EPT.
- Apply electrolyte on the tooth electrode and place it against occluso buccal or inciso buccal surface.
- Avoid contacting any restoration.
- Retract the cheek away from tooth electrode with other hand.
- Turn the rheostat slowly and ask patient about sensation.
- Record the finding numerically.

- A false positive can occur if moist gangrenous pulp is present.
- Multi rooted teeth can give false result.
- Calcifications, diminishing pulp cavity, fibrotic pulp, teeth with big restorations, recently traumatized teeth, patient on sedatives all these factors contribute to false results.
- Should not be done on teeth with full coverage restorations.

7. **Thermal testing** - → **Heat test** / → **Cold test**

Heat testing –

- One can use hot water, hot burnisher, hot gutta percha or hot compound.
- Touch the occluso buccal surface, move to central portion and then the cervical area.
- Hot water should be delivered by a syringe and under rubber dam.
- Abnormal response indicates pulpal or periapical disorder.

Cold testing –

- Stream of cold air, Ethyl chloride spray, pencils of ice can be used.
- Carbon dioxide snow (dry ice) can be used.
- Temperature of dry ice is around – 78 degrees.
- Can be helpful in checking vitality under full coverage restorations.

8. <u>Anesthetic testing</u> –

- Helpful in localizing tooth.
- Can be performed when the patient is in pain.
- Anesthetize the most posterior tooth and keep on moving mesially tii the tooth is localized.

9. <u>Test Cavity</u> –

- Should be avoided.
- Prepare a cavity without coolant at slow speed.
- Sensation indicates tooth is vital.
- No sensation indicates that the tooth is non vital.

RECENT ADVANCES IN PULP VITALITY TESTING

- Very crucial test to monitor the health of pulp.

Traditional methods --

- Depend on innervation.
- False positive and False negative results.
- Give no indication of blood flow in the pulp.
- All the tests are subjective.
- Are they reliable ?

- **Newer methods** --
- Depend on blood circulation.
- More objective therefore more reliable.

1. Pulse oximetry.
2. Dual Wavelength Spectrophotometry.
3. Laser Doppler Flowmetry.
4. Crown surface temperature changes:
   - Infrared Thermographic imaging.
   - Liquid crystal testing
   - Hughes probeye camera.
5. Photoplethysmography
6. 133Xenon radioisotope

1. PULSE OXIMETRY –

- Detects pulpal blood circulation.
- Non invasive oxygen saturation monitoring device.
- Based on modification of Beer’s law.
- On the absorption characteristics of hemoglobin in the red and infra red region.
- In the red region, oxyhemoglobin absorbs less light than deoxy-hemoglobin and vice versa in the infra red region.
- Still in developing stage.
- System consists of a probe containing a diode that emits light in 2 wavelengths.
  Red light – 660nm and Infra red light – 850nm.

Advantages –

- **Detects pulpal blood circulation.**
- **Useful in impact injuries.**
- **Effective and Objective method.**

Disadvantages –

- **Background absorption.**

2. Dual Wavelength Spectrophotometry –

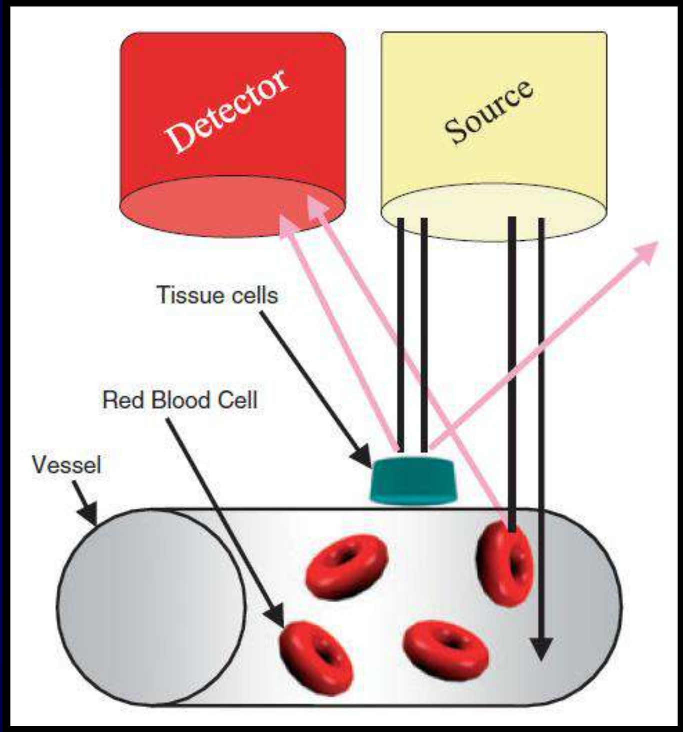
- DWLS is a method that measures oxygenation changes in the capillary bed rather than in the supply vessels.
- DWLS detects the presence or absence of oxygenated blood at 760nm and 850nm.
- Probe is placed on the labial surface of the tooth crown and sensor on the palatal surface. Place probe on the middle 3rd of crown.

Advantages –

- Uses visible light that is filtered through fibre optics
- No eye protection required for patient.
- Small and portable.
- Relatively inexpensive.

3. Laser Doppler Flowmetry –

- **Measures blood flow in very small vessels.**
- **Depends on Doppler’s principal.**
- **Light from a laser source incident on tissue is scattered by moving RBC’S and frequency broadened.**
- **This frequency is photo detected and processed to provide output.**
- **The output is proportionate to number and velocity of RBC’S.**



Disadvantages –

- **Expensive**
- **Technique sensitive.**

4. Crown surface temperature changes

Vital teeth are warmer and rewarm quickly after cooling than non vital teeth.

- **Infrared thermographic imaging**
- **Liquid crystal Testing**
- **Hughes Probeeye Camera**

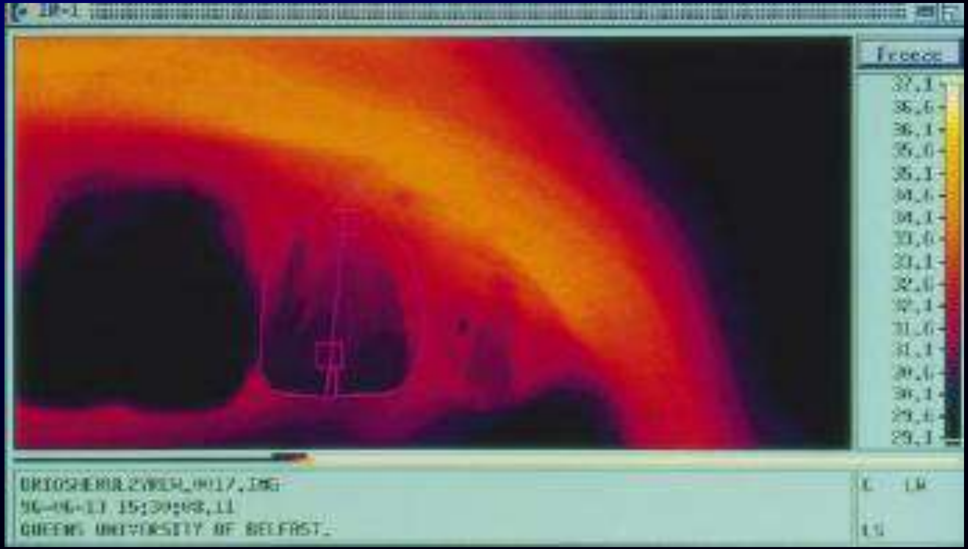
Temperature Measurement –

- **Sensors used to record temperatures may be small electric probes called thermistors, liquid crystals or infrared scanners which are used to record temperature over wide areas.**

- **Non vital teeth have lower temperature than vital teeth.**

Computer controlled infrared thermographic imaging

- Non invasive method of recording the surface temperature of the body .
- Crown temperature patterns of non vital teeth to be slower to rewarm than that of vital teeth.
- Aim is to increase the detectable differences between vital and non vital teeth.
- Still in research stages.



Liquid crystal Testing:

Color change of Cholesteric liquid crystals are used to show temperature difference between teeth with vital pulp(hotter) and necrotic(cooler) pulp.

Camera: Hughes Probeeye

Used to assess pulp vitality which measures temperature changes as small as 0.10 c

Hughes probeye camera consists of thermal video system with a silicon close up lens with a resoluable spot size of 0.023 inches. It was possible to focus accurately on individual teeth.

Photoplethysmography

- The detection of blood flow within the pulp by passing light through the tooth

- Hemoglobin absorbs certain wavelengths of light, while the remaining light passes through the tooth and is detected by a receptor.

133Xenon radioisotope

- Radioactive materials for measurement of pulpal blood circulation
- The material is a radioactive substance and pulpal blood circulation is checked by washout of Xenon-133 radioisotope using radiolabelled microsphere injection method.

Gingival tissue management

- Very important aspect of cast restorations.
- Can have profound effect on ultimate result.
- Mandatory to have healthy gingiva prior to cast restorations.
- Periodontium should be sound.
- Bleeding gums are a strict no no.
- Introduce patient to regimental oral hygiene program.

Methods –

1. Mechanical
2. Chemicomechanical
3. Surgical.

Mechanical –

- One of the oldest method.
- Physically displacing gingiva away from tooth.

1. Copper Band –

- A copper band or tube is used to displace gingiva.
- One end of the tube is festooned to follow the gingival contours.
- Tube is filled with impression compound and carried.

Disadv –

- Can cause incisional injuries to the tooth.

2. Rubber dam –

- A rubber dam can also accomplish the exposure needed.
- Extra heavy dam effects good retraction.

Disadv –

- Not possible in cases where preparation extends subgingivally.
- Can not be used with polyvinylsiloxane material.

3. Plain cotton cord –

- Plain cotton cord physically pushes gingiva away from tooth.
- Limited effectiveness.
- Pressure alone is not sufficient to control haemmorhage.

4. Custom Temp Restorations –

- The use of custom temp restoration with bulky margins using temp cements like ZoE.

Chemico mechanical

- Combination of chemical action with pressure.
- Caustic chemicals such as sulphuric acid, trichloroacetic acid and zinc chloride have been tried but they have undesirable effects on gingiva.

Chemicals used mainly fall under three categories –

1. <u>Vasoconstrictors</u> – restricts blood supply to the area by decreasing

the size of blood capillaries.

- Racemic epinephrine and nor epinephrine.

C/I –

- Causes an increase in blood pressure and heart rate.
- Avoid in hyperthyroidism, diabetes, allergic to epinephrine.
- Avoid in patients taking Rauwolfia compounds, ganglionic blockers or epinephrine potentiating drugs, monoamine oxidase.

Epinephrine syndrome –

- Tachycardia, rapid respiration, elevated blood pressure, anxiety and post operative depression.

2.5 cm of cord 5 – 15 min is 71 micrograms.

Safe dose –

Healthy dose for adult – 200 microgram.

Cardiac patient – 40 microgram.

B. Biologic fluid coagulant –

- Coagulate blood and tissue fluids locally.
- Creates surface layer that is an efficient sealer.
- These are very safe agents.
- 100% alum, 15-25% Aluminium chloride, 10% aluminium pottasium sulphate, 15-25% Tannic acid and ferric sulphate.

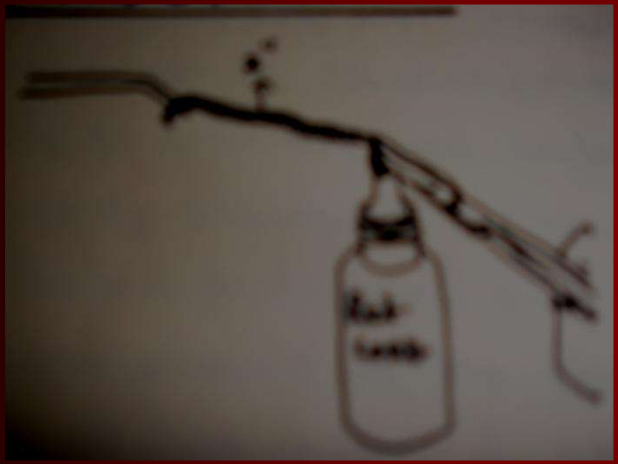
C. Surface layer tissue coagulation –

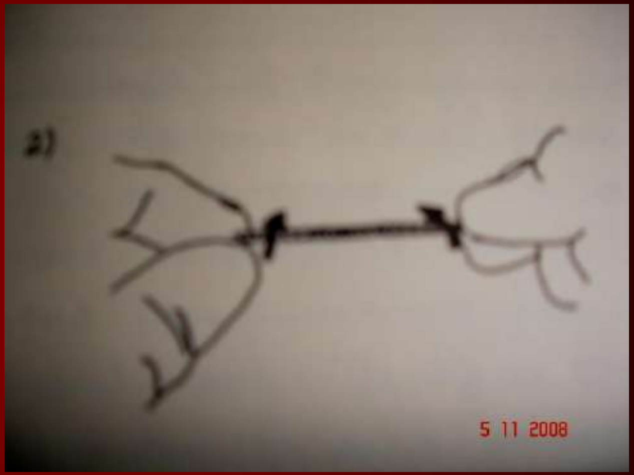
- Coagulate surface layer of sulcular and free gingival epithelium and seeped fluids.
- 8% Zinc chloride and Silver nitrate.

Side effects –

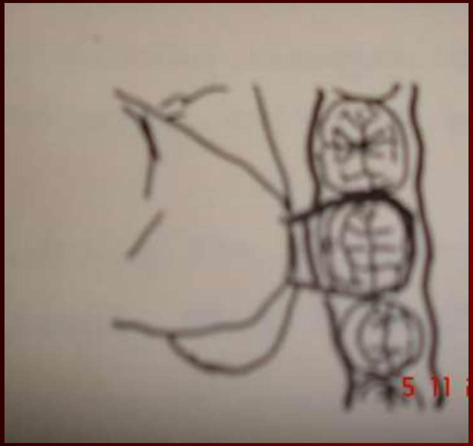
1. Ulceration.
2. Local necrosis.

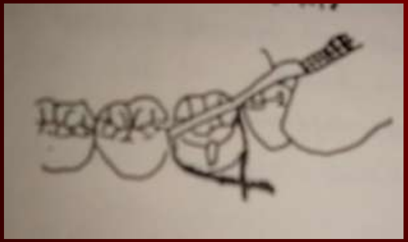
Retraction cord (procedure)





1. Operating area must be dry.
2. Cut 5.0 cm of cord from dispenser.
3. Make it taut by twisting and moisten it in 25% Aluminium Chloride.

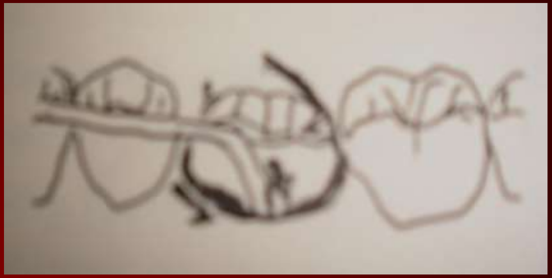




4. Form a ‘ U ‘ and loop it around tooth.

5. Gently slip the cord between tooth and gingiva in mesial inter prox. Area using Fischer packing inst.

6. Proceed to lingual surface from ML to DL corner.



Correct method **Incorrect method**

7. Tip of the instrument should be inclined where the cord has already been packed.

8. Continue in buccal area.

9. Overlap in mesial prox. Area.

10. Cut off all but 2-3 mm of cord.

11. Remove cord after 10 min.

III Electrosurgery

- Used in situations where use of retraction cord is not feasible.
- Introduced by D' Arsonval (1891).
- Electricity at high frequency will pass through the body without producing a shock, producing instead an increase in the internal temperature of the tissue.

Electrosurgical unit –

It is a high frequency oscillator or radio transmitter that delivers a high frequency current of at least 1.0 Mhz.

It is also called as Surgical diathermy.

Mechanism –

- Produces controlled tissue destruction.
- Current flows from small cutting electrode.
- The cells directly adjacent to electrode are destroyed by this temp. increase.
- The current concentrates at points and sharp bends.
- Circuit is completed by contact between patient and ground electrode.
- Cutting electrode remains cold.

Types of action –

1. Cutting
2. Coagulation
3. Fulgeration

4. Dessication.

Technique –

- Profound anesthesia.
- Place a drop of aromatic oil on vermillion border of upper lip to mask the burning smell.
- Check the equipment to rule out any loose connection.
- Cutting electrode should be applied with very light pressure and quick deft stroke.
- Electrode should move at speed of 7mm per sec.
- If necessary retrace the path of previous cut after 8-10 sec.
- Electrode should not drag or char tissues.

- Electrode should not drag or char tissues.
- Moist tissue will cut best.
- Stop to clear fragments of tissues clinging to electrode.

C/ I –

- Not to be used in patients with cardiac pacemakers.
- Not to be used in case of flammable agents.
- Keep cotton moist when used with nitrous oxide analgesia.

<u>Grounding</u> –

Ground electrode shall be under thigh rather than under back. Make sure there are no keys in patients pocket.

IRRIGANTS USED IN ROOT CANAL TREATMENT

INTRODUCTION

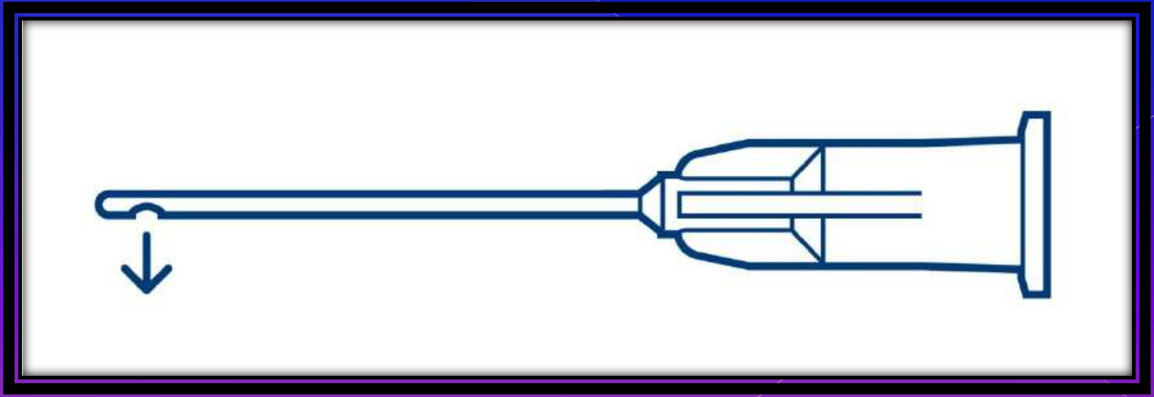
- With the endodontic procedures, it is impossible to shape and clean the root canal completely. This is mainly due to the complex anatomy of the root canal system.
- To assist in the cleaning and debridement of the canal a range of irrigating and disinfecting solutions have been used.

IDEAL PROPERTIES OF IRRIGANTS

- Should remove debris and smear layer
- Disrupt adhesive biofilm
- Highly effective disinfectant
- Opening of the dentinal tubule
- Destruction of microorganisms, have a broad spectrum antibacterial activity.
- Dissolve necrotic pulp tissue remnants.
- Inactivate endotoxin.
- Be non toxic and non-allergenic

TECHNIQUE OF IRRIGATION

- Instrument used:- Disposable luer lock syringe with endodontic blunt ended side vented needle. The needle should be bent at an obtuse angle.
- The needle is inserted partway into the root canal.
- Should be inserted passively without binding.



VARIOUS IRRIGANTS

- Normal saline
- Sodium hypochlorite,
- Chlorhexidine Digluconate
- EDTA
- Hydrogen peroxide
- Biopure MTAD
- RECENT ADVANCES

NORMAL SALINE

- Gross debridement and lubrication of root canals
- 0.9%w/v is commonly used
- Acts by flushing action
- Used as an adjunct to other chemical irrigants
- Can be used as final rinse to remove any chemical irrigant left after root canal preparation

Advantages

- It is biocompatible in nature
- No adverse effect even if extruded periapically

Disadvantages

- Does not possess dissolution and disinfection properties
- Does not remove smear layer

SODIUM HYPOCHLORITE

- Most popular irrigant
- Reducing agent, clear ,straw coloured solution containing about 5% of available chlorine
- On ionization produces:- hypochlorous acid and hypochlorite ion
- Antimicrobial ability

- Most effective concentration :- 5.2%
- Commonly employed 2.5% as it decreases the potential for toxicity while maintaining some tissue dissolving and antimicrobial activity Oxidize and hydrolyze cell proteins
- Completely dissolves entire pulp in 20 mint to 2 hours

Destruction of bacteria takes place in two phases:-

1. Penetration in to the bacterial cell wall
2. Chemical combination with the protoplasm of the bacterial cell and disruption of DNA synthesis

DRAWBACKS :-

1.Cytotoxicity and caustic effects on healthy periradicular tissues
2. Does not remove the inorganic component of endodontic smear layer
3. It has an unpleasant taste
4. Should be kept in cool place , away from sunlight .

SODIUM HYPOCHLORITE ACCIDENT

CHLORHEXIDINE DIGLUCONATE

- Broad spectrum antimicrobial agent
- 0.2% -2% concentration
- Most effective against Ent.faecalis seen in clinical failure cases

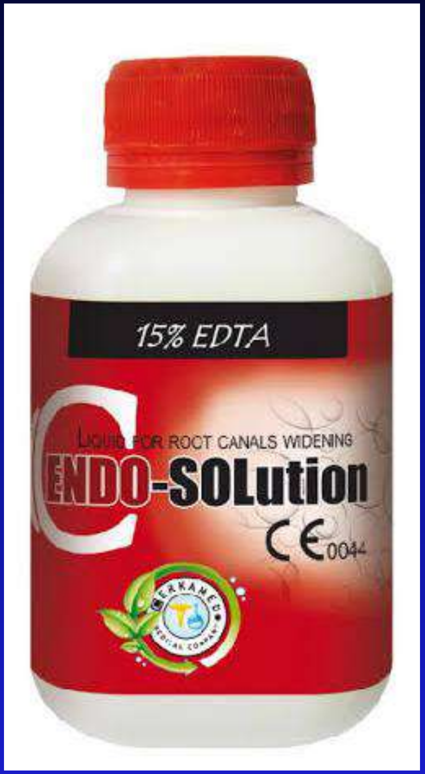
Mechanism of action

- CHX is a cationic molecule that acts by adsorbing onto the cell wall of the microorganism, disrupting the integrity of the cytoplasmic membrane.
- 0.2% it is bacteriostatic
- 2% it is becteriocidal

Properties

- Effective antimicrobial with low toxicity
- Substantivity
- Draw back:- does not remove the smear layer

EDTA (Ethylene diamine tetraacetic acid) by Nygaard- Ostby

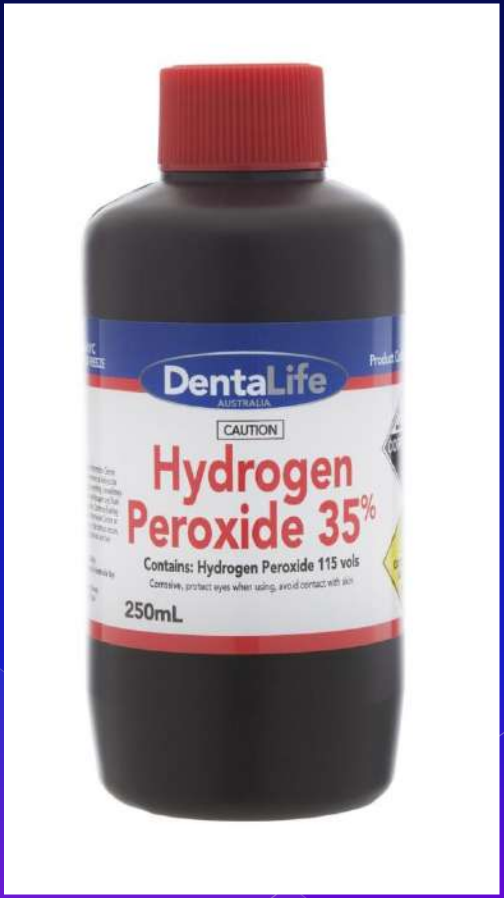


- Most commonly used to remove the smear layer
- Lubricating instruments
- EDTA is normally used in the concentration of 17%.
- Mechanical preparation because of its chelating effect
- Time is for 1 minute followed by final rinse.

- Relatively non toxic and only slightly irritating in weak solutions
- Forms highly stable soluble metal chelates in combination with heavy metals or alkaline earth ions.
- Effective in softening dentin
- Removes smear layer
- Capable of causing moderate degree of irritation

HYDROGEN PEROXIDE

- It is an oxidizing agent. It has two modes of action
  - Bubbling of the solution, physically forms debris from the canal
  - Liberation of oxygen destroys strictly anaerobic microorganisms.
- However, peroxide should not be the last irrigant used in a canal because nascent oxygen may remain after access preparation closure and build up pressure.



BIO PURE MTAD

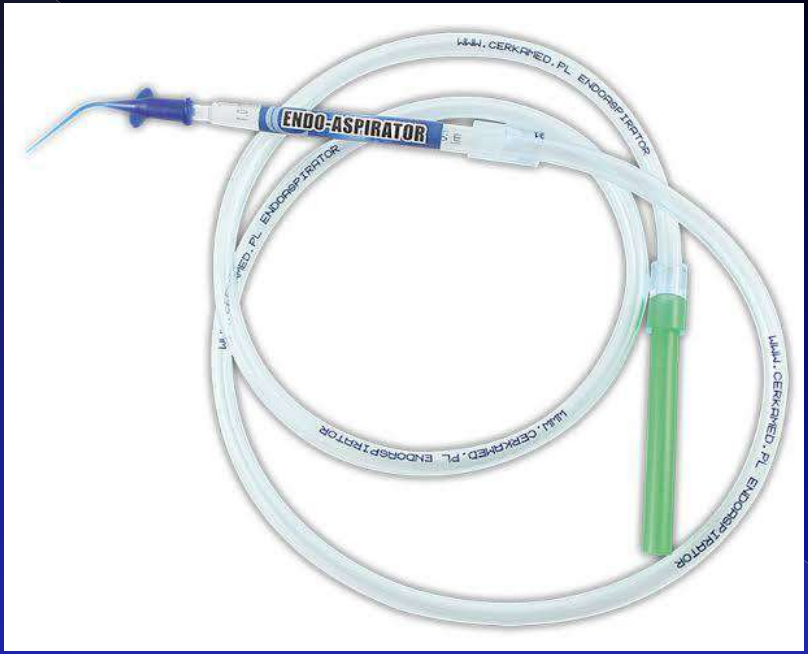
- It is a mixture of a tetracycline isomer, an citric acid, and a detergent (Tween 80)
- Removing smear layer.
- More effective in killing E. Faecalis than NaOCl.
- The combination of NaOCl and MTAD has been advocated to remove the smear layer and also has substantial antimicrobial efficacy

RECENT IRRIGANTS

- Electrochemically activated water
- Ozone
- Lasers
- Photo activated disinfection

IRRIGATION SYSTEMS

- The Endox System
- Endovac System
- Dental Aid (Apical Irrigation Delivery) System
- Rinse Endo
- Ultrasonic Irrigation


ENDO-ASPIRATOR
WWW.CERKAMED.PL

IRRIGATION REGIMEN

- Between instruments, canals should be irrigated using copious amounts of the hypochlorite solution.
- Once the shaping procedure is completed, canals can be thoroughly rinsed using aqueous EDTA or citric acid.
- Generally each canal is rinsed for at least 1 min using 5 to 10ml of the chelator irrigant.
- After the smear removing procedure a final rinse with an antiseptic solution appears beneficial.

COMPLICATIONS DURING ROOT CANAL IRRIGATION

1. Damage to clothing
2. Damage to eye
3. Injection of hypochlorite or hydrogen peroxide beyond the apex
4. Allergic reaction to NaOCl
5. Air emphysema


Thank You!

OBTURATION OF ROOT CANAL SYSTEM

INTRODUCTION

"***Obturation of the root canal system*** *is defined as the three dimensional filling of the entire root canal system as close to the cemento-dentinal junction as possible"* ***to obtain a fluid impervious seal*** *which will hinder the invasion of microorganism and potential nutrients that would support biological growth.*

OBJECTIVES OF CANAL OBTURATION

A 3-dimensionally well-fitted root canal system does the following:

•Prevents **PERCOLATION** of Periapical exudates into the Root canal .

•Prevents **REINFECTION.**

•Creates a **FAVOURABLE BIOLOGICAL ENVIRONMENT** for the process of tissue healing to take place.

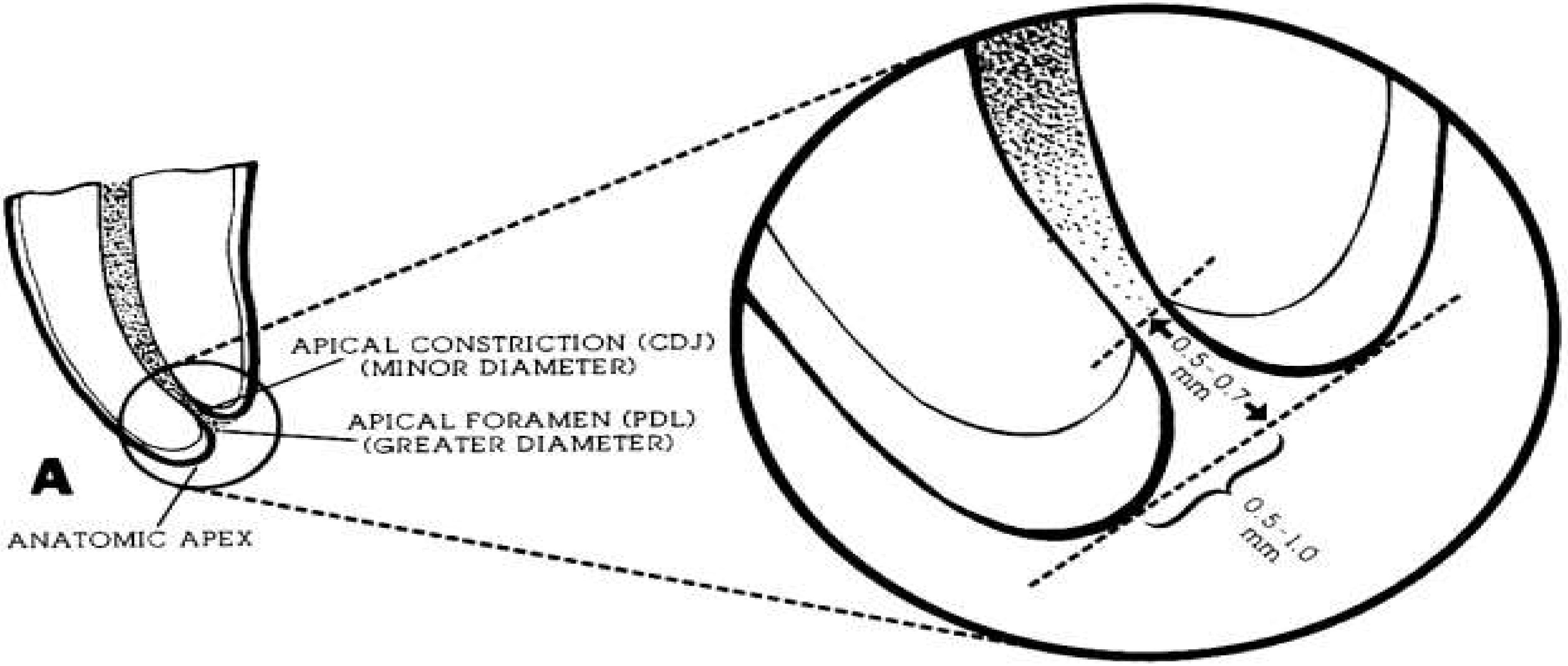
ROOT CANAL READY TO OBTURATE?

CRITERIA

- The tooth is asymptomatic, no pain, tenderness, or apical periodontitis.
- The canal is dry. There is no exudate / seepage.
- No sinus tract.
- There is no foul odour (suggests residual infection / reinfection) due to anaerobes.
- Temporary filling is intact (Broken / leaking filling cause recontamination of the canal).
- A negative culture.

EXTENSION OF THE ROOT CANAL FILLING

- The ***dentinocemental junction is an average of about 0.5 to 0.7 mm from the external surface*** of the apical foramen, as clearly demonstrated by ***Kuttler,*** and is the major factor in limiting filling material to the canal.



Requirements of an ideal root canal filling material

Grossman 1940
Easily introduced
Liquid or semisolid and become solid
Seal laterally and apically
Not shrink
Impervious to moisture
Bacteriostatic
Not stain tooth
Not irritate periapical tissues
Easily removed
Sterile or sterilizable
Radiopaque

ROOT CANAL FILLING MATERIALS

Solid root canal filling materials

- SILVER CONES
- STAINLESS STEEL FILES
- AMALGAM

NEWERMATERIAL :- RESILON

Semisolid root canal filling materials

GUTTA PERCHA

- Thermoplasticized gutta percha
- Thermo-mechanical
- Carrier based gutta percha

Paste filling materials

- Russian red
- Paraformaldehyde pastes
- Mineral trioxide aggregate

SEALERS

SILVER POINTS

Introduced by JASPER 1933 ,Widely used till 1960 s.

INDICATIONS

1)**Mature teeth** with small or round tapered canals:

2)Maxillary first premolars with two or three canals,

3)Buccal roots of mature maxillary molars

4)Mesial roots of mandibular molars if they are straight.

CONTRAINDICATIONS

1)In youngsters, even these canals are too large and too ovoid for single silver point use.

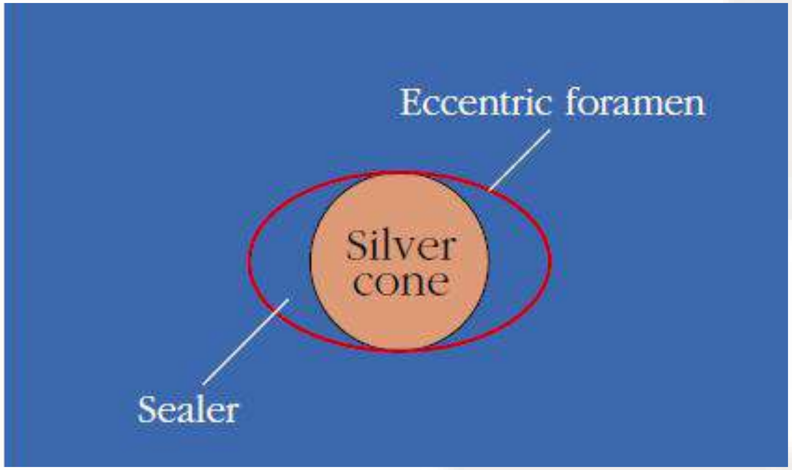
2)Silver points are also not indicated for filling anterior teeth,

3)Single canal premolars, or

4)Large single canals in molars.

DISADVANTAGES OF SILVER POINTS

- when the apical foramen is ovoid, will never be able to seal that foramen .



- If the silver cone has been sectioned at the canal orifice or, worse yet, within the root canal itself, its removal can be very difficult.

- Metallic corrosion sets in as a result of oxidation.

SEMI SOLID FILLING MATERIAL
GUTTA - PERCHA

- Gutta-percha is a name derived from two words.

"GETAH"- meaning gum

"PERTJA"- name of the tree in Malay language

- **Bowmen in 1867.**
- **Source** :-from the rubber trees
- Gutta-percha is a Trans- isomer of poly isoprene.
- **Alpha and beta**
- **commercial gutta-percha: beta crystalline form.**

COMPOSITION (*Friedman et al)*

Material	Percentage	Function
Gutta-percha	18-22%	Matrix
Zinc oxide	59-76%	Filler
Waxes/resins	1-4%	Plasticizer
Metal Sulfates	1-18%	Radiopaquer

Schilder et al investigated temperatures at which phase transitions

GUTTA PERCHA BETA FORM → Heated 42-49 °C → **ALPHA FORM** → Heated 53-59 °C → **AMORPHOUS**

Melting point is 80-100 degree C

ADVANTAGES

- Adapts excellently to the irregularities and contour of the canal by the lateral and vertical condensation method.
- It can be **softened** and made plastic by heat or by organic solvents (eucalyptol, chloroform, xylol, turpentine).
- It is **inert**.
- It has **dimensional stability**; when unaltered by organic solvents, it will not shrink.
- It is **tissue tolerant** (nonallergenic).
- It will **not discolor** the tooth structure.
- It is **radiopaque.**
- It can be **easily removed** from the canal when necessary

DISADVANTAGES

- It lacks rigidity. The smallest, standardized gutta-percha cones are relatively more difficult to use unless canals are enlarged above size no. 25.
- It lacks adhesive quality.
- It can be easily displaced by pressure. Gutta-percha permits vertical distortion by stretching. This characteristic may tend to induce overextension during the condensing process.

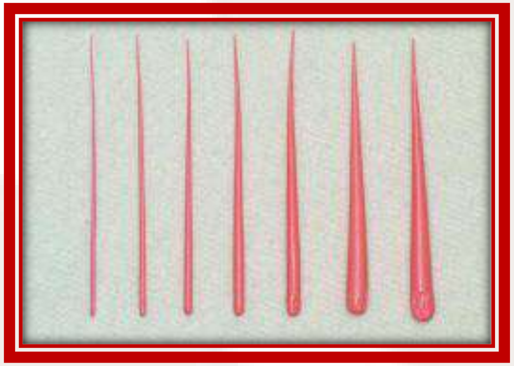
CONFIGURATION

Gutta-percha points (or cones) are supplied in two shapes.

Also available as pellets for thermoplasticized techniques

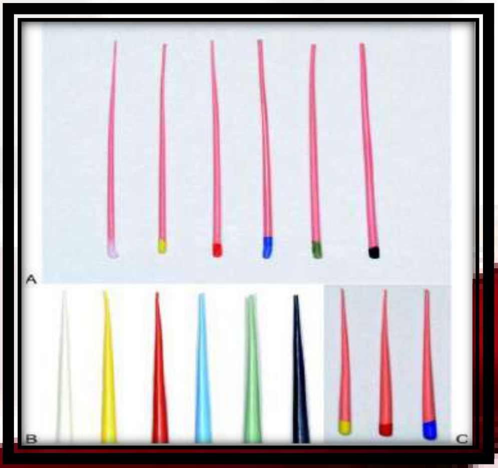
Traditional Form

sizes:- Conventional gutta-percha cones: extra fine, fine fine, fine, medium fine, fine medium, medium, large, and extra large.



Standardized form

A, Standardized cone sizes #15 to #40.
B, Standardized cones #.06, taper sizes #15 to #40.
C, Standardized cones Protaper S1, S2, S3.

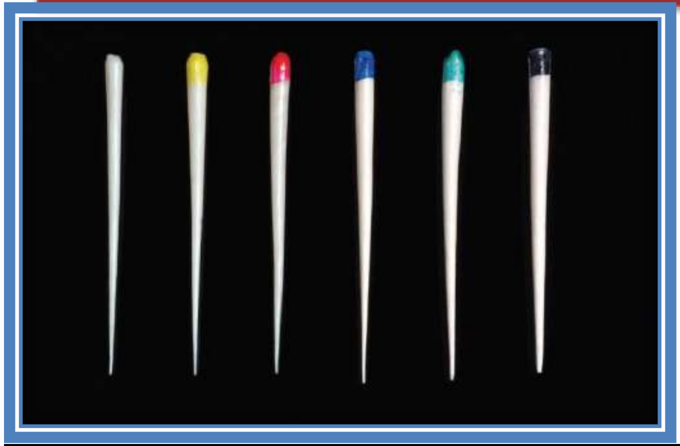


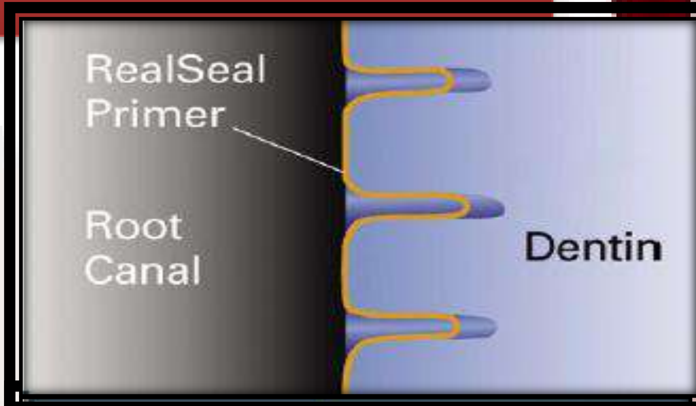
STERILIZATION :- 5.25%NaOCl for 1 mint

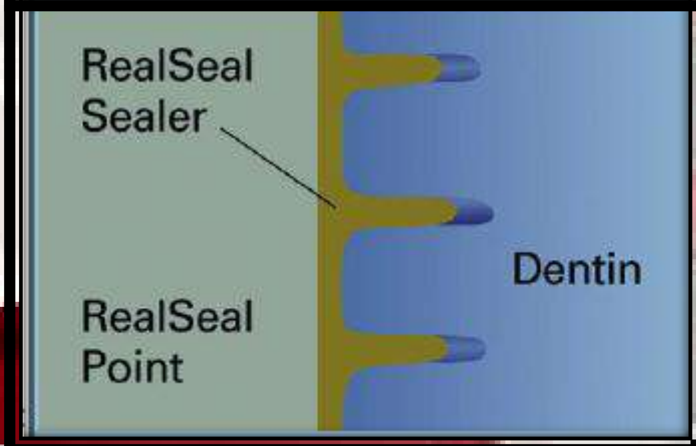
RESIN BASED OBTURATION SYSTEM :- RESILON

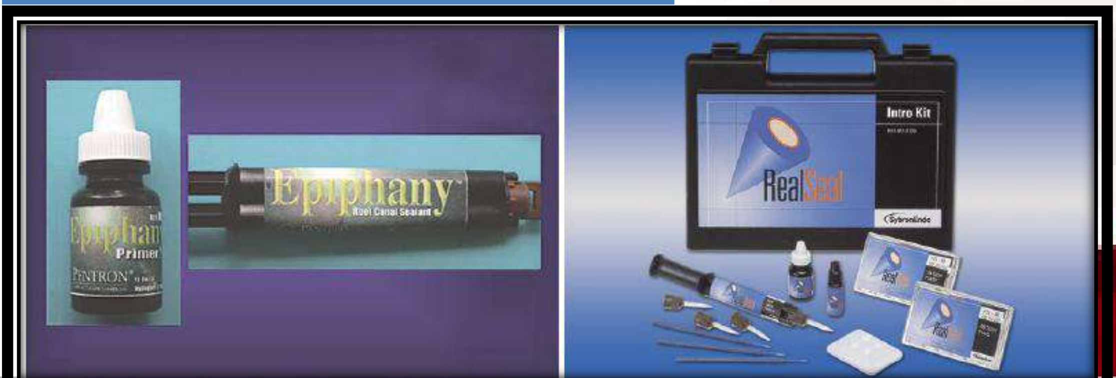
Resilon system consists of primer ,sealer:- epiphany and synthetic polymer points or pellets .

Composition :- polyester, difunctional methacrylate resin, bioactive glass, and radiopaque fillers and a resin sealer.



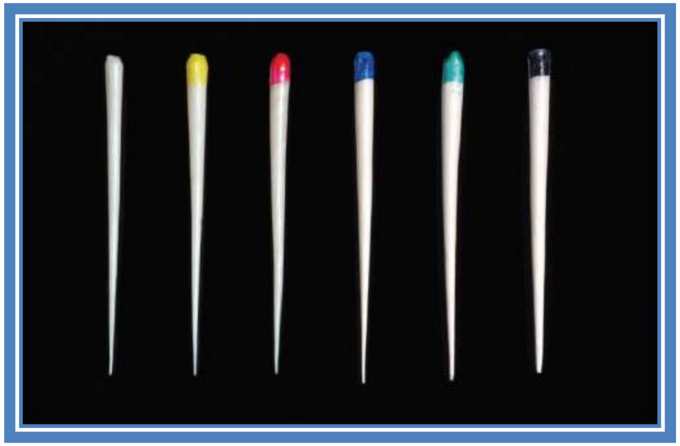


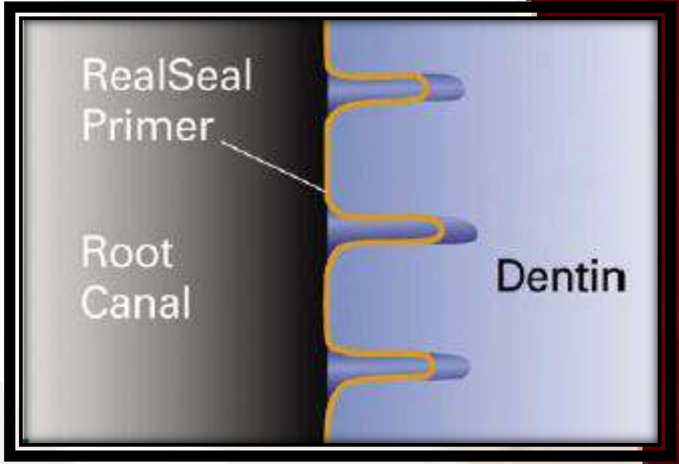


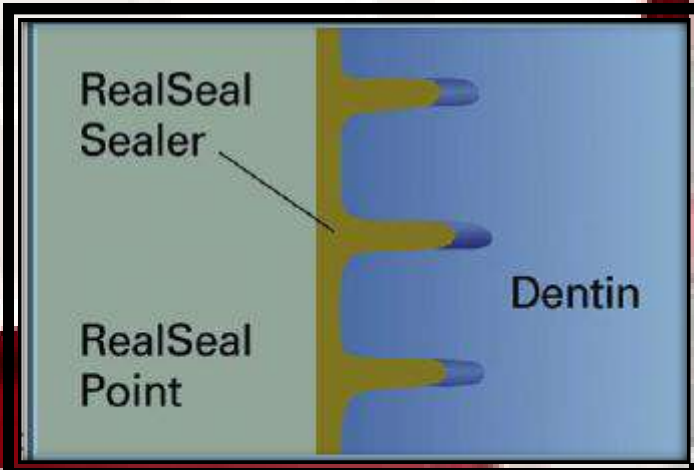


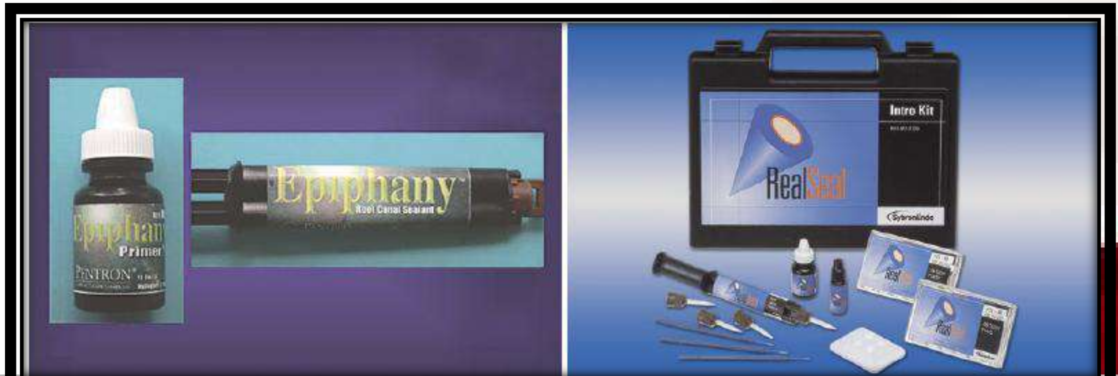
Resilon system consists of primer ,sealer:- epiphany and synthetic polymer points or pellets .

Epiphany system with the primer, thinning resin, sealant and standardized Resilon points.









ACCORDING TO GROSSMAN

- Cold Lateral condensation
- Warm Vertical Condensation
- Continuous wave compaction technique
- Compaction (McSpadden thermomechanical technique)
- Thermoplasticized gutta percha injection
- Carrier based gutta percha :- thermafill thermoplasticized ,simplifill sectional obturation
- Chemically plasticized gutta percha
- Custom cone

ACCORDING TO INGLE

I. Solid Core Gutta-Percha with Sealants

A. Cold gutta-percha points

1. Lateral compaction
2. Variations of lateral compaction

B. Chemically plasticized cold gutta-percha

1. Essential oils and solvents
a. Eucalyptol
b. Chloroform
c. Halothane

C. Canal-warmed gutta-percha

1. Vertical compaction
2. System B compaction
3. Sectional compaction
4. Lateral/vertical compaction
a. Endotec II
5. Thermomechanical compaction
a. Microseal System, TLC, Engine-Plugger,and Maillefer Condenser
b. Hybrid Technique
c. J.S.-Quick-Fill
d. Ultrasonic plasticizing

D. Thermoplasticized gutta-percha

1. Syringe insertion
a. Obtura
b. Inject-R-Fill, backfill
2. Solid-core carrier insertion
a. Thermafil and Densfil,
b. Soft Core and Three Dee GP
c. Silver points

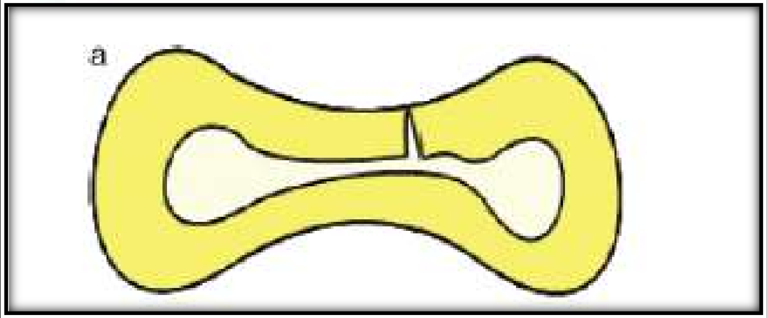
II. Apical-Third Filling

A. Light speed Simplifill
B. Dentin-chip
C. Calcium hydroxide

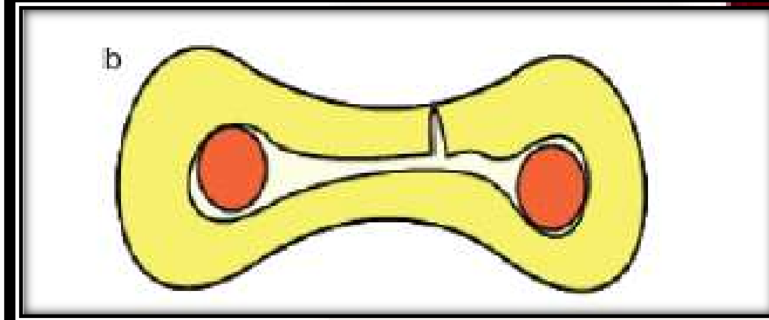
III. Injection or “Spiral” Filling

A. Cements
B. Pastes
C. Plastics
D. Calcium phosphate

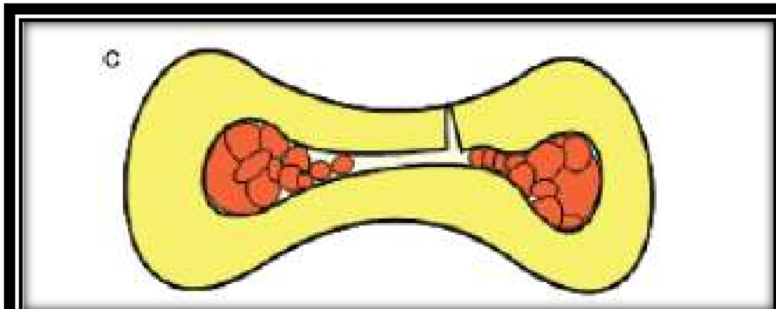
BASIC APPROACHES FOR OBTURATION



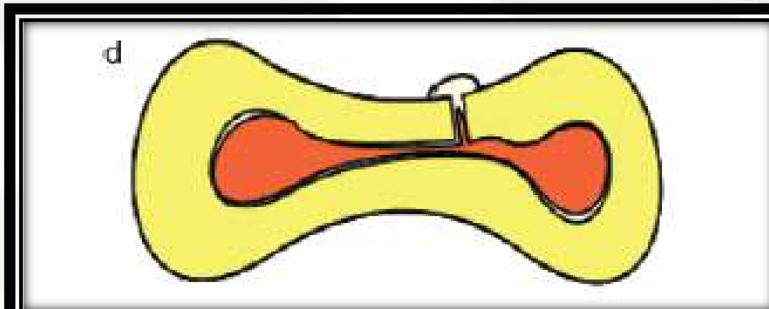
(A) paste only (sealer)
(least desirable)



(B) Single cones with paste (sealer)



(C) cold lateral condensation



(D) thermoplastic compaction.

A)COLD GUTTA PERCHA POINTS

LATERAL CONDENSATION TECHNIQUE(SOMMER)

First placing a sealer lining in the canal, followed by a measured primary point, compacted laterally by spreader to make room for additional accessory points. The final mass of points is severed at the canal's coronal orifice with a hot instrument, and final vertical compaction is done with a large plugger

Primary master cone selections

- Visual test
- Tactile test
- Patient response
- Radiographic test

1.0 to 2.0 mm of the true WL & match taper of preparation.

SPREADER SIZE DETERMINATION

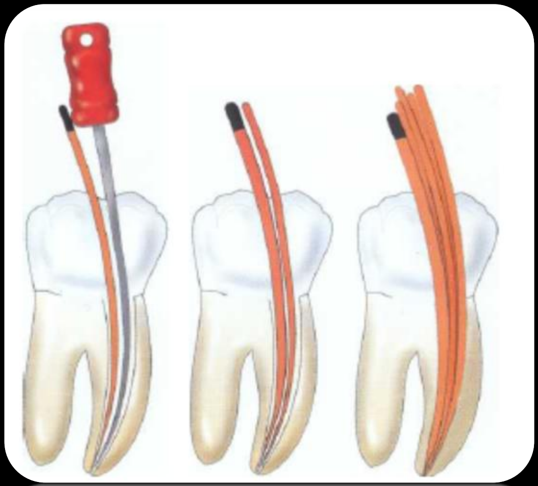
DRYING THE CANAL

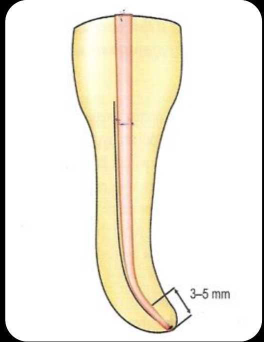
MIXING THE SEALER

PLACEMENT OF SEALER

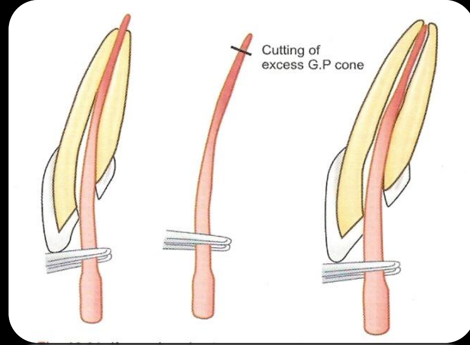
PLACEMENT OF MASTER CONE

AUXILIARY CONE PLACEMENT

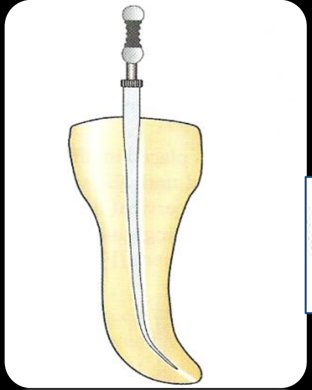




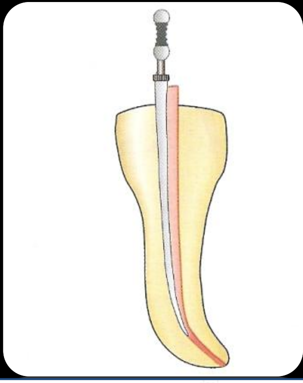
Tugback with master gutta-percha cone



If cone is going beyond apical foramen, cut the cone to working length or use larger no. cone



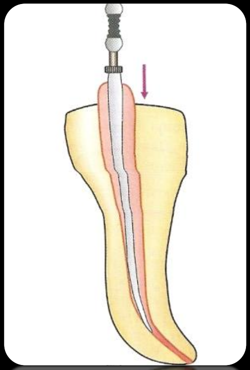
Spreader should match the taper of canal



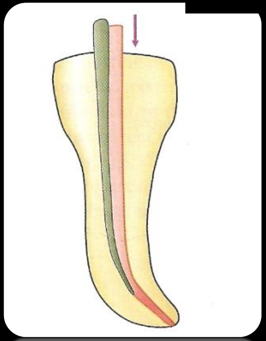
Placing spreader along gutta-percha cone

Rotary vertical motion is slowly moved apically to full penetration

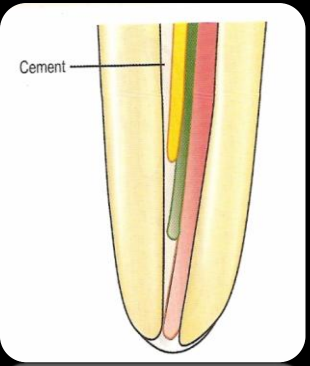
Weine recommends that the initial spreader be left in place a full minute

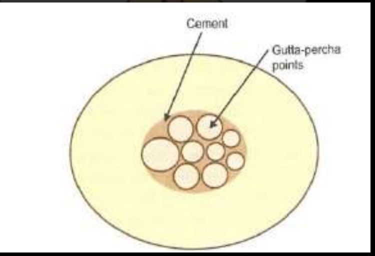


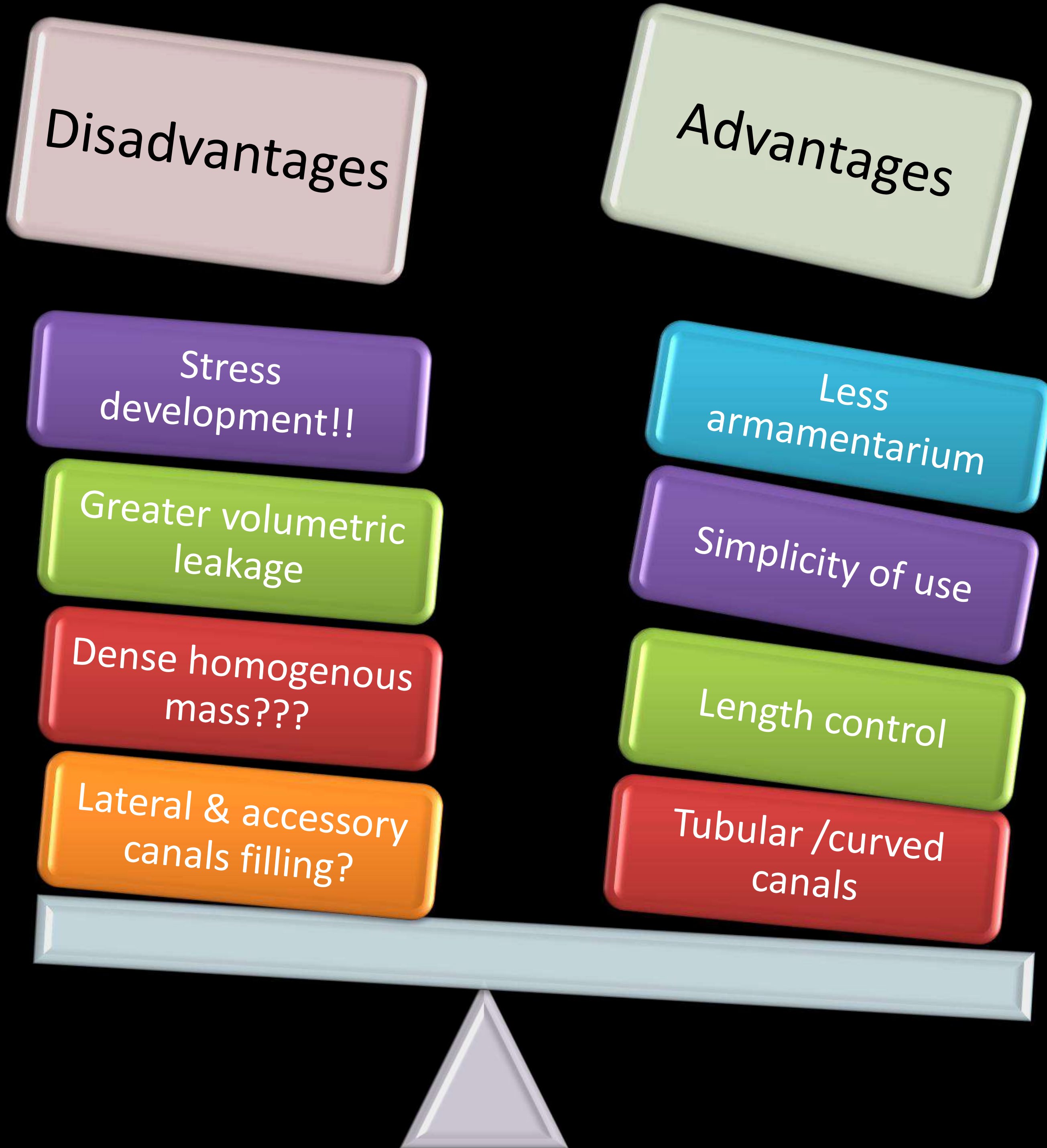
Compaction of gutta-percha using spreader



Placing accessory cone along master cone







Disadvantages
Advantages
Stress development!!
Greater volumetric leakage
Dense homogenous mass???
Lateral & accessory canals filling?
Less armamentarium
Simplicity of use
Length control
Tubular /curved canals

B) CHEMICALLY PLASTICIZED COLD GUTTA PERCHA

- This is a variation of a very old obturation method called "Callahan-Johnston technique" first given by Callahan in July of 1911.

Technique:

Primary point is blunted and fitted 2 mm short of working length.

Dipped in solvent (chloroform) for 1 second and kept aside for the partial evaporation of the solvent. Mean while sealer is placed in the canal

Primary cone is inserted to the working length, spreader placed for 1 minute to allow softened gutta percha to flow.

WARM VERTICAL CONDENSATION METHOD

Schilder introduced a concept of cleaning and shaping root canals in a conical shape and then obturating the space “three-dimensionally” with gutta-percha, warmed in the canal and compacted vertically with pluggers.

Indications

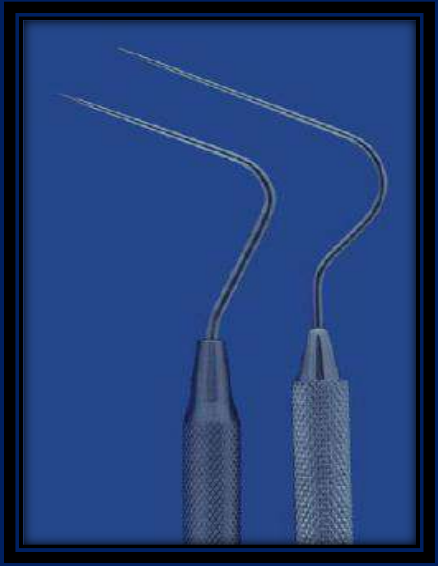
- When the fitting of a conventional master cone to the apical portion of a canal is impossible, as when there is a ledge formation,
- Perforations
- Unusual canal curvatures
- Internal resorptions
- Large lateral canals

WARM VERTICAL CONDENSATION METHOD

Technique (Schilder in 1967)

- **Prefitting the vertical pluggers**
- **Fitting the master point :-fit of the master cone is the key to success in this technique.**

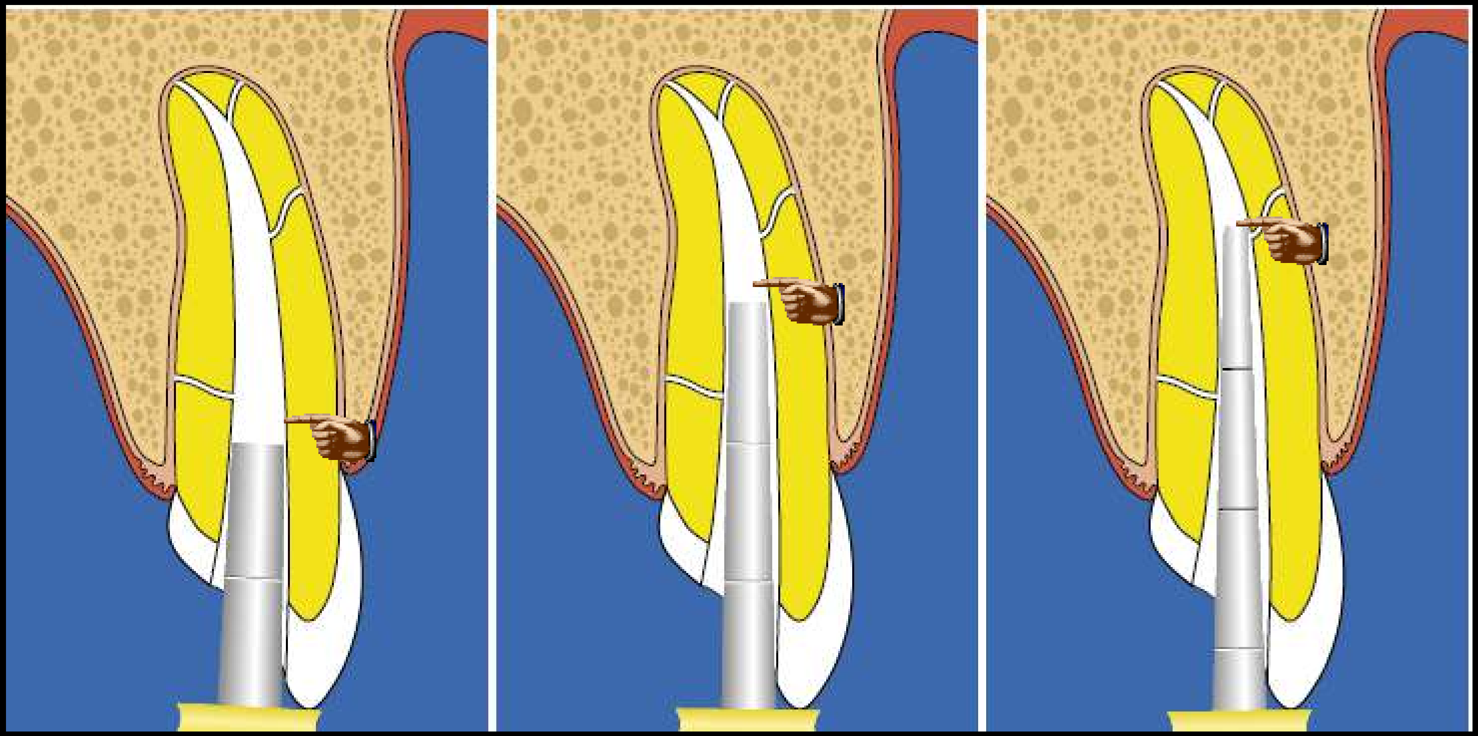
PLUGGERS



Heat carrier :-
O (LARGER) and OO (THINNER)

Touch n heat 5004

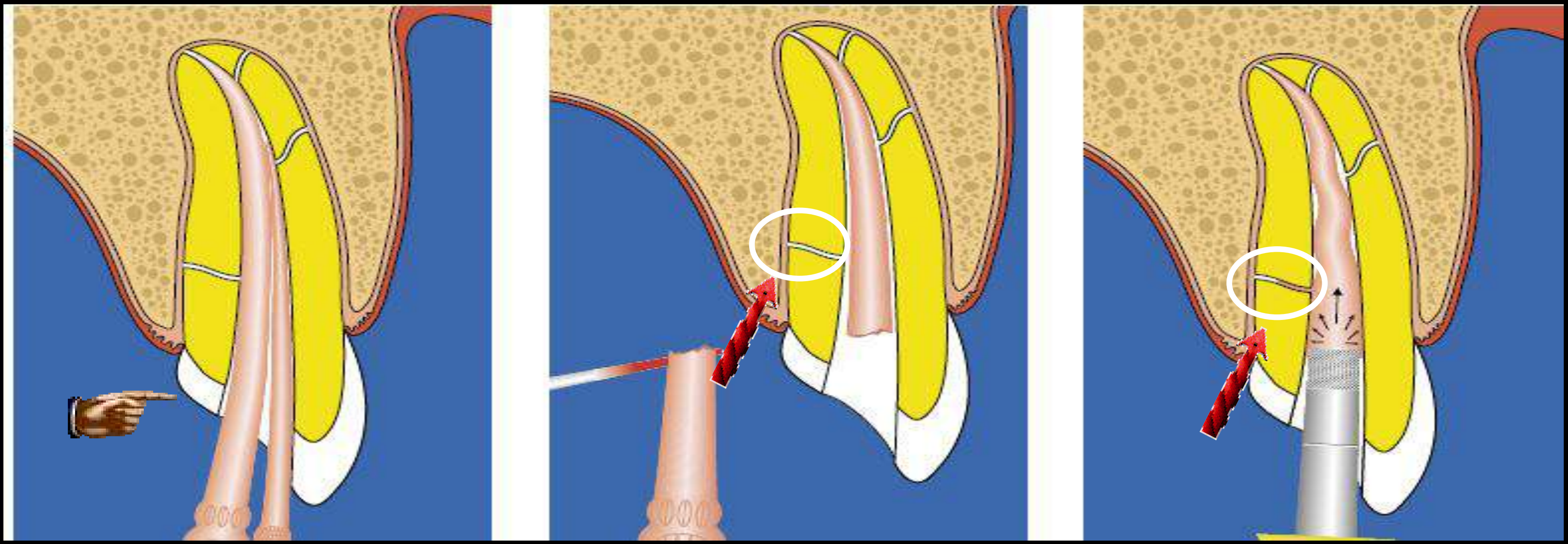
PREFITTING OF PLUGGERS



CORONAL THIRD VERTICAL PLUGGER :-10MM DEPTH

MIDDLE THIRD:- 15MM DEPTH

3-4 MM OF APEX



Master gutta-percha cone fits tightly to radiographic apex.
Marked at incisal edge to establish length reference.
Master cone cut back 0.5 to 1.0 mm at tip and retried in canal.

Sealer deposited in mid canal with Lentulo spiral. Apical third of master cone is lightly coated with sealer and gently teased to place. Incisal reference checked.
Surplus gutta percha removed with heat carrier down to canal orifice.

Largest plugger compacts warmed gutta-percha with sustained 5- to 10-second pressure. **This is the first heat wave**.

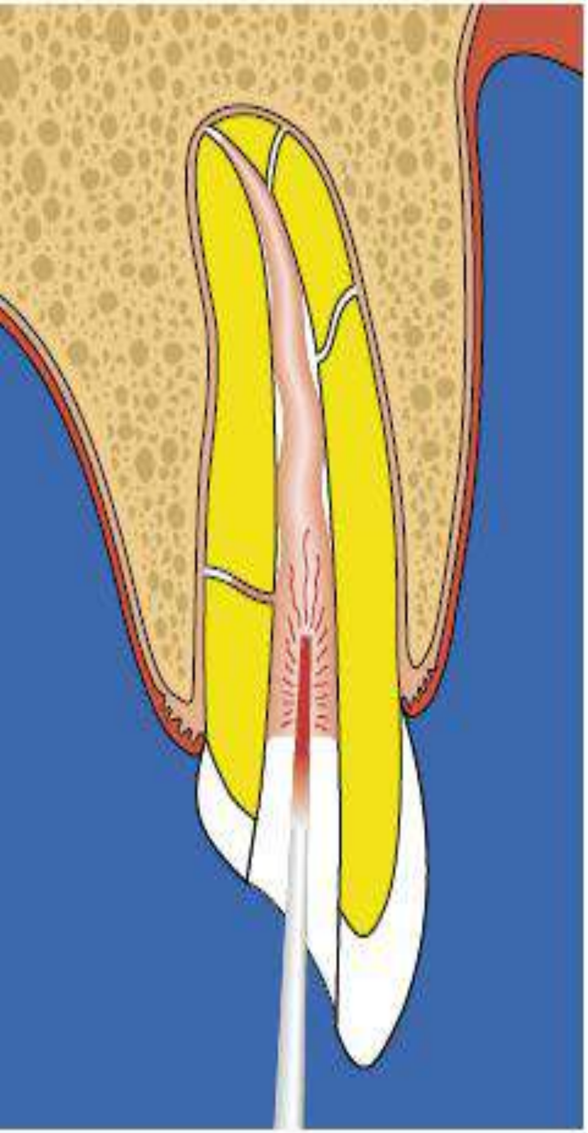


Fig. 24.34. The assistant returns the heat-carrier, which is introduced into the center of the gutta-percha cone in the root canal.

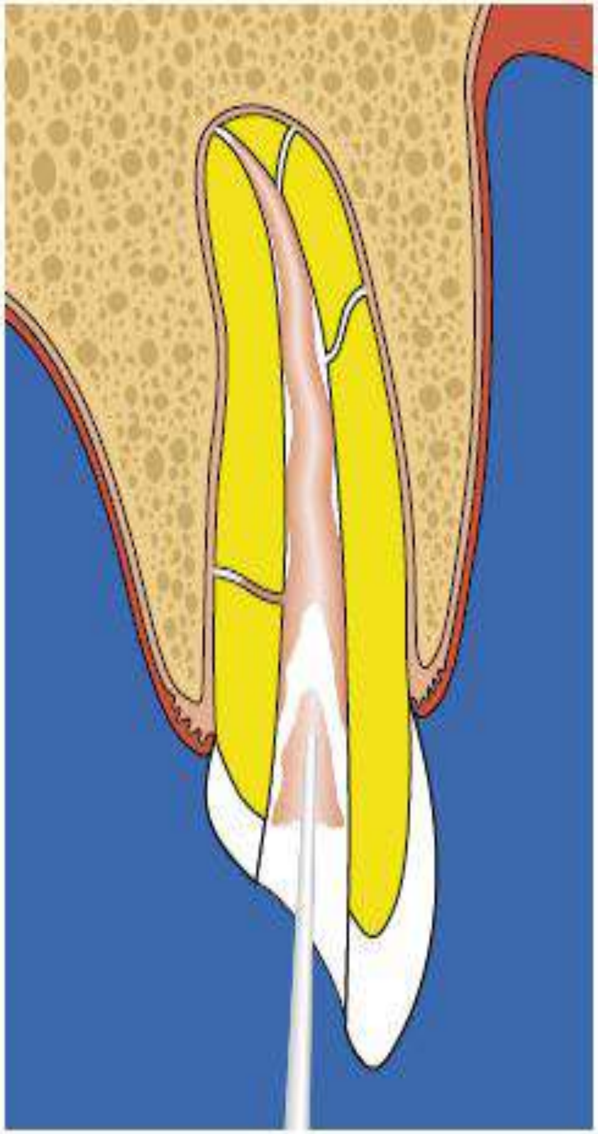


Fig. 24.35. The heat-carrier is heating the gutta-percha apically to its tip and removes the surrounding material from the canal.

Fig. 24.36. The heat-carrier is withdrawn, carrying the cooled gutta-percha around it. This way, the level of the next compaction will be more apical.

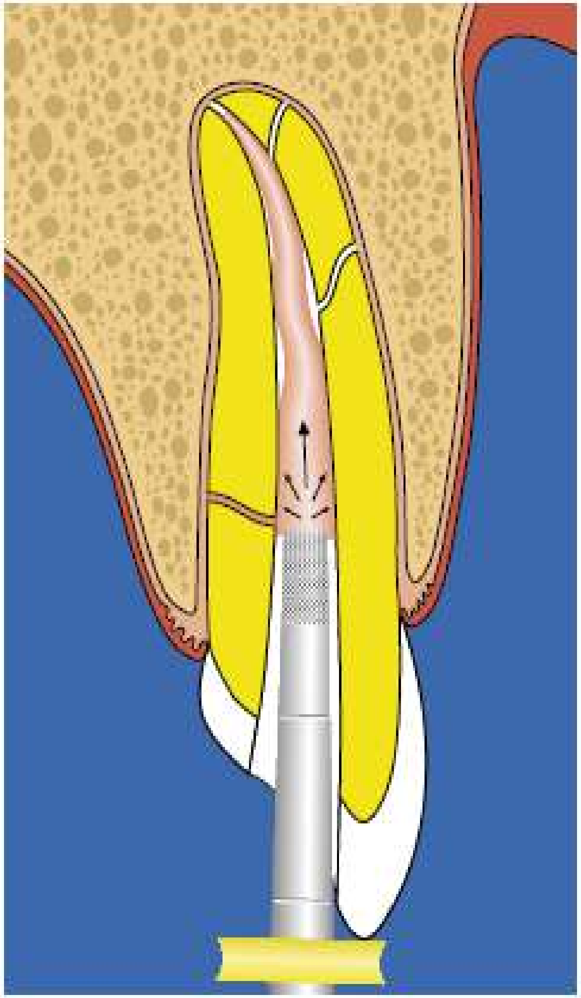


Fig. 24.37. The # 10 plugger repeats and completes the vertical compaction process in the coronal third. Once the rubber stop is approaching the reference point, it is time to select a plugger of slightly smaller diameter, like the # 9.

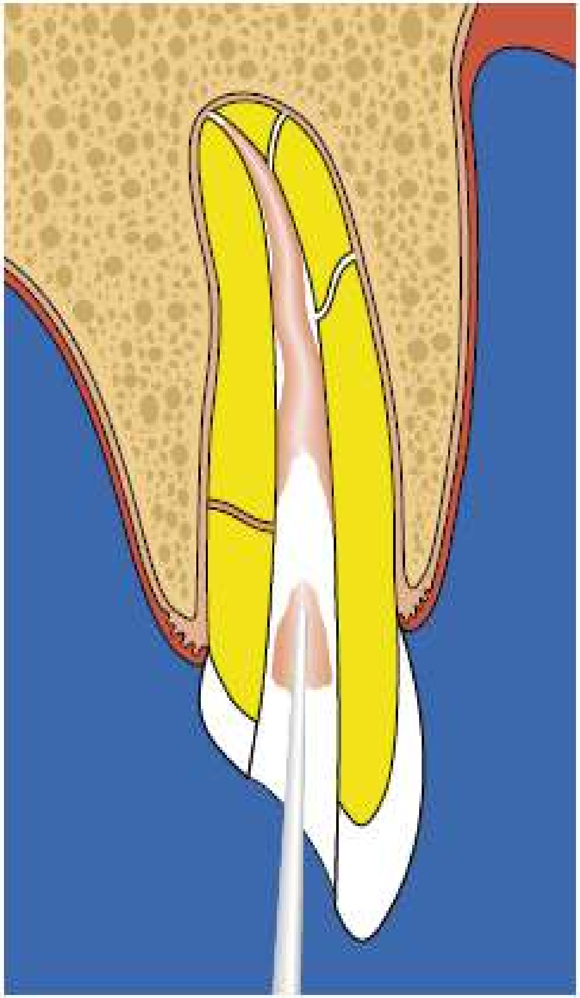


Fig. 24.38. The assistant returns the heat-carrier, which is activated for just one second once it is in contact with the gutta-percha inside the root canal. It is then inserted directly into the central portion of the gutta-percha to a depth of 3-4 mm and quickly inactivated and withdrawn while it is cooling, so that at the same time it removes another bite of material from the root canal.

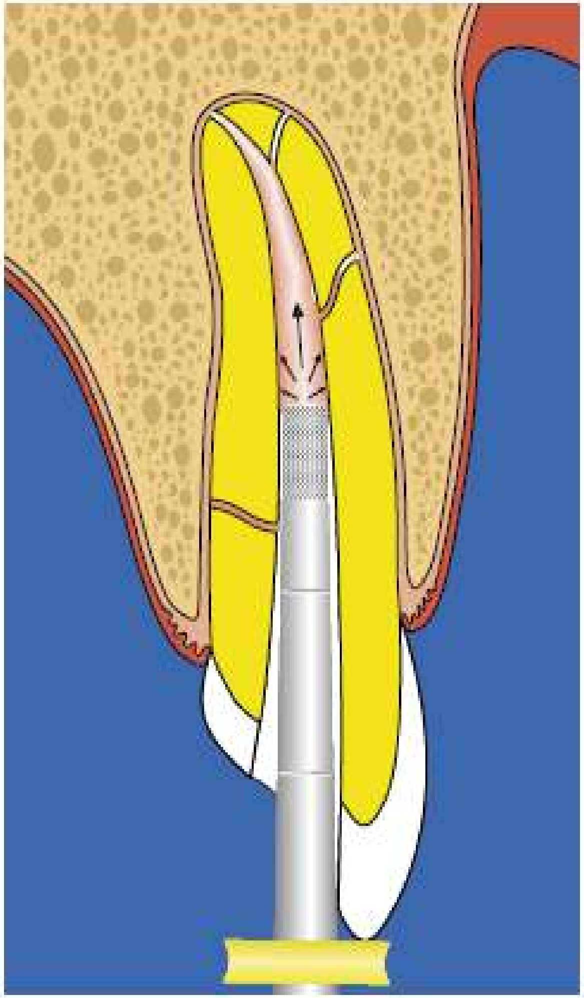


Fig. 24.39. The # 9 plugger has completed its vertical compaction to its maximal working depth.

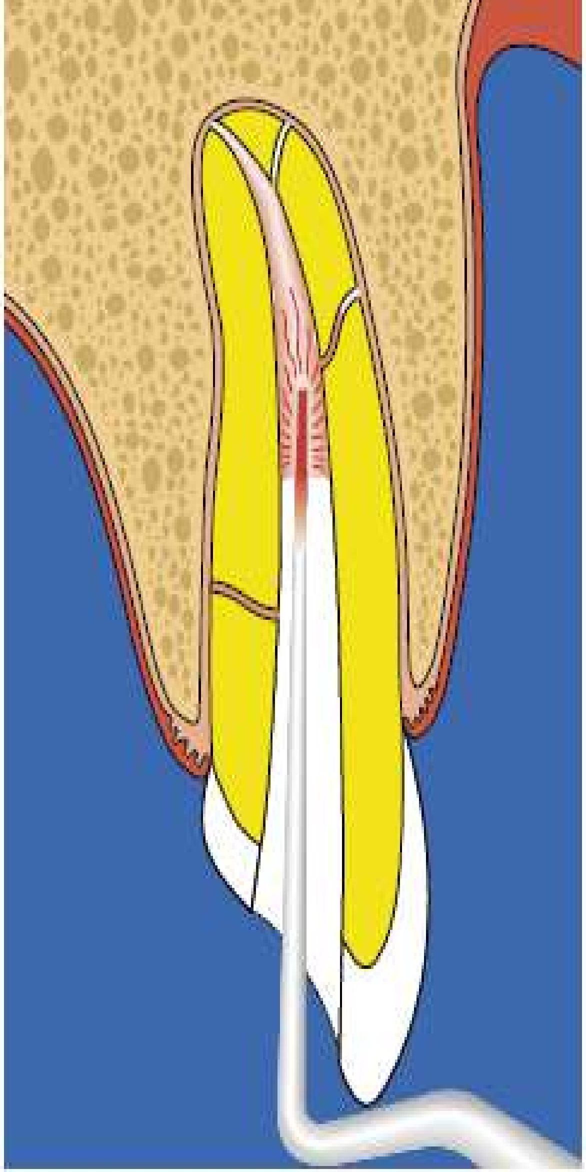


Fig. 24.40. A new introduction of the heat-carrier is softening the gutta-percha in the apical one third.

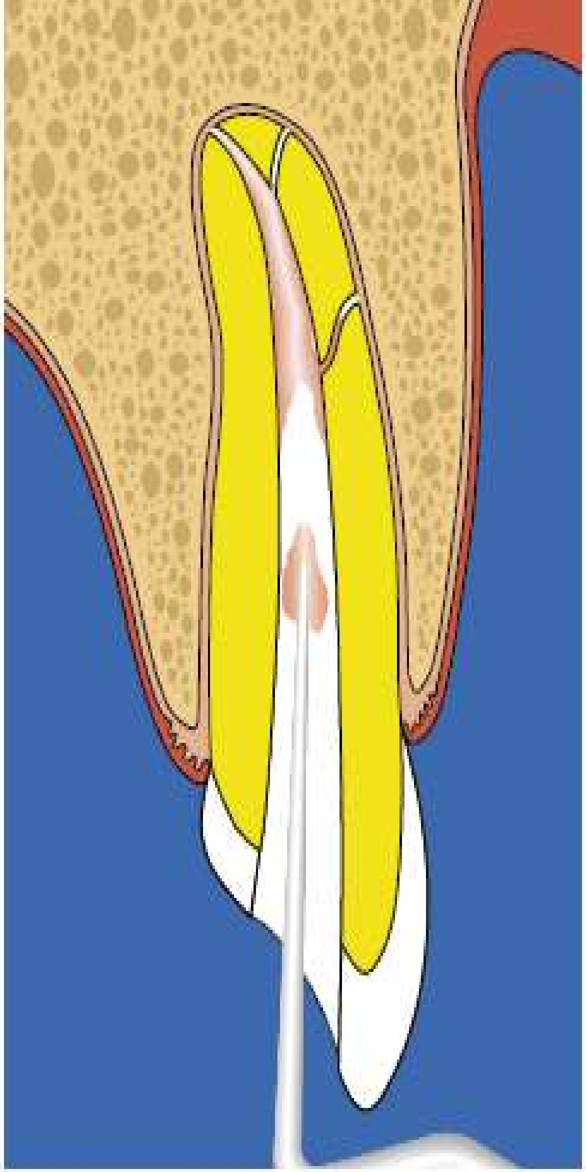


Fig. 24.41. Another piece of gutta-percha has been removed. Now it is time to use the smallest plugger, # 8.

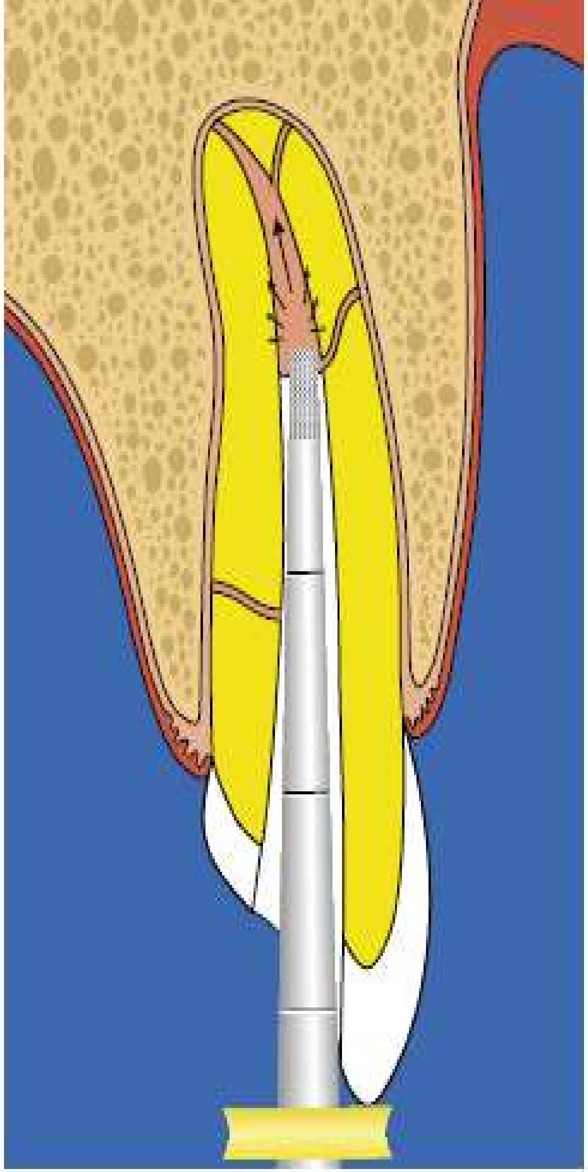
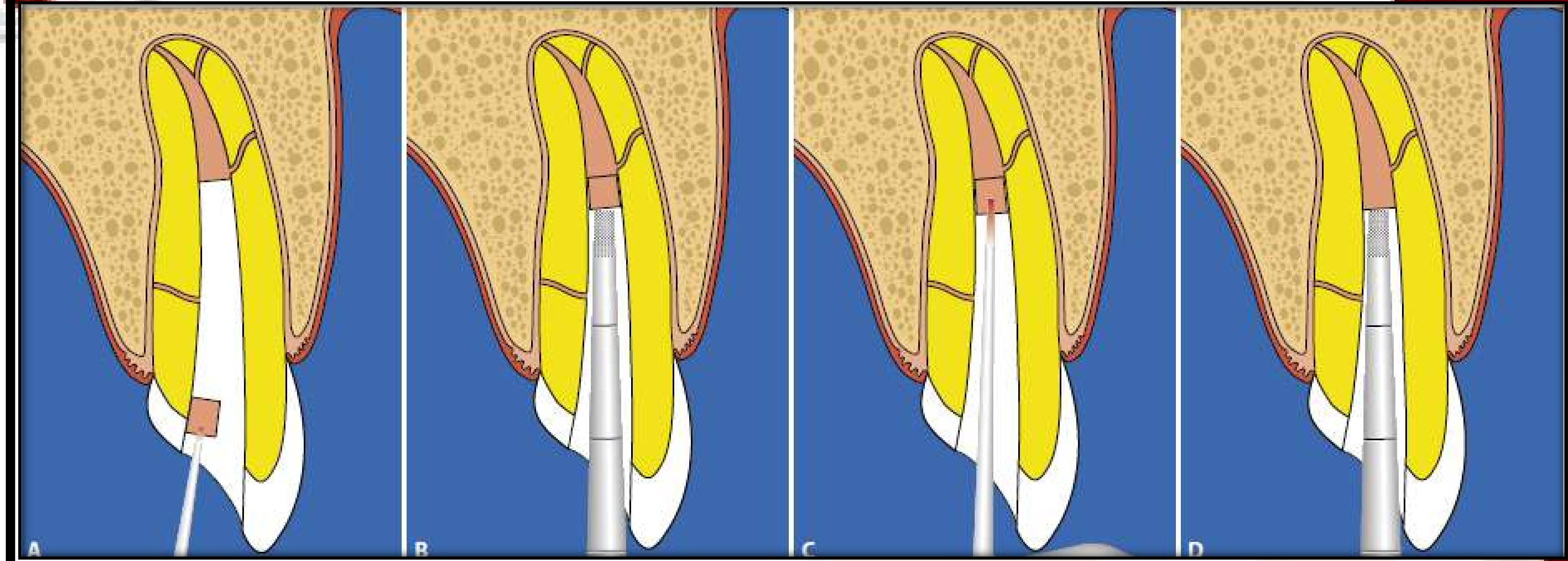
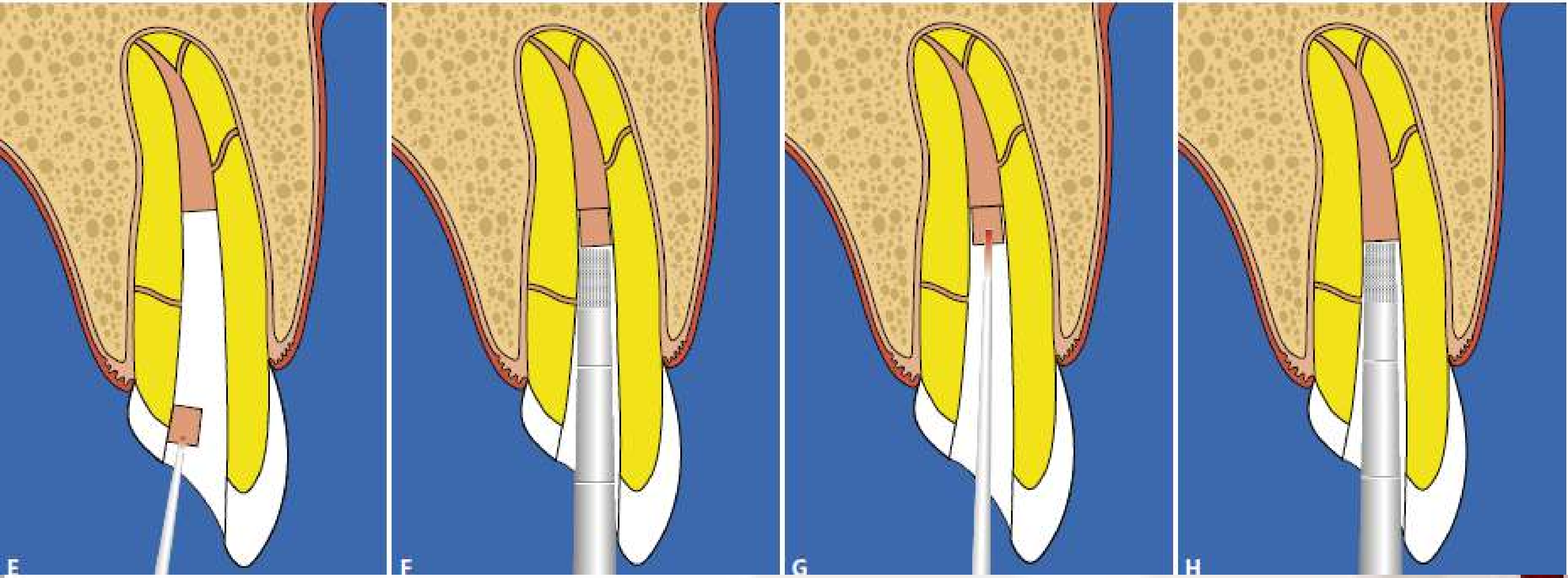


Fig. 24.42. The # 8 plugger has advanced, compacting about 5 mm from the canal terminus.

REVERSE FILLING OR “BACK-PACKING”

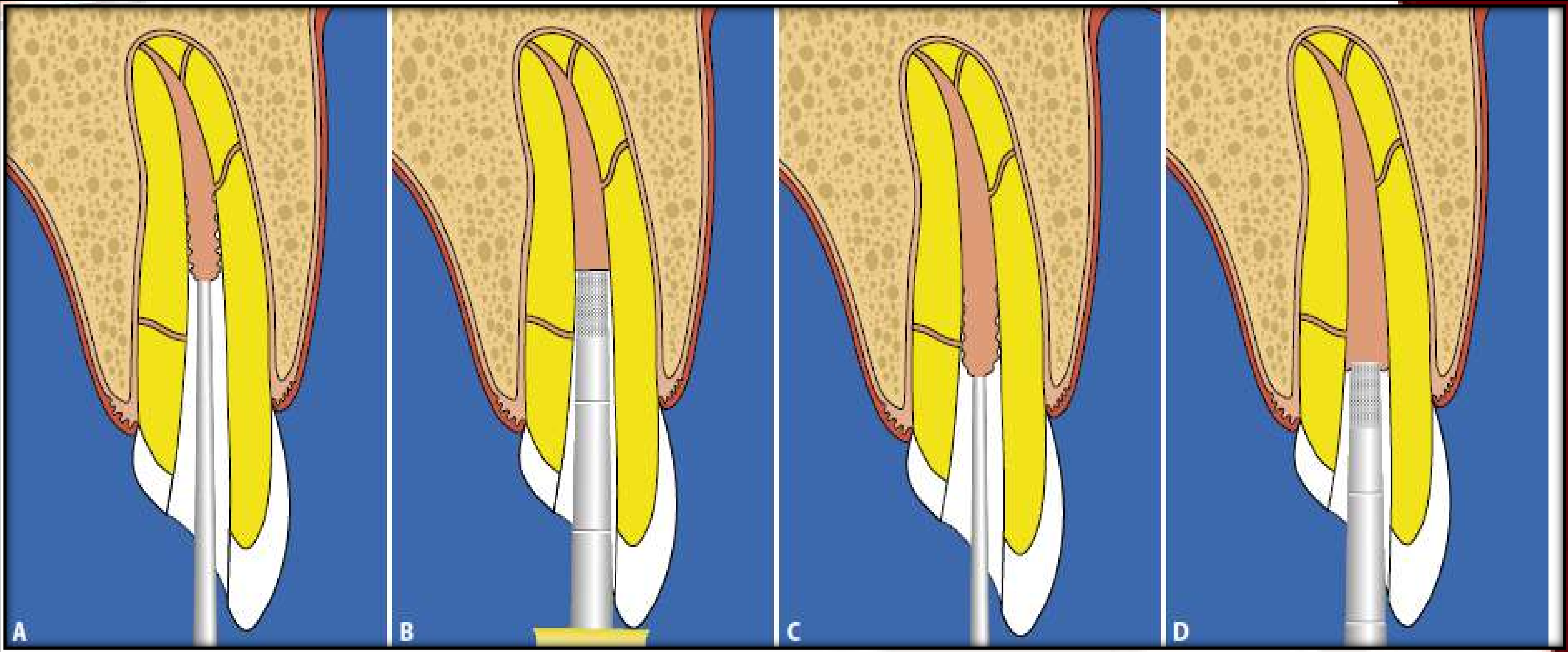


A. The first piece is transferred by the heat-carrier to the margin of the access cavity.
B. A # 8 plugger pushes the piece into contact with the gutta-percha that has already been compacted at the apical one third.
C. The heat-carrier heats the piece without removing gutta-percha from the canal.
D. The same # 8 plugger compacts the piece, which fuses with the rest of the apical gutta-percha



E. The heat-carrier now supports a medium-sized piece of gutta-percha at the margin of the access cavity.
F. A # 9 plugger pushes it apically.
G. The heat-carrier heats it without removing gutta-percha.
H. The # 9 plugger compacts apically in such a way that it fuses with the gutta-percha present in the root canal.

"BACK-PACKING" WITH THERMOPLASTIC GUTTA-PERCHA



A. The needle of the Obtura II touches and heats the apically compacted gutta-percha. Then a small amount of material is injected, in order to fill no more than 5 mm of space.

B. The plugger previously used in the middle third (# 9) is now used to firmly compact the material until the gutta-percha is plastic.

C. Five more millimeters of gutta-percha are injected in the root canal.

D. The compaction is completed using the bigger plugger.

→Homogenous GP

→Dense 3D fill

→Obturation of Lateral & accessory canals

→Numerous steps

→Time consuming

→uncontrolled Heat

→vertical root fracture

→Procedural accidents:- overfilling

SYSTEM B COMPACTION
"Continuous wave of obturation Technique"
STEPHEN BUCHANAN IN 1996

This technique is called the ***Continuous Wave Technique because it allows a single tapered electric*** heat plugger to capture a wave of condensation at the orifice of a canal and ride it, without release, to the apical extent of down packing in a single, continuous movement

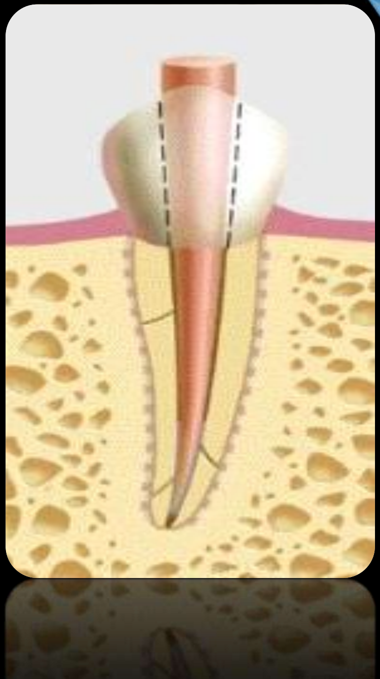
- ✓ **Heat source**
- ✓ **Handpiece: Pluggers / Tips**
- ✓ **Technique: done in 3 stages**
  - ❑ **Cone fit + plugger fit**
  - ❑ **Down pack technique**
  - ❑ **Backfill technique**

Technique :

Fit a standardized gutta percha cone in the root canal preparation.

A plugger is chosen that matches the taper of the selected gutta percha cone and a rubber stopper is placed on the plugger 5 mm short of WL.

The master cone is cemented in the canal with sealer.



INITIATION OF DOWN PACK

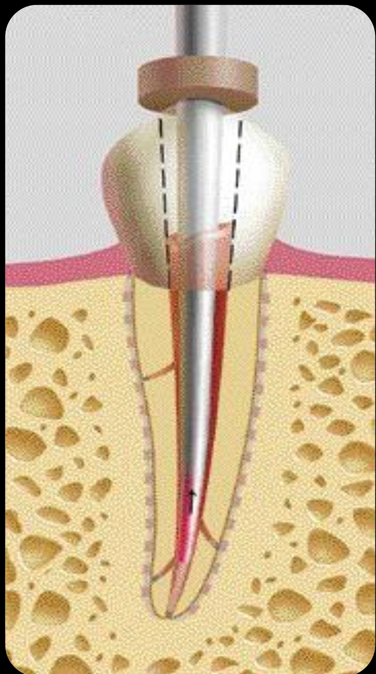
System B unit is set to 200^{0}c at touch mode and plugger is introduced in the canal and activated to remove excess coronal material.

Preheated plugger is driven smoothly through the GP until it stops. Procedure is repeated until the plugger is within 5-7 mm of the working length.

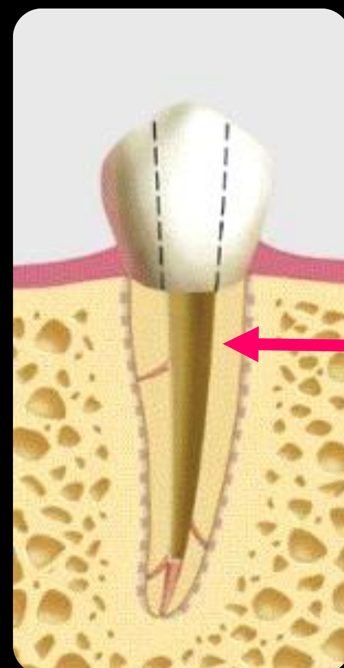
SUSTAINED APICAL CONDENSATION

The "trigger" switch should be released once within 3-4 mm of the apical constriction

Apical pressure without heat is maintained for 10 seconds to take up any shrinkage that might occur upon cooling.



SEPARATION BURST. The heat source is activated for one second



Remainder of the canal is ready for backfill.

Backfill Technique.

- **Using the same size gutta-percha** cone and plugger, the cone is coated with sealer and positioned in the backfill space in the canal.
- The System B temperature is now set at 100°C. Preheat the plugger out of the canal for only 1⁄4 second, cut the heat, but immediately plunge the plugger into the backfill cone and hold it in place for 3 to 5 seconds as the gutta-percha cools.
- Another cone is added in the backfill space and heat is again applied. The final plugging is done with a large cold regular plugger.
- ***Another method of backfilling is to use the Obtura II gutta-percha gun***.

Advantages

→Control over amount of heat

→ Temp at the tip monitored

→ "continous wave" orifice of a canal and ride it, without release, to the apical extent of down packing in a single, continuous movement

→ Faster than veritcal condensation

Disadvantages

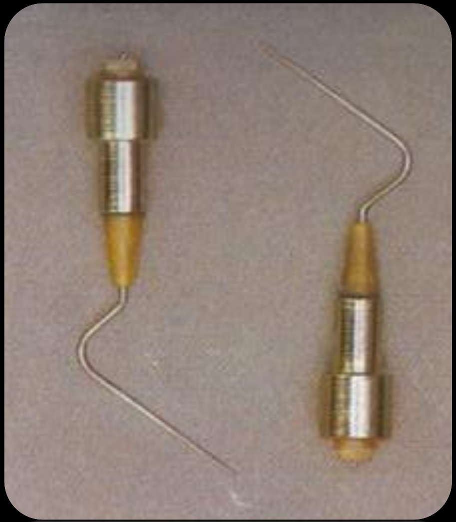
→Potential for extrusion

→thermal damage to the PDL & alveolar bone

LATERAL / VERTICAL COMPACTION ENDOTEC

- Developed by **Howard Martin and Fisher**

ENDOTEC HANDPIECE:-
CORDLESS,BATTERY OPERATED



ENDOTEC TIPS

Length :- 21mm long
2 sizes :- larger tip 45 ,Small tip 30
Autoclavable

- Temperature
  - 315.5 – 343.9 C
  - Takes 2 sec to cool down
- Designed to combine the best of the two obturation techniques: warm; vertical and relative simplicity of lateral compaction. Compensates for the voids created during the "cold welding" of cones during lateral compaction

PROCEDURE

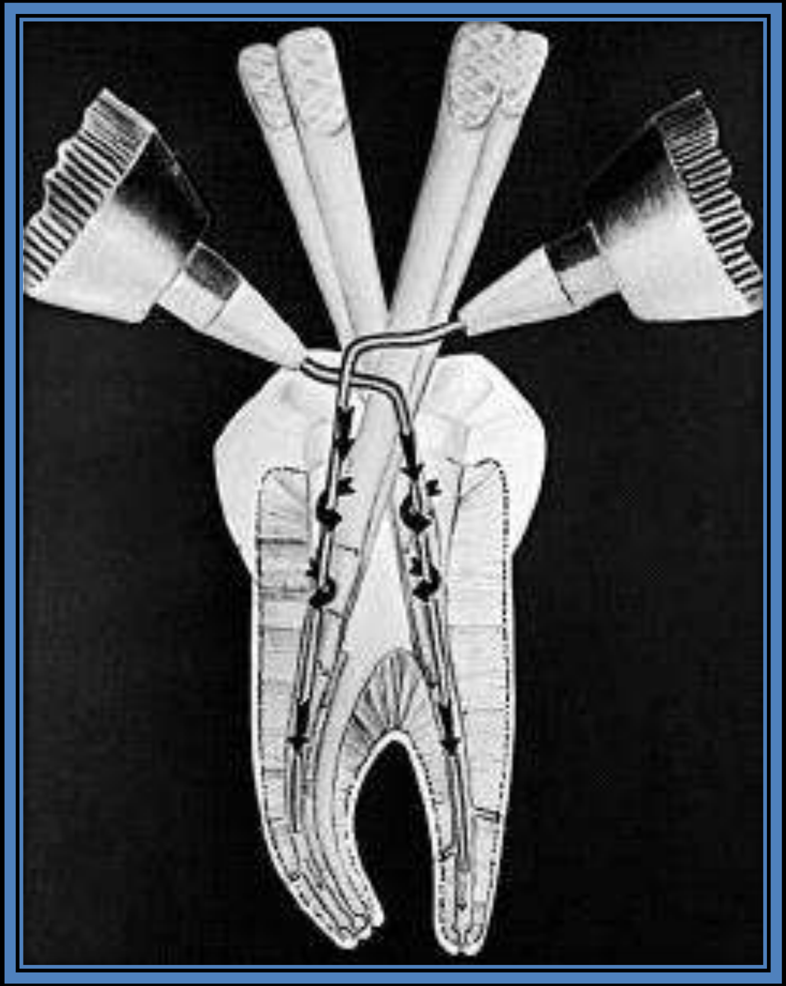
- Canal preparation with continuous taper design and with definite apical stop.

- Dry the canal.
- Apply sealer.
- Primary / master cone adaptation with hand / finger spreader, plugger.
- Additional gutta-percha placed to reduce the possibility of warm plugger loosening the point when the tip is retracted.

- ENDOTECH is placed in the canal to full depth alongside the gutta-percha.

- Later activator button is pressed and plugger / spreader moved in clockwise direction.

- Release the heat button, and the plugger cools immediately.



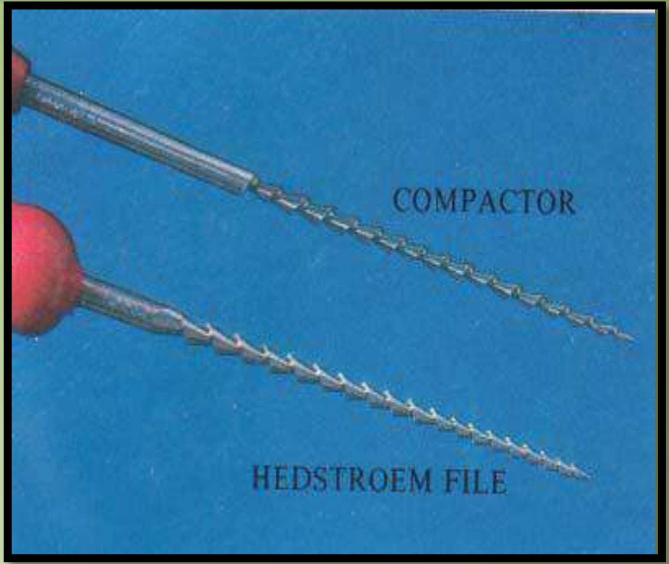
Vertical pressure with sweeping lateral pressure

- Now remove in COUNTERCLOCKWISE direction.
- This motion creates a space for additional point to be added.
- Procedure is repeated.
- Now the plugger can be used cold to compact the softened gutta-percha.
- In this manner the canal is completely obturated by using Endotech plugger.

Lateral compaction with the heated plugger to provide space for additional gutta-percha, and the vertical compaction with the cooled plugger to condense the heat-softened gutta-percha

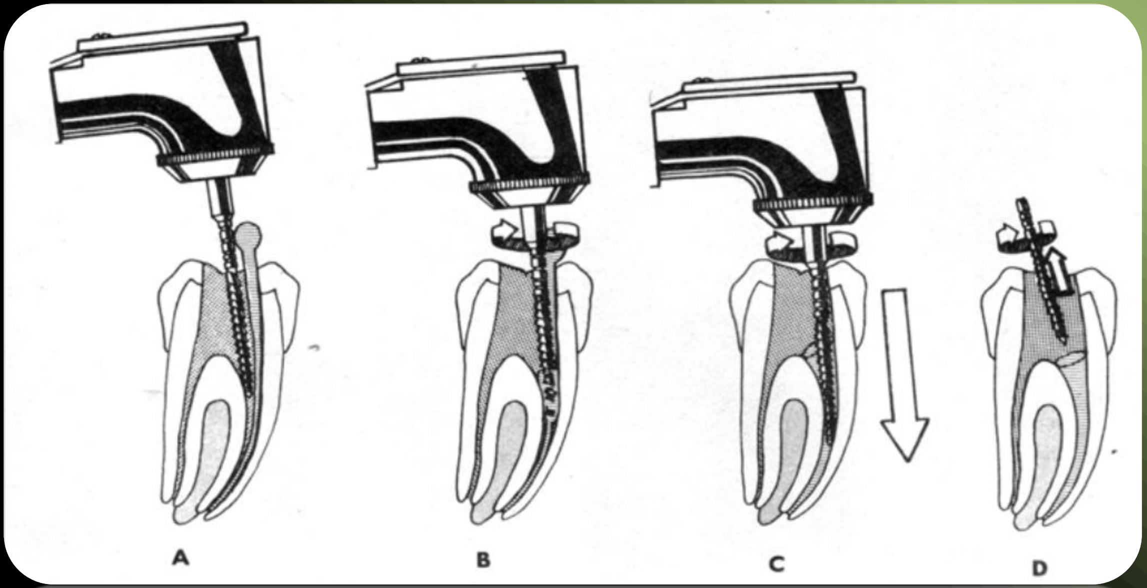
THERMOMECHANICAL COMPACTION

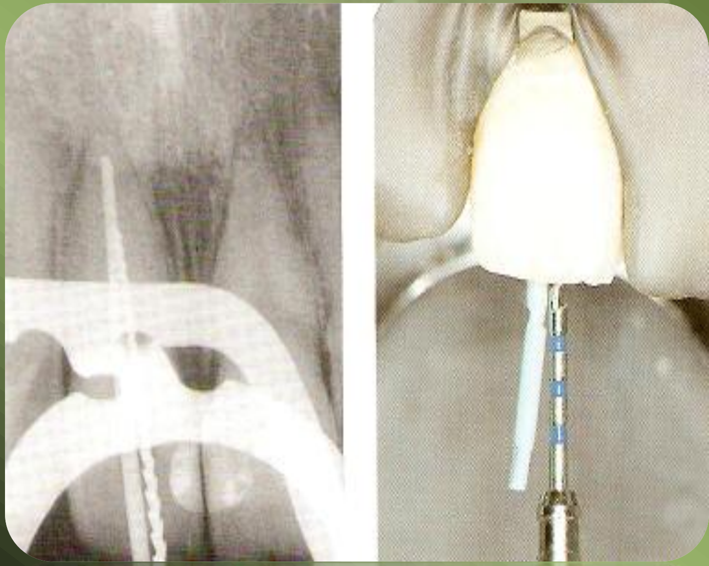
By McSpadden in 1979. Initially called the *'McSpadden Compactor'*. REVERSE HEDSTROEM FILE



A well adapted master cone is placed in the canal with a suitable sealer.

A mechanically activated rotating compactor similar to reverse Hedstroem file is introduced in the canal which heats up the GP and **thermoplasticizes it.** At these speeds, the heat generated by friction softened the gutta-percha and the design of the blades forced the material apically





Advantages

- Canals could be filled in seconds
- Ability to fill very irregular spaces and teeth with resorptive defects
- Gave a dense fill
- Conservative use of gutta percha

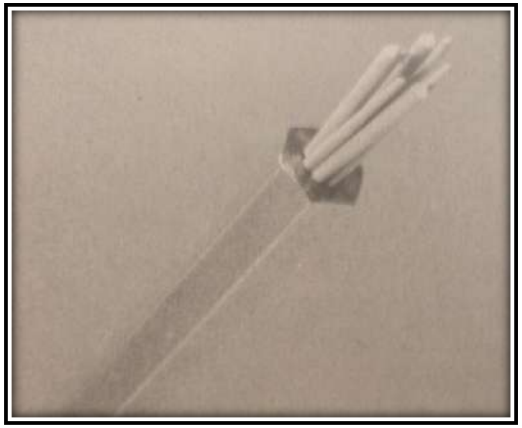
Disadvantages

- ❑Fragility and fracture of the instruments
  - In canals less than size 50
  - Curved canals
- ❑Overfilling
- ❑Void formation ‘popcorn appearance’ of gutta percha
- ❑Poor seal

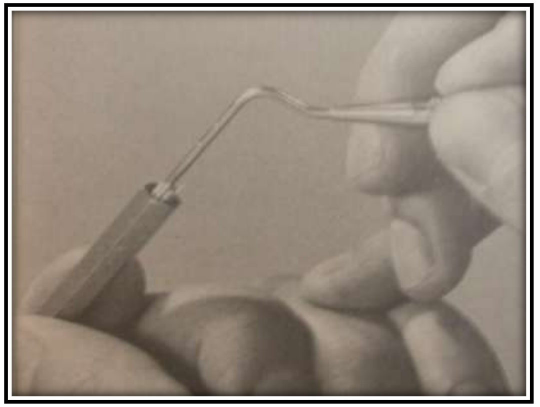
THANK YOU

OBTURA (Obtura/Sparton ; Fenton , MO)

Also called the " High heat technique"



PRINCIPLE
by Yee et al in 1977
Original prototype
- Pressure Syringe

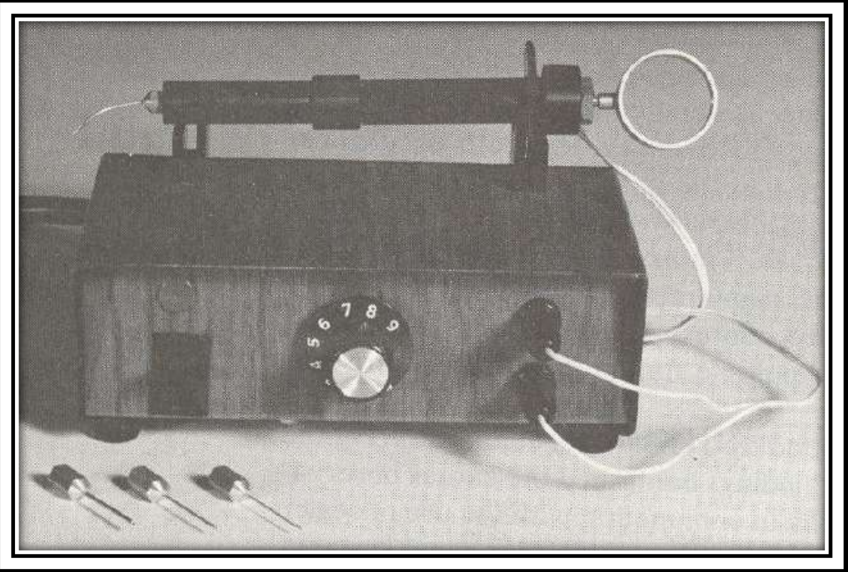


Warmed in a hot glycerin bath to 160°C
Expressed through an 18 gauge needle

Disadvantage
- **was clumsy to use**
- **not efficient**

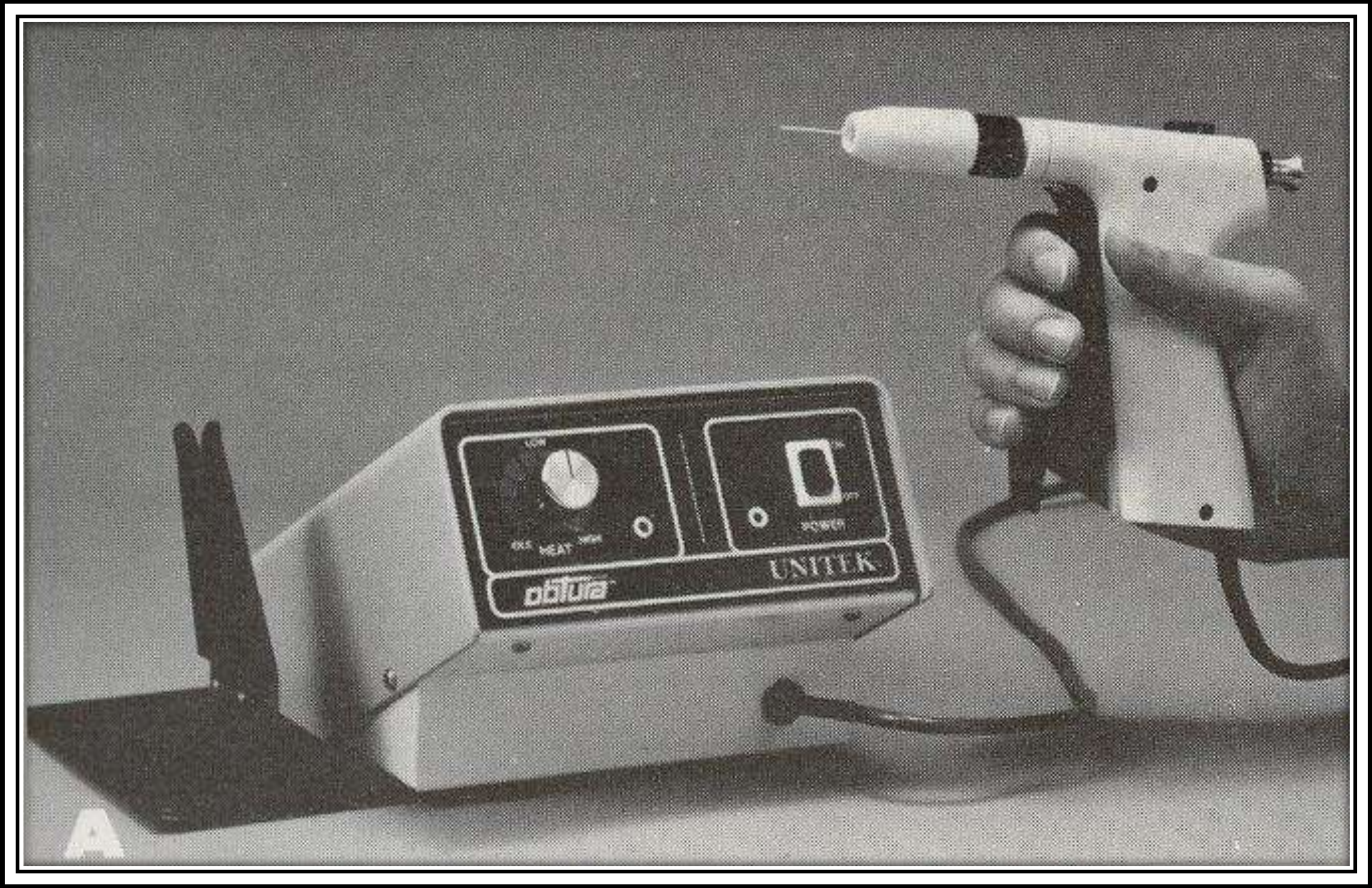
Jay Marlin - Injection Molding Device

- Electrical control unit
- The injection molding syringe
  - needle (18, 20 and 25 gauge)
  - heating element
  - barrel
  - plunger



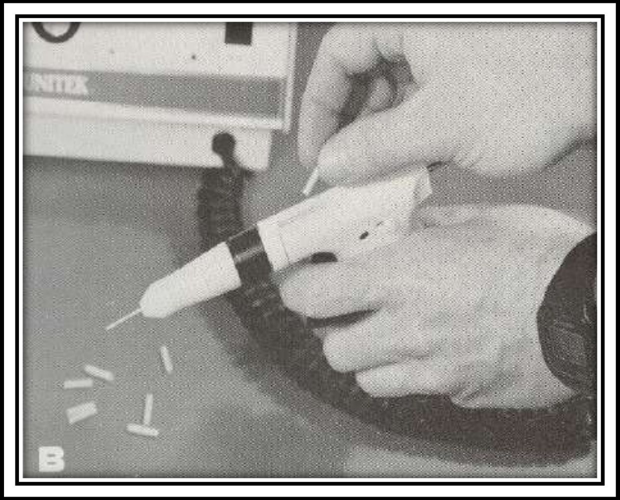
- Conventional gutta percha cones were used to load the syringe

This was later patented and made commercially available as Obtura (Unitek Corp U.S) in 1983



- **Obtura gun**

  Also called “gutta gun”



  - **a pistol grip syringe**
  - **Uses pellets of gutta percha which were loaded in a chamber of the Obtura gun**
  - **It used silver needles**
    - **more flexible**
    - **retained heat to keep the gutta percha soft**

Gutta percha pellets

- available as β phase gutta percha pellets

- variations in consistency of the gutta percha
  - to improve flow and regulate viscosity

  - REGULAR-FLOW GUTTA PERCHA
  - EASY-FLOW GUTTA PERCHA

- **REGULAR –FLOW GUTTA PERCHA**
  - Homogenized formulation with superior flow characteristics
  - Cools rapidly and hardens within 1 minute

- **EASY –FLOW GUTTA PERCHA**
  - has longer working time (10-15 seconds more than regular)
  - less viscous, higher flow form
  - Softens at a lower temperature
    - Used with 25 gauge needles

This was later modified and commercialized as Obtura II (Texceed Corp. U.S) 1991

THERMOPLASTICIZED INJECTABLE GUTTA-PERCHA OBTURATION.

Obtura II Heated Gutta-Percha System

Digitally controlled temperatures --160°C to 200°C

Needle size -- 20 gauge (equal to a size 60 file)
23 gauge (equal to a size 40 file).

- **Consists of hand held 'gun' that contains a chamber surrounded by heating element into which pellets of GP are loaded.**
- **Silver needles are used to deliver the material into the canal.**
- **Control unit allows the adjustment of temperature and thus viscosity of GP.**
- **Temp of GP from needle – 60^0 to 70^0 c**

TECHNIQUES OF USING OBTURA II

Canal is prepared, dried and the walls are coated with sealers.

GP is preheated in the gun and the needle is positioned in the canal so that it reaches within 3-5 mm of the apical preparation

GP is passively injected by squeezing the trigger of the gun.

Needle backs out of the canal as the apical portion is filled.

Pluggers dipped in alcohol are used to compact the GP when it gets cooled

Installing a Needle

1. 

Place needle in the lock nut.

2. 

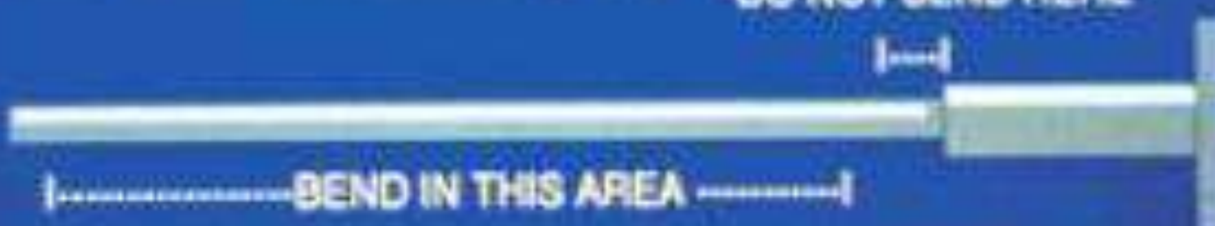
Install needle & lock nut.

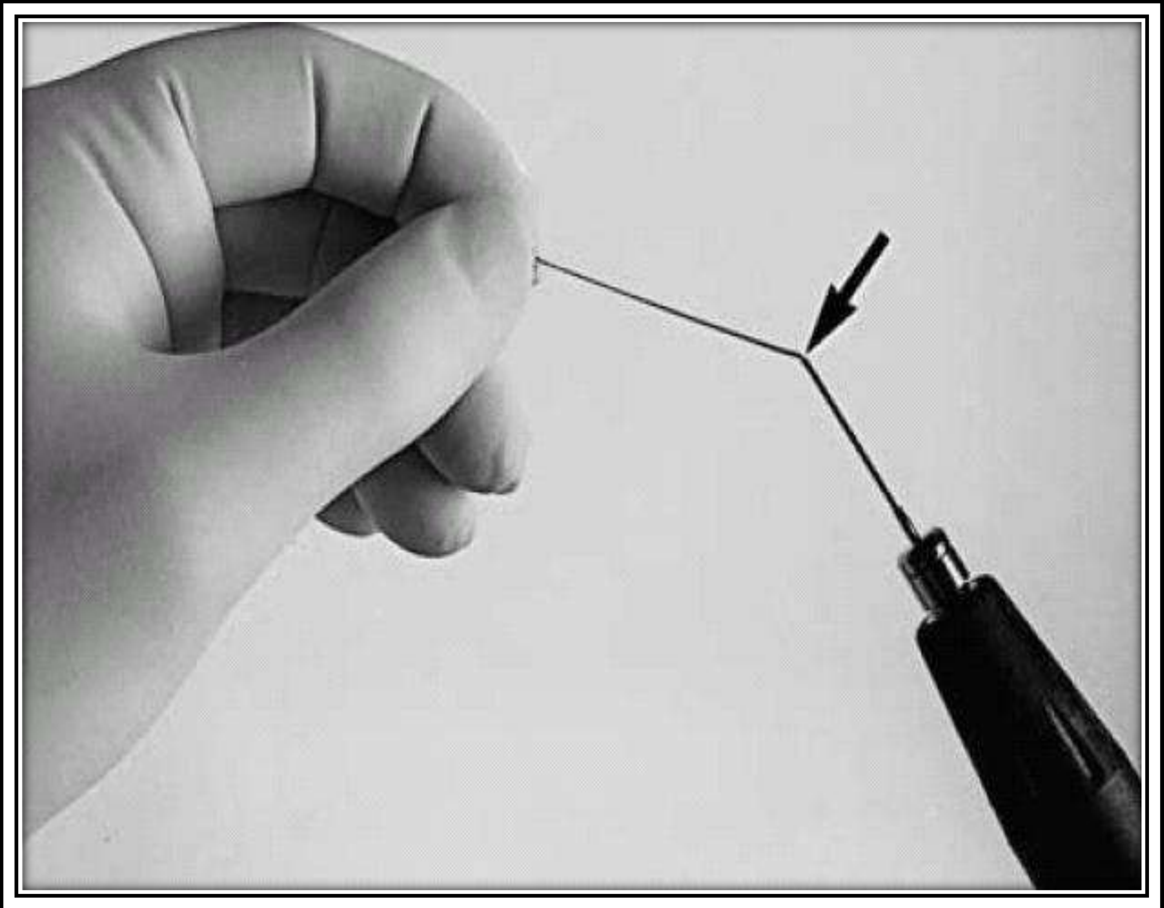
3. 

Tighten with needle wrench.

Bending the Needle

Use the Bending Tool
to Bend the Needle fo
Easy Canal Access





Warm plasticized gutta-percha stream extruded through needle tip (arrow) of Obtura II.

CALAMUS FLOW OBTURATION DELIVERY SYSTEM

- Thermoplastic obturation delivery system with cartridge system with 20 and 23 gauze needle
- Pluggers are available for use with this system
- The 360 degree activation switch allows greater tactile sensation during use

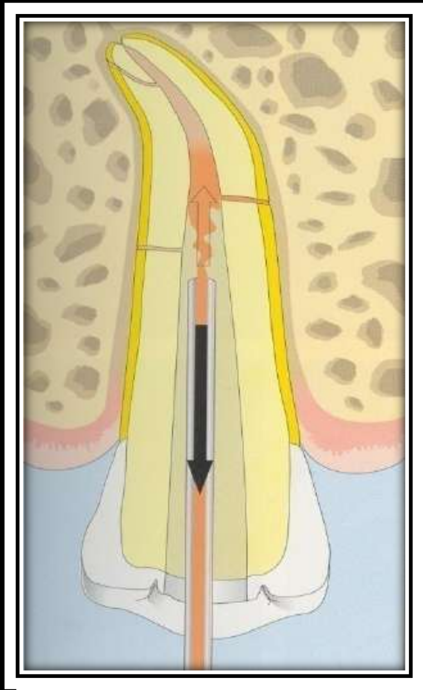
ELEMENTS OBTURATION SYSTEM

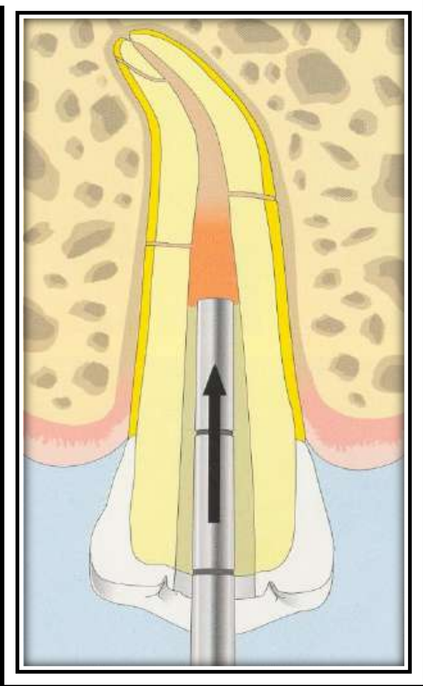
- System B heat source and plugger as well as hand piece extruder for delivering thermoplastic gutta percha or real seal from disposable cartridge .
- The cartridges come with -20 -23 -25 gauze needles for gutta percha and 20 and 23 gauges for Real seal

HOT SHOT DELIVERY SYSTEM

- Is a cordless thermoplastic device that has a heating range from 150 degree C to 230 degree C
- The unit is cordless and can be used with either gutta percha or Resilon
- Needles :- 20,23,25 gauze

- requires a minimum, size 40 preparation in body of canal
- continuously tapering funnel from the apical matrix to the canal orifice
- needle and pluggers should reach within 3.5 to 5mm of the terminus (binding point) and fit loosely at that point
- compaction necessary
  - to close space and gaps
  - compensates for shrinkage as gutta percha cools





USES:

- Complete or primary obturation
  – Total
  – Segmental
- Backfilling (sectional techniques)
- Managing canal irregularities
  – fins
  – webs
  – cul de – sacs
  – internal resorption
  – accessory /lateral canals
  – arborized foramina

- Combination techniques
  – Master cone + Obtura injection around the point

Obtura (Unitek Corp.U.S)

- No digital display

Obtura II (Texceed Corp U.S)

- digital display of temperature reading

- Disposable silver needles
- Syringe made of stronger heat resistant plastic material
- Highly polished chamber and well-fitting round plunger

Efficacy and Safety of the Thermoplastic Injectable Gutta-Percha Technique

- Gutmann et al. found *in vitro that the gutta-percha* emerged from the needle at 71.2°C in a body temperature environment.
- Hardie recorded a temperature rise of 9.65°C on the external surface of a tooth. This dropped to 4.75°C in 3 minutes and compared with a 15.38°C rise in temperature generated by an Engine Plugger compactor spinning at 8,000 rpm.
- Bone injury has been reported with external root temperature rises of 10°C if maintained for 1 minute.
- Hardie's reported 9.65°C increase (dropping to 8.20°C in 1 minute) appears to fall within safe limits.

- Weller and Koch evaluated external root temperatures *in vitro* when using gutta-percha thermoplasticized at 200°C and additionally found that the rise in temperature was well below the critical level of 10°C.
- Sweetman TL et al :- at 6 mm from apex internal temperature with Obtura II was 27 degree celcius
- Clinical success rates with the injection technique have been reported at 93.1%

THERMOPLASTICIZED GUTTA- PERCHA TECHNIQUES

- SYRINGE INSERTION
  - With gun
    - Beta- Phase
      - Obtura
      - Obtura II
    - Alpha- Phase
      - Ultrafil

Ultrafil (MichanowiZ, 1984)

Is a ‘low heat’ injectable gutta percha system

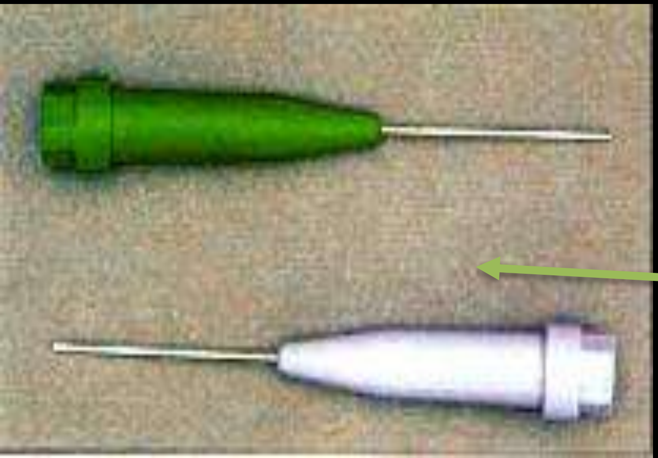
TEMP – 70^{O}-90^{0}

Heating Unit

3 VISCOSITIES

Ultrafil regular set (white cannule) 30 mins
Endo set (Green cannule) 2 mins
Firm set (Blue cannule) 4 mins

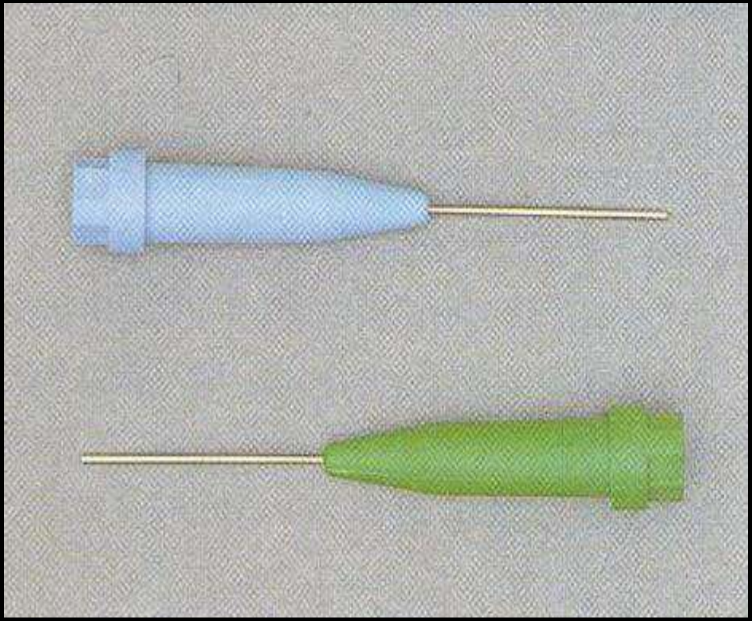
METAL SYRINGE
Also called peripress syringe
Does not have a heating element



GP Cannules (α phase)

- **CANNULES**
  - **Prefilled with gutta percha**
  - **Has attached needles of 22 gauge (0.7 mm diameter)**
  - **Disposable**
  - **Contains enough gutta percha to fill at least one molar**
  - **Available in 3 colours**

- WHITE (Regular set)
  - Setting time – 30 min
  - Low viscosity, compaction not required
- BLUE (Firm set)
  - Setting time – 4 min
  - Condensation possible but not required
- GREEN (Endoset)
  - Setting time – 2min
  - Highest viscosity
  - Must be condensed



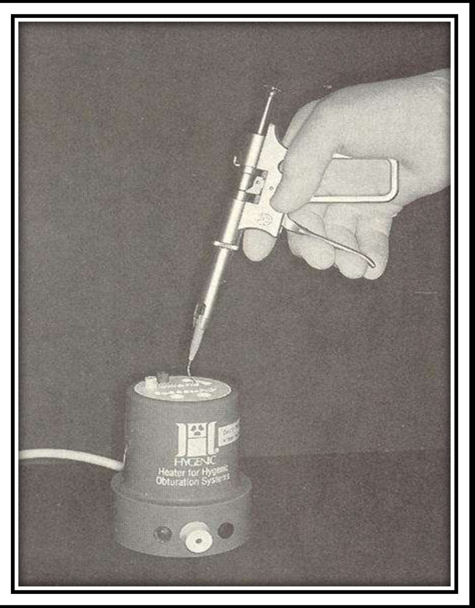
- Cannule is chosen and needle may be bent on the barrel of the syringe

- Cannule is placed in the preset heater at 90 ^{0}C for 15min

- Cannule is placed in injection syringe during which time it loses heat rapidly and drops to 70 ^{0}C – ready for injection

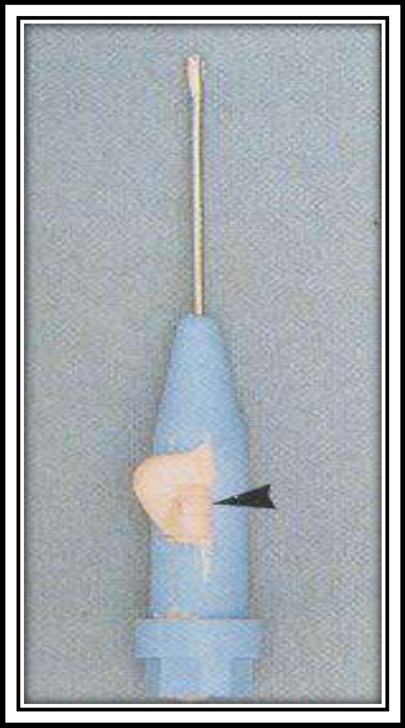
- Has a 1 minute working time

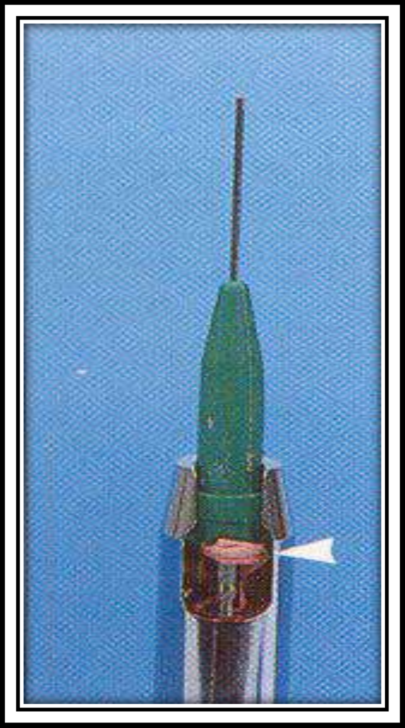
- If required the cannule with the gun can be returned to the heater for further softening
  - – if unused at one sitting may be reheated



- If left in the heater for more than 4 hours should be discarded

- Injection procedure is technique sensitive
  - trigger should be squeezed slowly and steadily
- Excessive pressure can
  - Fracture the cannule
  - gutta percha extrudes through back of the cannule





ADVANTAGES

- Versatile (varied viscosities)
- Can be compacted (Vertically & laterally)
  - Requires minimal pressure during compaction
- Increased patient comfort (thermoplasticized at low temperature)
- Disposable cannules
- Can be used for back filling
- Flows into canal irregularities (moldable)

Can be used for different cases

- Large canals
- Retrograde filling
- Internal resorption
- Perforations
- Lateral canals
- Ledges
- Open apex

DISADVANTAGES

Requires a wide middle 1/3 preparation (to at least size 70)

The filling can be pulled out if the injector is removed prematurely

ULTRAFIL	OBTURA II
Low temperature	High temperature
Gun has no heating element, separate oven	Gun with heating element
No digital readout	Digital display of temperature
Uses 22 gauge needles	Needles – 18, 20, 22 and 25 gauge
Working time of less than 1 min	Remains soft for 3min

THERMOPLASTICIZED GUTTA- PERCHA TECHNIQUES

SYRINGE INSERTION

With gun

Beta-Phase

- Obtura
- Obtura II

Alpha-Phase

Ultrafil

Without gun

- Inject-R-Fill

INJECT-R FILL BACK FILLING TECHNIQUE

By James B. Roane at the University of Oklahoma in 1994

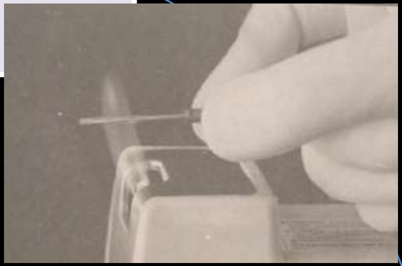
Consists of

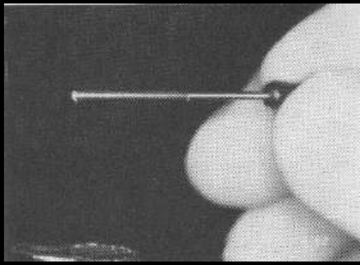
A miniature – sized metal tube containing gutta percha

Plunger

Heated in a flame or an electronic heater

Softened GP





Pre-fitted hand or finger pluggers used to compact the gutta-percha.

Coronal surface of the gutta-percha - canal should be warmed unit -placed into the orifice

The technique is rapid

Produces results similar to warm vertical compaction

handle pushed - injects the heated gutta-percha into the canal.

canal orifice must be at least 2 mm in diameter.

THERMOPLASTICIZED GUTTA- PERCHA TECHNIQUES

SYRINGE INSERTION

Without gun

- Inject-R-Fill

With gun

Beta-Phase

- Obtura
- Obtura II

Alpha-Phase

-Ultrafil

SOLID –CORE CARRIER INSERTION

Pre coated carriers

- Thermafil and Densfil
- Soft core and Three Dee GP
- One Step Obturator

PRINCIPLE

W. Ben Johnson

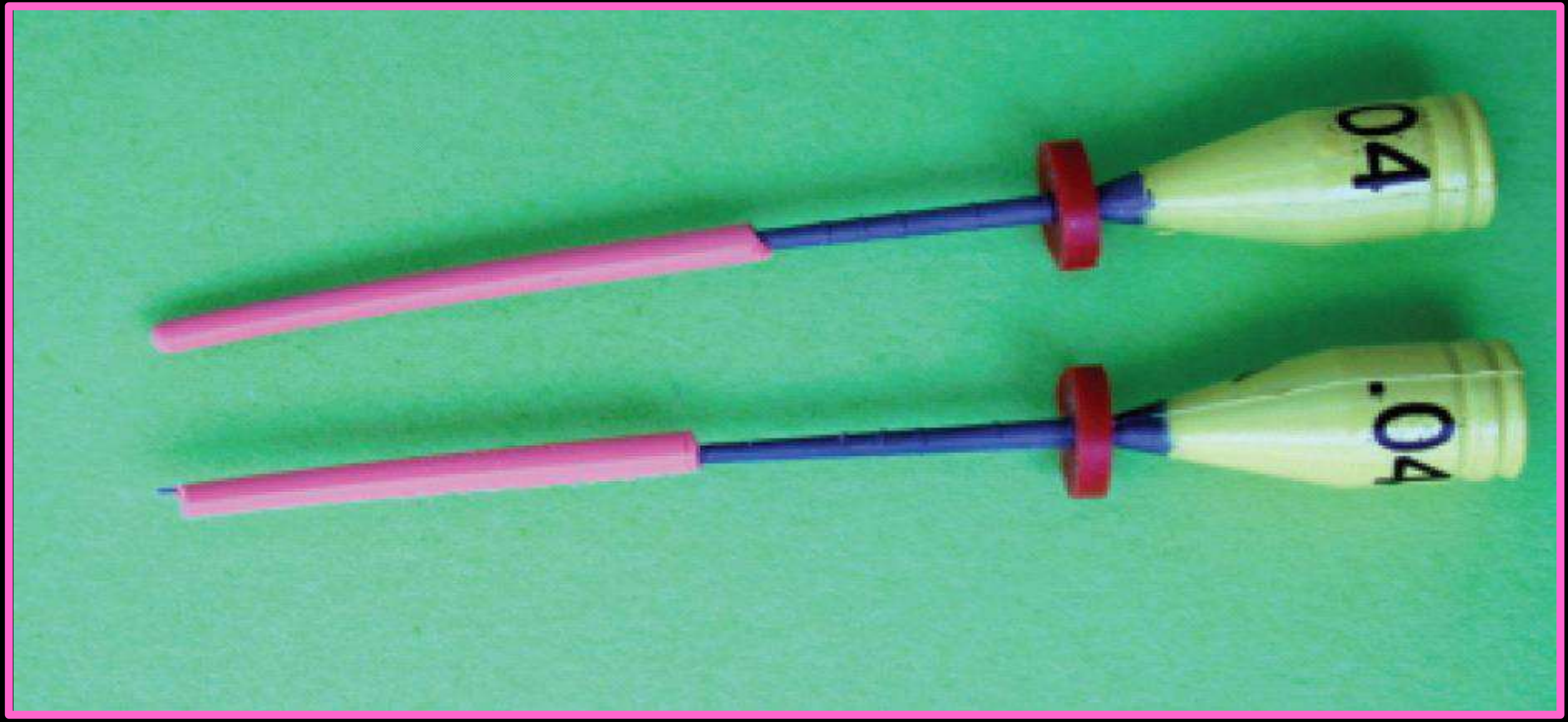
1978

(Baylor University)

Original hand made gutta-percha obturator

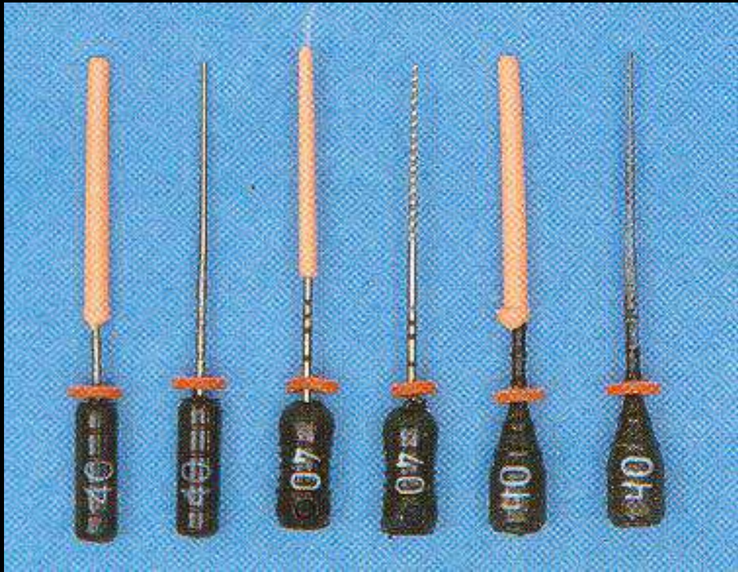
Thermoplasticized alpha-phase gutta percha on an endodontic file

- Then in 1989 it was commercialized in the form of **THERMAFIL**
  - A patented endodontic obturator
  - Consisting of a flexible central carrier uniformly coated with a layer of refined and tested alpha-phase gutta percha.



CARRIERS

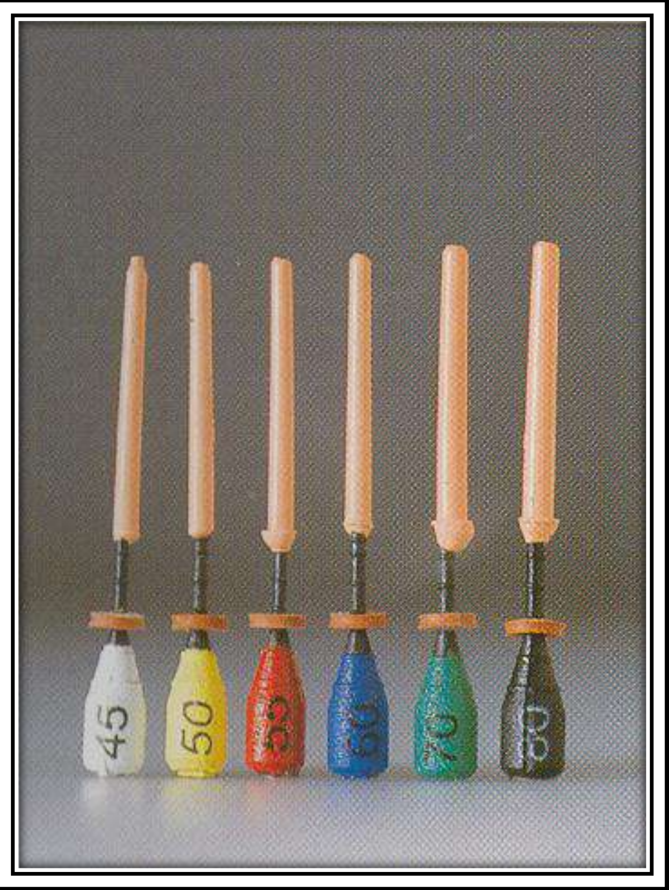
– Made of
  - Stainless steel (initially)
  - Titanium (later)
  - Plastic
– Have ISO standard dimension with matching color coding
– Comes in sizes of 20-140
– **Plastic carrier**
  - Made of special synthetic resin
    – Liquid plastic crystal
    – Polysulphone polymer



- Liquid plastic crystal
  - To make sizes 25-40
  - Stiffer material
  - Resistant to solvents

- Polysulphone polymer
  - To make sizes 45 and above
  - Can be dissolved in most organic solvents

- Both plastics are
  - Non toxic
  - Highly stable polymers
  - Well tolerated by the body

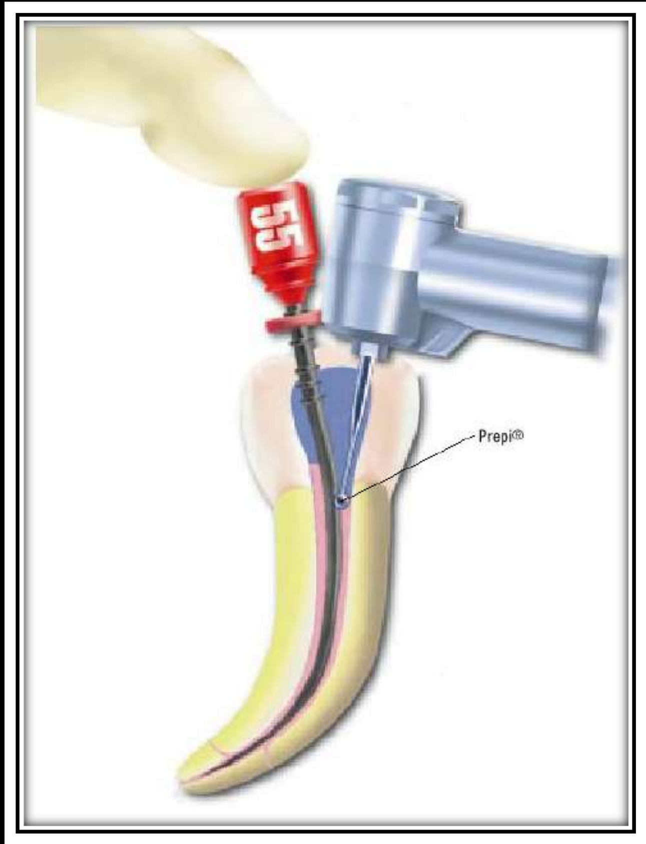


Advantages of plastic core

- Allows post space to be made more easily
- Retreatment of larger sizes performed more easily

Plastic carrier is cut off

- Heated instrument
- Long shank diamond stone
- Inverted stainless steel bur
- Prepi bur



THERMA-CUT BURS

The Therma Cut are steel burs for use with a high speed handpiece and are used to section the obturator after insertion in the canal. Available in 4 diameters, 25 mm long

POST SPACE BURS

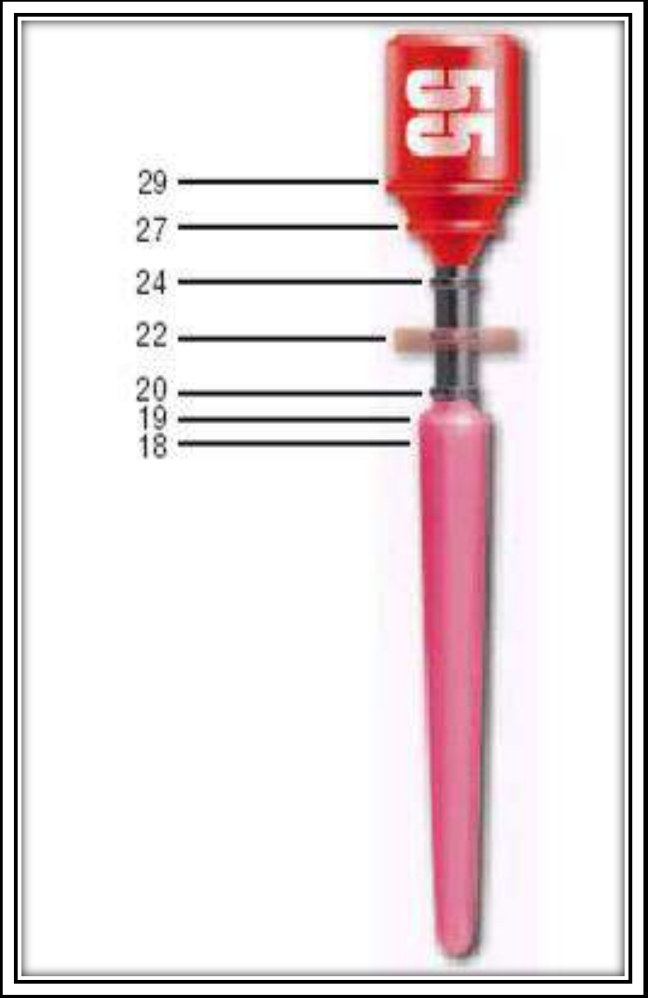
These are steel burs that are useful for rapidly preparing post space in a root canal obturated with the Thermafil system.
Available in 2 diameters, 25 and 31 mm long,

- The gutta percha normally covers the first two or three gradation marks at 18, 19, 20mm and must be cut away if required

- The gutta percha coating extends beyond the length of the carrier by 1-2mm

- Previously the gutta percha was molded into
  - a non standardized thick parallel sided point

- More recently gutta percha
  - shaped into a tapering cone



OBTURATORS :- THERMAFIL, PROFILE GT OBTURATORS, GT SERIES X OBTURATORS, PROTAPER UNIVERSAL OBTURATORS

Classic Obturators :- are available in 17 sizes with the tip diameter from 0.20 to 1.40 mm with taper between 4 and 5% .

These obturators are very versatile: the variety of diameters at the tip in fact allow their use in most variations of endodontic anatomy while their taper adapts to the canal preparation obtained with the use of most Nickel-Titanium instruments currently commercially available.

GT Thermafil Obturators were introduced by L.S. Buchanan to complement the GT Endodontic files.

The GT Thermafil are available in the following four series:~

– **series 20** consisting of 4 obturators with taper .04, .06, .08 and .10 with the tip diameter of 0.20 mm and a maximum diameter of 1.00 mm

– **series 30** consisting of 4 obturators with taper .04, .06, .08 and .10 with the tip diameter of 0.30 mm and a maximum diameter of 1.00 mm for the GT Thermafil 30 .04, .06 and .08 and 1.25 for the GT Thermafil 30 .10

– **series 40** consisting of 4 obturators with taper .04, .06, .08 and .10 with the tip diameter of 0.40 mm and a maximum of 1.00 mm for GT Thermafil 40 .04, .06 and .08 and 1.25 mm for the GT Thermafil 40 .10

– **large series** consisting of three obturators: 35 .12 with tip diameter of 0.35 mm and maximum diameter of 1.25 mm, 50.12 with tip diameter of 0.50 mm and maximum of 1.50 mm, and 70.12 with tip diameter of 0.70 mm and maximum diameter of 1.50 mm.

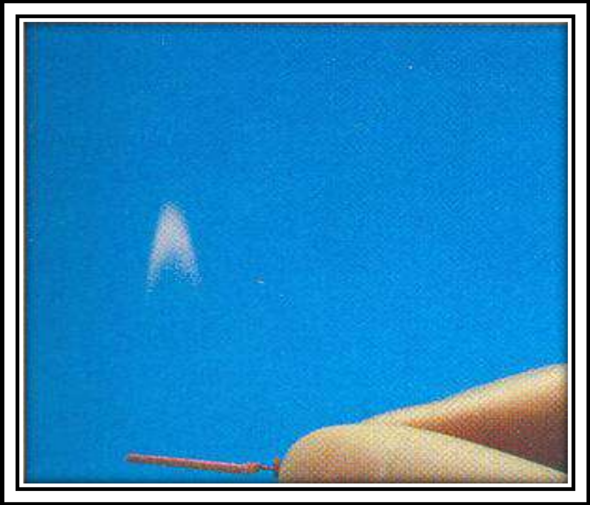
Size verifiers

- **Size verification kit**
  - Collection of plastic obturators
    - without the gutta percha portion
  - Size verifier of same as the master apical file is chosen

- The size verifiers are available in 12 sizes with tip diameters 0.20 to 0.90 mm and taper of 5%.
- Made from nickel titanium, they are similar to hand Profiles in that their tip is non cutting and the blades show the typical radial lands

HEAT

- Initially metal obturators
  - Heated over a Bunsen burner
  - Rotated in the blue zone of the flame
  - Until a shiny coat developed on the gutta percha
- Disadvantages
  - heat is not controlled



If not heated sufficiently

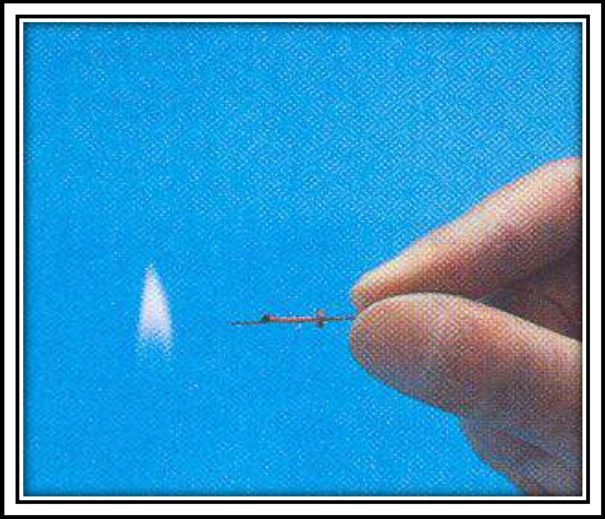
• obturator did not go to place.

• metal would push through the gutta percha made the entire unit unusable

If overheated

•Causes gutta percha to conflagrate

•Becomes unusable

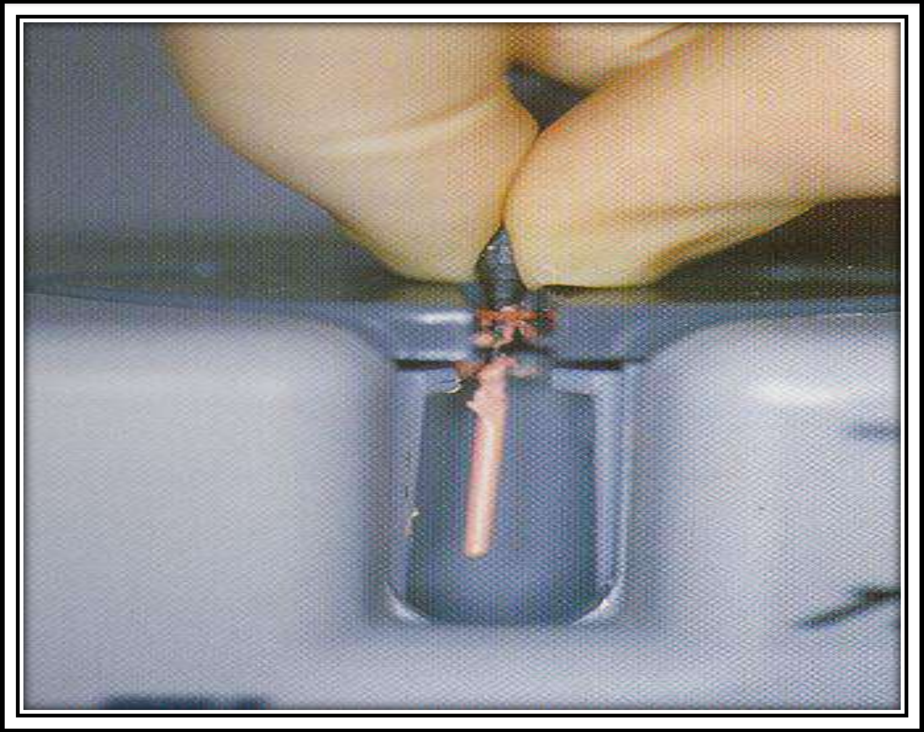


THERMA PREP OVEN

- Was especially needed with introduction of plastic carrier
- **ADVANTAGES**
  - Enables operator to have a consistently reliable temperature of the obturator
  - Better chance for smooth complete placement
- Consists of
  - On / off button
  - Dial
  - Heater

- Heating temperature
  - 115^0 C (constant)

- Heating time
  - 3-7 min depending on size of carriers
  - Time was operator controlled
  - Gutta percha sets in 2-4 minutes



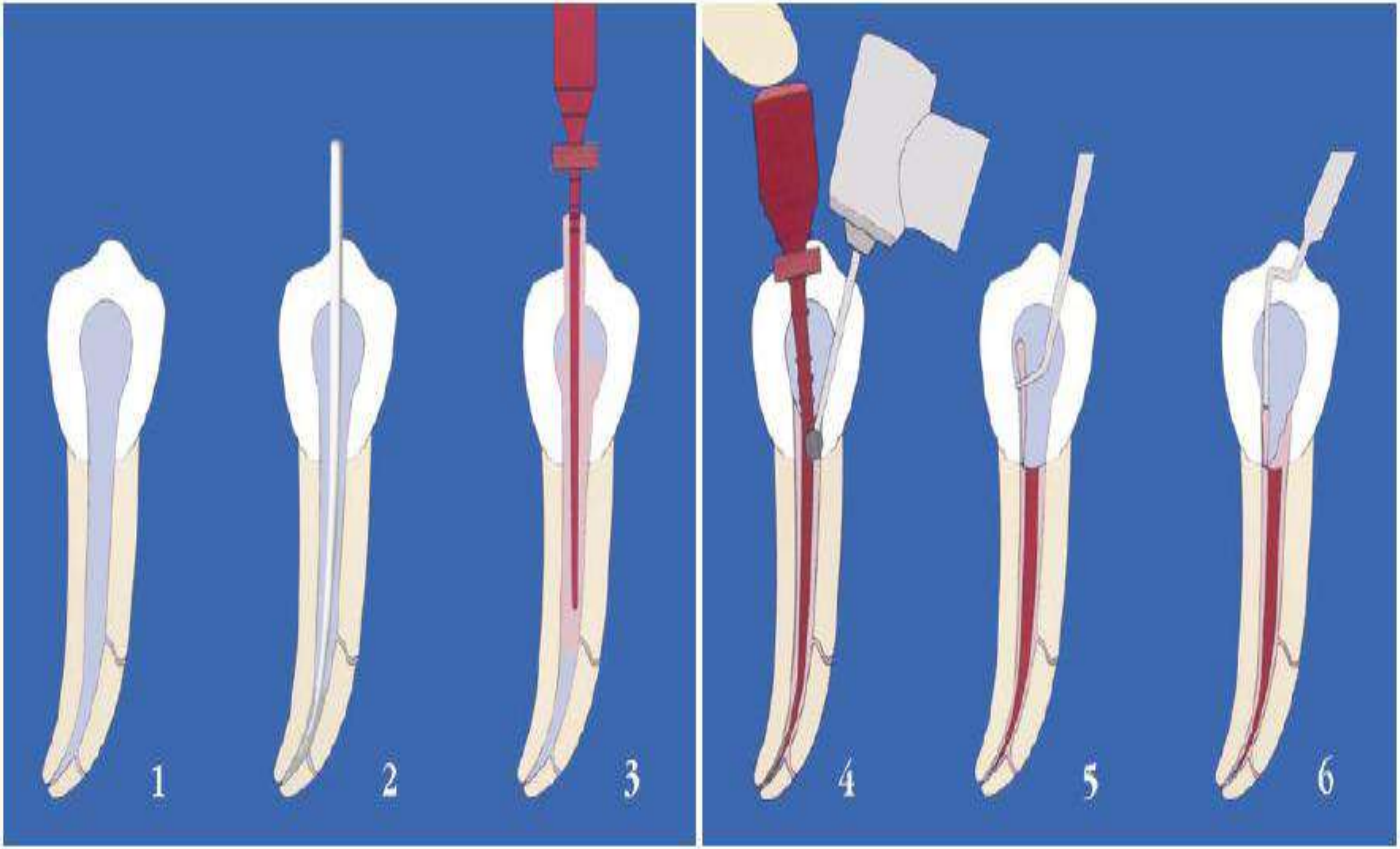


Fig. 26.26. **A.** Operative sequence for Thermafil obturation. In the shaped and dried canal (**1**), one places a very small amount of sealer using a paper point (**2**). One then slowly inserts the obturator (**3**). **B.** After waiting a few seconds the obturator is sectioned using a Therma-cut bur (**4**). Where necessary it is possible to increase the mass of gutta-percha coronally by adding accessory cones and manually condensing them (**5, 6**).

- It is recommend that it should preferably be heated in the therma-preparation oven at 115°C for 3-7 minutes depending on the size which ranges from 20-140.
- The gutta percha coating extends beyond the carrier by 1-2mm.

Continuous taper preparation is required

- Plastic carriers are used now-a-days. There are relatively flexible, small sizes *25, 30, 35 have a incrementally greater taper than the normal 25, 30, 35 sized files.*
  - Final set is reached in 2-4 minutes.

IMPORTANT POINTS

- In teeth with multiple canals the other orifices must be sealed with damp cotton or the gutta-percha may block the other orifice.

Potential problems:

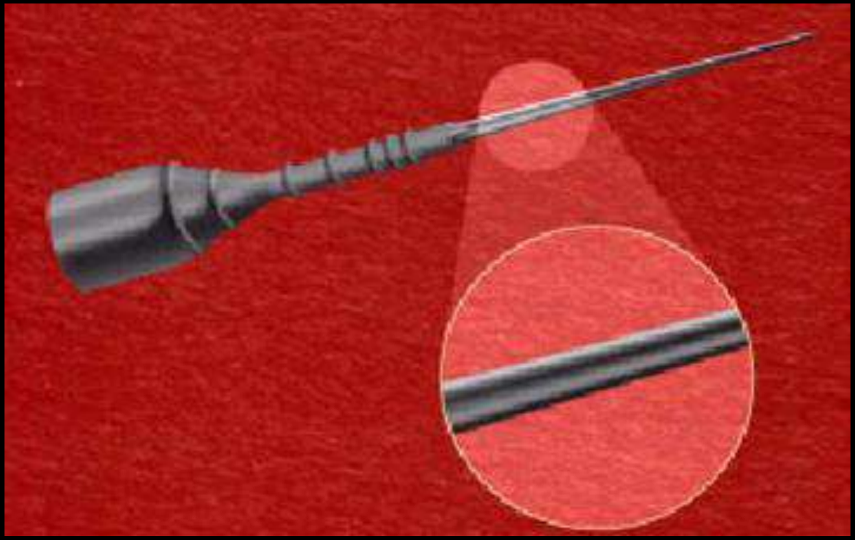
- Extrusion.
- Post space preparation

THERMAFIL SYSTEM PLUS

- is the second generation obturation technology

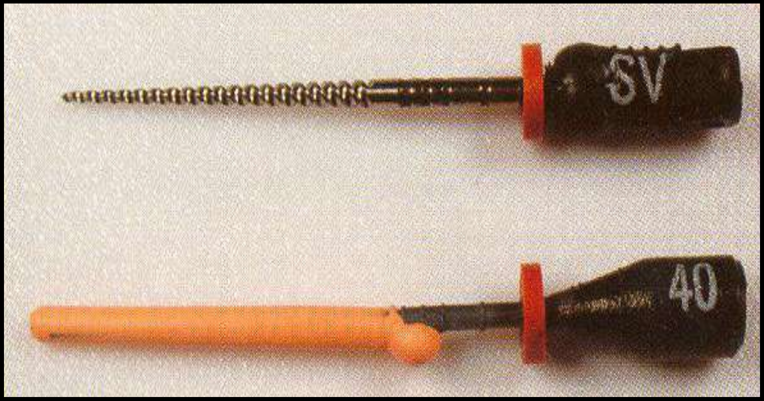
THERMAFIL PLUS OBTURATORS

- Redesigned with a slight groove along 60^0 of the circumference.
- Allows for the backflow of excess gutta percha.
- Provides a pilot point / space for carrier retrieval if retreatment is necessary.



Thermafil Plus size verifiers

- Available in nickel titanium
- Can be heat-sterilized for reuse
- Redesigned with flutes, making them excellent for minor apical shaping



- **Therma Prep Plus Oven**
  - in less time
    - from up to seven minutes down to as little as 17 seconds
  - The heating time
    - varies
      - depending on obturator size
      - from 17 to 45 seconds
    - regulated automatically

ThermaSeal Plus endodontic sealer

- improved paste:paste formula is easier to use
- lubricating and adhesive qualities

Advantages

- ❑ Much less time and effort
- ❑ Conservative canal preparation
- ❑ Obturation of the curved canals

DISADVANTAGES

- – canals enlarged to size 25 :- frequently underfilled
- – canals enlarged to size 35 :- point almost always reaches the apex but overfilling results *(Chohayeb 1993)*
- – Overfilling occurred more frequently with the Thermafil technique than with lateral condensation *(Clark and El Deeb 1993)*
- – Gutta percha tends to be partially stripped from the point during insertion
  - the plastic carrier point comes into direct contact with the periapical tissue (Juhlin et al 1993)

The ability of Thermafil gutta-percha obturate the lateral canals was shown to be equal to that of vertical condensation and System-B, but significantly superior to that of lateral condensation, warm lateral condensation and Obtura.

Gutmann et al. and W. P. and E. M. Saunders reported that “ThermaFil resulted in more dense and well adapted root canal fillings than lateral condensation with standard gutta-percha.” Both techniques “demonstrated acceptable root canal fillings in the apical one-third of the canal.” Similar excellent adaptation was observed when comparing ThermaFil with the System B technique. However, the gutta-percha from the ThermaFil carrier did show a greater propensity to extrude beyond the apex.

Wolcott and co workers, found that the movement of ThermaFil gutta-percha and sealer into lateral canals was comparable to lateral compaction; however, the ThermaFil was more effective in the main canal.

Weller et al. at Georgia used a split-tooth model to assess gutta-percha adaptation using Obtura, three types of ThermaFil core carriers, and lateral The best adaptation was with Obtura obturations, followed by ThermaFil plastic, ThermaFil titanium, ThermaFil stainless steel, and lateral compaction.

SOFT-CORE OR THREE DEE GP OBTURATORS

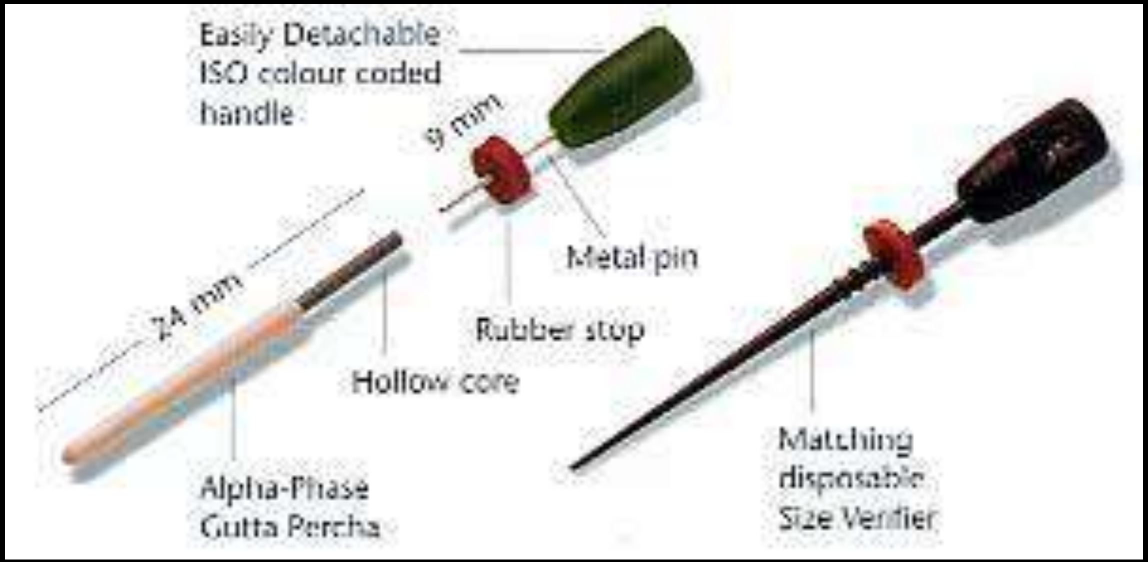
- Similar to ThermaFil; however, it contains a bipolymer compound and a tungsten core that is radiopaque.
- It has an easily detachable handle, referred to as a metallic insertion pin, that is removed with a slight twisting action.
- This leaves the coronal portion of the plastic core hollow, thus facilitating post space preparation.
- It is supplied in a sterile blister pack that also contains a matching size verifier.
- Heating of the gutta-percha on the Soft-Core carrier is done in a halogen oven that is thermostatically controlled

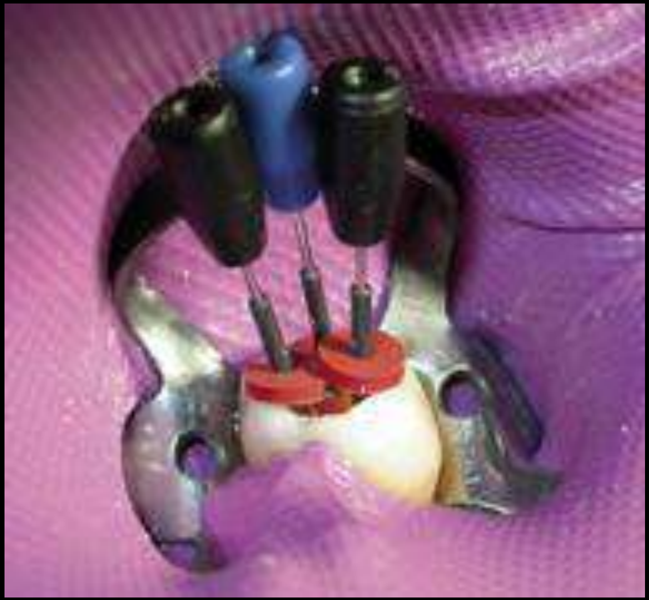
SOFT-CORE OR THREE DEE GP OBTURATORS

- Soft-Core Regular and Low Heat are available in sizes: 20-25-30-35-40-45-50-55-60 and 70
- Soft-Core Low Heat is the latest version developed for accommodating those dentists who prefer:

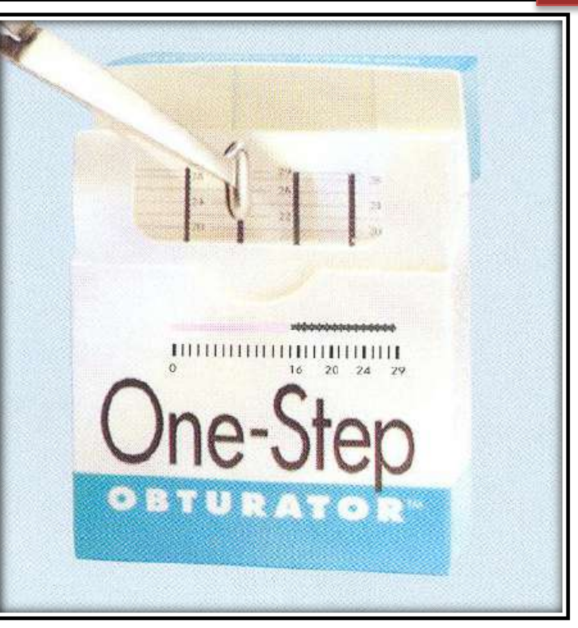
1. Lower temperature of the gutta percha
2. Easier drilling in the plastic carrier
3. Added radio-opacity in the plastic carrier

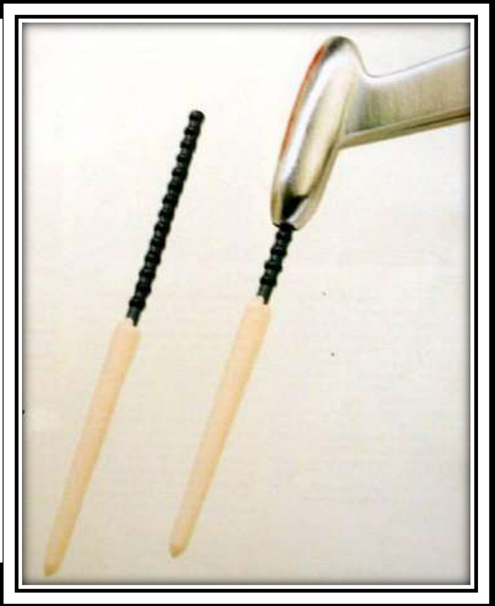
SOFT-CORE OR THREE DEE GP OBTURATORS





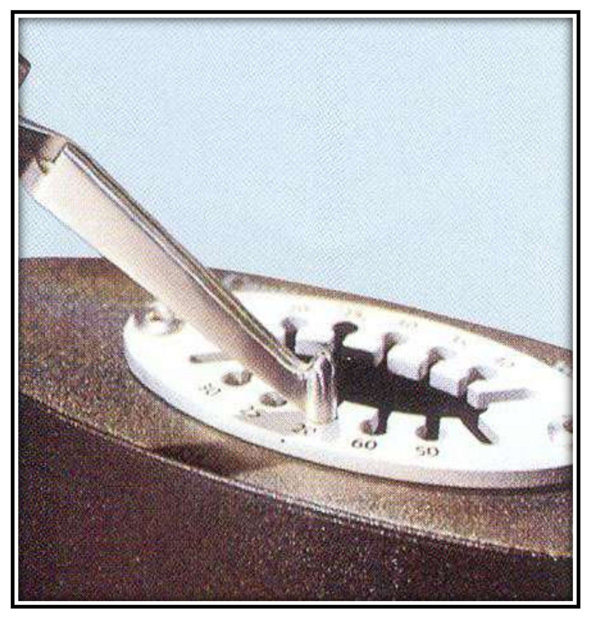
ONE STEP OBTURATORS





- Without the handle/insertion pin and endo rubber stop, One- Step Obturato is aprox. 20 % less expensive compared to Soft-Core Endodontic Obturator.
- Another advantage is that there is far less difficulty in filling multi rooted canals because
- No handles are blocking your view and the entrances of the other canals.
- Use the tip of the tweezer to indicate the WL.
- One-Step Obturator is available in sizes: 20-25-30-35-40-50 and 60


One-Step™ Oven


60
50

THERMOPLASTICIZED GUTTA- PERCHA TECHNIQUES

SYRINGE INSERTION

Without gun

- Inject-R-Fill

With gun

Beta-Phase

- Obtura
- Obtura II

Alpha-Phase

- Ultrafil

SOLID –CORE CARRIER INSERTION

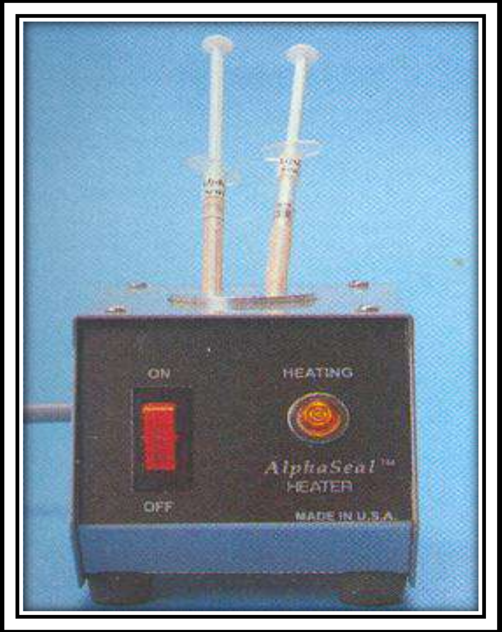
Pre coated carriers

- Thermafil and Densfil
- Soft core and Three Dee GP
- One Step Obturator

Operator coated

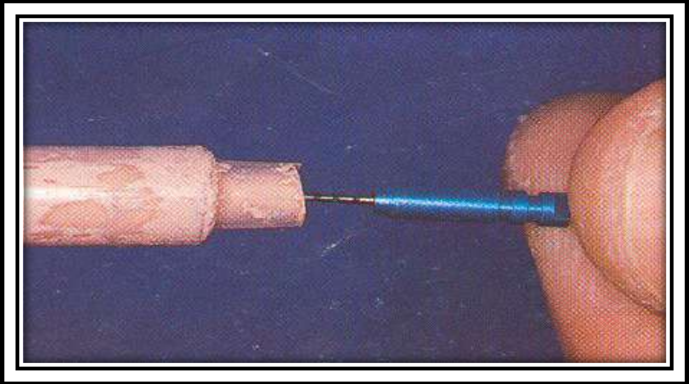
- AlphaSeal
- SuccesFil

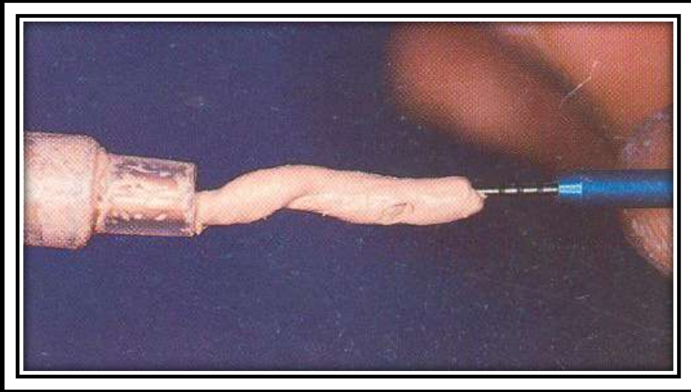
Alpha Seal :- Provides α-phase guttapercha in a syringe which is heated in a special oven



- This system uses conventional K files or similarly sized carriers as the carrier

- Similar in concept to the Thermafil system, but in contrast , the clinician does the "coating" of the carrier





ADVANTAGES

- Is more effective in resisting slippage and displacement of the gutta-percha than pre-coated carriers
  - Use of master apical file or similarly sized titanium carrier
- Ability to try in the carrier prior to obturation
- Ability to precurve the carrier prior to coating

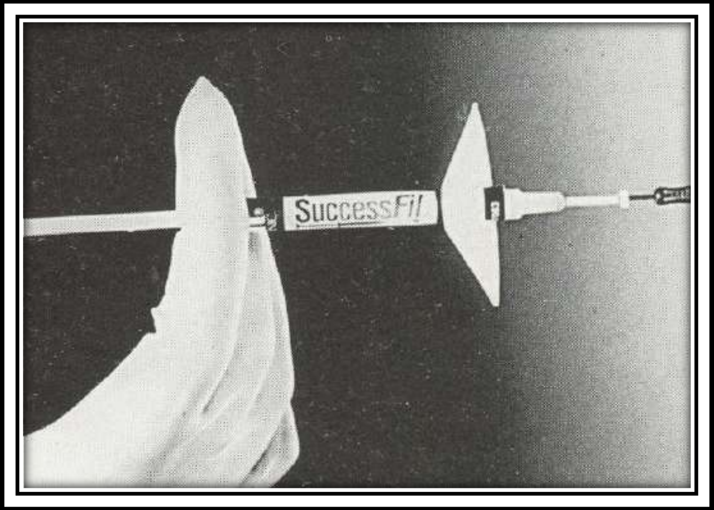
SuccessFil

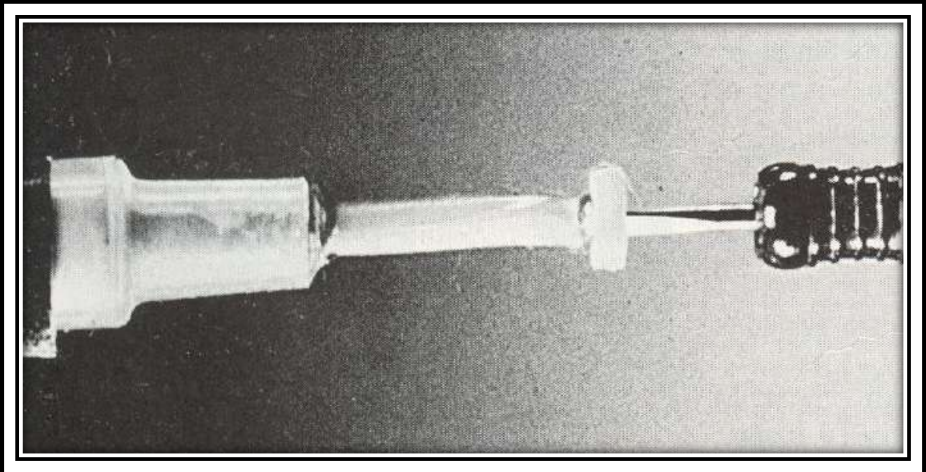
- Consists of
  - SuccessFil solid-core carriers
    - Titanium cores
    - Radiopaque plastics
  - SuccessFil syringes
    - Contain high viscosity alpha phase gutta percha
    - Heated in special heater oven
    - It sets in 2 minutes
  - SuccessFil heater

TECHNIQUE

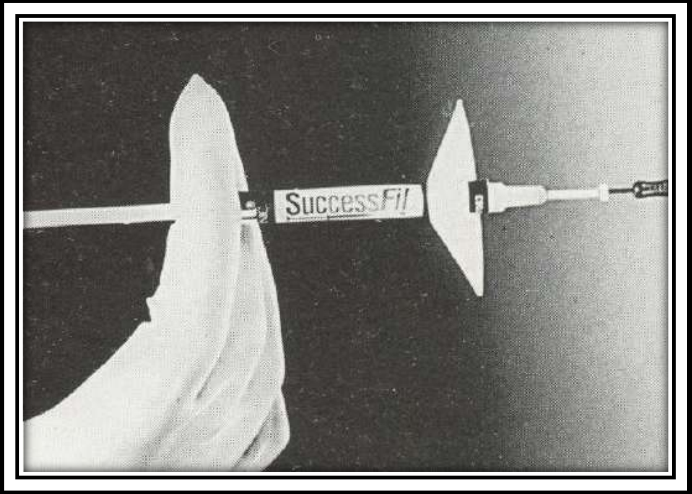
– The gutta percha syringe is warmed

– The carriers are inserted to the measured depth into the gutta-percha in the syringe and then extruded by forcing the plunger



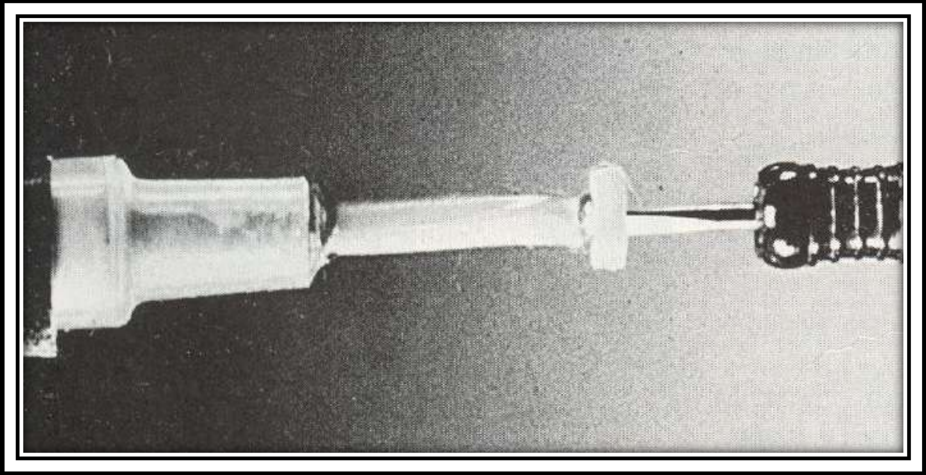


- Rapid withdrawl
  - Creates a tapered shape
- Slower withdrawl
  - creates a cylinder shape



- Inserted into the canal

- Core is separated by holding the handle and severing the core shaft 2mm above the orifice



AlphaSeal

- Uses conventional K-files
- Alpha phase of the gutta percha is processed through heat fractionization

SuccessFil

- Uses its own titanium cores
- Alpha phase of the gutta percha in processed through extensive milling

THERMOPLASTICIZED GUTTA- PERCHA TECHNIQUES

SYRINGE INSERTION

Without gun

- Inject-R-Fill

With gun

Beta- Phase

- Obtura
- Obtura II

Alpha- Phase

- Ultrafil

SOLID –CORE CARRIER INSERTION

Pre coated carriers

- Thermafil and Densfil
- Soft core and Three Dee GP
- One Step Obturator

Operator coated

- AlphaSeal
- SuccesFil

TRIFECTA

TRIFECTA SYSTEM

- A method to block the apex and prevent extrusion
  - A plug of gutta percha at the apical foramen
    - SuccessFil
  - remainder of canal
    - Ultrafil

- 2-3mm of warm, plasticized gutta-percha is retrieved from a SuccessFil syringe on the tip of a sterile endodontic file one size smaller than the last enlarging file used at the apex
- File rotated counterclockwise and retrieved
- Plugger is used to compact
- Sectional injections of Ultrafil is used to fill the rest of the canal and compacted

THERMOPLASTICIZED GUTTA- PERCHA TECHNIQUES

SYRINGE INSERTION

Without gun

- Inject-R-Fill

With gun

Beta- Phase

- Obtura
- Obtura II

Alpha- Phase

- Ultrafil

SOLID –CORE CARRIER INSERTION

Pre coated carriers

- Thermafil and Densfil
- Soft core and Three Dee GP
- One Step Obturator

Operator coated

- AlphaSeal
- SuccesFil

Lateral Compaction

Trifecta

Modified Trifecta

APICAL THIRD FILLING

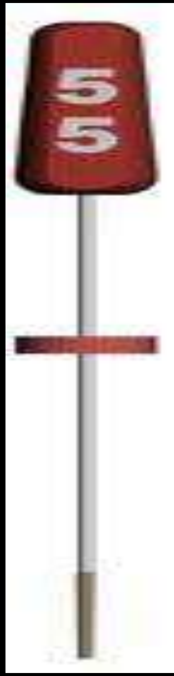
WITH GUTTA PERCHA

- Lightspeed Simplifill obturator
- Fibrefill obturator

WITHOUT GUTTA PERCHA

- Dentin chips
- Calcium hydroxide
- Mineral Trioxide aggregate

SIMPLIFILL



- Originally developed by Senia at Lightspeed Technology
  - to complement the canal shape created using Lightspeed instruments

- The Apical GP Plug size is the same ISO size as the Lightspeed “MasterApical Rotary” (MAR)

- Use of a stainless steel carrier to place and compact a 5 mm segment of gutta-percha into the apical portion of a canal

- Once the GP Plug is snugly fit, the **GP Plug is released by rotating the carrier handle counter clockwise.**
- **During this** rotation, the carrier must not be pushed or pulled.
- Phase two consists of backfilling the remaining canal if no post is desired.

- ❑A **Simpli Fill syringe is loaded with a sealer is slowly injected into the canal** space as the tip of the needle, equivalent to size #40 file, contacts the GP Plug and is slowly withdrawn.
- ❑An ISO standardized gutta-percha cone, equivalent in size to the Apical GP Plug used to fill the apical segment, is then coated with sealer and placed into the sealer-filled canal until it contacts the compacted GP Plug. Accessory gutta-percha cones can be added as space fillers.
- ❑Backfill using **traditional warm-vertical compaction** or may simply backfill using the **Obtura II.**

ADVANTAGES

- Helps conserves dentin because of the Lightspeed instrumentation technique (less flaring)
- It eliminates additional internal forces since no spreader or plugger is used to compact the apical plug
- Simple
- No carrier is left in the canal

FIBREFILL OBTURATORS

- A combination obturation technique
  - Combines a post and obturator in a single unit
  - Apical 5 to 8 mm is gutta percha
    - attached via a thin, flexible filament
    - for negotiation of moderately curved canals
  - Coronal two thirds is a resin core post
    - comprised of unidirectional fibers in an organic resin matrix

- **Fibrefill obturation system consists of**
  - Fibrefill obturators
  - Fibrefill Root Canal Sealant
    - Dual cure resin sealer
  - Fibrefill primer and bonding agent

- **Advantage**
  - can be bonded to the tooth, dramatically reducing coronal leakage

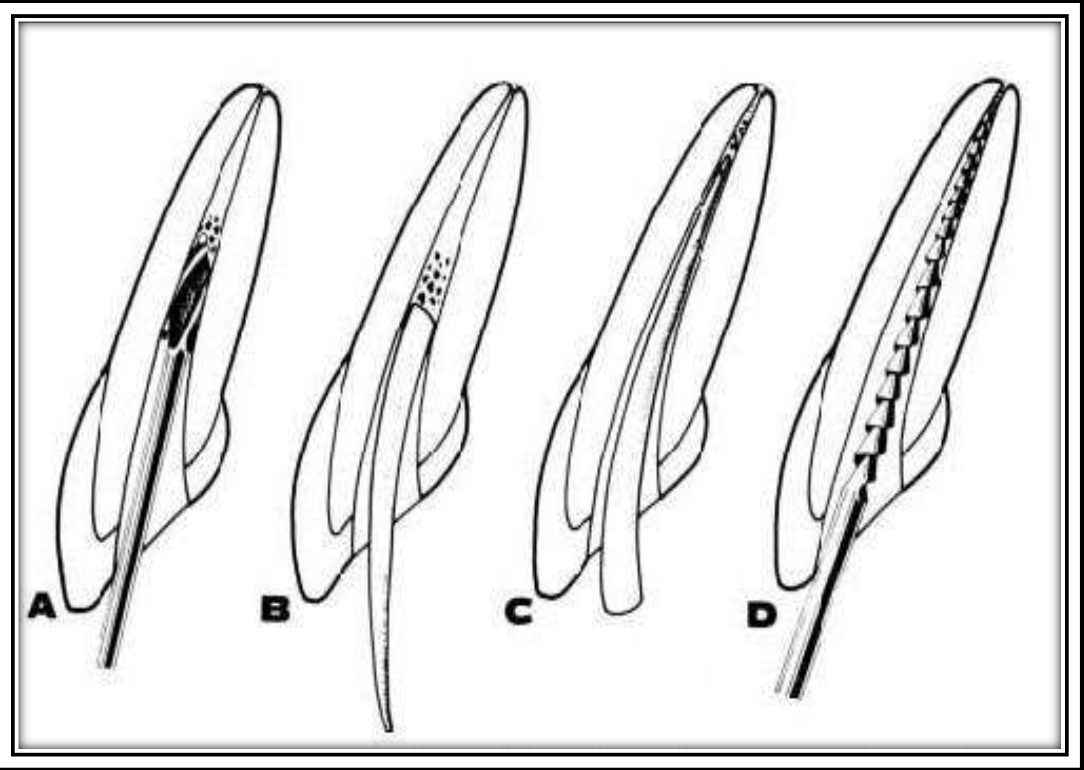
- **Disadvantage**
  - Difficulty of retreatment

DENTIN CHIP APICAL FILLING

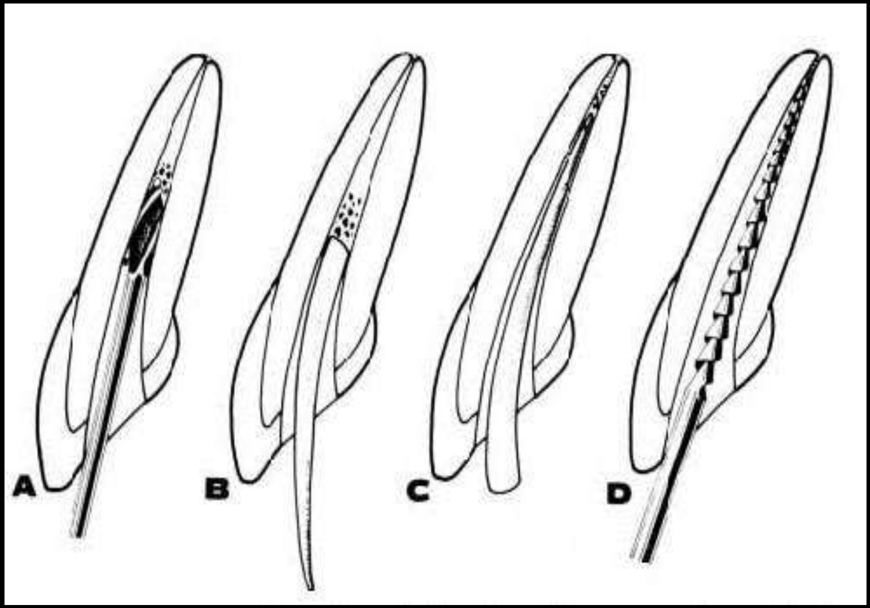
- Based on premise
  - dentin fillings will stimulate osteo or cementogenesis
- **ADVANTAGES**
  - Prevents overfilling and confining the irrigating solutions and filling materials to the canal space *(El Deeb et al)*
  - lead to quicker healing, minimal inflammation, and apical cementum deposition, even when the apex is perforated *(Oswald et al)*
- **DISADVANTAGE**
  - dentin chips, if infected, are a serious deterrent to healing *(Holland et al)*

Dentin Chip Technique

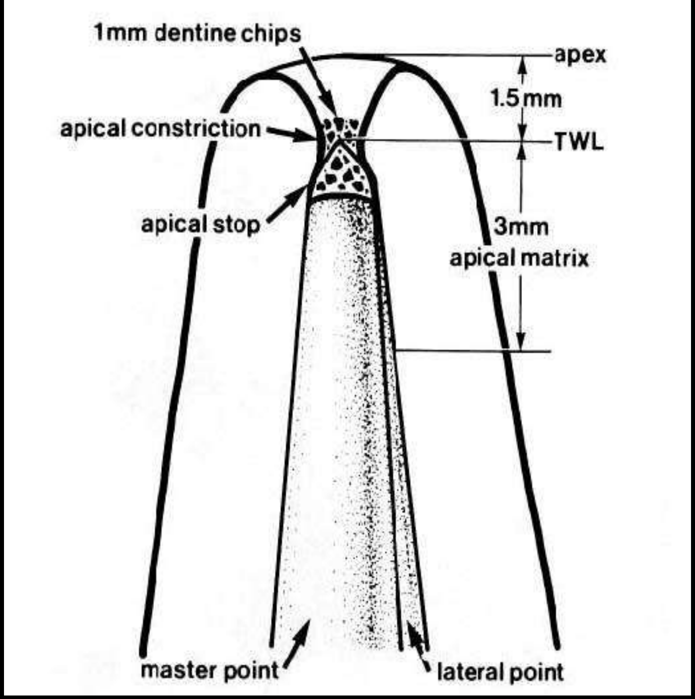
- the canal is totally debrided and shaped
- Gates-Glidden drill or Hedstroem file is used to produce dentin powder in the central position of the canal



- These dentin chips may then be pushed apically with the butt end of a paper point and then the blunted tip of a paper point .
- They are finally packed into place at the apex using a premeasured file one size larger than the last apical enlarging instrument



- One to 2mm of chips should block the foramen
- Completeness of density is tested by resistance to perforation by a No. 15 or 20 file
- The final gutta-percha obturation is then compacted against the plug



EFFICACY OF DENTIN CHIP APICAL FILLING

- Gottlieb and Orban noted cementum forming around dentin chips in the PDL as early as 1921.
- Mayer and Ketterl filled 1,300 canals with apical dentin chips and reported 91% success.
- Ketterl later reported 95% success with cementum-like closure at the apex.
- Waechter and Pritz also reported “osteocementum” apical closing in 20 human cases.
- Baume et al. described “osteodentin” closings but incomplete calcification across all of their histologic serial sections.

Calcium Hydroxide Apical Filling:-

- Cementogenesis, which is stimulated by dentin filings, appears to be replicated by calcium hydroxide as well
- Calcium hydroxide resorbs away from the apex faster than do dentin chips

METHOD OF USE

- Calcium hydroxide can be placed as an apical plug in either a dry or moist state
- Dry calcium hydroxide powder

- ❑ May be deposited in the coronal orifice from a sterilized amalgam carrier.
- ❑ The bolus may then be forced apically with a premeasured plugger .
- ❑ Tapped to place with the last size apical file that was used.
- ❑ One to 2 mm must be well condensed to block the foramen.
- ❑ Blockage should be tested with a file that is one size smaller

- Moist calcium hydroxide
  - can be placed in a number of ways
    - amalgam carrier and plugger
    - Lentulo spiral
    - injection from one of the commercial syringes loaded with calcium hydroxide
      - » Calasept (J.S. Dental Prod., Sweden/USA)
      - » TempCanal (Pulpdent Corp.; Boston Mass.)
  - calcium hydroxide deposit should be thick enough and well condensed
    - serve not only as a stimulant to cemental growth but also as a barrier to extrusion of well compacted gutta-percha obturation

EFFICACY OF CALCIUM HYDROXIDE APICAL FILLING

- The University of Washington group reported good results with calcium hydroxide plugs.
- Both calcium hydroxide and dentin chips worked equally well controlling extrusion of filling materials.
- Weisenseel et al. confirmed much the same, stating that "…teeth with apical plugs of calcium hydroxide demonstrated significantly less leakage than teeth without apical plugs.

INJECTION OR SPIRAL FILLING

- By all accounts, filling the entire root canal by injection, or pumping, or spiralling material into place has great appeal.
- Unfortunately, the methods fall short, either because the technique is inappropriate or the materials used are inadequate.
- An earlier favourite method of filling the canal with **chloropercha and pumping it into place with gutta-percha points** failed because of the severe shrinkage from chloroform evaporation.

INJECTION OR SPIRAL FILLING

- This method was followed by **totally filling the canal with injected ZOE cement,** which will provide an immediate seal, but is often subject to dissolution and leakage over the years, leading to eventual failure
- **Fogel tested** five sealers placed in canals with a pressure syringe. After 30 days, he found that AH-26, Cavit, Durelon, and ZOE cement all exhibited microleakage, although AH-26 had the least marginal leakage and was the easiest to manage.
- The fate of totally obturating canals with cements alone using a Lentulo spiral was sealed when a number of disasters of gross overfilling with **N2 or RC2B** were reported.

INJECTION OR SPIRAL FILLING

- One possible exception to the dangers of injecting filling material into the root canal may lie with the emerging hydroxyapatite as an obturant.
- In this case, the calcium phosphate powders are mixed with glycerine and the paste is injected into the canal.
- The moisture left in the canal and the apical moisture cause the paste to set to hydroxyapatite.
- If the material is extruded, it resorbs and will be replaced by bone.
- In testing the sealing ability of CPC when used as a root canal sealer-filler, the Paffenbarger group reported that in most of the specimens there was "no dye penetration into the filler-canal wall interface"

CONCLUSION

Two important principles must be realized about obturation techniques.

No filling method will be effective without proper cleaning and shaping of the root canal system.

"The obturation is in essence an impression of what the canal looks like after it has been instrumented"

S.I. Kratchman 2004

- During the past 15 years, great efforts have been made to enhance the manipulative properties of gutta-percha by either thermoplasticizing the rubber like material before its insertion or thermo softening the gutta percha once it has been cemented in the canal “cold”.
- As a result obturation systems have evolved that use heat softened gutta-percha delivered via injection or in a carrier; and that deliver heat to cold gutta percha cones cemented in place.

In light of this, perhaps one of the biggest challenges that faces endodontics in this millennium is to find a gutta-percha replacement; a material that actually bonds to the dentin of the canal walls and form a leak proof seal, that is bioinductive and promotes regeneration or a “smart” material that can adapt to the ever changing microenvironment of the canal systems.

REFERENCES

1. Ingle, bakeland, baumgartner *Ingles endodontics 6 " Root canal filling materials" pg 1019-1053*
2. Ingle, bakeland, baumgartner *Ingles endodontics 6 " obturation of the radicular space" pg 1053-1088.*
3. Ingle, bakeland, baumgartner Ingles endodontics 5^{th} Edition *"Obturation Of The Radicular Space" pg 571-656*
4. *Kenneth M.hargreaves Stephen Cohen Cohen pathways of pulp Tenth edition "Obturation of the cleaned and shaped root canal system pg 349-389.*
5. *Franklin S.WEINE Endodontic therapy sixth edition "canal filling with semisolid materials pg 266-313.*
6. *Nicholis E. Root canal Filling . Endodontics.3rd ed. pp- 159-183.*

7. **JOHN WHITWORTH Methods of filling root canals: principles and practices. Endodontic Topics 2005, 12, 2–24**

8. **DAG ORSTAVIK Materials used for root canal obturation: technical, biological and clinical testing . Endodontic Topics 2005, 12, 25–38.**

9. **Renato Leonardo Obturation of the Root Canal — Listening to the Needs of the Tooth with Science and Simplicity . Oral health 2009 (10) :66-70**

10. **George Bogen and Sergio Kuttler Mineral Trioxide Aggregate Obturation: A Review and Case Series J Endod 2009;35:777–790**

DISEASES OF PERI RADICULAR TISSUES

- Inter relationship between pulp and periapical tissues.
- Bacteria and their toxins, immunologic agents, tissue debris etc.
- Communicate through periapical and accessory foramenae.
- Pulpal disease is the most common cause.
- Other causes are neoplastic disorders, developmental factors and trauma.

Classification –

1. Acute Periradicular diseases –

a. Acute alveolar abscess.

b. Acute apical periodontitis – i) Vital

ii) Non vital

2. Chronic periradicular diseases with areas of rarefaction –

a. Chronic alveolar abscess.

b. Granuloma.

c. Cyst.

3. Condensing Osteitis.

4. External root resorption.

5. Diseases of the periradicular tissues of non odontogenic origin.

1. Acute alveolar abscess (Acute abscess, Acute apical abscess, Acute dento-alveolar abscess, acute periapical abscess and acute radicular abscess).

Defn – It is a localized collection of pus in the alveolar bone at the root apex of a tooth, following death of pulp, with extension of the infection thru the apical foramen into the periradicular tissues.

Causes –

- Bacterial invasion from dead pulp tissue.
- Traumatic injury.
- Chemical or mechanical irritation.

Symptoms – Localized symptoms

- Tenderness may be the first symptom.
- Patient has severe, throbbing pain with attendant swelling of overlying tissues.
- Tooth is painful, elongated and mobile.
- Sinus may be present in labial or buccal mucosa.

- Cellulitis of facial tissues .
- Swelling depends upon tooth involved.
- Upper ant – upper lip, both eyelids.
- Upper post – Swelling of cheek.
- Mand ant – Lower lip, chin and neck.

- Mand post – cheek, ear and sub maxillary region.
- Tissue overlying swelling is taut and inflammed.
- Pus formation due to proteolysis – cathepsin and trypsin.
- Exudation of pus thru one or more openings.
- Pus takes path of least resistance.

Generalized symptoms –

- Patient may appear pale, irritable and weakened.
- Fever depending upon severity (99 to 103 degrees).
- Chills.
- Coated tongue and foul breathe.
- Headache and malaise.

Diagnosis –

- Difficult to localize in earlier stages.
- Easier to localize in later stages.
- Tooth is extruded, tender and mobile.
- Radiograph may show defective restoration, thickened PDL.
- As lesion is acute periapical rarefaction may be absent on radiograph.
- EPT and thermal tests will be negative.

D/D –

- Periodontal abscess.
- Irreversible pulpitis.

Bacteriology –

- Streptococci and Stapylococci.

H/P –

- Polymorphonuclear leukocytes.
- Few mononuclear cells.

Management –

- Control systemic symptoms.
- Establish Drainage.
- Endodontic treatment.

Prognosis –

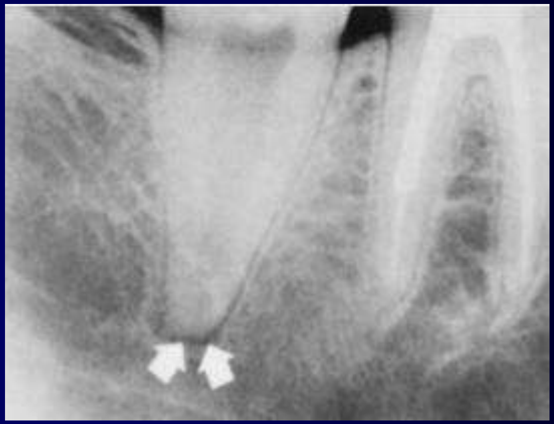
- Usually fair.
- Depends on degree of involvement.
- Endo perio treatment required.

Acute Apical periodontitis –

Defn – It is a painful inflammation of the periodontium as the result of trauma,

Irritation or infection through the root canal, regardless of whether the pulp is

Vital or non vital.



Etiology –

In vital teeth –

- Due to occlusal trauma (Defective occlusal plane, faulty restoration).
- Wedging of foreign object between teeth.

In Non Vital teeth –

- Sequelae of pulpal diseases.

Iatrogenic (Over instrumentation, Perforation, Overobturation).

Symptoms –

- Pain and tenderness of tooth.
- Tooth may be sore.
- Tooth may be extruded .

Diagnosis –

- H/o tooth under treatment.
- Tenderness to percussion.
- Radiograph shows thickened PDL ligaments.

D/D –

- Differentiate from acute apical abscess.
- Difference is only of degree.
- Patients history, symptoms and clinical tests.

Treatment –

- Determine the cause and relieve the symptoms.
- Ascertain the vitality of tooth.

Prognosis – Generally favorable.

D/D –

- Differentiate from acute apical abscess.
- Difference is only of degree.
- Patients history, symptoms and clinical tests.

Treatment –

- Determine the cause and relieve the symptoms.
- Ascertain the vitality of tooth.

Prognosis – Generally favorable.

Acute exacerbation of a chronic lesion (Phoenix abscess) –

Defn – It is an acute inflammatory condition superimposed on an existing Chronic lesion.

Etiology -

- Influx of necrotic product from diseased pulp.
- Mechanical irritation from instruments.
- lowering of body defences.

Symptoms –

- Tenderness to percussion.

- Extruded tooth.
- Palpation positive.

Diagnosis –

- Most commonly associated with initiation of RCT.
- Radiograph shows well defined radiolucency.
- Vitality tests negative.

D/D – Painful pulpitis.

H/P – Usually sterile abscess.

Treatment – Same as for acute alveolar abscess.

Prognosis - Good once the symptoms subside.

Chronic peri radicular diseases –

Chronic alveolar abscess –

Defn - It is a long standing low grade infection of the periradicular alveolar bone.

Etiology - Natural sequelae of death of pulp.

C/F –

- Asymptomatic tooth.
- Discovered during routine investigation.
- Sinus tract usually present.

- Drainage may occur thru the root canal.

Diagnosis –

- Tooth is not very painful.
- Radiographic evidence or discoloration of crown.
- PDL thickening.
- H/O sudden sharp pain that subsided.
- Pain on mastication.
- Vitality tests negative.

D/D – Practically impossible to differentiate between peri radicular diseases.

- Diffuse area - Abscess.
- Well circumscribed – granuloma.
- Sclerotic bony outline – Cyst.
- Differentiate it from cementoma or osiffying fibroma in which the tooth is vital.

H/P - alpha hemolytic streptococci of low virulence, obligatory anaerobes.

Treatment – RCT.

Prognosis - Depends upon endodontic treatment.

Granuloma –

Defn – A dental granuloma is a growth of granulomatous tissue continuous with the periodontal ligament resulting from the death of the pulp and the diffusion of bacterial toxins from the root canal into the surrounding periradicular tissues through the apical foramina.

It is basically a chronic low grade defensive reaction of the alveolar bone to

Irritation from the root canal.

Etiology –

Death of pulp followed by a mild infection or irritation of the periapical tissues.

This stimulates a productive cellular reaction.

Symptoms –

- It may not produce any symptoms.
- In rare cases it may undergo suppuration.

Diagnosis –

- Generally discovered on routine radiography.
- Well defined area of rarefaction , lack of continuity of lamina dura.
- No Mobility.
- No Pain on percussion.
- Sinus tract may be present.
- Tooth does not responds to EPT.

D/D –

- Can not be differentiated from other periradicular diseases.
- Must be differentiated from cementoma in which tooth is vital.

Bacteriology –

Mostly sterile.

Treatment – Root canal therapy.

Prognosis – Excellent.

Radicular cyst –

Defn - It is a closed cavity or sac internally lined with epithelium, the center of which is filled with fluid or semi solid material.

Etiology –

- Physical, chemical or bacterial injury resulting in the death of pulp.
- Stimulation of epithelial cell rest of Malassez.

C/F –

- Usually asymptomatic.
- Large cyst can cause swelling, movement of teeth.

Diagnosis –

- Pulp does not react to electrical or thermal stimuli.
- All clinical tests except radiograph are negative.
- Loss of continuity of lamina dura on radiograph.
- Area of rarefaction.
- Radiolucent area is generally round in outline except where it contacts the adjacent teeth.
- The radiolucent area may be larger than a granuloma.

D/D –

- Differentiate between cyst and granuloma.
- Differentiate between normal anatomy and cyst.

- Differentiate between Globulomaxillary cyst and radicular cyst.

Treatment –

- Root canal therapy.
- Surgical enucleation if lesion fails to resolve after RCT.

Prognosis-

Depends upon extent of lesion and accessibility.

- **Condensing Osteitis –**

Defn –

Condensing Osteitis is the response to a low grade, chronic inflammation of the periradicular area as a result of mild irritation through the root canal.

Etiology –

- Mild irritation from pulpal diseases that stimulates osteoblastic activity in the bone.

C/F –

- Usually asymptomatic.

Diagnosis –

- Made from radiographs.

- Appears as localized area of radioopacity.
- Most commonly affects mandibular posteriors.
- Results of vitality may be in normal range.

Treatment –

Endodontic treatment is indicated.

Prognosis –

Good.

External root resorption –

Defn –

Is a lytic process occurring in the cementum or cementum and dentin of the roots of teeth.

Etiology –

- Trauma, excessive force, granuloma, cyst, central jaw tumours, replantation of teeth, bleaching of teeth, impaction of teeth and systemic diseases.

H/P – Osteoclastic activity.

C/F – Aysmptomatic in earlier stages.

- In later stages tooth may become mobile.
- If it extends into crown, it will give the appearance of “ pink tooth”.

Diagnosis –

- Usually diagnosed radiographically.
- Concave or ragged areas on the root surface.

D/D –

- Differentiate it from internal root resorption.
- In internal resorption, one sees a root canal with well demarcated enlarged ballooning area of resorption.
- In external resorption scooped out or ragged areas are seen.

Treatment –

- Remove etiology.
- CaOH therapy.
- Root canal treatment.

Prognosis –

Guardable.

Periradicular diseases of non odontogenic origin –

- Multiple neurofibromatosis.
- Cementoma.
- Fissural cysts.
- Central giant cell granuloma.
- Apical scar.

THANKS

DISEASES OF DENTAL PULP

- Pulp is the formative organ of the tooth.
- Sensation of pain is the warning sign.
- Highly resistant organ with little or no resistance ?
- **“ Some pulps will die if you look crossly at them, while others can’t be killed with an ax ”**.
- Recuperating ability depends on cellular activity, nutritional supply, age and other metabolic and physiologic parameters.

- ***Integrity of pulp is frequently violated to satisfy mechanical principals.***
- We are still doing it !!

Causes of pulp diseases

- Physical
  - Mechanical
    - Trauma
    - Pathological
    - Crack tooth syndrome
    - Barodontolgia
  - Thermal
    - Heat from cavity prep
    - Exothermic heat
    - Conduction
    - Frictional heat
  - Electrical
- Chemical
  - Phosph acid
  - Erosion
- Bacterial
  - Toxins
  - Caries
  - Anachoresis

I. Physical Causes

A. <u>Mechanical Injuries</u> –

- **<u>Trauma</u>** –

a. **Accidental :**

- May or may not involve fracture of tooth.
- Sports, automobile accidents, habits viz. bobby pin opening, bruxism, nail biting and thread biting.

b. Iatrogenic :

- Accidental exposure of pulp, too rapid orthodontic movement, rapid separation of teeth, pins for amalgam restorations, malleting of DFG.
- Dehydration of pulp – prolonged blast of air, Cavit.

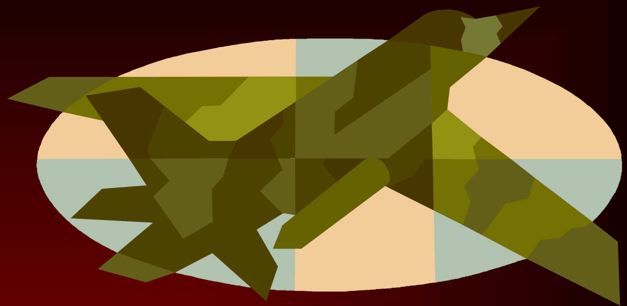
2. **Pathological wear** –

- Abrasion, attrition.

3. **Cracked tooth Syndrome** –

- Incomplete fracture through the body of the tooth.
- Mild to excruciating pain at the initiation or release of biting pressure.
- Make patient bite on cotton applicator or rubber block.
- Dye, Trans illumination using fiber optic light may help in visualization.
- Enamel crack running into dentin is commonly detected under restorations.
- Sometimes even pulp may be necrotic.
- Treatment needs depend on extent of fracture.

4. **Barodontalgia** -



- Also referred to as Aerodontalgia.
- Toothache occurring at low atmospheric pressure.
- Usually experienced during flight or in decompressed chamber.
- Observed at altitudes above 5000 feet.
- Occurs in tooth with chronic pulpitis which is asymptomatic at ground level.
- Occurs because of reduced pressure.
- Lining the cavity with varnish or sub base in deep cavities prevents it.

B. **<u>Thermal injuries</u> –**

1. Heat from cavity preparation –

- Heat generation by bur or diamond is the chief offender.
- Slow speed cutting without coolant is most detrimental.
- Take care while preparing large cavities or jacket crowns.
- The water spray must be directed at dentin directly under the bur.
- If water spray is not directed properly it might lead to burns in dentin.
- Aspiration of odontoblastic nuclei occurs if water spray is inadequate.
- Pulpal damage gets repaired fast when cavity is prepared under water spray.

2. Exothermic Heat during setting of cements –

- Exothermic heat produced by cements like zinc phosphate can lead to transient pulp injury.

- Sub base should be given in deep cavities.

- Try to maintain at least 1.1 to 1.5mm of remaining dentin thickness.

3. Conduction of heat –

- Metallic fillings close to the pulp without adequate base conduct temperature changes to the underlying pulp.

- Sudden temp changes may also contribute to pulpal injury.

- Always give base under metallic fillings and sub base if the cavity is is deep.

4. Frictional Heat during Polishing –

- Heat generated during polishing of metallic filling can lead to transient pulp injury.

- Avoid dry polishing.

C. Electrical –

- Mainly caused due to production of galvanic current.

- Avoid placing dissimilar metallic fillings in oral cavity.

- Place good insulating base under the fillings.

II. Chemical Causes

- Least common cause.
- Arsenic in silicate powder, Para formaldehyde in desensitizing paste.
- Cavity cleansers such as citric acid.
- Self curing plastic material.
- Dehydrating agent such as alcohol and chloroform.
- Acid etchants.
- NaF solution for more than 5 min.
- Use CaOH liners in hallow cavities and as sub base under the base in deep cavities.

III. Bacterial Causes

- Suggested by W. D. Miller in 1894.
- Most common cause of pulp injury.
- Streptococci and Staphylococci have been most commonly isolated.

Bacteria may enter pulp by one of three ways –

1. **Direct invasion by way of the dentin** (caries, fracture of crown, exposure during excavation of caries, attrition, abrasion, erosion.).
2. **Invasion through open blood vessels or lymphatics** (periodontal disease, accessory canal in the furcation area, gingival infection.).
3. **Invasion through the blood** (Infectious diseases or transient bacteremia).

Reaction of Pulp to bacterial invasion

Pulp exposed by trauma, caries

↓

Microorganisms gain access to it.

↓

Localized inflammation of pulp.

↓

PMN leucocytes infiltration.

↓

Localized infection no further spread.

Few bacteria enter tubules and gain foothold

↓

Difficult to dislodge.

↓

Severe inflammation reaches deep.

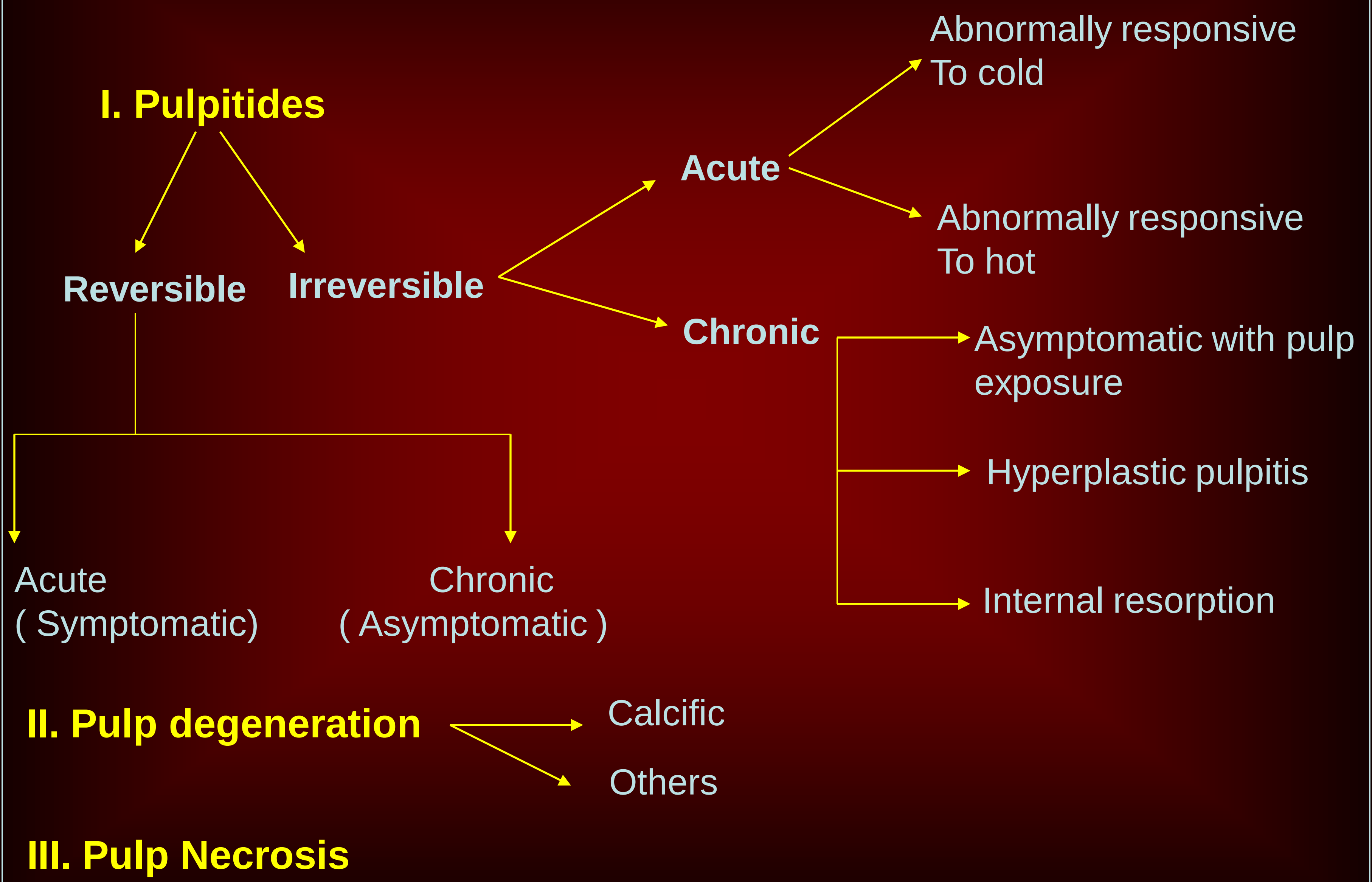
↓

Necrosis and exudate develops under periapical area.

↓

Irreversible pulpitis.

Classification of pulpal diseases.



Classification by Baume –

Based on clinical symptoms –

- Symptomless vital pulp which has been injured or involved by deep caries for which pulp capping may be done.
- Pulps with a history of pain for which pharmacotherapy can be done.
- Pulps indicated for extirpation and immediate root filling.
- Necrosed pulps involving infection of radicular dentin accessible to antiseptic root canal therapy.

Classification by Seltzer and Bender –

A. Treatable –

a. Intact, uninflammed pulp.

b. Transitional stage.

c. Atrophic pulp.

d. Acute pulpitis.

e. Chronic partial pulpitis without necrosis.

B. **Untreatable –**

a. Chronic partial pulpitis with necrosis.

b. Chronic total pulpitis.

c. Total pulp necrosis.

Reversible pulpitis –

Definition –

Mild to moderate inflammatory condition of the pulp caused by noxious Stimuli in which the pulp is capable of returning to the uninflammed state Following the removal of stimuli.

Causes –

a. Trauma
b. Thermal shock
c. Dehydration of cavity
d. Galvanism.
e. Chemical stimulus.
f. Circulatory disturbances.
g. Local vascular congestion.

Diagnosis –

Involved tooth is over reactive to cold. PPM negative.

Symptoms –

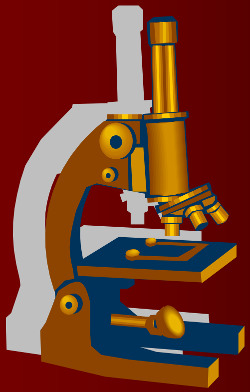
- Symptomatic reversible pulpitis is more responsive to cold.
- Does not occur spontaneously.
- Does not continue once the cause has been removed.
- Asymptomatic pulpitis may result from incipient caries.
- Resolves on restoration of teeth.

D/Diagnosis –

- In reversible pulpitis the pain is transitory lasting for few seconds.
- Onset, character and duration of pain is diagnostic.
- Responds to EPT on lesser current.

H/P –

- Hyperemia to mild to moderate inflammatory changes.
- Limited to involved area.
- Reparative dentin.
- Disruption of odontoblastic layer.
- Dilated blood vessels.
- Extravasation of edema fluid.
- Chronic inflammatory cells.
- Few acute inflammatory cells.



Treatment –

- Prevention.
- Restore incipient lesions.
- Desensitize areas of cervical erosion.
- Use liners and bases.

Prognosis –

Usually favorable if detected early.

Irreversible pulpitis –

Definition –

Persistent inflammatory condition of the pulp symptomatic or asymptomatic caused by noxious stimuli.

Causes –

a. Bacterial involvement because of caries.
b. Thermal shock
c. Chemical stimulus.
d. Mechanical stimulus.
e. Reversible pulpitis may become irreversible.

Diagnosis –

- Visual inspection reveals deep caries extending to the pulp covered by grayish scum like layer.

- Usually odor of decomposition present.

- No pain on superficial probing into the lesion.
- Radiograph shows pulpal involvement.
- More responsive to hot and pain lingers on removal of stimulus.

Symptoms –

In early stages –

- Paroxysm of pain initiated by cold, sweet or acidic stuff, initiated by packing of food stuff into the cavity or suction exerted by tongue or cheek.
- Pain continues after cause has been removed.
- Sharp, piercing or shooting pain.
- Postural cahnged aggravate the pain.
- Referred to adjacent areas.

In later stages –

- Boring, gnawing or throbbing pain.
- Pulp is covered with soft leathery decay.
- Patient kept awake at night.
- Increased with heat and sometimes relieved with cold.

H/P –

- Chronic inflammatory changes in pulp.
- Congested venules.
- Necrotic areas attract PMN and start an acute inflammatory reaction.
- Pus formation.

D/Diagnosis –

- Differentiate it from reversible pulpitis.
- Asymptomatic irreversible pulpitis may exhibit little or no pain .
- PPM are usually positive.

Prognosis –

Usually favorable with endodontic therapy.

Chronic Hyperplastic Pulpitis (Pulp Polyp)

– It is a productive pulpal inflammation due to an extensive carious exposure of a young pulp.
– It is characterized by development of granulation tissue covered at times with epithelium and resulting from long standing low grade irritation.

- HISTOPATHOLOGY:
  - Surface is covered by stratified squamous epithelium.
  - The tissue in chamber is often transformed into granulation tissue, which projects from pulp to carious lesion.
  - Granulation tissue is young, vascular connective tissue containing PMN’s, lymphocytes and plasma cells.

- CAUSE:
  - Slow progressive carious exposure of the pulp.
  - For pulp polyp development, a large open cavity a young resistant pulp and a chronic low grade stimulus is necessary.
- SYMPTOMS:
  - Symptomless except during mastication when pressure of food bolus may cause some discomfort.

- DIAGNOSIS:
  - Generally seen in teeth of children and young adults.
  - Appearance of polypoid tissue is clinically characteristic: a fleshy reddish pulpal mass filling most of pulp chamber or even extending beyond the confines of the tooth.
  - Polypoid tissue is less sensitive than pulp and more sensitive than gingival tissue.

- Cutting of this tissue produces no pain.
- Does not respond to thermal tests
- Electric pulp tester – more current is required
- Bleeds easily

- Radiographically:
  - A large open cavity with direct access to pulp chamber.

- DIFFERENTIAL DIAGNOSIS:
  - To differentiate it from gingival tissue proliferation raise and trace the stalk of tissue back to its origin which is pulp chamber in case of Pulp Polyp.
- TREATMENT:
  - Elimination of polypoid tissue followed by extirpation of the pulp then pulpectomy is done.

Internal Resorption

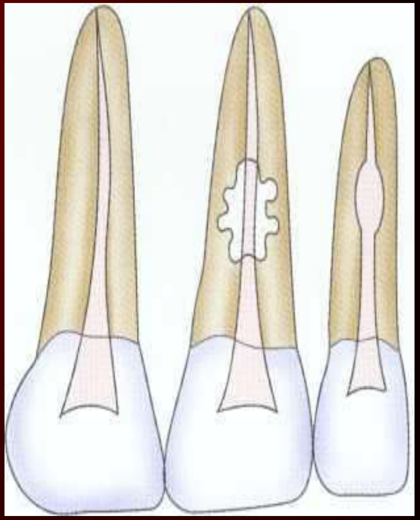
- It is an idiopathic slow or fast progressive resorptive process occurring in dentin of the pulp chamber or root canals of teeth.

- HISTOPATHOLOGY:
  - It is a result of the osteoclastic activity.
  - Resorptive process is characterized by lacunae which may be filled by osteoid tissue.
  - Osteoid tissue may be regarded as attempt of repair.

- CAUSE:
  - Not Known, but generally patients have history of trauma.
- SYMPTOMS:
  – Asymptomatic
  – In crown may be manifested as a reddish area called “Pink Spot” which is due to granulation tisue showing throgh resorbed area.

- DIAGNOSIS:
  - May affect either the crown or the root or both.
  - Any tooth in the mouth can be involved but the most common are maxillary anterior.
  - Usually diagnosed during routine radiographic examination as round or oval radiolucent area in wall or root canal or pulp chamber.

- DIFFERENTIAL DIAGNOSIS:
  - When it progresses into periodontal space and perforation of root occurs it is difficult to differentiate from external resorption.
  - In internal resorption defect is more extensive on pulpal wall than root surface.



- TREATMENT:
  - Extirpation of pulp stops resorption process.
  - Routine endodontic treatment is indicated
- PROGNOSIS:
  - Best before perforation of root or crown.

Pulp Degeneration

- 1. CALCIFIC DEGENERATION:
  - In this, part of pulp tissue is replaced by calcific material i.e. pulp stones or denticles are formed.
  - These may occur within pulp chamber or root canals.
  - These are laminated structures
  - unattached or attached to wall of pulp cavity
  - It is estimated tha pulp stones are present in more than 60% of adult teeth.
  - Considered harmless.

- 2. ATROPHIC DEGENRATION:
  - Observed histopathologically in pulps of older people, fewer stellate cells are present.
  - Intercellular fluid is increased.
  - Pulp tissue is less sensitive tha normal.
  - No clinical diagnosis exists

- 3. FIBROUS DEGENRATION:
  - It is characterised by replacement of cellular component with fiberous connective tissue.
  - On removal from root canal such pulp has leathery fiber appearance.
  - No distinguishing symptoms.

NECROSIS OF PULP

- It is death of the pulp.
- May be partial or total
- Necrosis although sequel to inflammation can also occur following trauma.
- TYPES:
  - 1. Coagulation
  - 2. liquefaction

- **1.Coagulative necrosis** - Soluble portion of tissue is precipitated or converted into solid material.
- **2.Caseation necrosis-** Type of coagulative necrosis in which tissue is converted into cheesy mass consisting of coagulated proteins, fats or water.
- **3.Liquefactive necrosis** - Proteolytic enzymes convert tissue into softened mass, liquid or amorphous debris

- CAUSE:
  - Any noxious insult injurious to pulp.
- SYMPTOMS:
  - No painful symptoms.
  - Discoloration of tooth is generally first sign.
  - Radiographically it is non diagnostic.
  - Teeth with partial necrosis responds to thermal stimuli.

- HISTOPATHOLOGY:
  - Necrotic pulp tissue, Cellular debris & Micro organisms.
- TREATMENT:
  - Endodontic therapy.
- PROGNOSIS:
  - Prognosis is favorable if proper endodontic therapy is instituted

THANK YOU