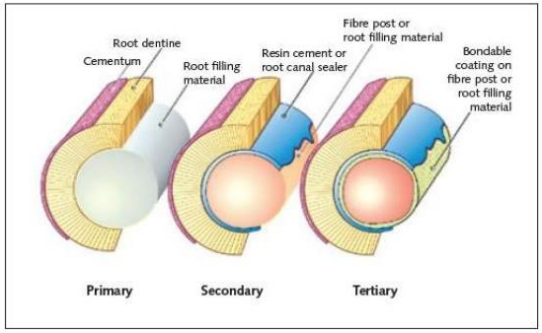
Obturation

PRESENTED BY : DR. GEETA ASTHANA (2017)

Contents

- Introduction
- Objectives
- Hermetic Vs Fluid Impervious Seal
- 3 Main Functions
- Factors Influencing Leakage
- Gp : Sealer Ratio
- Def:obturate And Obturation Technique
- Importance Of Effectively Sealing The Rc System
- Historical Perspectives
- Timing Of Obturation
- Preparation For Obturation
- Monoblock Concept
- Apical Extent Of Obturation
- Underfilling & Underextension
- Overfilling Vs Overextension



- Evaluation of obturation
- Radiographic evaluation
- Clinical evaluation
- Methods of microleakage evaluation
- Obturating materials
- Ideal requirements
- Earlier root canal filling materials
- Silver cone
- Gutta Percha
- Evolution
- Chemistry
- Dental GP composition
- Phases
- Phase transformation
- Properties

- Commercial Manufacture
- Coagulation
- Obach's Technique
- Current Forms

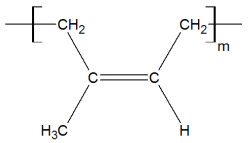
Solid Core Gutta Percha Points:

- Standardized Points:
- Non Standardized Points

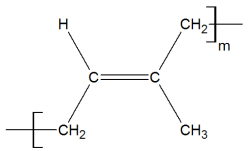
Thermoplasticized Gutta Percha:

Chemically Plastisized Gp

- Immuno Cross Reactivity
- Disinfection
- Disinfecting Agents



cis-1,4-polyisoprene



trans-1,4-polyisoprene

Other newer obturating materials

- Resilon
  - Components
  - Primer:
  - Resilon sealer (epiphany)
  - Resin matrix
- Endorez
- Activ gp
- Medicated gp
- Smartseal
  - Controlled expansion

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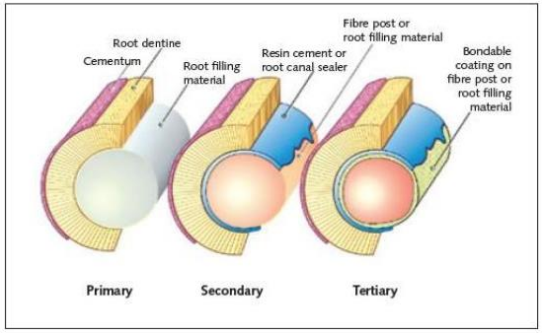

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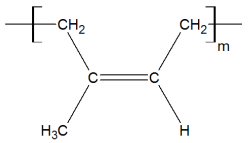

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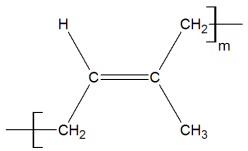

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Obturation techniques

- Lateral compaction
  - Procedure
  - Advantages
  - Limitations
  - Variants on cold lateral compaction
  - *Warm Lateral Compaction Technique*
- Warm vertical condensation technique:
  - Procedure
  - Advantages
  - Disadvantages
- *Continuous Wave Compaction Technique*
  - System B™ Obturation
- McSpadden Thermomechanical Compaction

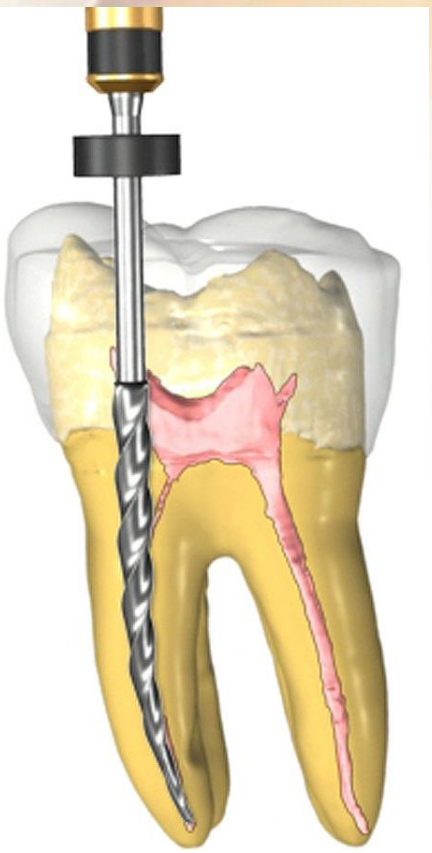
- Procedure
- Advantages
- Limitations

- **Thermoplastic injection techniques**
  - Obtura iii
  - Calamus
  - Elements
  - Hotshot
  - Ultrafil 3d
  - Obtura ii
- **Carrier-based gutta-percha techniques**
  - Generations
  - Thermafil
  - Simplifil
  - Successfil
  - Trifecta technique
  - Js quick-fill

- Chemically Plasticized Gutta Percha
  - Chloropercha
  - Callahan-Johnson diffusion technique
  - Nygaard-Ostby technique
- Custom Cone Technique
- Immediate Obturation
- Single- cone obturations

- Removal of obturation material
  - Guttapercha
  - Solid core obturators.
  - Paste
  - Resilon
  - Silver points.

- Removal of single cone GP
- Removal of Condensed GP
  - manually
  - using rotary system
  - using LASER
- Remove solid core obturators
  - Metal core obturators
  - Removal of plastic core obturators
  - Removal of Modified GP core carrier
- Conclusion
- Referrences



Introduction

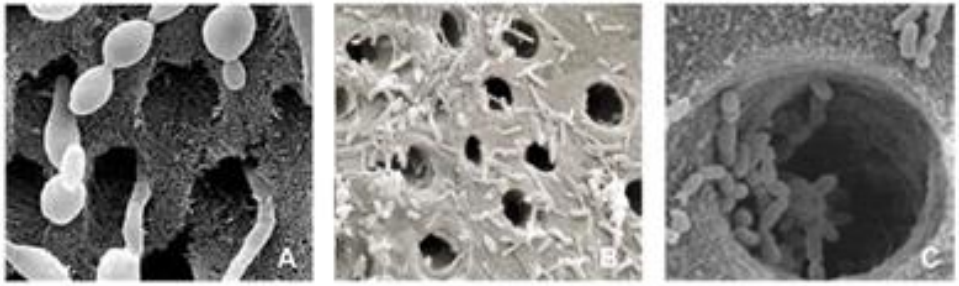
- Whether treatment is being undertaken to remove a vital pulp, manage a necrotic/infected pulp, or revise a previous root canal treatment, filling the root canal represents a critical final stage of endodontic therapy

Textbook of Endodontology, Lars Bjørndal

Objectives

- The final objective - total obturation of the root canal space
- It is the sealing off of the complex root canal system from the PDL & bone which insures the health of the attachment apparatus
- **Key to success:** The elimination of microorganisms & their byproducts

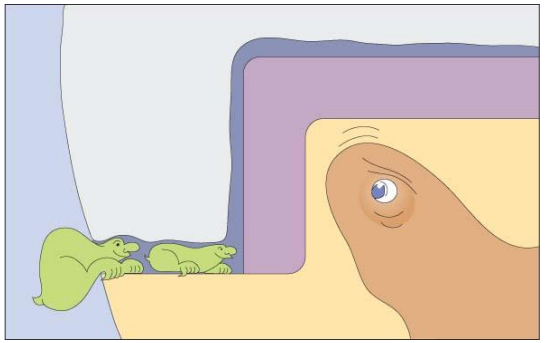
Schilder.H. JOE — Volume 32, Number 4, April 2006



YEAST (A) AND BACTERIA (B AND C) GROWING WITHIN THE DENTINAL TUBULES

After disinfection, the obturation stage:

- Fill the root canal- hermetic seal from the coronal orifice of the canal to the apical foramen at the CDJ
- **The responsibility does not end here**
- Coronal seal- an integral part of endodontic treatment & vital role in the treatment's success



- BRITISH DENTAL JOURNAL Volume 216 No. 6 MAR 21 2014

Hermetic vs Fluid impervious seal

- According to accepted dictionary definitions, the word *hermetic means* sealed *against the escape or entry of air*—or made airtight by fusion or sealing.

- Instead, terms such as *fluid-tight, fluid-impervious, or bacteria-tight seals* are more contemporary.

3 main functions

1. *Prevent coronal leakage* of microorganisms or potential nutrients to support their growth into the dead space of the root canal system

2. *Prevent periapical or periodontal fluids percolating* into canals and feeding microorganisms

3. *Entomb any residual microorganisms* that have survived the debridement & disinfection stages of treatment

BRITISH DENTAL JOURNAL VOLUME 216 NO. 6 MAR 21 2014

Core concept :Factors influencing leakage

- Root canal anatomy and preparation
  - Oval, C-shaped and keyhole shaped root canal cross-sectional profiles
  - unsuitable shapes created during instrumentation prevent the correct application of root canal filling materials.
- Access cavity
  - Microorganisms may *penetrate* an obturated root canal within a few days/weeks (coronal leakage).
- Smear layer
  - Removal using citric acid (10–50%) or EDTA (17%) may influence leakage
  - The effect depends apparently on the sealer used.

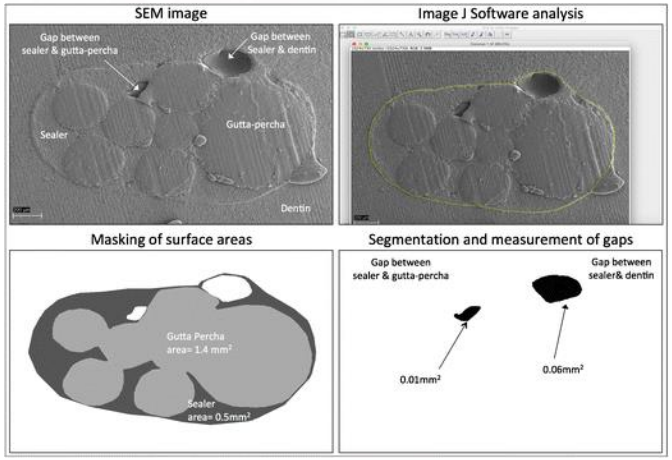
- Hemostasis/dryness of the root canal.
  - The wall must be clean and dry for tight adaptation of the sealer to the wall.
- Root canal filling material
  - Stability, adhesion to dentin and lack of pores.
- Sealer thickness and filling technique.
  - Thick layers showed more leakage, because most sealers contain pores or dissolve more rapidly in thick layers.
- Rinsing regimen
  - Removal of the smear layer allows better penetration of the sealer into dentinal tubules
  - Formation of an *interdiffusion zone* between the sealer and dentin collagen fibers.

Biocompatibility

- Root canal filling materials comes in contact with host tissue- must show *acceptable biocompatibility*.
- Newer materials actively stimulate tissue regeneration.
- They are *osteoconductive* or *osteoinductive.*

GP : Sealer

- Maximize volume of core material and *minimize sealer*.
- No magic filling material that will eliminate the need for correct diagnosis, careful chemomechanical preparation, and optimal coronal restoration



- **Obturation** —*the 3 dimentional filling of the entire root canal system as close as possible to CDJ. (AAE)*

- **Obturation technique**—*The method used to fill and seal a cleaned and shaped root canal using a root canal sealer and core filling material; sealers are frequently used as the sole obturating material in deciduous teeth*

  - Glossary of Endodontic Terms

Importance of Effectively Sealing the RC System

- Ingle & colleagues: 58% of treatment failures – **incomplete obturation**
  - Often poorly prepared
  - Procedural errors

- *Correlation between the quality of obturation & nonhealing*: presence of bacteria

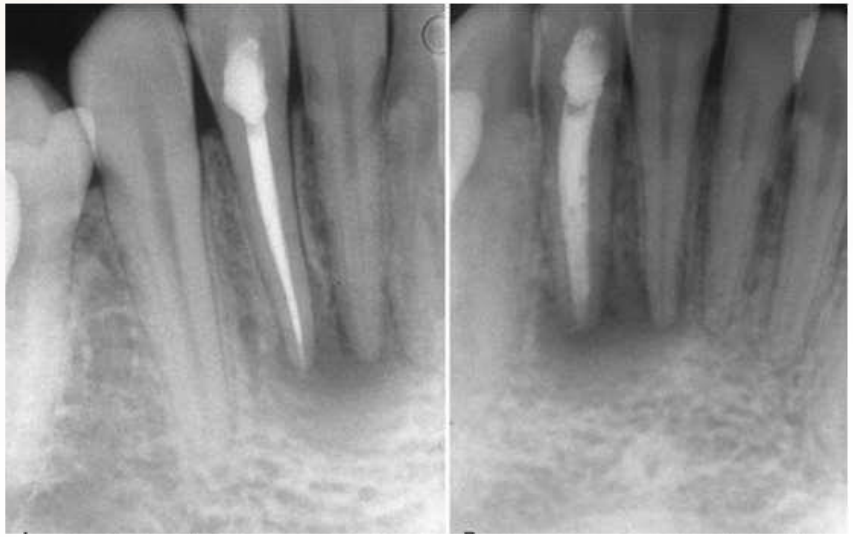
Fabricus et al.

- Cleaning & shaping determines: the degree of disinfection & the ability to obturate the radicular space.
- Reflection of the cleaning and shaping

Failure of diagnostics

- Not possible to *assess the quality* of the seal with a radiograph
- Porous tubular structure of dentin and canal irregularities
- An *adequate radiographic* appearance : may *not-adequate seal*

- Variation in radiographic interpretation by the clinician
- Overlying osseous structures
- Lack of uniformity in the obturation materials



Historical Perspectives

- Over 100 years
- *Edward Hudson in 1825*: Filling with gold foil

- **1847** - Hill Developed "Hill's-stopping" a restorative material, a mixture of bleached Guttapercha and carbonate of lime and quartz.

- ***1967*** **-"***Hermetic seal"*** of the canal terminating at the dentinocemental junction- Grossman's Principle 9
- "Sealed against the escape or entry of *air"* or made '*Airtight by fusion or sealing'* – *inaccurate*
- Hermes Trismegistus - seal of wax
- Obturating the canal space: fluid leakage at the apex or the coronal level.
- *"Impermeable seal" fluid-tight, fluid-impervious,* or *bacteria-tight* seals

- **1867** - Bowman was the first to use Guttapercha for root canal filling.

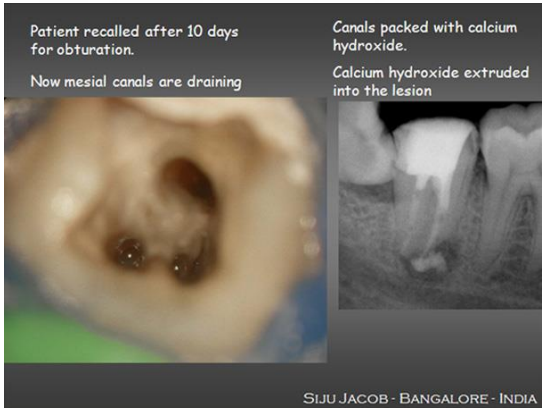
- **1883** - Perry used pointed gold wire wrapped with soft GP, rolled and packed it into the canal.
- 1**887** - S.S White Company was the first to start the commercial manufacture of GP points.
- **1893** - Rollins used Gutta-percha with pure oxide of mercury into root canal filling.
- *Edmund Kells*- first endodontic radiograph in *1899*
- **1914** - Callahan introduced softening and dissolution of GP with the use of rosins in obturation.

- **1959** – Ingle and Levine were the first persons to propose standardization of root canal instruments and filling materials and at their behest, standardized Gutta-percha was introduced to the profession after 2nd International Conference of Endodontics at Philadelphia.

- **1976** - A group evolved into the present day International standards organization (ISO) for approval of specification of root canal instruments and filling materials.

Timing of Obturation

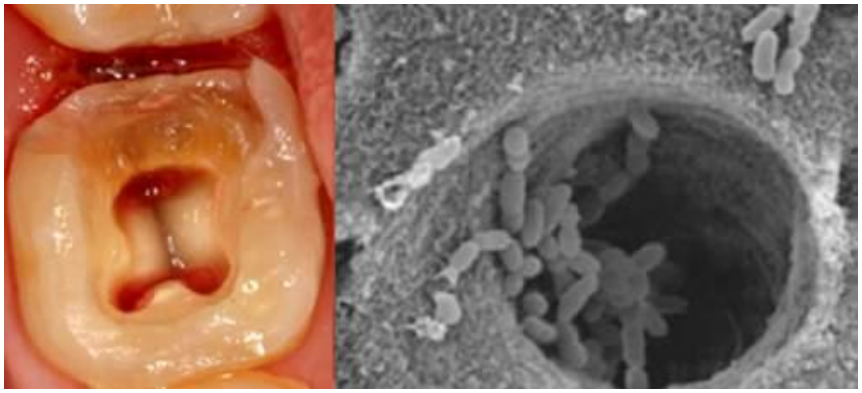
- RC system is dry and time permits, obturating at the same visit is recommended.
- If a dry root canal system not achieved: inter-appointment dressing.
- Asymptomatic
- Mild/ significant symptoms: asymptomatic upon obturation



BRITISH DENTAL JOURNAL
VOLUME 21 NO. 6 MAR 21 2014

- **Negative bacterial cultures.**
- *Sjogren et al.* 5-year recall
- 94% of cases - negative cultures: successful
- 68% of those filled with positive cultures were successful

- **Procedural concerns**
- Difficult cases- multiple appointments
- Medical conditions, psychologic state of mind, and fatigue.



Preparation for Obturation

- Obturation materials designed to bond with dentin,
- Irrigation solutions must be used with consideration of the condition of the dentin surface that is most suitable for bonding
- Smear layer: slowly disintegrate & dissolve around leaking obturation materials
- Sealer penetration into dentinal tubules does not occur when the smear layer is present

- *Colleagues for Excellence*. Fall 2009

Smear layer removal

- 17% disodium EDTA for one minute, followed by a final rinse of NaOCl
- Sonic and ultrasonic instrumentation
- MTAD
- 50% HNO3
- Tetracycline

- **Concern:** increased dentin *permeability* due to demineralization

LENGTH / APICAL EXTENT OF OBTURATION

- The totality of the 3D filling of the RC is more important than its vertical extent alone

Kuttler : Termination should be to the **apical constriction**, when the apical constriction exists.

Seltzer et al. The reaction to tissues were milder when instrumenting short of the apex as compared to instrumenting beyond the apex.

Schilder.H. JOE — Volume 32, Number 4, April 2006
Schaeffer et al. JOE — Volume 31, Number 4, April 2005

- Most North American and European Schools: instrumentation & obturation should be contained within the root canal (**Cailleteau & Mullaney 1997**)

- **Weine:** A point located 1mm coronal to the apex is close to the area of the *CDJ; 1mm short* of the radiographic apex probably acceptable.

- Agreed with **Kuttler**'s study (1955) which identified a smaller diameter or `*apical constriction*' as the point where the canal preparation should end and where the deposition of calcified tissue is most desirable.

FROM THE APEX	CONDITION
1mm	No bone/root resorption
1.5mm	Only bone resorption
2mm	Bone & root resorption

Wein's recommendation

- **Ingle** (1973): Obturation at 0.5mm from the radiographic apex; obturating up to the radiographic terminus of the root actually results in an overfilling.
- **Pecchioni** (1983) : "during instrumentation it is better not to go nearer than 0.5±1mm from the radiographic apex".

- *"While it is very serious and damaging to go beyond this limit with instrumentation, it is less serious to slightly overfill the apex, since the common sealers are generally tolerated and easily resorbable'*

Nguyen (1985) indicated the ***CDJ*** as the limit of the preparation

Guldener (1985): A working length which corresponds to the tooth length less ***0.5mm*** for cases with a ***necrotic pulp***.

In cases of ***vital pulp*** extirpation: an additional reduction of 0.5 mm, ***1mm*** short of the tooth length.

Taylor (1988): a narrower spot at the apical level called `***Minor Diameter***' which he believed to correspond histologically to the CDJ

Langeland (1957, 1967, 1987, 1995)

- Termination of instrumentation & obturation at the *apical constriction*

  - "The most frustrating clinical aspect is that no exact distance from the radiographic apex could be given, because the distance from the radiographic apex to the apical constriction varies widely from root to root"

- All endodontic sealers are irritant and resorbable (1974, 1995)

- *Ricucci.D.* International Endodontic Journal (1998) 31, 384 -393

Schilder -1967, 1976

- Debridement and obturation to the radiographic apex, which often results in material being extruded into periradicular tissues
- 3 - 5% NaOCl solution completely removes necrotic organic debris

- Opposed limitation of preparation at the CDJ or at the apical constriction: too approximate to apply a mathematical or statistical formula (0.5, 1 or 2 mm).
- Schilder (1987) later requested that canal instrumentation and obturation should *stop at the canal terminus*

- **Scianamblo** (1989): RCs & ramifications can be effectively cleaned during cleaning and shaping if these systems are *properly irrigated with NaOCl*

- *Ricucci.D.* International Endodontic Journal (1998) 31, 384 -393

Longitudinal studies

- **Strindberg (1956):** 775 endodontically treated roots, reviewed up to 10 years after treatment: the *highest success rate* - obturation terminated *1mm short* of the radiographic apex

- **Swartz et al. (1983):** 1007 endodontically treated teeth, 1770 canals: ' *overfilled* canals were four times *more likely to fail* than canals filled short of the radiographical apex'.

- **Friedman et al. (1995):** Presence of *extruded sealer* the success rate was 56.7% against 81.9% in the absence of extrusion.

Underfilling & Underextension

- **Over and under extension** refer solely to the vertical dimension of the root canal filling, beyond or short of the root apex.

- **Underfilling**—*An incomplete obturation of the root canal space with resultant voids*

- **Underfilled tooth** : A tooth whose RC system has been inadequately obturated in *any dimension*, leaving large reservoirs for recontamination and infection.

  - *Schilder.H.* JOE — Volume 32, Number 4, April 2006
  - Glossary of Endodontic Terms

Overfilling vs Overextension

- **Overfilling**—*A solid or semi-solid core root canal filling extending beyond the apical foramen; commonly used to imply that the root canal space is completely obturated.*

- **Overextension**—*A solid or semi-solid core root canal filling extending beyond the apical foramen, often the result of failure to create an apical stop during instrumentation; commonly used to imply that the root canal space is not completely obturated.*

  - *Schilder.H.* JOE — Volume 32, Number 4, April 2006
  - Glossary of Endodontic Terms

- *No* case of endodontic *failure due to overfilling*, ie. when the root canal has been obturated in its entirety & surplus material has been intruded into the apical periodontium
- Numerous cases of *failure* of *vertical overextensions of underfilled root canals.*
  - *Schilder.H.* JOE — Volume 32, Number 4, April 2006

Evaluation of obturation

1. Three-dimensionally fills the entire RC system as *close to the CDJ* as possible
2. Shape reflecting a continuously *tapered funnel*: approx. the same as the external root morphology
3. Radiographically: *dense, 3D filling* that extends as close as possible to the CDJ

- Root Canal Obturation: An update

Clinical evaluation

1. Normal findings to routine tests
2. Concerned about prognosis, the reevaluation visit should be scheduled in a few weeks
3. Routine reevaluation periods: 6 months and 1 year.
4. If symptoms occur they should call the office for an appointment

- *Colleagues for Excellence*. Fall 2009

Radiographic evaluation

- The **length** of an ideal fill should be from the minor constriction to the canal orifice unless a post is planned.
- The **shape** of the completed case: obturation technique being used
- **Voids** should **not** be **visible** on the radiographic image
- Adequate provisional **restoration** or definitive

- *Colleagues for Excellence*. Fall 2009

In vitro studies

- **Methods of microleakage evaluation**
- Dye penetration
- Radioisotopes
- Electrochemical
- Fluorometrics
- SEM
- Root clarification
- Fluid filtration
- Fluid transport
- Proteins
- Endotoxins
- Glucose penetration

Tissue toxicity

(1) cytotoxicity evaluation

(2) subcutaneous implantation

(3) intraosseous implantation

(4) in vivo periapical

- **Chisholm:** ZnO & oil of cloves, 130 years ago, to dentistry
- Eugenol: quite cytotoxic
- Proven track record

OBTURATING MATERIALS

Ideal requirements

1. It should be *easily introduced* into the root canal.
2. It should be *removed easily* from the root canal, if necessary.
3. It should *seal the canal* laterally as well as apically.
4. It should *not shrink* after being inserted.
5. It should be *impervious to moisture*.
6. It should be *bacteriostatic* or at least not encourage bacterial growth.
7. It should be *radiopaque*.
8. It should *not stain* tooth structure.
9. It should *not irritate* periradicular tissues.
10. It should be *sterile*, or easily and quickly sterilized, immediately before insertion.

Core concept : Requirements for an ideal root canal filling material

Technical

- No *shrinkage*
- No *solubility* in tissue fluids, undisturbed setting in the presence of moisture
- Good *adhesion*/adaptation to dentin or combining materials (cones, sealers)
- No pores and *water sorption*
- No tooth *discoloration*

Biological

- No general *health problems* or allergies for patients and dental personnel
- *No irritation* of local tissues
- Sterile
- *Antimicrobial* – no enhanced bacterial growth
- Stimulation of the periapical *healing* process

Textbook of Endodontology, Lars Bjørndal

- **Handling**
- Setting in an adequate time, allowing sufficient time for obturation and radiographic control
- Easy to apply and easy to remove using solvents, heat, or mechanical instrumentation

- ISO 6876 requires endodontic filling materials to have a radiopacity >3mm Al equivalent

- According to European regulations (Medical Device Regulations (EU) 2017/745) root canal filling materials must successfully pass a clinical risk assessment procedure before they can be marketed.

Earlier root canal filling materials

- Amalgam
- Asbestos
- Balsam
- Cement
- Copper
- Gold Foil
- Iron
- Lead

- Oxy- Chloride of Zinc
- Paraffin
- Pastes, Plaster of Paris
- Resin, Rubber
- Silverpoints
- Tin foil

Silver cone

- Jasper introduced - claimed produced the same success rate as GP and were easier to use.
- The rigidity made them easy to place and permitted more predictable length control
- Inability to fill the irregularly shaped RC system permitted leakage .
- When silver points contact tissue fluids or saliva, they corrode.

- The corrosion products have been found to be cytotoxic and produced pathosis or impeded periapical healing.
- Treatment failures were the result of leakage and failure to remove the irritants from the root canal system.

- No longer used in contemporary endodontic practice.

Gutta Percha

- "GETAH"- meaning gum
- "PERTJA"- name of the tree in Malay language

- The first person to discover this material was *John Tradescant*, in *1656*
- he named this material as "Mazer wood".
- But the honour of introduction of this material goes to *Dr. William Montogmerie (1843),* who was a medical officer in Indian service.

Evolution

- GP was *first introduced to dentistry* as a temporary filling material by *Edwin Truman*.
- ADA specification - No.78.

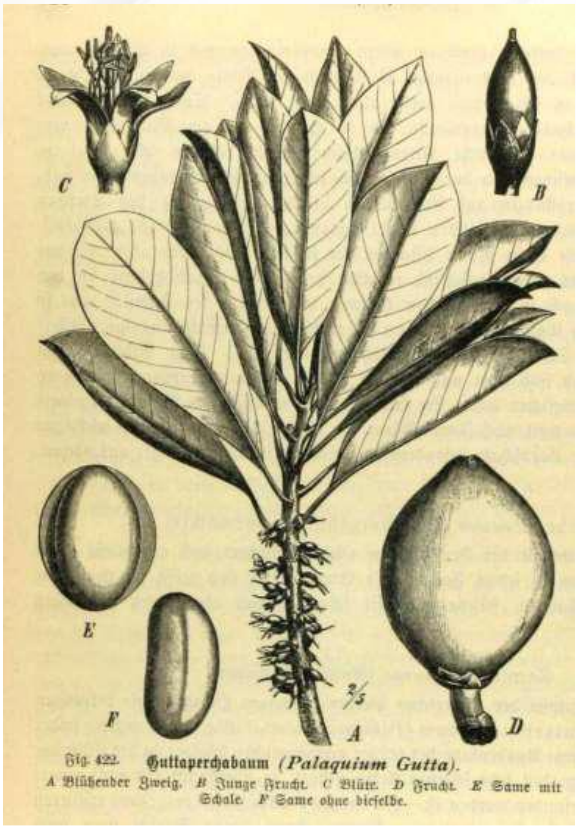
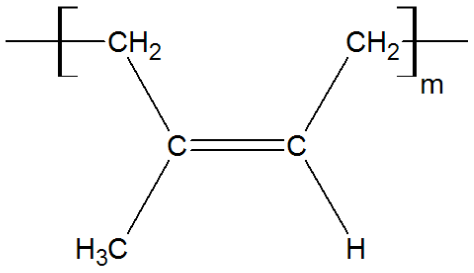


Fig. 422. Guttaperchabaum (*Palaquium Gutta*).
A Blühender Zweig. B Junge Frucht. C Blüte. D Frucht. E Same mit Schale. F Same ohne dieselbe.

Chemistry

- It is a Trans- isomer of poly isoprene.
- Its chemical structure is 1, 4, trans-poly isoprene.
- Its molecular structure is close to that of natural rubber



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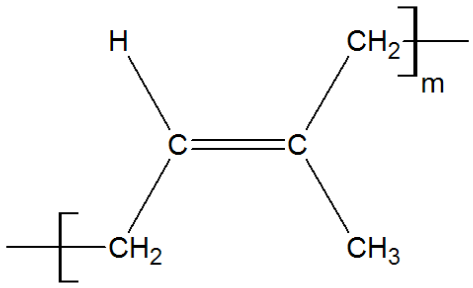


trans-1,4-polyisoprene

- GUTTA -------- 75-82%
- ALBAN -------- 14-16%
- FLUAVIL --------- 4-6%
- Also contains Tannin, salts and saccharine substance.

- **Dental GP composition:**

Materials	Percentage	Function
Gutta-percha	18-22%	Matrix
Zinc oxide	59-76%	Filler
Waxes or resins	1-4%	Plasticity
Metal sulfates (barium or strontium)	1-18%	Radiopacity

Phases

- Chemically pure Gutta-percha exists in two distinctly different crystalline forms (α and β)
- *Natural* gutta percha from tree- *α form*
- most *commercial* available product is in *β form*
- During the process of manufacture, if the *cooling* is done *rapidly, 'β'* form results.
- If it is *cooled slowly*, less than *0.5°c/hr*, '*α '* form results.
- Another unstable form *(γ)* exists, which is *amorphous* in nature.

- **α** ---- runny, tacky and sticky (lower viscosity)
- **β** ---- solid, compactible and elongatible (higher viscosity)
- **γ** ----- similar to α (unstable)

Phase transformation

- When heated from room temperature to 100^0 C.
- ***Beta to alpha***: occurs between *42-49* (this phase transformation is <u>reversible</u>)
- ***Alpha to amorphous***: occurs between *53-59^{0}C*

Alpha form	Beta form
Brittle at room temperature	Stable and flexible
Becomes gluey, adhesive and highly flowable when heated (low viscosity)	Becomes less adhesive and flowable when heated (high viscosity)
Thermoplastisized GP for warm condensation is in alpha form	In cold condensation it is beta form

Properties

- ***Biocompatibility:***
- highly biocompatible; does not react with body fluids
- inert irrespective of alkaline or acidic medium
- does not initiate allergic host response.
- ***Dimensional stability:***
- expansion or shrinkage of material occurs only during phase transformations.
- ***Ductility and malleability:***
- depending on existing phase, material may be ductile or malleable.
- ***Melting point:*** around 60^0C, starts softening
- ***Ease of handling:*** easy to manipulate. When required can be easily removed from root canal.
- ***Adaptation to root apex:*** either in cones or warm, thermoplasticized form.

COMMERCIAL MANUFACTURE

- **Coagulation**

- The sap that oozes out is collected and put into a pot and boiled with little water.
- kneaded under running water.
- Chemical method of coagulation is by addition of alcohol and creosote mixture (20:1), ammonia, limewater or caustic soda

Obach's technique

- The obtained pulp is mixed with water and **heated** to **75°c** to release the GP threads and then **cooled** to **45°c.**
- The flocculated GP called **"yellow Gutta"** contains **60% poly isoprene** and **40%contaminants** .
- Yellow Gutta is **mixed with cold industrial gasoline** at below 0°c temperature.
- This treatment not only **flocculates the GP** but also **dissolves resins** and denatures any residual proteins.
- Then **dissolved** in warm water at **75°c** and dirt particulate is allowed to precipitate.
- Residual greenish yellow solution is **bleached with activated clay, filtered** to remove any particulate and then steam distilled to remove the gasoline.
- "Final ultra pure" GP has gasoline scent, before it is modified with fillers into its final commercial product formulation.

CURRENT FORMS

1. Solid core gutta percha points:

- **Standardized points:**
- manufactured in coherence to instrument taper and apical gauge.
- Stiff due to high ZnO

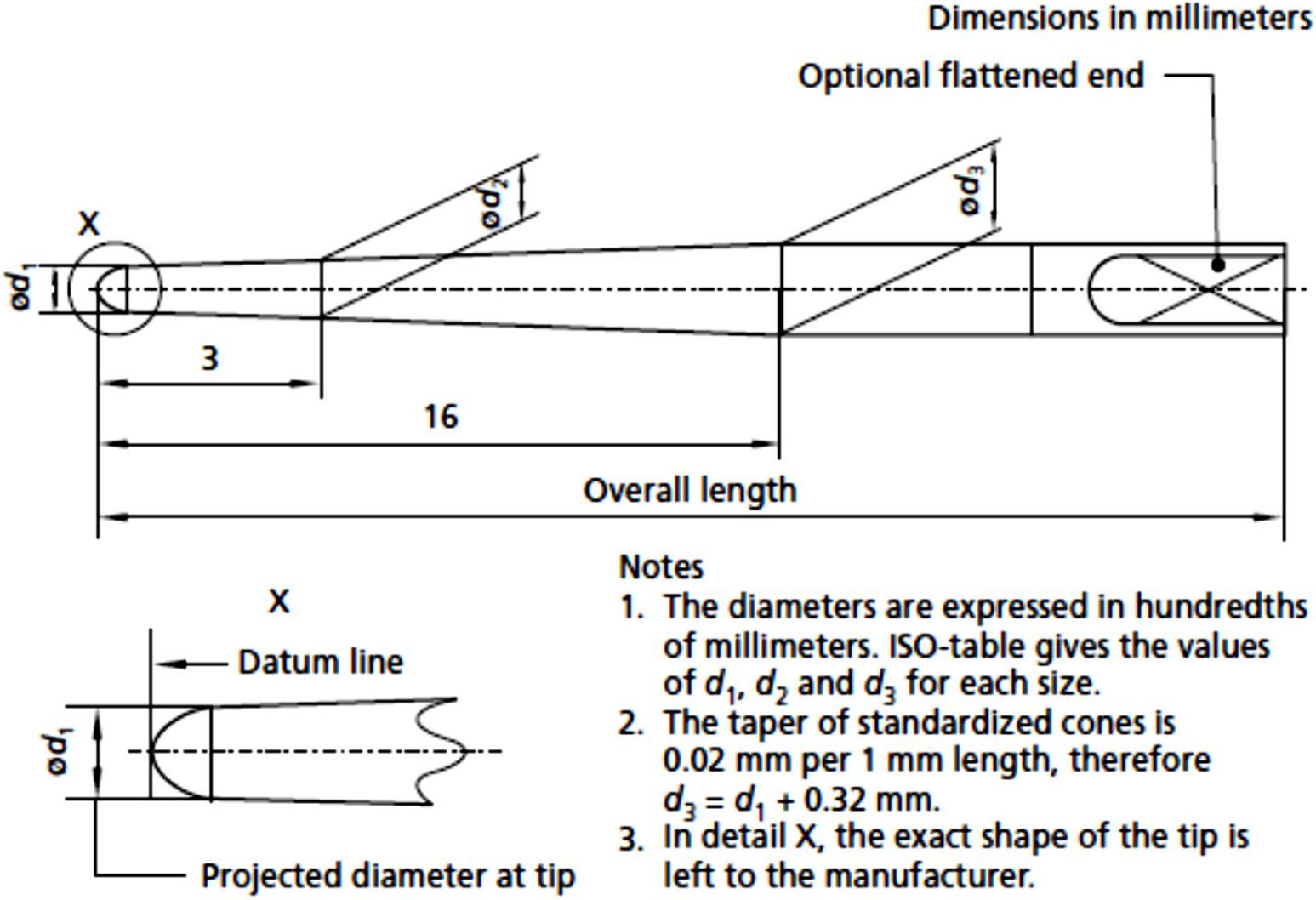
- **Non standardized points:**
- manufactured in variable taper
- The tip of point is adjusted with an apical gauge to best fit and seal the apex.
- Flexibility is enhanced due to low content of zinc oxide.

2. *Thermoplasticized gutta percha:*

- Usually available in injectable form (alpha phase).
- These systems provide special heaters which heats till the temperature when it flows.
- Apical seal is achieved with the plugging of master cone and then the gutta percha is backfilled.

3. **Chemically plastisized Gp**

- Gutta percha may be dissolved in various solvents, such as ***chloroform, oil of eucalyptus or xylol***.



Scheme for the dimensions of a standardized gutta-percha cone according to ISO 6877; d1 × 100 = size designation of gutta-percha cone (ISO 10–ISO 140).

IMMUNO CROSS REACTIVITY

- GUTA PERCHA and NATURAL RUBBER LATEX (NRL), are from different trees of the same botanical family
- Raw GP contains the rubber molecule *trans*-polyisoprene
- NRL contains *cis*-polyisoprene intermingled with a variety of latex-allergen proteins
- Dental latex materials can cause immediate hypersensitivity (type I allergy) in dental professionals and patients.
- include ocular, nasal, pulmonary, gastrointestinal, cardiovascular and genitourinary symptoms
- be localized and systemic

- ***Gazelius et al. and Boxer et al.*** reported that - a potential cross-reactivity between NRL and gutta percha allergens in latex allergy patients exists.

- ***Costa et al.*** investigated the cross-reactivity between gutta percha, gutta balata, and NRL using a competitive radio-allegro-sorbent test (RAST) inhibition assay.
- These results demonstrated that the raw or manufactured GP points did not show detectible cross reactivity.
- However, raw gutta balata extracts cross-reacted with NRL-specific IgE antibody.

- Using the RAST inhibition and the immunoblot inhibition assays, ***Hamann et al.*** - there is no cross-reactivity between GP and NRL, but raw GP cross-reacted with serum from patients with type 1 NRL allergy.

- ***Kang PB et al. studied the*** postulated immuno cross-reactivity between proteins derived from raw GP (RGP), GP point (GPP) and natural rubber latex (NRL).

- Determined by ELISA inhibition assay.
- Except for NRL glove extracts, neither extracts from RGP or GPP were reactive in ELISA inhibition assay.

- The immuno cross-reactivity of gutta percha points *Peter B. Kang*, Kristy Vogt, Stephen E. Gruninger, Milton Marshall, Chakwan Siew, Daniel M. Meyer Dental materials 23 (2007) 380–384*

Disinfection

- GP can be contaminated by handling, aerosols and physical sources during the storage process.

- ***Why disinfection of GP?***
- free from pathogenic microorganisms
- Penetration of bacteria into the blood stream should be avoided
- cannot be sterilized by moist or dry heat - cause alteration of structure.
- Therefore, a rapid chairside chemical disinfection is needed.

Why do we need a quick decontamination method?

- Difficult to know beforehand how many accessory cones will be used.
- **5.25% NaOCl** is an effective agent
- CHX was not effective in eliminating Bacillus subtilis spores after 72 h of contact

Disinfection of gutta-percha cones with chlorhexidine and sodium hypochlorite Brenda Paula Figueiredo de Almeida Gomes et al. Oral SurgOral Med Oral PatholOral Radiol Endod 2005;100:512-7

Disinfecting agent

- Polyvinyl pyrolidone-iodine
- Ethyl alcohol
- Sodium hypochlorite
- Hydrogen peroxide
- Quaternary of ammonium
- Glutaraldehyde
- Chlorhexidine liquid.

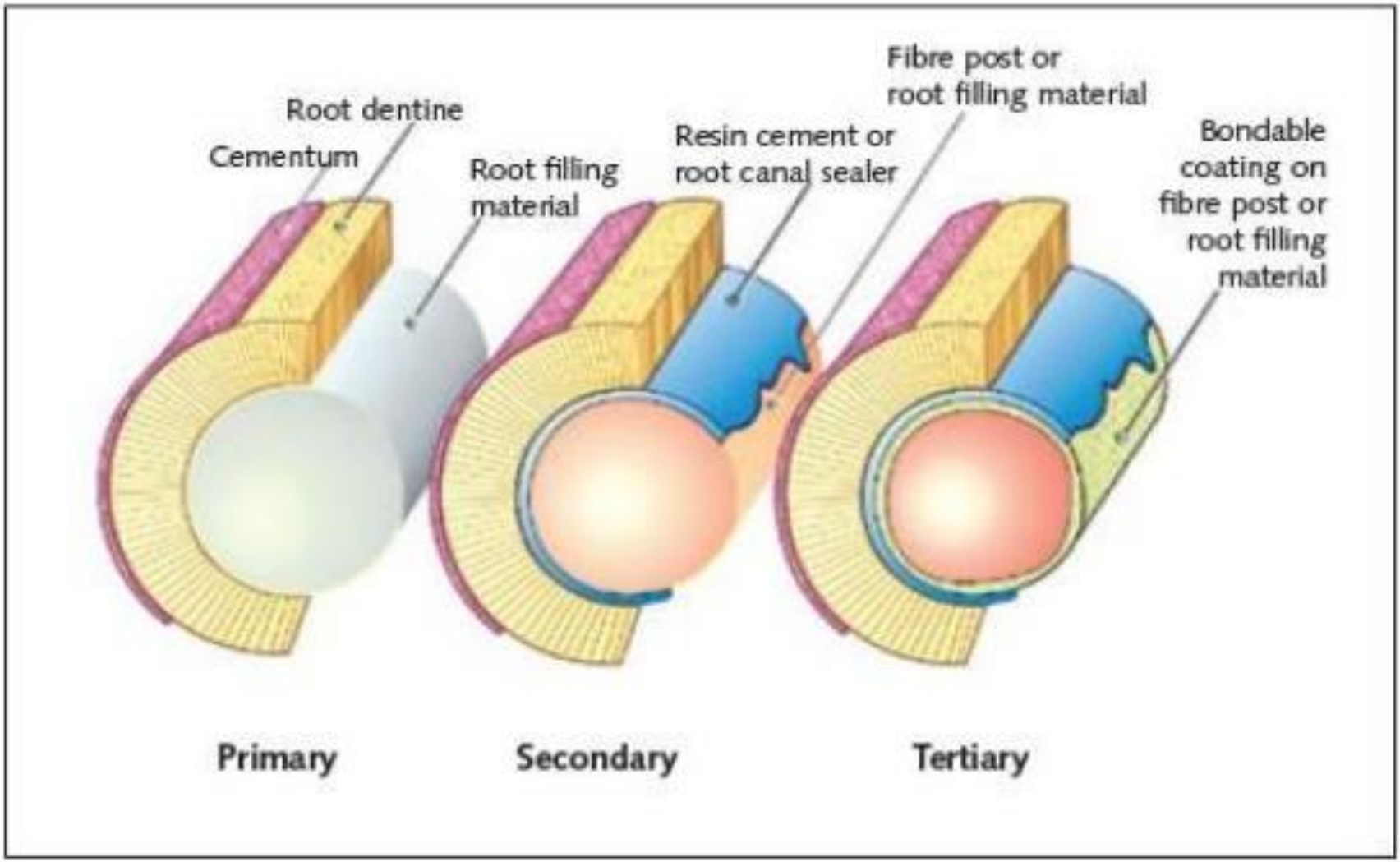
OTHER NEWER OBTURATING MATERIALS

Resilon

- It offers solutions to the problems associated with GP:
  - Shrinkage of GP after application of heat.
  - Gap formation between the sealer and the GP.

- This resilon core material bonded to the sealer by polymerization.

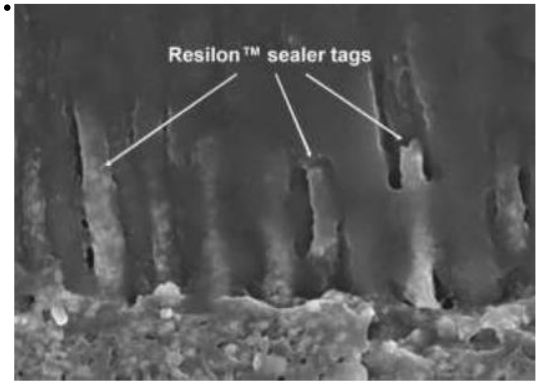
Monoblock concept



Components

- 1. Primer:
- It is a self etch primer
- contains a sulfonic acid terminated functional monomer, HEMA

- 2. Resilon sealer (Epiphany)
- a dual-cured, resin-based composite sealer.
- bonds to both the root dentin and Resilon cones.



- The resin matrix is comprised of Bis-GMA, ethoxylated Bis-GMA, UDMA and *hydrophilic difunctional methacrylates.*

- 3. Resilon core material:

- It is a thermoplastic synthetic polymer based (polyester) core material
- contains bioactive glass, bismuth oxychloride and barium sulphate.
- filler content - 65 % by weight.

- Noncytotoxic and nonmutagenic.

EndoREZ

- **It** is a *hydrophilic*, two-component (base and catalysts), dual curing self priming sealer.
- It has hydrophilic characteristics providing *penetration into dentinal tubules*.

- The radiopacity is equivalent to gutta-percha.
- does not compromise the function of dentin bonding agents or luting resin polymerization.

- Designed to be used with EndoREZ Points and/or gutta percha.
- EndoREZ Points are standard ISO-sized gutta percha points overlayed with a thin resin coating, which bonds chemically with EndoREZ sealer.

Activ GP

- a core material containing GP which is impregnated and coated with glass ionomer.
- sealer is a traditional glass ionomer sealer which can adhere chemically and micromechanically to the Activ GP cones and bond to the dentin.
- Coating helps bonding between gutta-percha and glass ionomer sealer.

- Activ GP Sealer - *12 minute* working time
- no need for a bonding agent (primer)

Medicated GP

1. Calcium hydroxide containing GP
2. Chlorhexidine diacetate containing GP
3. Iodoform containing GP

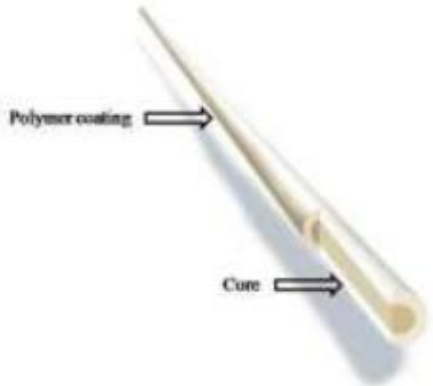
Smartseal

- Based on polymer technology.

- Principle - the hydrophilic nature of the obturating points which can absorb surrounding moisture and expand resulting in filling of voids and spaces.

constructed in two parts

- **Central Core**
- point with the flexibility to easily pass around any curves in the prepared canal
- **Outer Polymer Layer**
- this hydrophilic, hydrogel layer allows the point to swell to adapt to the ramifications of the root canal.



- **Advantages :**
- Any geometry of point can be accurately made
- Controlled expansion
- Biocompatibility

Smart paste Bio

- Is a hydroxyapatite based sealer that is used with the smartseal obturation points.
- delivered in a pre-mixed syringe.
- expand slightly on setting

Controlled Expansion

The smartseal polymer is **hydrophilic** which allows water present in the root canal to be absorbed.

This water can **hydrogen bond** to the polar sites present, **enabling expansion** within the polymeric chains.

Expansion **occurs within the first 4 hours**.

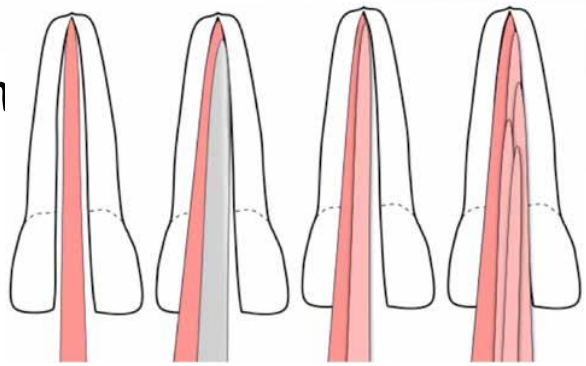
This results in the polymer and **sealer being expressed into the dentinal tubules.**

Forms a seal that is **impermeable to bacterial micro-leakage.**

OBTURATION TECHNIQUES

Obturation techniques

1. Cold lateral compaction
2. Warm compaction (warm gutta-percha)
    - (a) Vertical (condensation)
    - (b) Lateral (compaction)
3. Continuous wave compaction technique
4. Thermoplasticized gutta-percha injection
5. Carrier-based gutta-percha
    - (a) Thermafil thermoplasticized
    - (b) SimpliFill sectional obturation
6. McSpadden thermomechanical compaction
7. Chemically plasticized gutta-percha
8. Custom cone



Grossman

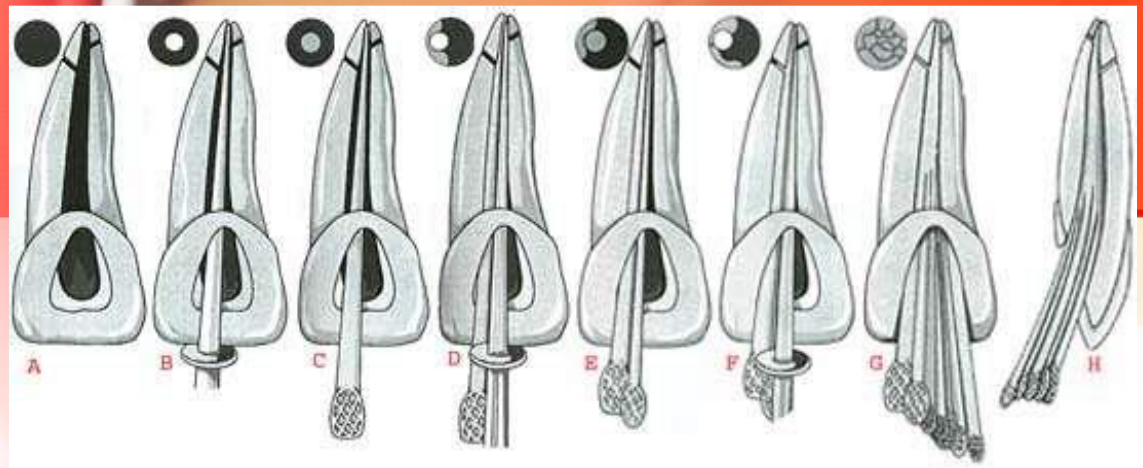
- These techniques are classified by Bhatti & Joshi (1997) as

- Intraradicular (In this the GP is heated within the RC and allowed to flow into the RC.)
- Extraradicular (In this the GP is heated outside the mouth and then placed in the RC.)

Lateral compaction

- Isolation & drying the canals
- Selection of master cone
- Checking for apical "TUG BACK"

- Inadequate fit- beyond the apex
  - Tip cut off: reinserted primary cone fits snugly at the WL
- Inadequate fit- short of the apex
  - Patency established to the corrected length
  - Another primary GP inserted & verified



Sealer manipulation

Canal coated

Master cone inserted till WL

Spreader inserted alongside: level 1mm short of the WL

Spreader disengaged

Placement of sequential accessory cones by lateral compaction

- Butt end of the GP: cut off with heated instrument
- Chamber cleaned & Restoration placed

Endodontic Topics 2005, 12, 2–24

- Advantages
- " Deep spreader penetration": minimize apical leakage/ percolation
- Positive dimensional stability of the root canal filling
- Less likelihood of carrying filling material beyond the root apex

- Limitations
- Presence of voids
- Less able to seal intracanal defects & lateral canals
- Less homogeneous mass
- Time consuming

JOE—Volume 32, Number 4, April 2006
Endodontic Topics 2005, 12, 2–24

VARIANTS ON COLD LATERAL COMPACTION

- Warming spreaders before each use in a hot bead sterilizer
- Softening GP with heat before insertion of the cold spreader
- Mechanical activation of finger spreaders in an endodontic reciprocating handpiece
- Application of an ultrasonically energized spreader

- Endodontic Topics 2005, 12, 2-24

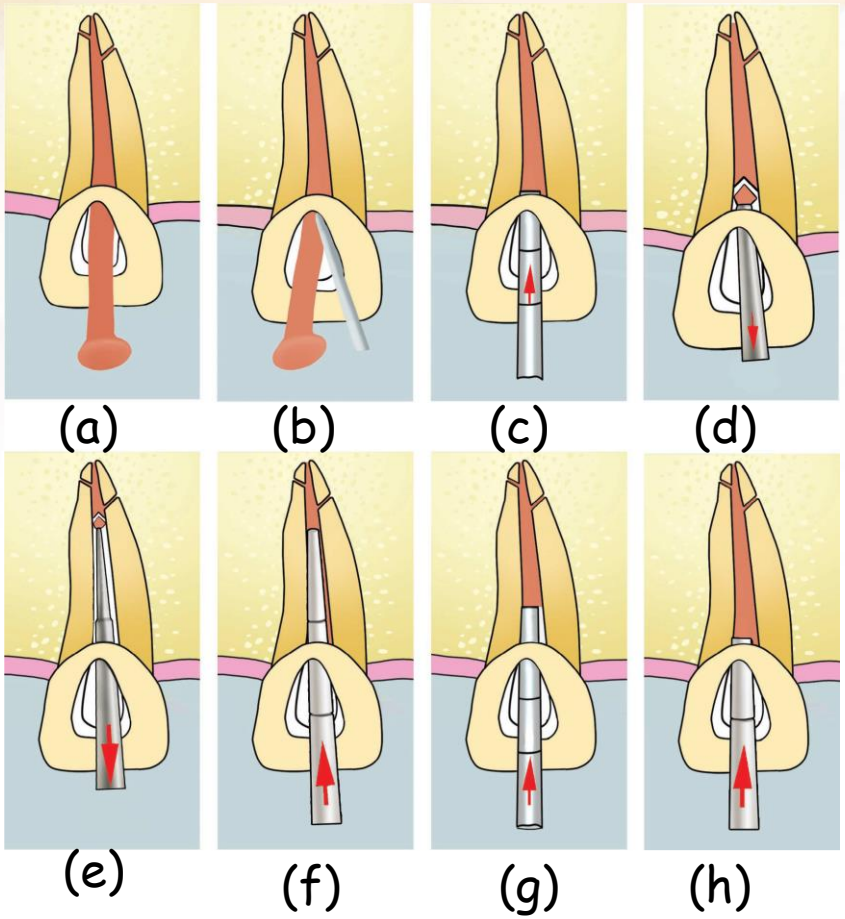
Warm Lateral Compaction Technique

- **Martin**
- Endotec II, Endo Twinn, EI DownPak device is used in warm lateral compaction.

Warm vertical condensation technique:

- **Herbert Schilder 1967**
- Objective - filling the main root canal as well as *lateral and accessory canals*
- Eg - Touch 'n Heat

- (a) and (b) Master cone adaptation
- (c) Severing of the coronal portion of the master cone with a heated instrument.
- (d) Compaction of the master cone.
- (e) Sequential segments removed with the heat carrier followed by compaction.
- (f)–(h) Once the apical third is reached, the canal is backfilled with heated segments of gutta-percha followed by compaction with suitable pluggers.



- *Advantages*
- Excellent seal of the canal apically and laterally
- Obturation of the larger lateral and accessory canals

- *Disadvantages*
- The amount of time it takes
- The risk of *vertical root fracture* resulting from undue force
- *overfilling* of GP or sealer that cannot be retrieved from the periradicular tissues
- difficult in curved canals

- A study compared root surface temperatures for warm vertical obturation using the System B heat source, the Touch 'n Heat device and a flame-heated carrier in maxillary and mandibular incisors and premolars.

- System B and the Touch 'n Heat produced a surface temperature rise that was less than 10° C.
- The flame-heated carrier produced temperature changes greater than 10° C in all experimental teeth.

- Critical level of root surface heat required to produce irreversible bone damage - greater than 10° C

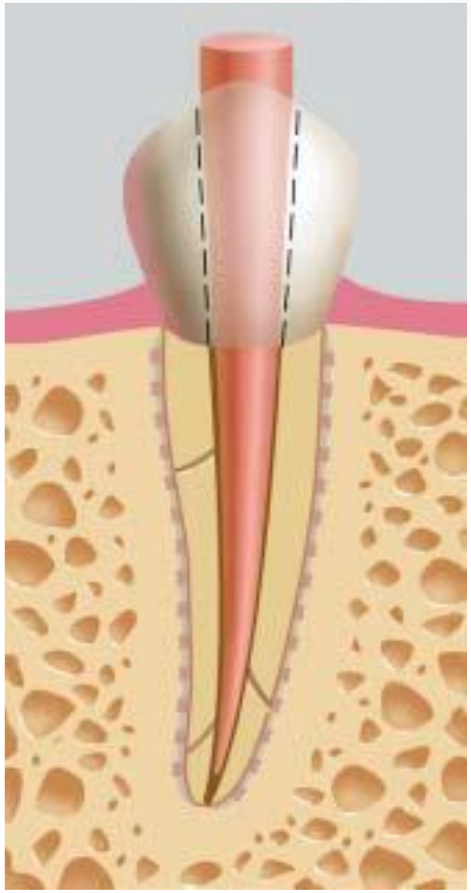
- warm vertical compaction with the System B should not damage supporting periodontal structures

Continuous Wave Compaction Technique

- By *Buchanan*
- Variation of warm vertical compaction technique.
- Introduced to reduce time
- employs an electric heat carrier
- The recommended temperature setting for system B unit is 200^0 C.
- System B
- Obtura II system

System B™ Obturation

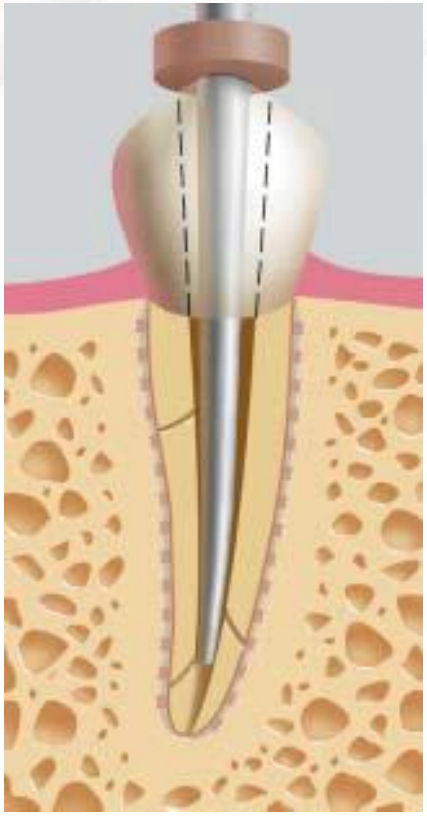
- *A gutta-percha cone is chosen*
- *Tug back* occurs within the apical control zone



- A System B™ condenser/ *plugger is chosen* that matches the shape of the prepared canal and the GP cone.

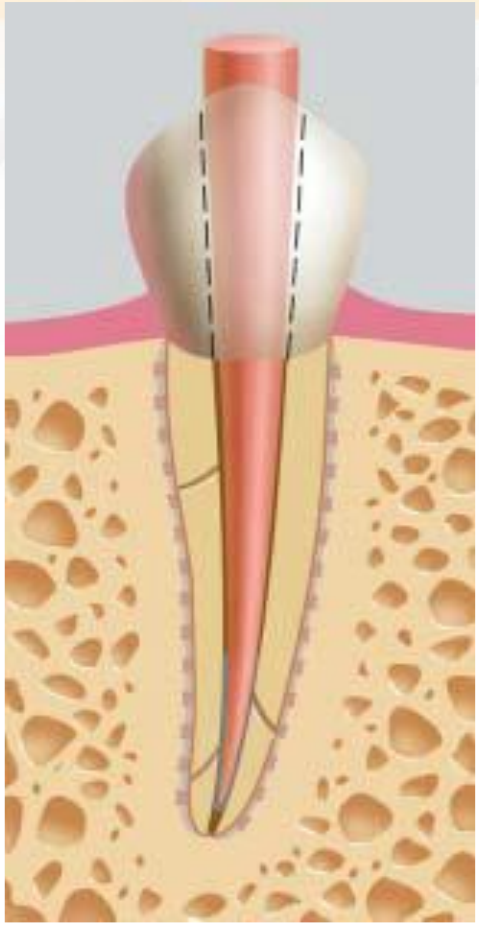
- The plugger is <u>prefit to its binding point</u>

- The *rubber stopper is then positioned* <u>*2mm short*</u> binding point to minimize direct contact on dentin



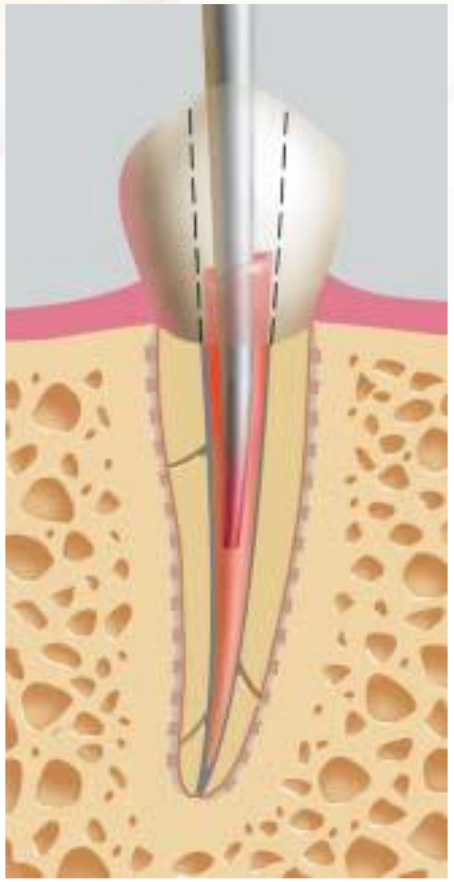
- Sealer is placed in the canal

- *The apical 4 mm* of the master cone is coated with sealer and using gentle pressure, the cone is seated to place.



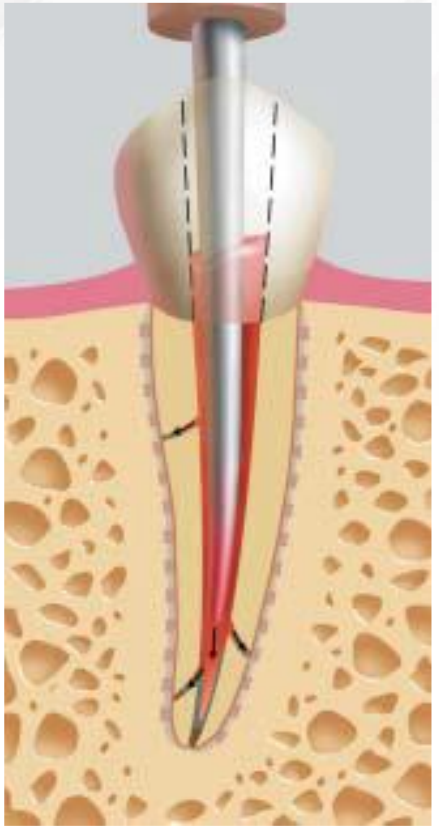
- The System B™ *Heat Source* is turned to use and *placed* it theTouch mode.

- The plugger plunges smoothly through the gutta-percha mass.



- As the heated plugger (200 ^{0}C) approaches the binding point, the ring switch is released

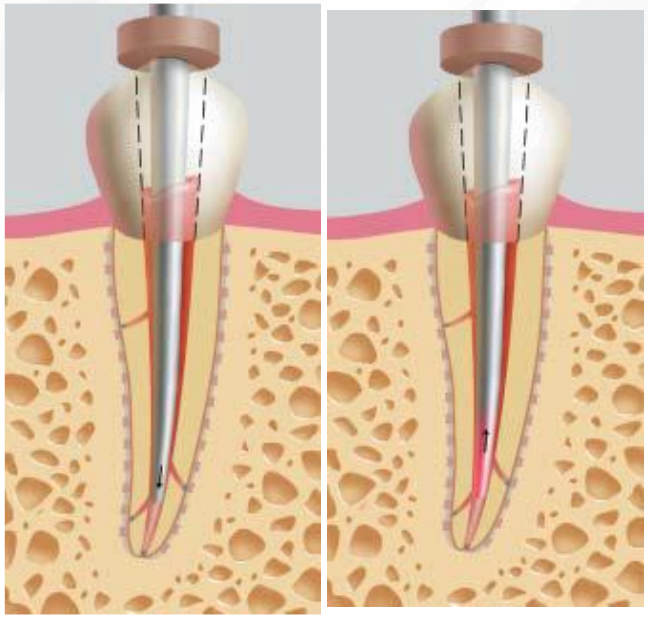
- which allows the plugger/condenser to continue its apical movement.



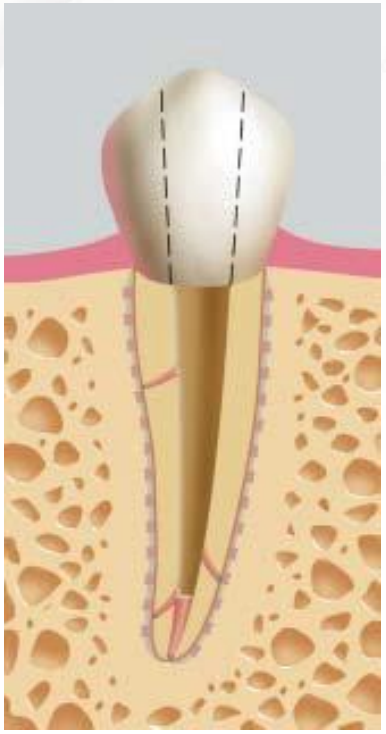
- Apical pressure is maintained on the apical plug of GP for a 10second sustained push to prevent cooling shrinkage.

- While maintaining apical pressure, the ring switch is activated again for1 second.

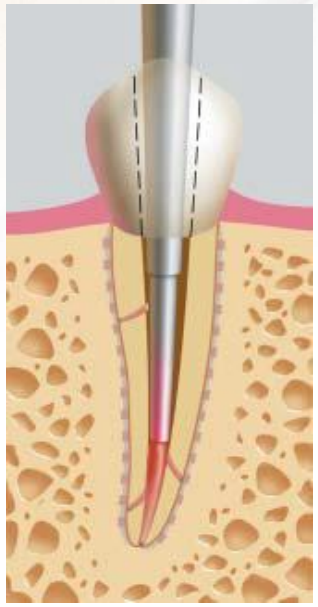
- The switch is released and the plugger quickly withdrawn.

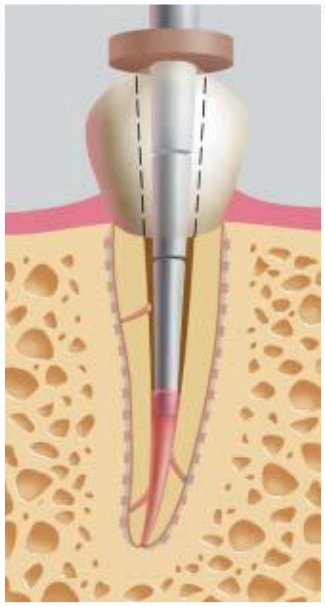


- As the pluggers heat from the tip to back
- It removes the coronal flash of GP leaving a clean interface and a dense homogeneous mass sealing the apical third



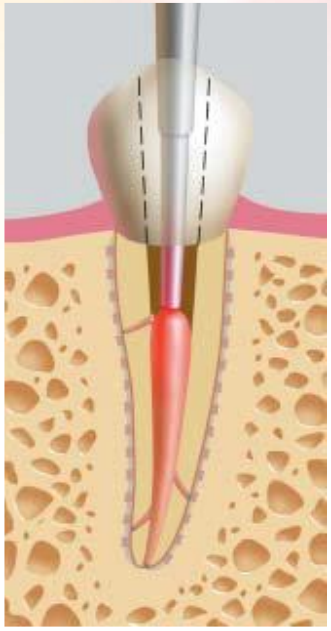
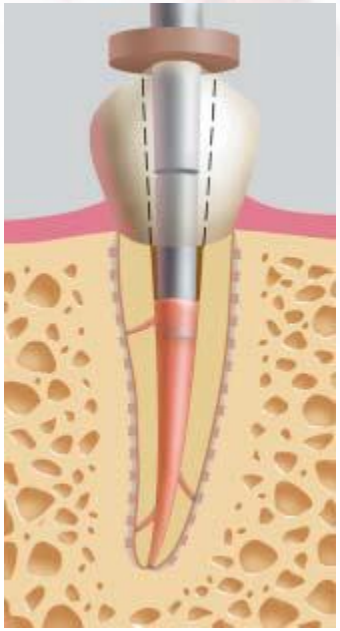
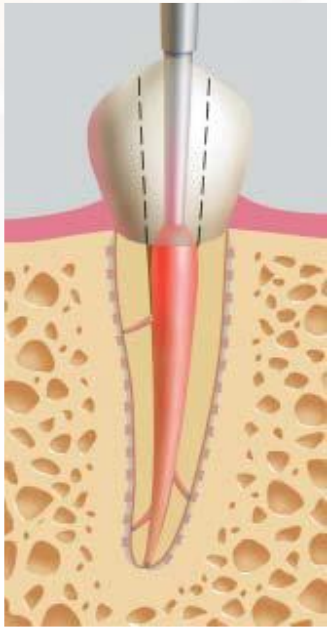
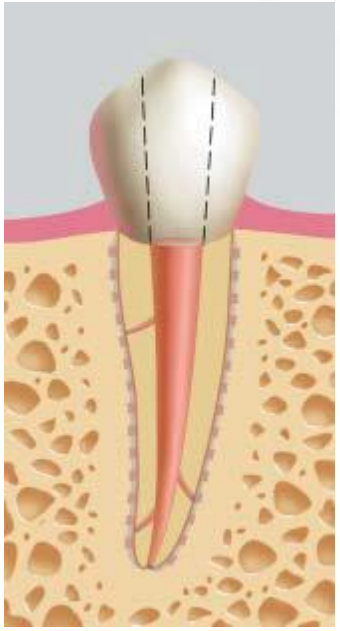
- Sealer is applied to the walls of the canal before beginning to back fill.
- thermoplasticized delivery system is inserted into the coronal aspect ofthe apical plug.
- 4 mm increment is placed





- Prefit Schilder pluggers are now used to condense the thermo-softened GP.

- The entire canal space is filled

- **Kenneth S. Serota**

McSpadden Thermomechanical Compaction

- Uses heat to *decrease* gutta-percha *viscosity* and *increase* its *plasticity*.
- heat created by rotating a compacting instrument in a slow-speed contra-angle handpiece at 8000-10000 RPM alongside GP cones.
- Compactor with spiraled 90^0 are similar to flutes on H-files, but in reverse, forces the softened GP apically and laterally.

used to fill straight canals as the compactor blade breaks if it binds.

Compactor blade selected according to width and length of prepared canal

GP cone is inserted and compactor placed between GP and canal wall up to 3-4 mm from prepared length

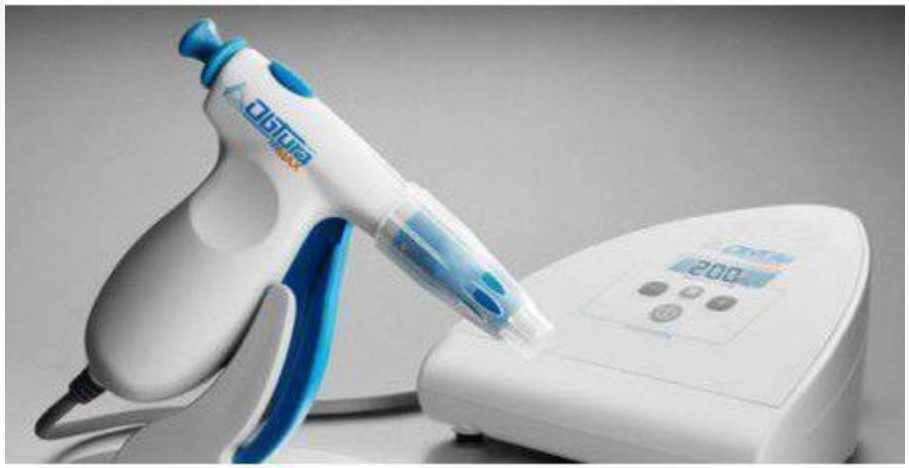
Handpiece activated. Rotating tip is guided to within 1.5mm of root apex

- ***Advantages*** :
- 1. Ease of selection and insertion of GP cones
- 2. Economy of time
- 3. Rapid filling of canals apically and laterally, including irregular spaces

- ***Disadvantages*** :
- 1. Inability to use it in narrow canals
- 2. Frequent breakage of compactor blades
- 3. Frequent overfilling of the canal
- 4. Shrinkage of cooled, set filling

THERMOPLASTIC INJECTION TECHNIQUES

- **Harvard/ Forsythe Institute: 1977**
- Obtura II
- Obtura III
- Calamus
- Elements
- HotShot
- Ultrafil 3D



OBTURA III

- Hand hold gun
- Ag needle
- Control unit

Ultrafil 3D

- Involving gutta-percha cannulas, a heating unit, and an injection syringe.

- The system has 3 types of cannulas.

- The Regular Set is a low-viscosity material that requires 30 minutes to set.
- The Firm Set is also a low-viscosity material but differs in that it sets in 4 minutes.
- Endoset has a higher viscosity and does not flow as well.
- It sets in 2 minutes.

Calamus

- Equiped with a cartridge system
- The unit permits control of temperature and also the flow rate.
- The 360 degree activation switch allows great tactile sensation.

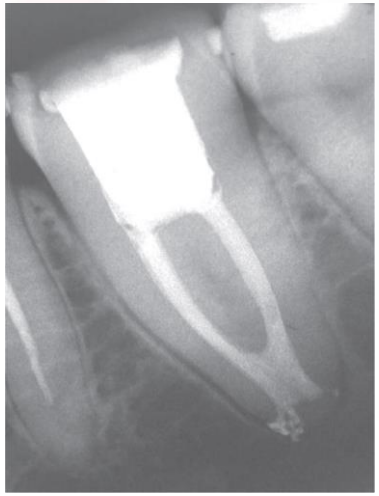
Elements

- consists of a System B heat source and plugger as well as a handpiece extruder

- The cartridges come with 20-, 23-, and 25-gauge needles for GP

Limitations

- *lack of precision in delivering the gutta-percha* near the apical foramen and not beyond



Extraradicular techniques

- **Endotec**:
- Considering the ease and speed of lateral compaction and the superior density gained by vertical compaction of warm GP as stated by Schilder in 1967, Martin in developed a device that appears to achieve the best qualities of both techniques.
- This device is called "Endotec", endotec is a thermal compacter consists of a cordless handpiece containing a battery that supplies energy to heat the attached spreader / plugger tips.
- When not in use the hand piece sits in a battery charger base. The quick change heated tips are sized equivalent to No. 30 and No. 40; 150 files.

Zap & Tap

- **Procedure**
- Preheat the endotec for 4-5 secs before insertion (Zap).
- Move the instrument in and out in short continuous strokes 10-15 times. (Tap)
- The plugger was removed while still hot.
- Cold spreader is used and accessory points are placed.
- The two causes for concern with this treatment may be – over heating, development of stresses.

Touch ‘n’ heat unit

- The main disadvantage with Schilders ‘V’ compaction is the need to warm the GP with an instrument heated over the flame. To over come these disadvantages analytic technologies develop of the first GP heating units the Touch N heat model 5001. Also models 5002, 5004 are available with different tips.
- The touch N heat 5003 is an electronic device specially developed for the warm vertical compaction of gutta percha. Battery /AC models are available.
- It exhibits the same thermal properties as the original heat carried used by schilder in 1967 but has the advantage of generating heat automatically at the tip of the instrument.
- This instrument is capable of providing a range of high temperatures instantly ranging from 0°-700°C.

- **System B** (Buchanan 1996)
- Recently Analytic technology introduced the system B heat source model 1005. this instrument has a digital temperature display and a variable resistor control that allows the user to use the desired temperature.
- These heat carriers are designed as pluggers that concentrate the heat at the tip of the carrier.
- The system B is based on the schilder technique. The tapered pluggers the system B heat upto 200°C at the tip at the touch of a button. This softens the GP in $\frac{1}{2}$ seconds.
- A wave of heat (250°-300°C) is produced as the plugger is forced through the already fitted cone is used to drive the GP into the canal.

- As the plugger approaches the apex the heat button released and apical pressure is maintained with the plugger for a 10 second. Sustained push to take up the shrinkage that occurs on cooling.
- The heat button is pushed again while maintaining pressure. A surge of heat is produced 300°C – 5 seconds. That immediately separates the plugger from the apical mass of gutta percha. Thus it can be rapidly with drawn. The canal is then backfilled with the same technique or obturation.
- **Disadvantages**
- Breakage and kinking of spreader.
- **Advantages**
  - Void elimination created during normal lateral condensation of warm GP.

Carrier-Based Gutta-Percha Techniques

- ***Eg- Thermafil*** and ***Simplifil***
- ***Thermafil*** comprises of a plastic core carrier coated with a phase GP
- Available in ISO standardized sizes as well as variable tapered
- Used with a heating device known as Thermaprep plus Oven.

- Removal of the smear layer is strongly recommended and has been shown to enhance the seal

carrier-based systems

First generation:

- Metal (Stainless steel or titanium) core and a coating of GP

Second generation:

- Plastic core coated with alpha form of GP e.g. Thermafill (Dentsplay)

Last generation:

- Modified GP core (cross linked guttapercha) rather than plastic core e.g. GuttaCore (Dentsply).

Thermafil obturation technique

Size of canal is assessed with a thermafil verifier .

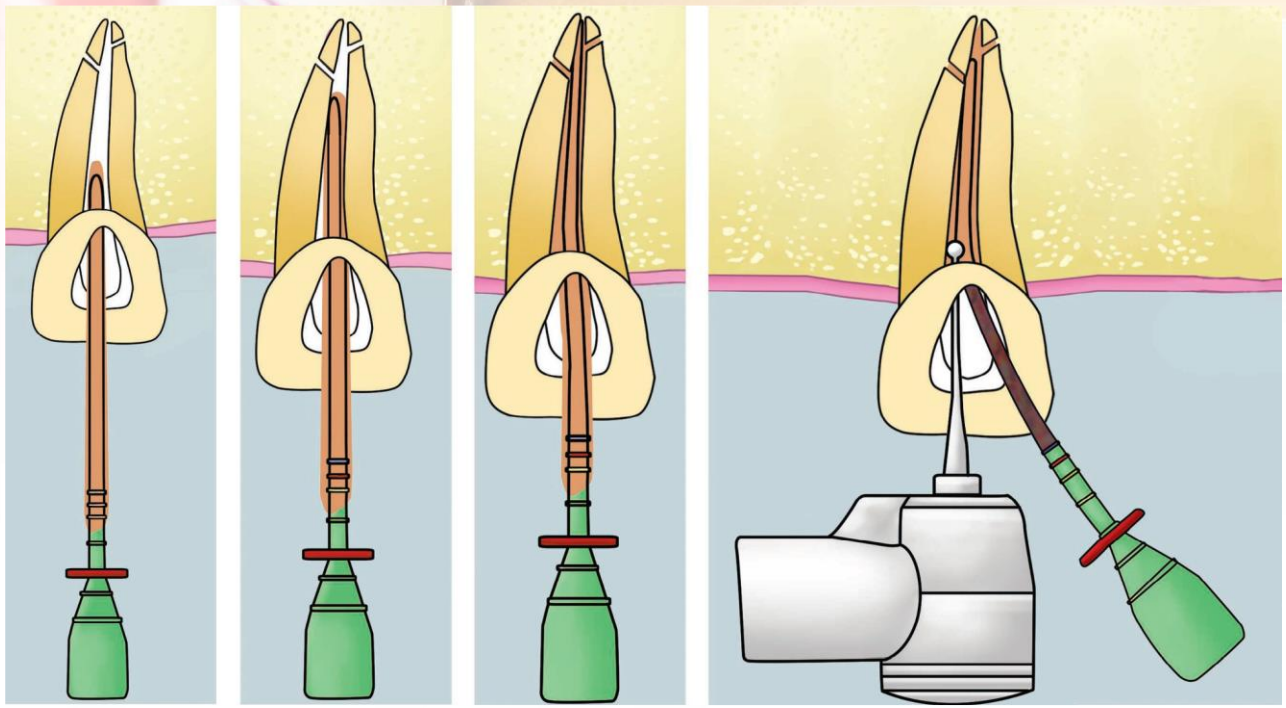
Canal dried, coated with sealer

Stopper of carrier is adjusted to WL

Carrier is loaded into Thermaprep plus Oven for 10 seconds

Inserted into the canal till WL with a firm apical pressure without rotating

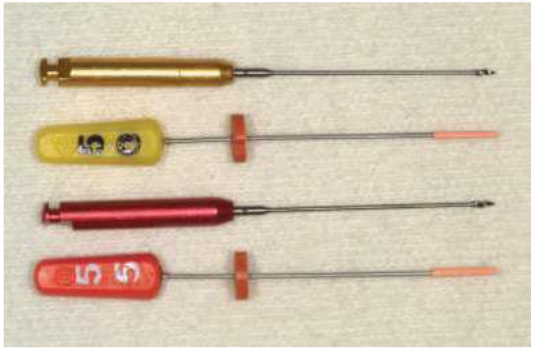
Allowed to cool for 2-4 min before resecting the carrier



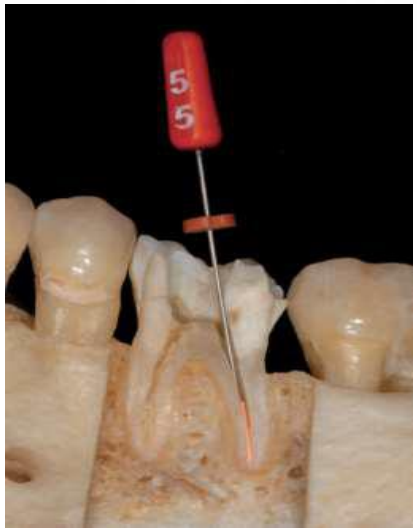
- (a)–(c) Heated core carrier is gently and firmly taken to the working length *without any rotation* of the carrier.
- (d) Carrier is cut off with a bur designed for this purpose.

Simplifil / Sectional obturation

- Used with light speed rotary instruments.
- has an apical 5mm plug of GP which performs cold sectional obturation of root canal



SimpliFill carrier and LightSpeed file



SimpliFill fitted to 1 to 3 mm from the prepared length.

Carrier size is chosen

Canal is dried and sealant is applied

Carrier is introduced upto WL

Handle of carrier is rotated quickly in counterclockwise direction 3-4 times to disengage the apical GP plug

Remaining coronal space is filled with lateral compaction or thermoplasticized gutta percha methods

SUCCESSFIL

- Associated with Ultrafil 3D
- GP: syringe
- Carrier inserted into syringe
- Sealer coated on canal walls: carrier with GP paced

TRIFECTA TECHNIQUE

- *Succesfil GP* injected onto sterile K-file tip
- Carried into most apical part: turned counterclockwise
- Soft GP condensed
- Remainder: Ultrafil GP
- ***Modified Trifecta:*** rest with lateral condensation

- Chandra & Shetty. Endodontology.

JS Quick-Fill

- Alpha phase gutta percha on a specially designed titanium carrier.
- Provides a smooth controlled obturation all in a single step.
- Plastification occurs from friction heat *without any preheating or open flames.*

Automated Plugger

- The canal finder plugger is a stepwise flexible plugger sloped like a telescope. It is used in a canal finder handpiece which delives a rapid vertical stroke that varies between 3 and 1mm.
- **Procedure**
  - Sealer placement
  - Master cone placement
  - Next, the vertical vituating plugger is kept.
  - The edges of the plugger blades catch in the gutta percha.
  - GP gets compacted vertically and laterally.

$CaPO_4$ obturation

- Recently calcium phosphate cement has been suggested as a total root canal filling material. ADA – Paffen barger Dental research center have developed a simple mixture of calcium phosphates that sets to become hydroxyapatite.
- They state that 2 $CaPO_4$ Compounds
- Acidic Basic
- When mixed with water set into a hardened mass – hydroxyapatite.
- Base – Tetracalcium phosphate
- Acid – Dicalcium PO4 dihydrate dihydrous dicalcium PO4.
- Water is a vehicle for the dissolution of the reactants. Glycerin may be added to extend setting time. Mild phosphoric acid – speeds the dissolution of the components.

Lasers

- Recently, a theory has bee part forth relating lasers to HA. A cross linked collagen HA has bee placed in the RC and melted into place with a laser beam through a fiber optic. There is no published data about this technique.

Chemically Plasticized Gutta Percha

- GP is plasticized by chemical sovants such as chloroform (Chloropercha), eucalyptol (Eucapercha), or xylol

- **Disadvantage :**
- inability to control overfilling
- shrinkage of filling after setting
- resulting in poor apical and lateral seal

- *No longer recommended*

CHLOROPERCHA

- dissolved in chloroform, a paste of **chloropercha** is formed

At first several pieces of gutta percha are cut into a dappen dish and stirred with a small amount of chloroform.

A small amount of chloropercha is streaked onto the walls of the dry root canal with a root canal spreader.

The apical third of the master cone is dipped into the chloropercha paste

the entire master cone is gently repositioned into the canal.

now forced laterally with root canal spreaders, making room for additional GP cones to provide a dense root canal filling.

form a homogeneous mass which conforms quite adequately to the configuration of the root canal system.

Callahan–Johnson diffusion technique

The root canal system is *flooded with 95% ethyl alcohol* and then dried with paper points.

It *removes some organic* and aqueous material from the canal.

Again *flooded with a chloro-rosin* solution.

It *spreads into inaccessible areas* in the root canal and into accessory canals as well.

This solution acts as a *solvent* both *for* a previously prepared *master cone and for fatty organic material*

so when the master cone and additional cones are added, dissolved GP will *diffuse effectively into inaccessible areas*.

Nygaard–Ostby technique

Variation of the Callahan-Johnson method

Finely ground specially prepared GP particles are spatulated with chloroform to produce paste

Reduce apical excess and the shrinkage in the final filling.

Custom Cone Technique

- Chair side procedure for customizing gutta percha in wide canals
- Customized to achieve a "tug back"

Soften appropriate size gutta percha with accessory cones with the help of heat

roll together between two glass slabs

Single master cone of increased diameter is created

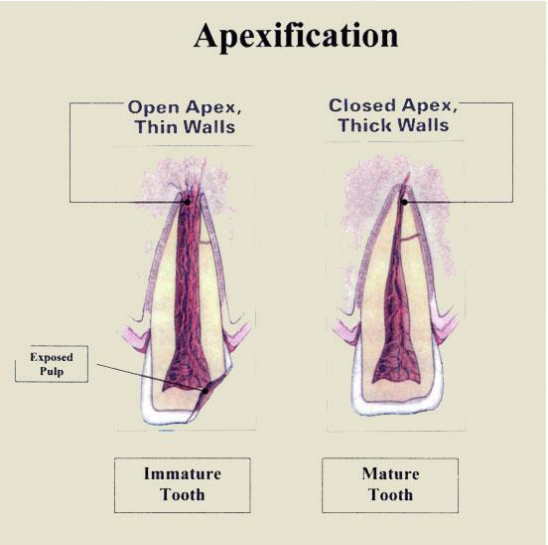
Soften the tip of this cone with chemical solvants for few seconds and insert it to the WL

On removal, gutta percha will carry the impression of canal

Repeat process till snug fit is achieved and ensure GP remains semi-rigid during this process

Immediate Obturation

- Immature teeth exhibiting apical resorption
- traditionally were treated with CaOH to establish an apical barrier (apexification) before obturation.
- Studies have demonstrated that teeth treated with CaOH for prolonged periods are more susceptible to fracture.
- Immediate obturation is an alternative to apexification.

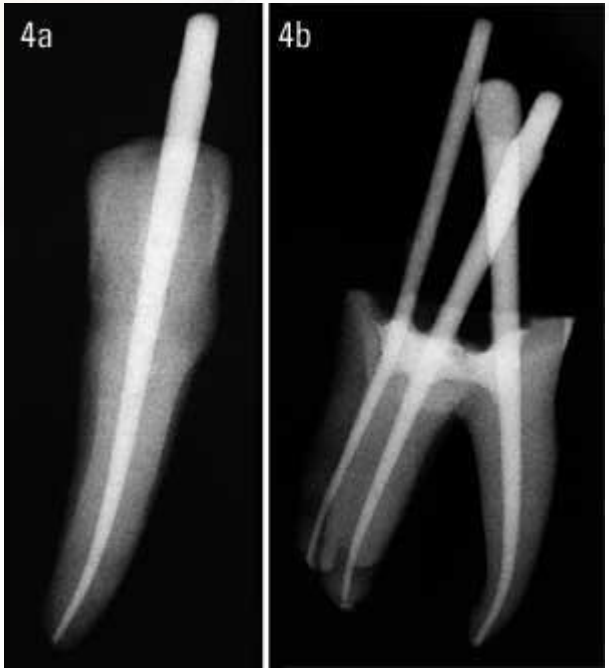


An apical barrier material should confine obturation materials to the canal space

MTA or biodentin has been successfully employed as an apical barrier material before obturation.

SINGLE- CONE OBTURATIONS

- 1960s: ISO standardization
- Tapered instruments
- Gp Cemented in place: thin & uniform layer of traditional sealer
- Ergonomic matched file & cone



- Endodontic Topics 2005, 12, 2–24

REMOVAL OF OBTURATION MATERIAL

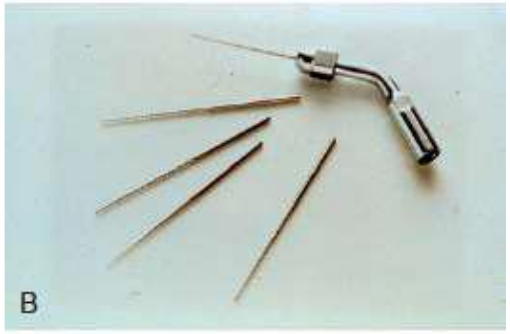
Removal of Guttapercha

- It is depend on the quality of obturation :

1. Single cone GP
2. Condensed GP

A. Removal of Single cone GP

- H file
- Ultrasonic files



B. Removal of Condensed GP

- *Removal of gutta percha*

1. *manually*
2. *using rotary system*
3. *using LASER*

1. Removal of GP manually

Probing of the orifice

Heating endodontic carrier (to remove the coronal part).

Using small **Gates gliding drills**(to remove any remaining coronal material)

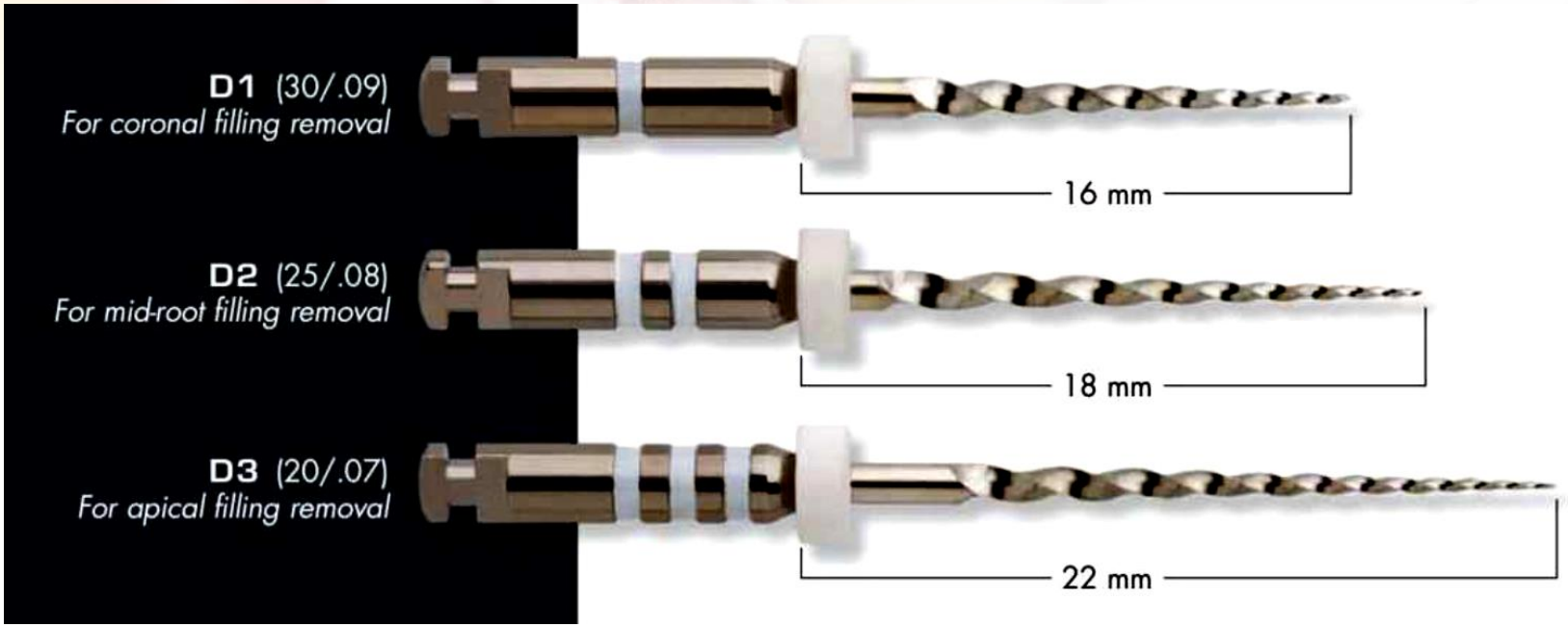
Using gutta percha **solvents** (to remove the remaining material).

Small hand files (#15 **C+ file** to penetrate the remaing root filling and enhance it is dissolution by solvent).

Radiographic assessment.

2. Removal of GP using rotary system:

- Protaper Universal Retreatment files (*DentSply*)



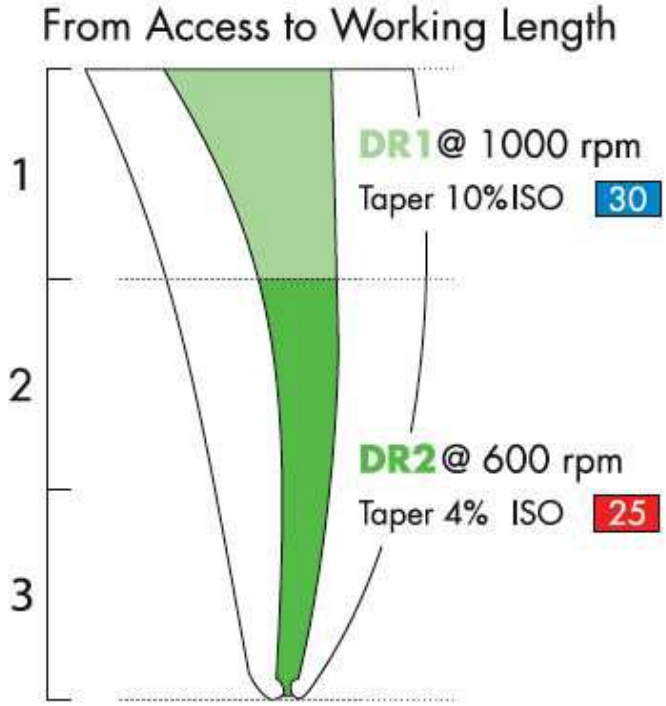
- Mtwo R (*VDW*)

Size/Taper		21 mm
R15/.05	○	0232 021 015
R25/.05	●	0232 021 025

- GPR (MANI, JAPAN)

Model	Name	Size	Taper	Working Length	Material
1S		#70	0.04	16mm	Stainless
2S		#50	0.04	18mm	Stainless
3N		#40	0.04	21mm	NiTi
4N		#30	0.04	21mm	NiTi

- D-RaCe (FKG)



DR1 - Access

- ISO 030/0.10 - L.15/8 mm
- active tip

DR2 - Full path

- ISO 025/0.04 - L.25/16 mm
- safety tip

- Recioroc (*VDW*)

3. Removal of Gutta percha using Laser

- using Nd:YAG Laser

Remove solid core obturators

1. Metal core obturators:

- ***1st technique***
- Heat application to the carrier to soft GP surrounding it to facilitate its removal with with *plier or Steiglitz forceps*.

- Endodontic retreatment of Thermafil versus laterally condensed gutta-percha. *Wilcox LR, Juhlin JJ. J Endod. 1994*

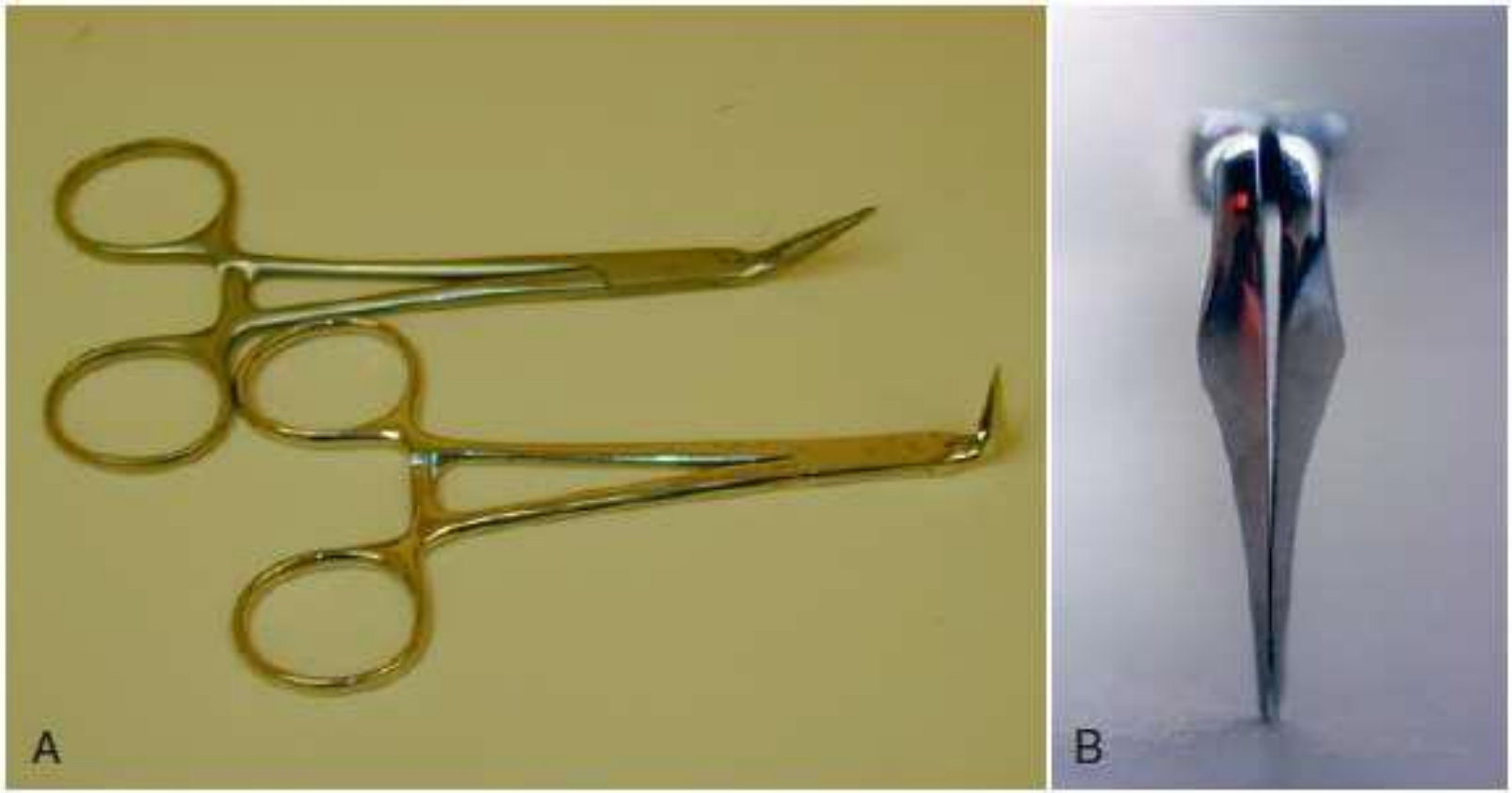


FIG. 8-39 A, Stelglitz forceps in 45- and 90-degree head angles. B, Tips of the Stelglitz forceps ground to a thinner contour to create the "modified" instrument. This allows deeper penetration into the tooth to enhance removal of obstructions. (*B*, Courtesy Dr. Daniel Erickson.)

- **2nd method:**

- Use of solvent and removal of surrounding GP with small hand instrument
- followed by ultrasonic troughing around the carrier and remove it like separated instrument.

- Problem solving in endodontics. Prevention, identification, and management. *Editors: Gutmann JL, Dumsha TC, Lovdahl PE, Hovland EJ, ed 3, St. Louis, 1997, Mosby.*

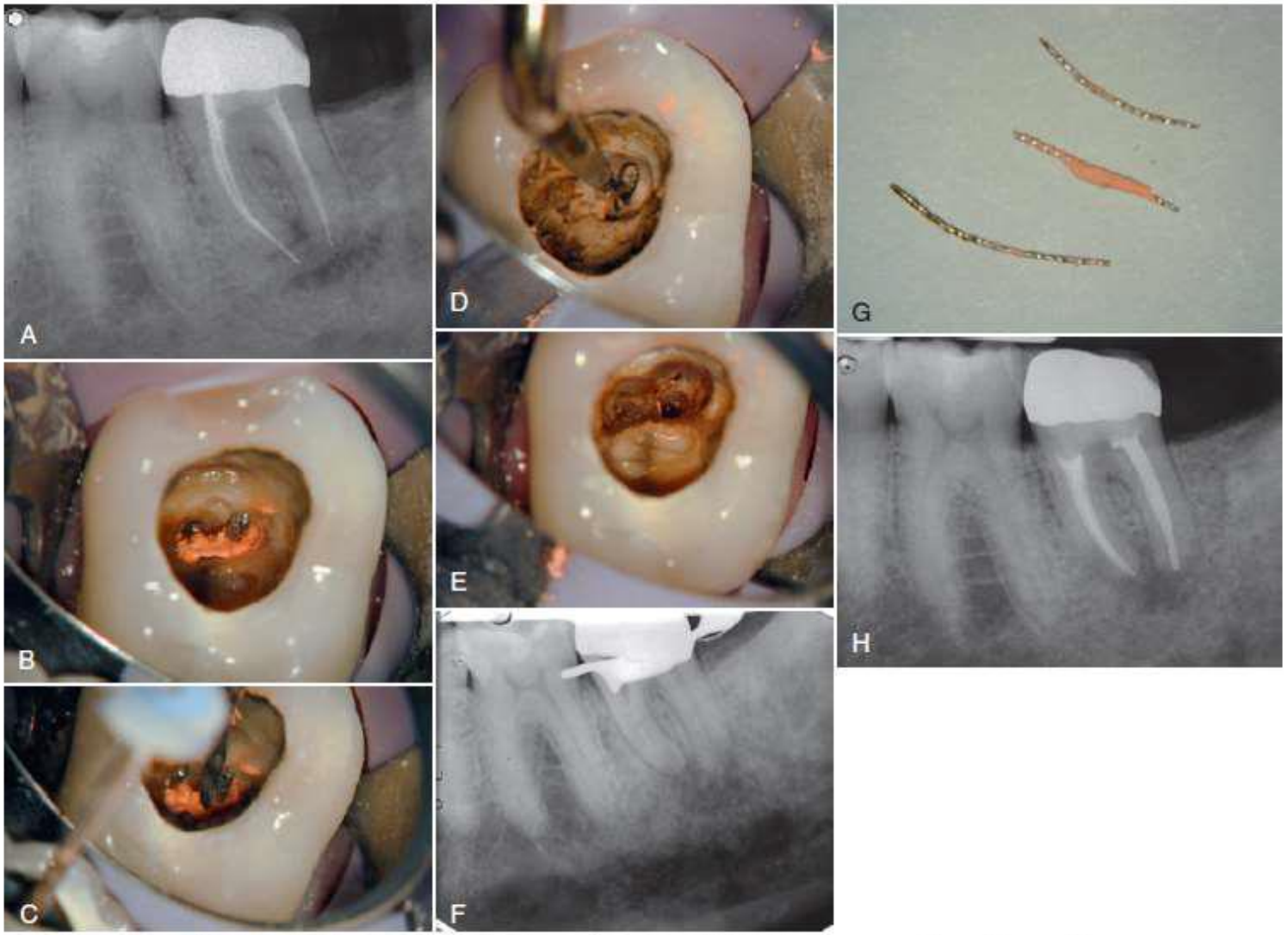


FIG. 8-40 Metal carrier retreatment A, Preoperative radiograph. B, Metal carriers exposed by careful excavation of gutta-percha. C, Use of the Touch 'n Heat instrument to heat the carriers and soften the gutta-percha. This allowed removal of one of the carriers using modified Steiglitz forceps. The other could not be removed using heat or solvents. D, Ultrasonic troughing around the carrier to facilitate grasping it with forceps. E and F, Carriers removed and confirmed with a radiograph. G, Metal carriers showing gutta-percha still adhering to them. H, Final obturation of the tooth.

2. Removal of plastic core obturators:

- ***1st technique:***
- Use of solvent and Hand files to remove the GP surrounding the carrier
- then a large H file used to remove the carrier.

- Removal of Thermafil root canal filling material. *Bertrand MF, Pellegrino JC, Rocca JP ; J Endod 1997*

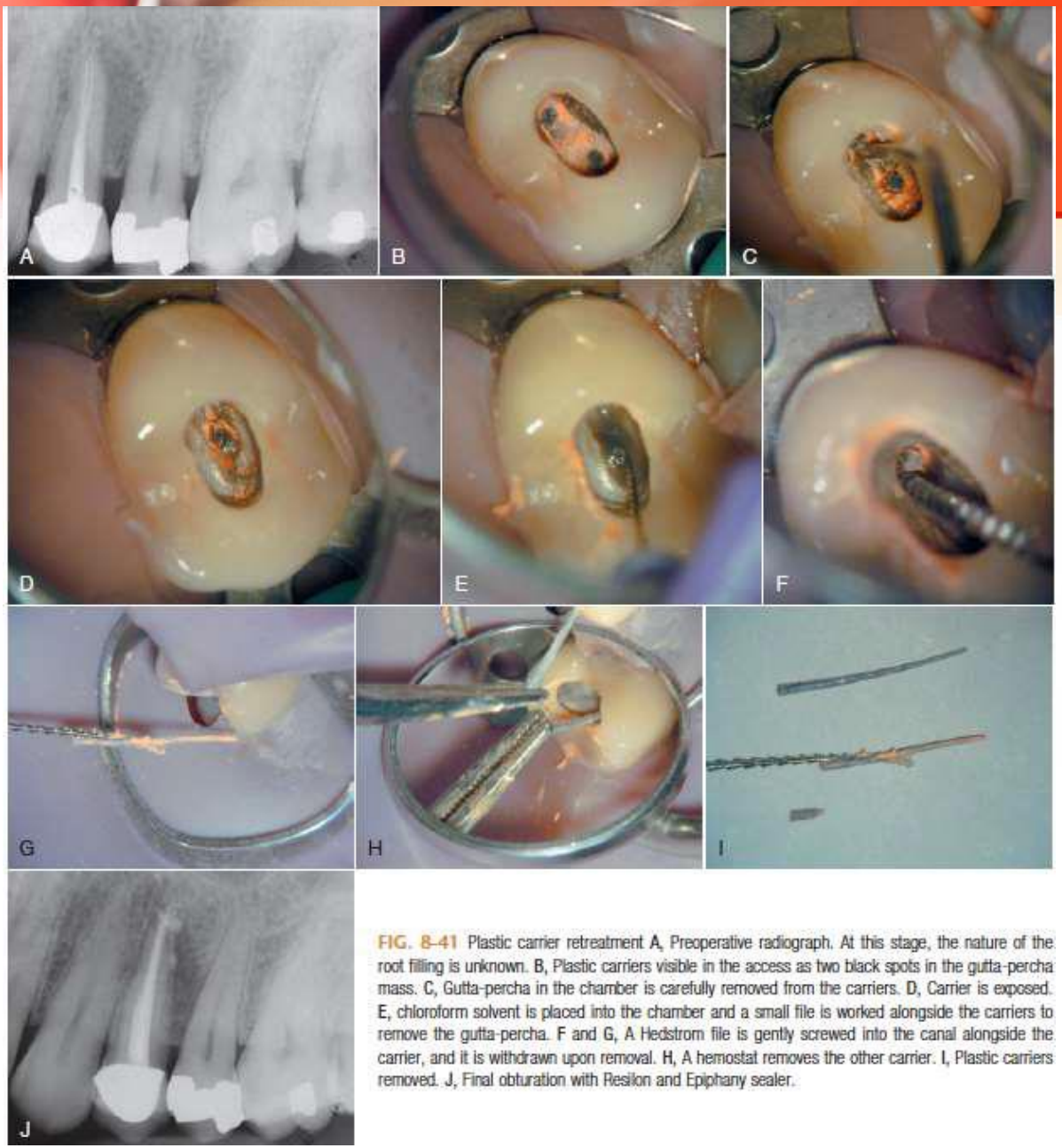


FIG. 8-41 Plastic carrier retreatment **A**, Preoperative radiograph. At this stage, the nature of the root filling is unknown. **B**, Plastic carriers visible in the access as two black spots in the gutta-percha mass. **C**, Gutta-percha in the chamber is carefully removed from the carriers. **D**, Carrier is exposed. **E**, chloroform solvent is placed into the chamber and a small file is worked alongside the carriers to remove the gutta-percha. **F** and **G**, A Hedstrom file is gently screwed into the canal alongside the carrier, and it is withdrawn upon removal. **H**, A hemostat removes the other carrier. **I**, Plastic carriers removed. **J**, Final obturation with Resilon and Epiphany sealer.

- ***2nd technique:***
- Use of rotary System e.g. Profile 0.04 taper

  - Efficiency of the 0.04 taper ProFile during the re-treatment of gutta-percha-filled root canals. *Baratto Filho F, Ferreira EL, Fariniuk LF, Int Endod J, 2002.*

3. Removal of Modified GP core carrier

- Rotary System e.g. Protaper universal Retreatment system

  - Time required to remove GuttaCore, Thermafil Plus, and Thermoplasticized gutta-percha from moderately curved root canals with ProTaper files. *Beasley RT et al ; J Endod 2013*

1. Removal of Non setting or Soft paste

1. Solvent
2. Hand or rotary instrument (copious Naocl irrigation).
3. Ultrasonic instrumentation.

- Problem solving in endodontics. Prevention, identification, and management. *Editors: Gutmann JL, Lovdahl PE, ed 5, ELSEVIER, 2011 Mosby.*

2. Removal of Hard sitting pastes:

A. Burs , Ultrasonic tips (accessible straight portion of the canal)

B. Precurved small hand files (apical area)

C. Use of Solvent (Endosolve – R, Septodent)

- The effect of endodontic solutions on resorcinolformalin paste in teeth. *Gambrel MG et al; J Endod 2005.*

Removal of Resilone

- Similar to the removal of condensed GP with heat, solvent and mechanichal instrumentation.

Removal of Silver Point

1st technique :

establish a proper access.

Carefully remove core material around the sliver cone by use of *ultrasonic*

Solvent to dissolve the sealer around the cone

Grasp the exposed end of the silver point with *plier*.

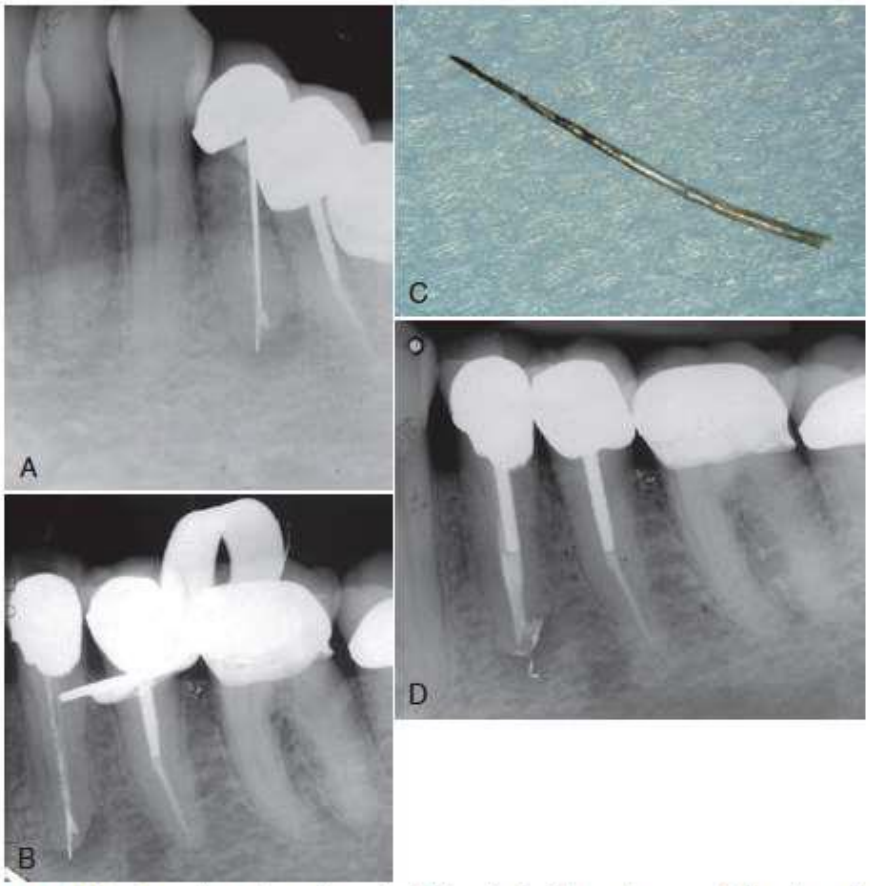


FIG. 8-47 A, Persistent disease in a silver point filled tooth. B, Silver point removed. Note the radiopaque material in the apical portion of the canal system. This represents corrosion products remaining in the canal and a possible separated apical segment of the cone. C, Removed silver point showing black corrosion products adhering to the apical one half. D, Crown-down instrumentation prevents extrusion of most of the corrosion products into the periradicular tissues.

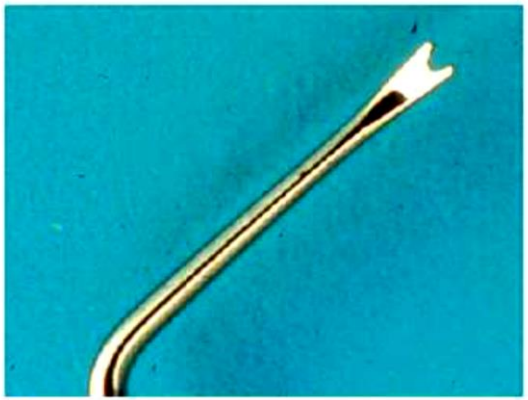


FIG. 8-51 Caufield elevator tip, useful for gripping and elevating silver points that are protruding a small amount into the pulp chamber.

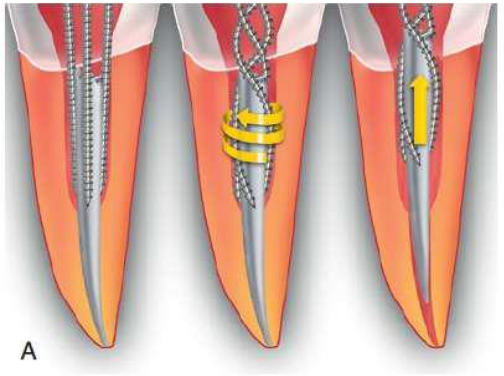
2nd technique : The Hedstrom file technique:

The sealer around the silver cone is dissolved by use of solvent.

Small file are negotiated as far apically as possibly in two to three areas around the silver point.

The spaces surrounding the silver point are carefully instrumented to size 15, and then small Hedstrom files are gently screwed in as far as possible apically.

The files then twisted together and pulled out through the access.



3rd technique: Use Instrument removal kits

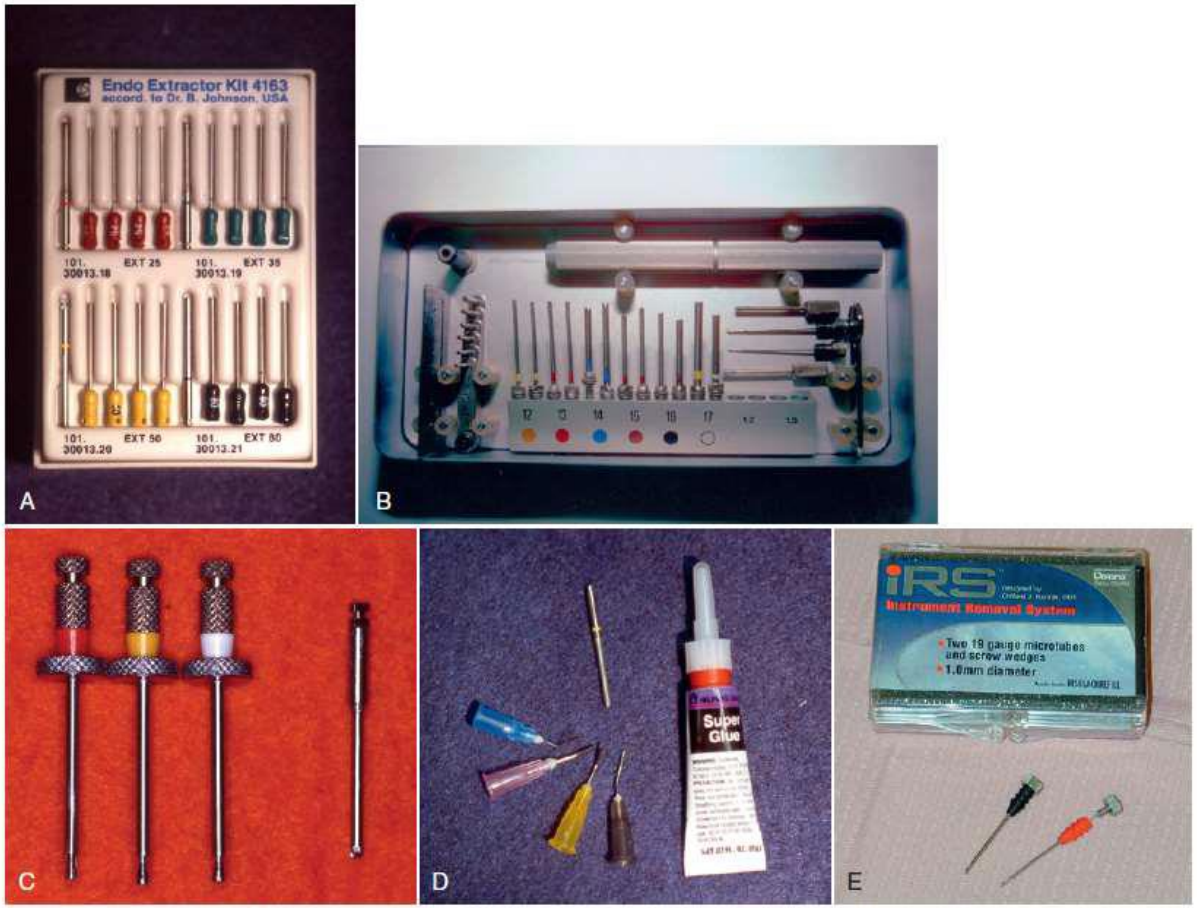


FIG. 8-54 A, Brasseler Endo Extractor Kit. B, Masserann Kit. C, Roydent Extractor System. D, Separated Instrument Retrieval System (SIR). E, Instrument Removal System (IRS). (*B*, Courtesy Dr. Daniel Erickson.)

Conclusion

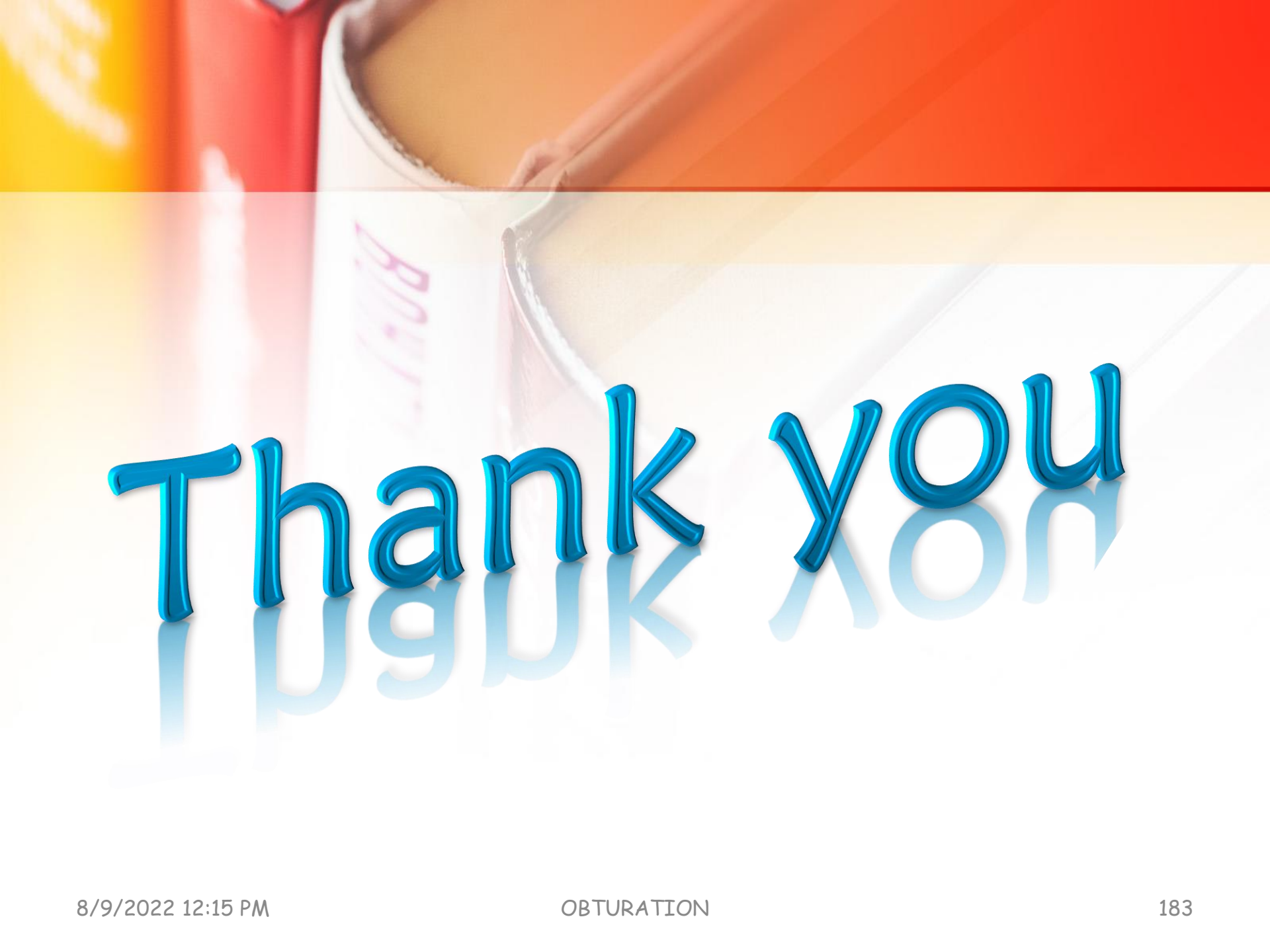
- The clinical success of endodontic therapy depends on proper diagnosis, access preparation, complete chemo mechanical preparation and three dimensional obturation of the root canal space.

- However complete obliteration of the root canal space from canal orifice to apical constriction has been shown to be very critical to achieve success.

- The difficulties involved in totally obliterating the root canal space has led to innovations of variety of techniques and filling materials.

Referrences

1. Textbook of Endodontology- Lars Bjørndal 3rd Ed
2. Clinical endodontics- Tronstad 2nd edition
3. Cohen's Pathway of the pulp 11th edition
4. Ingles endodontics
5. Endodontic Principles and Practice 4th Edition
6. Problem solving in endodontics. Prevention, identification, and management. Editors: Gutmann JL, Lovdahl PE, ed 5, ELSEVIER, 2011,Mosby.
7. Removal of root filling materials." Duncan, Henry Fergus, and BUN SAN CHONG. ,Endodontic topics 19 (2011): 33-57.


Thank you