Good Morning...

OBTURATION MATERIALS & TECHNIQUES OF ROOT CANALS

CONTENTS

- Introduction
- Definition
- History
- Rationale of obturation
- Importance of three dimensional obturation
- Role of sealers
- Various methods of root canal obturation and advances
  - –Solid core guttapercha with sealants
  - –Canal warmed gutta percha
  - –Chemically plasticized gutta percha

CONTENTS

INTRODUCTION

- Pulpal demise and subsequent periradicular infection result from the presence of microorganisms, microbial toxins and metabolites, and the products of pulp tissue degradation.
- Failure to eliminate these etiologic factors and to prevent further irritation as a result of continued contamination of the root canal system are the prime reasons for failure of nonsurgical and surgical root canal therapy.

INTRODUCTION

- A key to successful endodontic therapy is to seal the apical and coronal areas of potential leakage after meticulous cleaning and shaping.
- However the pulp space system consists of fins, lateral and accessory canals which are difficult to obturate using traditional techniques.
- The main objective of root canal obturation is the three dimensional sealing of the complete root canal system.

DEFINITION

Root canal obturation is defined and characterized as **"the three-dimensional filling of the entire root canal system as close to the cementodentinal junction as possible.** - ADA

HISTORY

- Before – 1800 – the root canal filling was limited to **Gold,** later various metals, oxy-chloride of zinc, paraffin, and amalgam were used for obturation (Koch et al 1909).
- 1867 - Bowman claimed first use of gutta percha
- 1883 – Perry used gold wire wrapped with gutta percha.
- 1887 – S.S. white manufacturers GP points.
- 1967 - Schilder popularized the use of warm vertical compaction of gutta percha
- 1914 – Callahan used chemically plasticized gutta percha.
- 1977 – Thermoplasticizing device was introduced.

HISTORY

- 1978 – Johnson introduced solid core carrier technique.
- 1979 – Mc Spadden introduced thermomechanical compaction
- 1982 – Touch 'n' heat device was introduced.
- 1984 - Michanowicz demonstrated the **low temperature 70° injectable thermoplastisised gutta-percha techniques i.e. Ultrafil**
- 1996 - Buchanan developed a **new method of vertical compaction of warm gutta-percha (i.e. continuous wave of condensation technique).**

PURPOSE

1. To eliminate all avenues of leakage from the oral cavity or the periradicular tissues into the root canal system.

2. To seal within the system any irritants that cannot be fully removed.

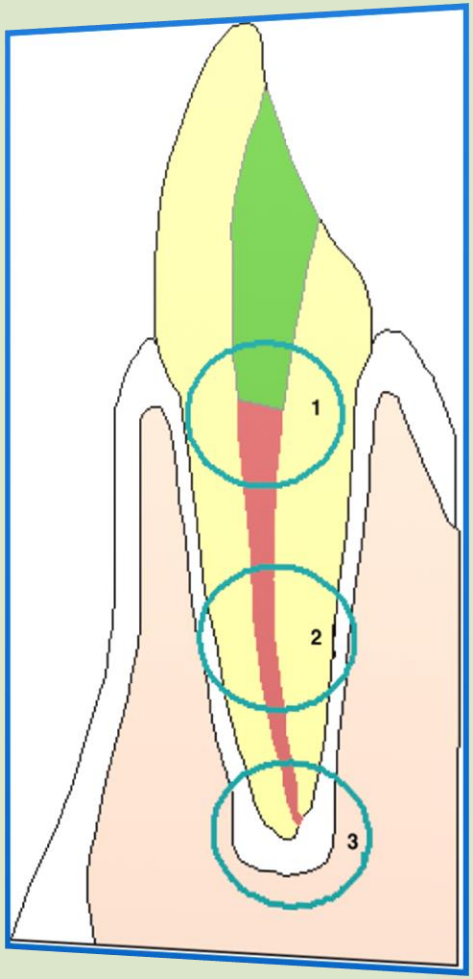


Fig. Primary functions of a root canal filling.
1. stop coronal leakage;
2. entomb surviving microorganisms;
3. prevent accumulation of stagnant fluid.

IMPORTANCE OF 3-DIMENSIONAL OBTURATION

1) Prevents **PERCOLATION** of Periapical exudates into the Rootcanal.

2) Prevents **REINFECTION.**

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

When is the root canal ready for obturation:

- The tooth is asymptomatic(no pain, no tenderness, or apical periodontitis)
- The canal is dry. There is no exudates/seepage.
- No sinus tract
- Negative bacterial culture.
- There is no foul odor .
- Temporary filling is intact .

SEALERS

- A large variety of root canal filling materials have been advocated through various decades.
- The materials run from amalgam, asbestos, balsam, bamboo, copper, gold foil, iron, lead, oxychloride of zinc, paraffin, plaster of paris, resin, rubber, silverpoints, tin foil etc. to most popularly **gutta-percha**.
- Minimal amounts of root canals sealers, which have been demonstrated to be biologically compatible, are used in conjunction with the core filling material to establish an adequate seal".

ROLE OF SEALERS

1) Root canal sealers are necessary **to seal the space between the dentinal wall and the obturating core interface.**

2) Sealers also **fill voids and irregularities in the root canal, lateral and accessory canals, and spaces between gutta-percha points** used in lateral condensation.

3) Sealers also serve as **lubricants** during the obturation process.

OBTURATION TECHNIQUES

- INGLE'S

Solid Core Gutta Percha With Sealants

- Lateral compaction
- Variations of lateral compaction

Canal Warmed Gutta Percha

- Warm vertical compaction
  - Continuous wave compaction technique
  - Touch and heat system
  - System B compaction
- Warm lateral compaction(Endotec II)
- Lateral / vertical compaction

Chemically plasticized Gutta percha

Thermomechanical Compaction

- McSpadden compaction
- Microseal System

Thermoplasticized Gutta Percha

Solid - core carrier insertion

- Thermafil
- Thermafil plus (Modified Thermafil)
- Soft core
- One step (Modified soft core)

Text book of endodontics - Ingle 7th edition

Cold Gutta-Percha compaction

- GuttaFlow

Apical third filling

Carrier based system

- Light speed Simplifill

- Fiberfill

Paste system

-MTA

-Dentin - chip

-Calcium hydroxide

Injection paste filling system

Pastes

Calcium phosphate

OBTURATION TECHNIQUES
- HARTY'S

- **Cold Gutta-percha techniques**
  - **Lateral condensation**
- **Heat softened Gutta-percha techniques**
  - **Intracanal heating techniques**
    - **Continous wave of condensation technique**
    - **Warm vertical condensation technique**
    - **Rotating condenser (thermomechanical compaction)**
    - **Hybrid technique**
  - **Extracanal heating technique**
    - **Precoated carriers**
    - **Operator coated carrier condenser**
    - **Thermoplastic delivery systems**
- **Solvent softened gutta percha**
- **Apical dentine plug**

LATERAL CONDENSATION OF COLD GUTTA-PERCHA

- This is the most common technique.

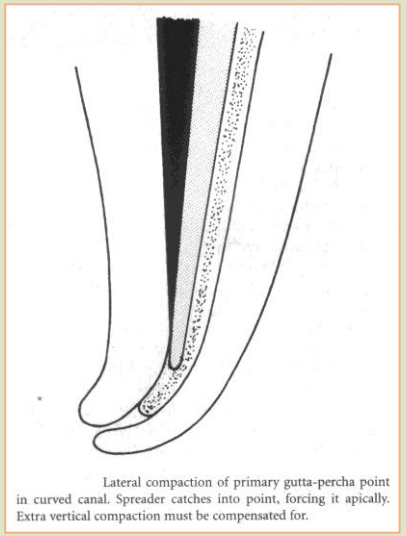
Disadvantages:

- Voids are inherent, excessive forces on root lead to root fracture.
- Time consuming
- Non homogenous mass of GP cones
- Not suitable in severe curvatures, internal resorption, immature open apices.

Variations of lateral condensation

In curved canals

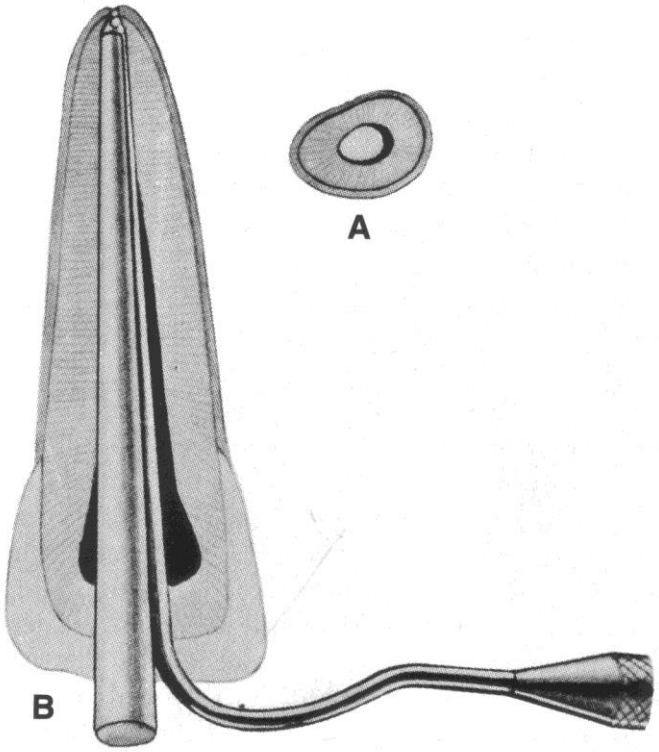
- Expecting a stiff spreader to reach within 1mm of working length precludes the use of lateral compaction .
- **NiTi flexible spreaders** can be used to follow the curves.
- These spreaders show incresased flexibility, reduce stress, and provide deeper penetration as compared to stainless steel instruments.



Lateral compaction of primary gutta-percha point in curved canal. Spreader catches into point, forcing it apically. Extra vertical compaction must be compensated for.

Variations of lateral condensation

In tubular canals



A, Cross-section of tubular canal in "young" tooth, ovoid in shape. B, Blunted, "coarse" gutta-percha cone or tailor-made cone used as primary point, followed by spreading and additional points to totally obturate ovoid space. Final vertical compaction with large plugger.

Variations of lateral condensation

Inverted cone technique

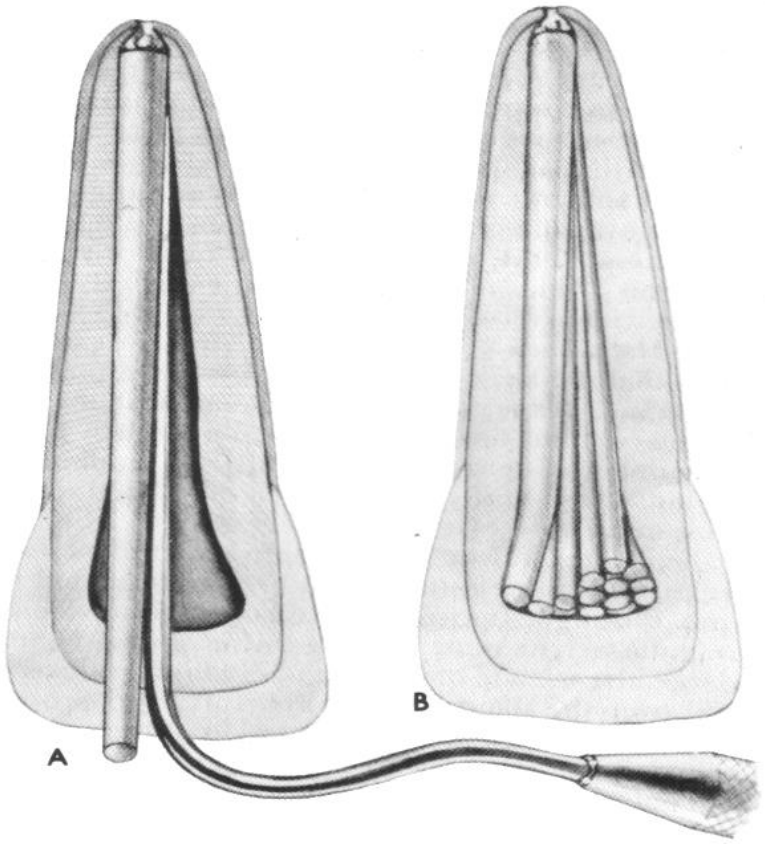
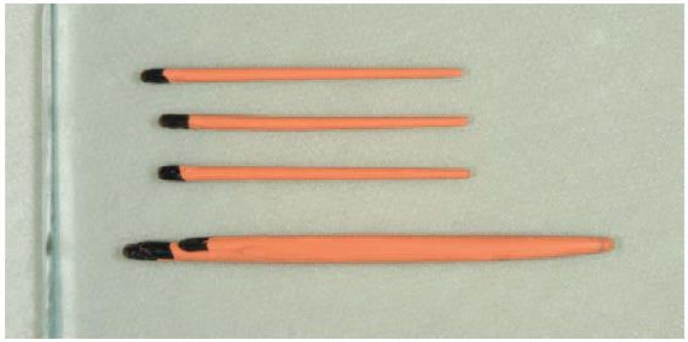


Fig. 4–42. Root canal obturation for large canal using inverted, blunted gutta-percha cone. ***A,*** Inverted cone should adequately fill apical canal space. Spreader should reach to within 1.0 mm of foramen. ***B,*** Total obturation with additional points. Excess gutta-percha and sealer are removed from crown filled by vertical compaction with large plugger.

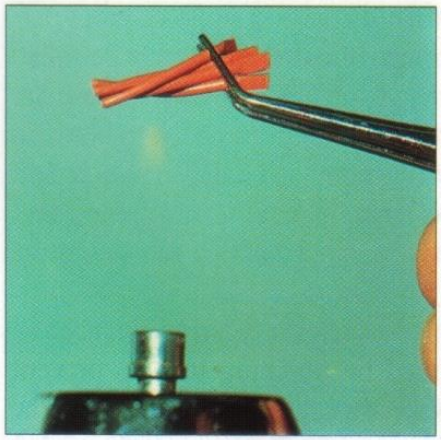
Variations of lateral condensation

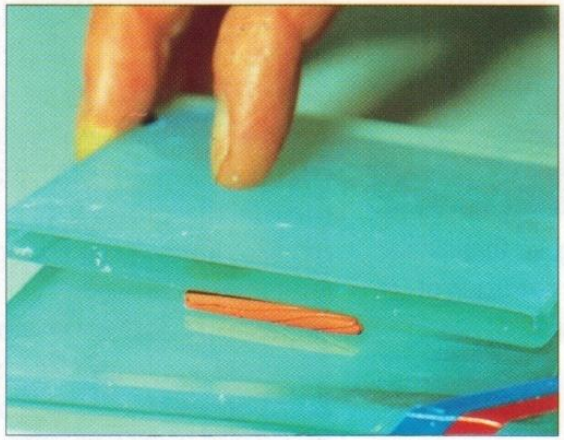
Rolled cone technique

- **Indications**
  - Reasonably parallel canal walls
  - Too wide canals



For large canals, several gutta-percha points can be heated and rolled together, using a spatula or two glass slabs.





WARM LATERAL CONDENSATION

- **Martin** developed a device that incorporates the **qualities of both techniques.**
- The **Endotec II** (Medidenta, Woodside, NY) is a battery-powered, heat-controlled spreader/plugger.
- An appropriate-size **Endotec II tip** is selected.
- Endotec II tips are available in various taper and tip diameters.
- The sizes consist of **#.02/20 and #.02/40.**

WARM LATERAL CONDENSATION

- The use of warm lateral compaction with the Endotec demonstrated an **increased weight of gutta-percha mass, by 14.63%,** when compared with traditional lateral compaction **(Liewehr FR, Kulild JC, Primack PD: Improved density of gutta-percha after warm lateral condensation. *J Endod* 1993;19:489.)**
- **Nelsen EA et al (2000)** found a **24%** increase in weight with warm lateral compaction when using the System B device. **(Nelson EA, Liewehr FR, West LA: Increased density of gutta-percha using a controlled heat instrument with lateral condensation. *J Endod 2000;26:748*)**

ADVANCES IN WARM LATERAL CONDENSATION

- **Kulid** ment for warm
- The E rate the electr
- They heat and vibrati provided statist ction.
- **It car vertical compaction. Suitable for use with GP as well as with Resilon.**

ADVANCES IN WARM LATERAL CONDENSATION

- EI, a subsidiary of Hu- Friedy, has now introduced the **EI DownPak**, a variation of the original EndoTwinn that can be used with either warm lateral or warm vertical compaction techniques.

The EI DownPak device for heat softening and vibrating gutta-percha (Courtesy EI/Hu-Friedy, Chicago, IL).

- **Li Peng et al (2017)** evaluated clinical outcome differences of root canal obturation by warm gutta-percha (GP) or cold lateral condensation (CLC) through a systematic review and meta-analysis.
- Overextension was more likely to occur in the warm GP obturation group in comparison with the CLC group.
- Postoperative pain prevalence, long-term outcomes and obturation quality were similar between the two groups.

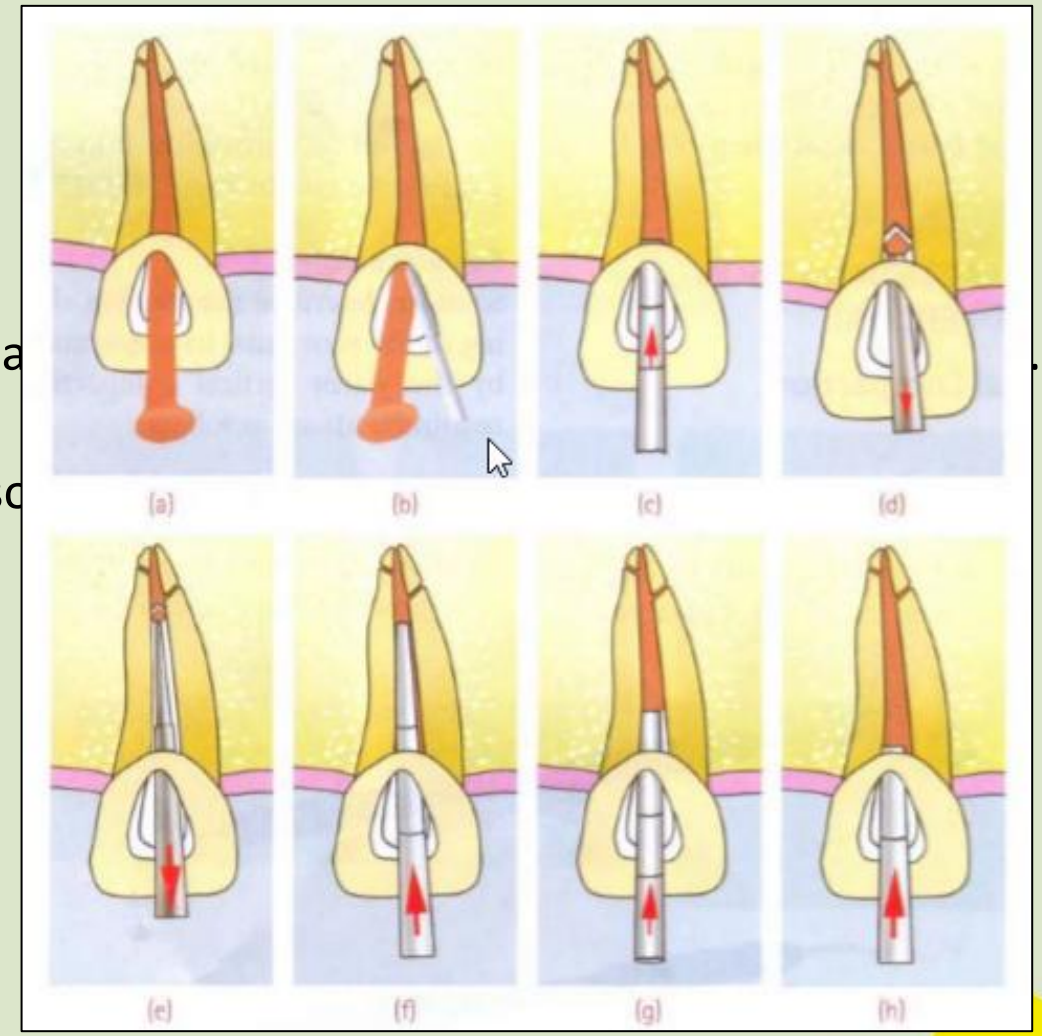
Li Peng, , MS, Ling Ye, , Hong Tan, and Xuedong Zhou -Outcome of Root Canal Obturation by Warm Gutta-Percha versus Cold Lateral Condensation: A Meta-analysis J Endod 2017;33:106 –109.

VERTICAL COMPACTION OF WARM GUTTA-PERCHA

Technique

Indications

- Ledge forma
- Internal resc



VERTICAL COMPACTION OF WARM GUTTA-PERCHA

Technique

Heat transfer instruments

- Flame heating instrument - traditional
- The touch n heat (Sybron endo),
- EI downpak(EI/Hu-Friedy)
- System B (Sybron endo)

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- Also
- This Heat and was r
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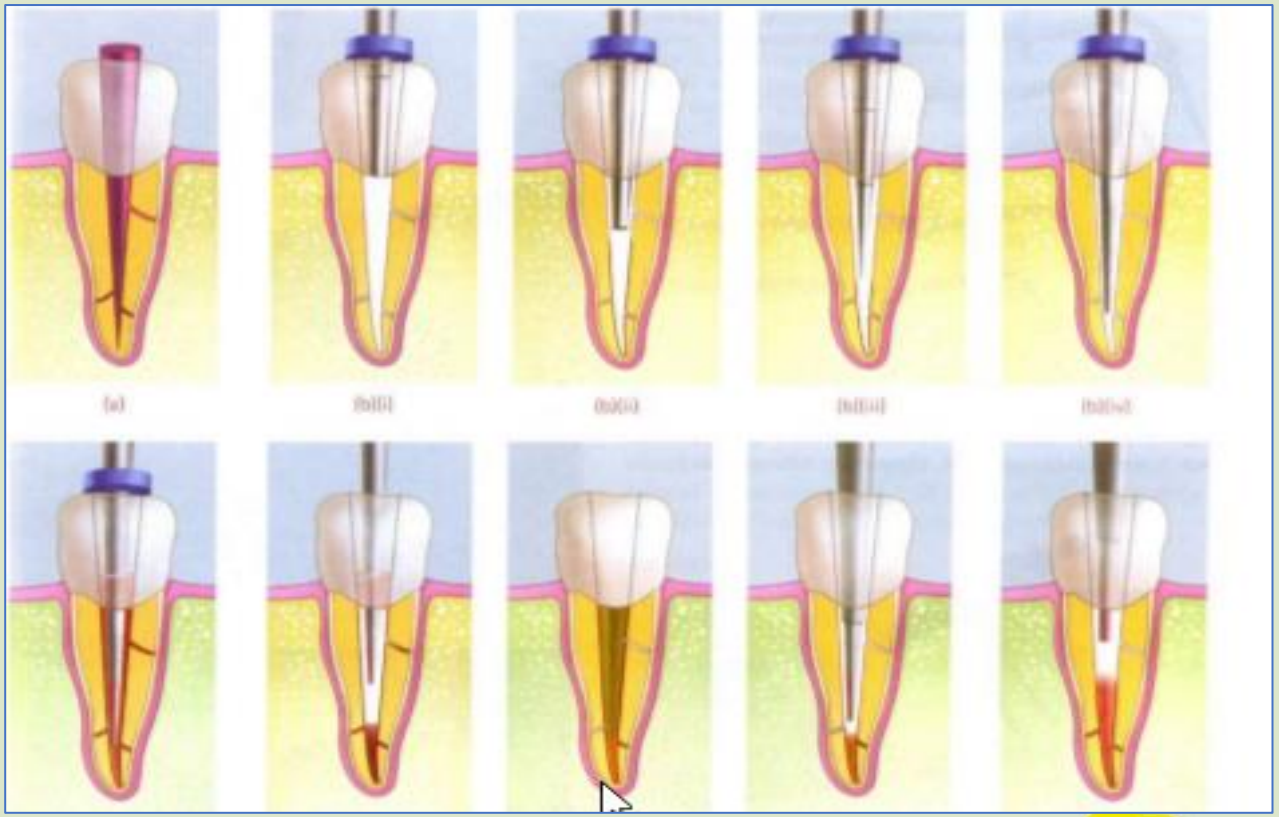
SYSTEM B COMPACTION

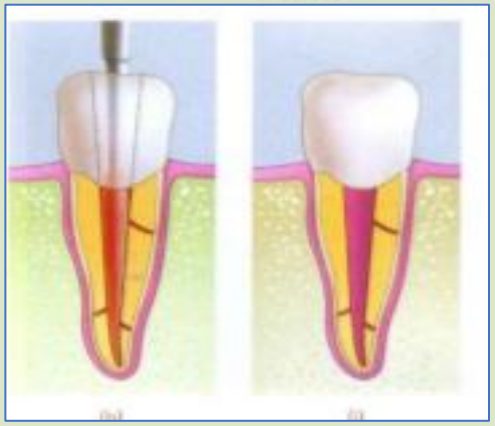
- System B unit, has #.04, #.06, #.08, #.10, and #.12 tapered stainless steel pluggers, each with a tip diameter of 0.5 mm.
- The #.06 tapered plugger approximates the fine nonstandard gutta-percha cone, the #.08 plugger- the fine medium cone, the #.10 plugger the medium cone, and the #.12 plugger the medium-large cone.

SYSTEM B COMPACTION

Technique(down packing)



SYSTEM B COMPACTION



Back Packing (Reverse filling)

- Filling the space left by the plugger can be accomplished by a

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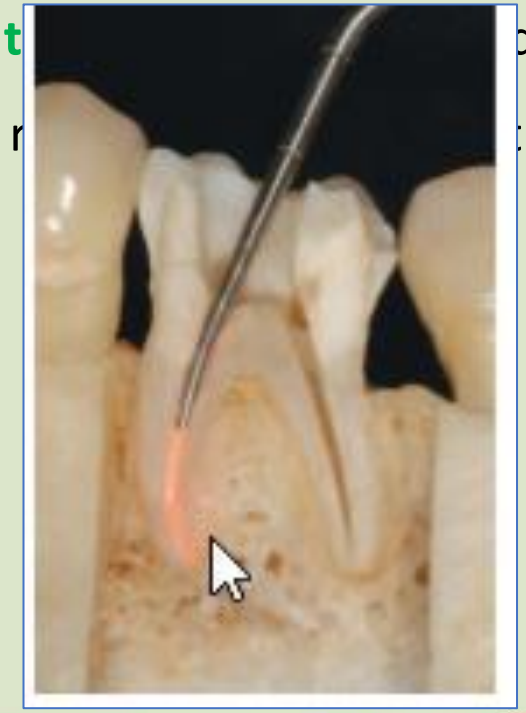
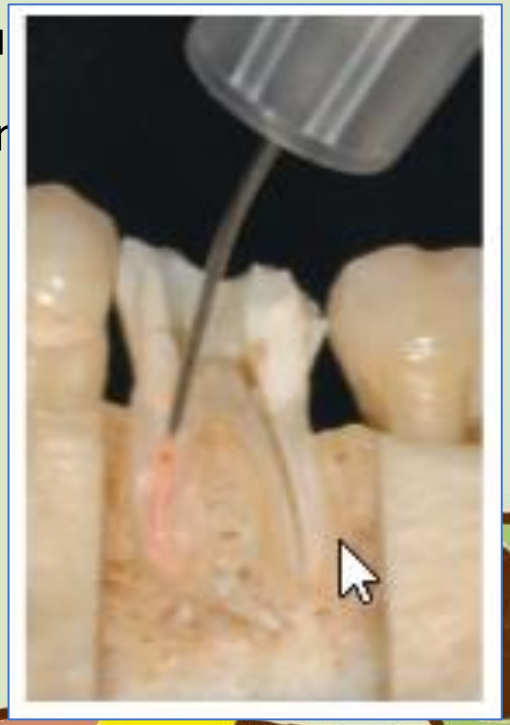




SYSTEM B COMPACTION

- **In ovoid canals**, where the canal configuration may prevent the generation of hydraulic forces, an accessory cone can be placed alongside the master cone before compaction.
- **With type II canals** the master cones are placed in both canals before compaction.
  - A hand plugger is used to stabilize the cone in one canal while the other is being obturated.

SYSTEM B: CONTINUOUS WAVE OF OBTURATION

- **Guess GM et al** studied the *in vitro* influence of system B plugger depth on GP filling adaptation to the canal wall using single cone continuous wave technique in one group and lateral compaction followed by down pack (hybrid technique) in the other.
- They found no significant difference in adaptability and the best results were obtained with plugger depths 3 -4.5mm from working length.

Guess GM, Edwards KR, Yang ML. Analysis of the continuous wave obturation using a single cone and hybrid technique. J Endod 2003;29(2):509

- **Aminsobhani M et al. (2015)** conducted a study to compare continuous wave compaction technique(CWC) obturation quality with that of lateral compaction(LC), warm vertical compaction.
- The voids were significantly more in the LC technique than other techniques in teeth.
- CWC technique resulted in better adaptation of gutta-percha to canal walls than LC at all cross-sections with fewer voids and faster obturation time compared to other techniques.

Aminsobhani M, Ghorbanzadeh A, Sharifian MR, Namjou S, Kharazifard MJ. Comparison of Obturation Quality in Modified Continuous Wave Compaction, Continuous Wave Compaction, Lateral Compaction and Warm Vertical Compaction Techniques. *J Dent* 2015;12(2):99–108.

SYSTEM B COMPACTION / ELEMENTS OBTURATION

- A newer generation System B Unit
- Coupled with a motor driven extruder handpiece that makes the backfill easy.
- Buchanan Pluggers are available in tapers of **.04, .06, .08, .10 and .12, to** correspond with the shapes created by GT Files.

Advantages

- Combines downpack to backfill.

Zap and Tap technique

- **For obturating mandibular molars with C - shaped canals**

Technique

- Preheating Endotec plugger (Medidenta, Woodside, NY) for 4-5 seconds before insertion (Zap)
- Then moving the hot instrument in and out in short continuous strokes **(Taps)** 10-15 times
- Plugger removed while still hot
- Followed by insertion of a cold spreader
- Insertion of additional accessory points.

Endotec II device (Medidenta, Woodside, NY) for warm lateral compaction.

CHEMICALLY PLASTICIZED COLD GUTTAPERCHA

- This technique is also called **Callahan Johnston technique.**

Indications

- Curved canals, canals with large apical foramen.
- This technique involves dissolving guttapercha in chloroform to produce a sealer (chloropercha), and placing the mixture into the canal with a syringe.
- A gutta-percha cone was then softened and placed into the canal; the mass hardened as the solvent evaporated.
- The techniques using solvents have been abandoned and replaced with materials and methods that do not exhibit shrinkage

Advantage

- Chloroform dipped point provides significantly better seal than standardized points.

Disadvantages

- Inability to control overfilling.
- More shrinkage (75%) as solvents evaporate.
- Poor apical and lateral seal.
- Irritation to periapical tissues.

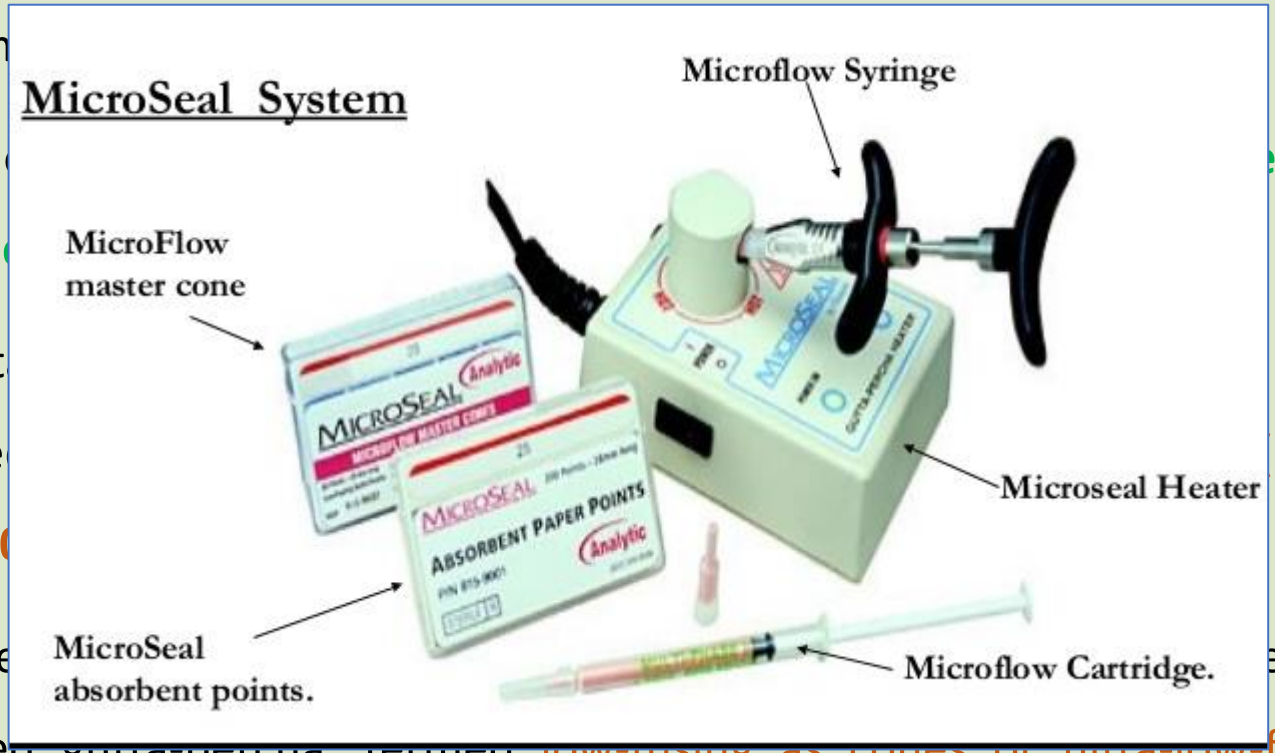
THERMOMECHANICAL COMPACTION

- **McSpadden first introduced the McSpadden Compactor.**

- This device resembled a reverse Hedstroem file, or a reverse screw design.
- **It fit into a latch-type hand piece and was spun in the canal at speeds between 8,000 and 20,000 rpm.**
- At these speeds, the heat generated by friction softened the gutta-percha and the design of the blades forced the material apically.

THERMOMECHANICAL COMPACTION

- Later, McSpadden developed a new technique, combining the principle of the therm
- The previ ers, of different
- This gutt then introduce 1,000 rpm to 4,
- The syste ecially formulated gutta-percha, termed low-fusing as cones of ultra-low-fusing gutta-percha, in a cartridge that is heated in the MicroSeal heater.



THERMOMECHANICAL COMPACTION

- The **NiTi condenser is coated with heated gutta-percha** and inserted into the canal next to the master cone.
- The rotating instrument generates heat from the friction that, in turn, thermally softens the master cone.
- It also **flows laterally, by centrifugal force,** into all areas of the canal.
- The material is therefore pushed both apically and laterally, providing a three-dimensional obturation of the root canal system.

THERMOPLASTIIZED INJECTION TECHNIQUE(1977)

- **Heating of gutta-percha outside the tooth and injecting the material in to the canal.**
- **The Obtura III, Calamus , Elements, HotShot and Ultrafil 3D are available devices.**

Indications

- Filling - “c”-shaped canals
- Internal resorption cavities.
- Accessory canals.

SYRINGE INSERTION

Obtura gun

- Consists of a **hand-held "gun"** that contains a chamber surrounded by a heating element into which pellets of gutta-percha are loaded.
- Silver needles (varying gauges of 20, 23,and 25) are attached to deliver the material into the canal. These are more flexible and retained heat to keep the gutta percha soft.
- The control unit allows the operator to **adjust the temperature and thus the viscosity of the gutta-percha.**

SYRINGE INSERTION

Obtura gun

Temperature

- **160°C-200°C**
- Extruded gutta percha has temperature of **62° - 65°C**
- Remains soft for 3min
- At the right consistency, temperature extruded gutta percha

  Strings out

  Viscous and sticky

Obtura

- no digital display

Obtura II

- Digital display of temperature reading
- Disposable silver needles
- Syringe made of stronger heat resistant material
- Highly polished chamber.

Gutta percha pellets

- *A*vailable as **beta phase gutta percha pellets**

TECHNIQUE :

- Requires a minimum size 40 preparation in body of canal
- Continuously tapering funnel from the apical 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.

Disadvantage

- Lack of length control. Both overextension and underextension are common results.
- Gross overfilling of root canal, known as

"SPAGHETTI PHENOMENON"

Radiographic picture showing "Spaghetti phenomenon

OBTURA III MAX

- Newer version of Obtura.
- Compact control unit
- Ergonomic handle

Obtura Sparton with ergonomic handle (newer version of obtura)

CALAMUS

- The Calamus Dual 3-D Obturation System is one

  combines both Calamus “Pack” and Calamus “P

- The Calamus Pack handpiece is the heat source

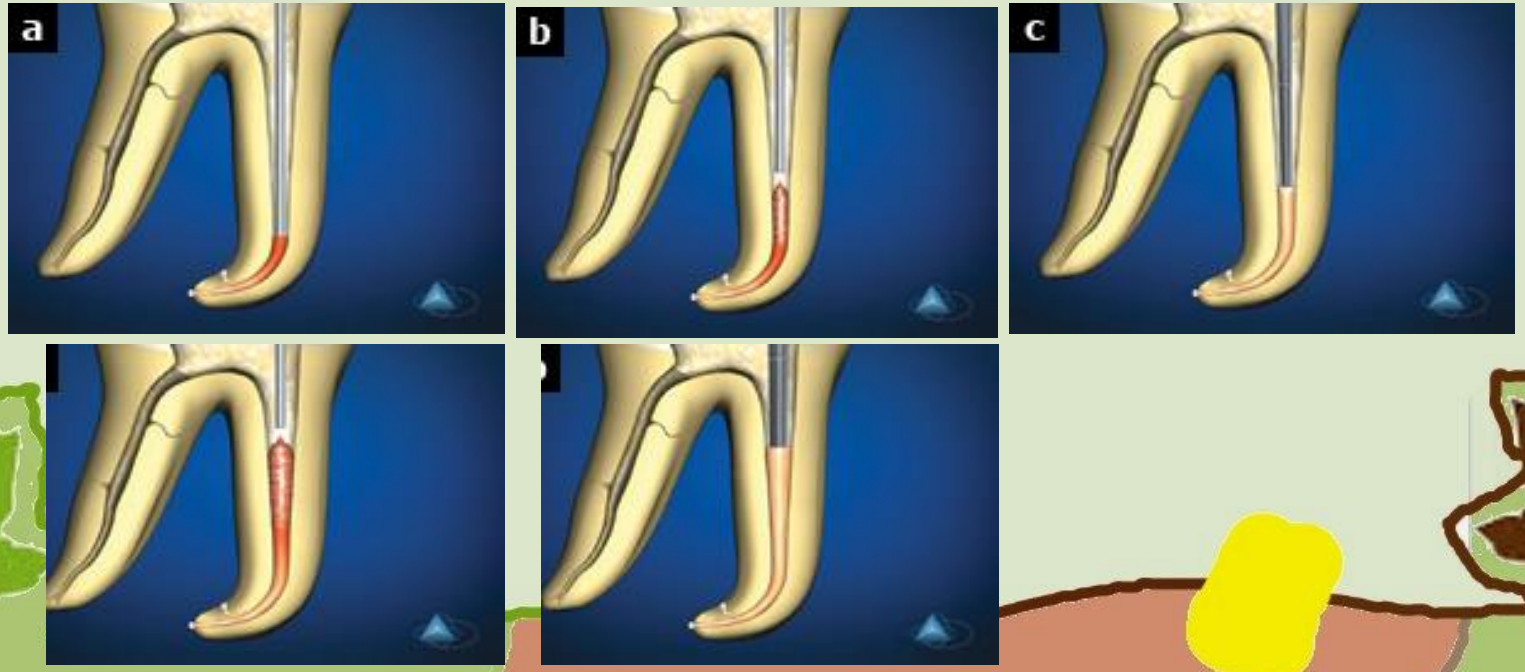
  an appropriately sized electric heat plugge

  thermosoften, remove, and condense gu

  downpacking phase of obturation.

CALAMUS

- The Calamus Flow handpiece is utilized, in conjunction with a one-piece gutta-percha cartridge and integrated cannula, to dispense warm gutta-percha into the preparation during the backpacking phase of obturation.
- The cartridges are single patient use and are available in 20 and 23 gauge sizes.



- **Gupta R et al. (2015)** compared the quality of three different root canal obturation techniques: lateral compaction, Thermafil and Calamus by using cone beam computed tomography.
- Teeth were divided into 3 groups of 10 teeth each according to the obturation technique.
- Cone beam computed tomography was used to measure filling area and voids at coronal, middle and apical third of the root canal after obturation by different techniques.
- The maximum amount of obturating material was observed in Calamus group followed by Thermafil and lateral compaction.

Gupta R .Comparative Evaluation of Three Different Obturating Techniques Lateral Compaction, Thermafil and Calamus for Filling Area and Voids Using Cone Beam Computed Tomography: An Invitro study *J Clin Diagn Res* 2015; 9(8): 15–17.

- **Mangat et al** evaluated the **adequacy of two obturation techniques, namely Calamus and Thermafil via volume rendering method utilizing a three dimensional helical computed tomography.**
- Sixty **single rooted teeth (maxillary first premolar)** were collected and randomly allocated into two groups..
- The teeth were then obturated utilizing following methods: **Group 1- Calamus and group 2 - Thermafill.**
- The **adequacy of obturation was better with Calamus as compared to Thermafill.**

Mangat P , Dhingra A , Muni S . Three dimensional helical computed tomographic evaluation of two obturation techniques: An in vitro study. International Journal of Applied Dental Sciences 2014; 1(1): 11-14.

HOT SHOT

- The HotShot delivery system (Discus Dental) is a **cordless thermoplastic device that has a heating range from 150° C to 230° C.**
- The unit is cordless and can be used with either gutta-percha or Resilon.
- Needles are available in 20, 23, and 25 gauges.

- Riva T et al (2018) conducted a study to evaluate the efficacy of different techniques used to obturate experimental internal resorptive defects using stereomicroscope.
- **Group I- lateral condensation, group II- thermoplasticized obturation.**
- Teeth were sectioned at 7 mm from the apex. Then sectioned root were examined under stereomicroscope.(10X magnification).
- It is seen that teeth obturated with **Hotshot (thermoplasticizing)** obturating technique show better results then lateral condensation technique.
- It was concluded that to obturate internal resorption cavities, thermoplasticized obturartion technique are superior then that of traditional lateral condensation technique.

Riva T. Comparison of the Percentage of Voids in the Canal Filling of a Calcium Silicate-Based Sealer and Gutta Percha Cones Using two Obturation Technique. Materials 2018; 18(4):22-34.

ULTRAFIL 3D

- **Is a 'low heat' injectable gutta percha system**

Consists of

- Heating unit
- Injection syringe
- Cannulas prefilled with gutta percha with attached 22-guage needles.

ULTRAFIL 3D

- The system employs three types of gutta-percha cannulas.
- Regular Set is a low-viscosity material that requires 30 minutes to set.
- 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 is recommended for techniques employing compaction and sets in 2 minutes.
- The heater is preset at 90° C and does not require adjustment.
- Each cannula has a 22-gauge stainless steel needle that measures 21 mm in length.

ULTRAFIL 3D

Technique

- Cannula is chosen and needle may be bent on the barrel of the syringe.
- Cannula is placed in the preset heater at **90 °C for 15min.**
- Cannula is placed in injection syringe during which it loses heat rapidly and drops to 70 degrees - ready for injection.
- Has a **one minute working time.**
- Material is injected into the preparation at 42°C - 45°C.
- The GP remains able to flow for 45 to 60 sec depending on the viscosity.

ULTRAFIL 3D

ULTRAFIL

- Low temperature
- Gun has no heating element and separate oven
- No digital readout
- Uses 22 gauge needles
- Working time of less than 1 min

OBTURA II

- High temperature
- Gun with heating element
- Digital display of temperature
- Needles-18,20,22 and 25 gauge
- Remains soft for 3min

WITHOUT GUN- INJECT R-FILL

- **Inject-R Fill, consists of a small metal tube filled with GP and a plugger/plunger attached.**
- **Used for backfilling process.**
- **Allows for delivery of a single backfill injection of gutta percha**
- The apical segment of the canal can be obturated using any technique including lateral compaction, traditional warm vertical compaction, or System B.

INJECT R-FILL

Technique

- Inject-R Fill must first be heated in a flame or an electronic heater and the coronal surface of the gutta-percha already in the canal should be warmed using a heated instrument.
- When a burner is used, the stainless steel gutta-percha filled sleeve is waved through the flame until gutta-percha **begins to extrude from the** open end.
- The warmed unit is then placed into the orifice of the canal.

INJECT R-FILL

- For the device to fit, the **canal orifice must be at least 2 mm in diameter.**
- **A push of the handle** toward the canal injects the heated gutta-percha into the canal.
- The carrier is then rotated to break it free from the access.

SOLID CORE CARRIER INSERTION

- The concept of a **carrier-based thermoplasticized gutta-percha obturation method** was introduced by **Johnson in 1978.**
- These products are marketed as **ThermaFil Plus Obturators** (Tulsa Dental Products), **Densfil** (Dentsply Tulsa, Tulsa, OK), and **Soft-Core** (Soft-Core System, Inc., CMS Dental, Copenhagen, Denmark), **Three Dee GP** (Deproco UK Ltd.)

THERMAFIL

- Introduced in 1978 by Johnson
- Consisting of a flexible central carrier uniformly coated with a layer of alpha-phase gutta percha.

Carriers made of Stainless steel (initially)

Titanium (later)

Plastic

Markings are made **at 18, 19, 20, 22, 24,27, and 29 mm.**

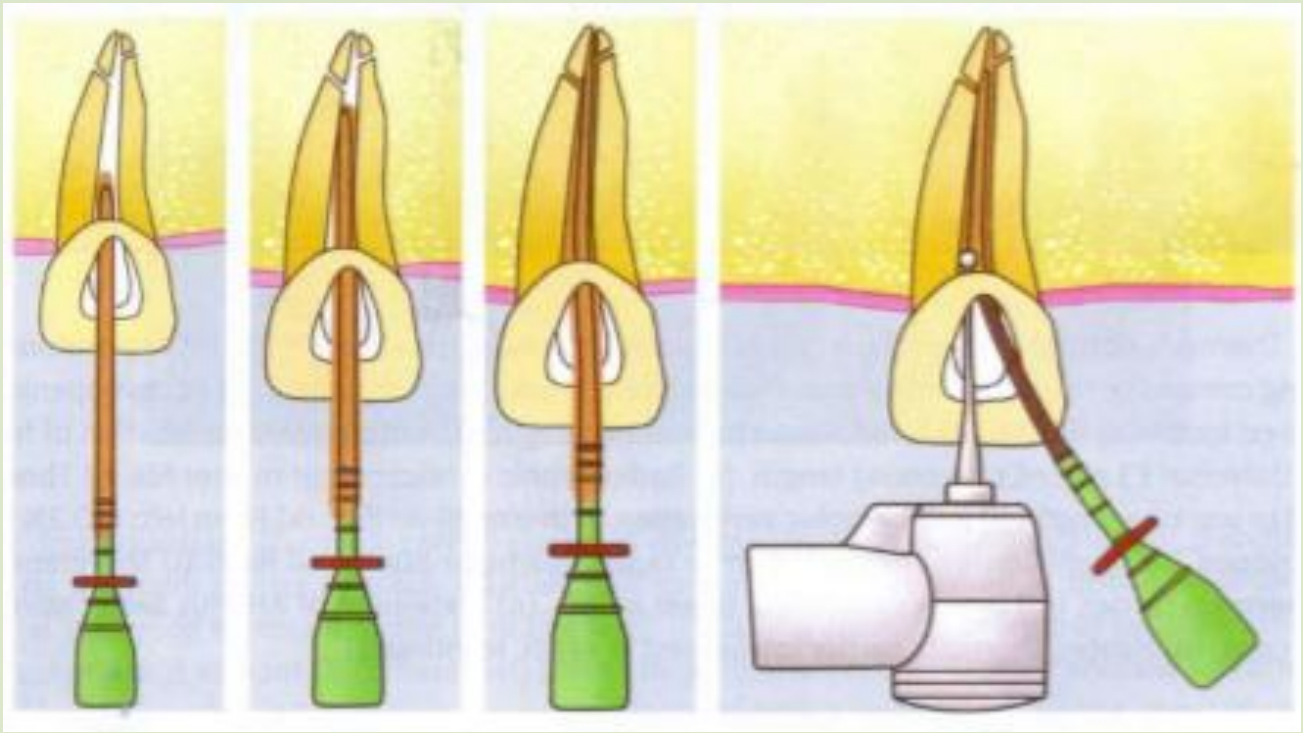
- Classic Thermafil obturators were available in 17 sizes with tip diameter ranging from 0.20 to 1.40 mm and taper that varied between .04 and .05.

THERMAFIL

- Later, every rotary shaping system has introduced different obturators, such as **GT and ProTaper Next, ProTaper, and WaveOne obturators.**
- Recently, the plastic carrier was replaced with a guttapercha carrier called as **GuttaCore** (Dentsply Tulsa Dental, Tulsa, Oklahoma).
- This product has the carrier made from a cross linked gutta-percha that is intimately adherent to the surrounding gutta-percha. The advantage is eliminating the existing gap between the carrier and the gutta-percha.
- GuttaCore obturators are available to be used in conjunction with **ProTaper Next and ProTaper Gold.**

THERMAFIL

TECHNIQUE



THERMAFIL

- Indicated in **narrow, curved canals** where spreaders, heat carriers, and pluggers are difficult, or impossibile, to use in the apical one-third.
- On the other hand, the technique should not be used in cases of **open apices, bi - or tri-furcations of the middle and apical thirds of the root canal, internal resorption or anatomical variations like C-shaped canals.**

THERMAFIL

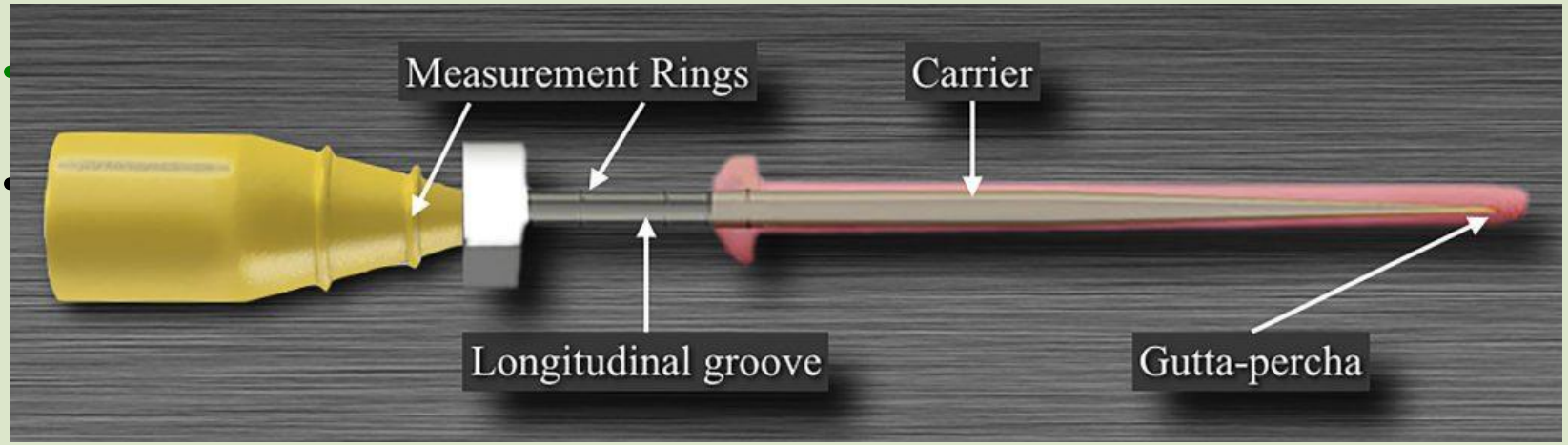
Advantages

- Quick and easy technique.
- Excellent flow characteristics.

Disadvantages

- Over filling.
- Very difficult to create post space with metallic core.
- Retreatment difficult.
- In addition, the gutta-percha was often stripped from the carrier, leaving the carrier as the obturating material in the apical area of the canal.

THERMAFIL PLUS



- The heating time is dependent on the size of the core carrier.

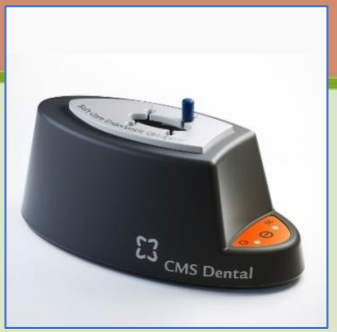
- **Elenjjikal MJ et al (2019)** compared the quality of root fillings in artificially created internal resorption cavities filled with warm vertical compaction, lateral condensation, Obtura II along with System B, and Thermafil, and to calculate the percentage of gutta-percha, sealer, and voids using an ImageJ software.
- Obtura II along with System B was found to be the most suitable obturation technique for the management of teeth exhibiting internal resorption.

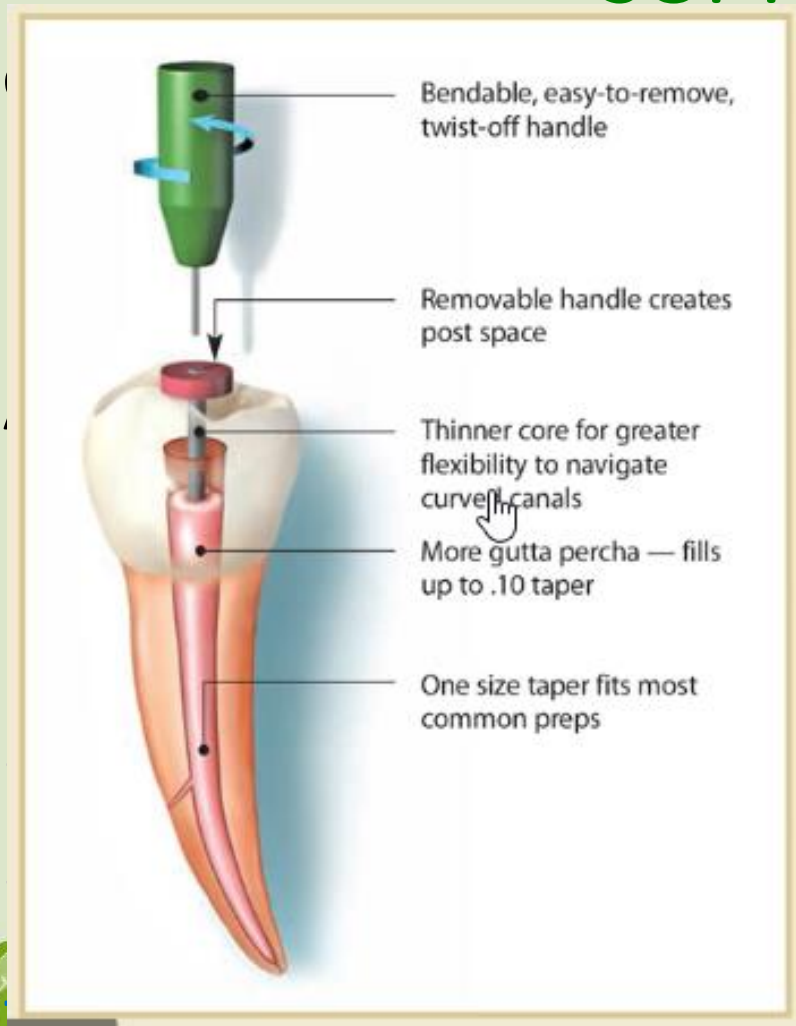
Elenjikal MJ, Latheef AA, Kader MA, Ganapathy S, Mohamed AB, Sainudeen SS, Abdulla AM, Saquib SS. A comparative evaluation of five obturation techniques in the management of simulated internal resorptive cavities: An *ex vivo* study. *J Pharm Bioall Sci* 2019;11, Suppl S2:450-6

- Pons M et.al conducted a study to evaluate obturation depth and volume by means of micro-CT when filling lateral canals.
- 30 single-rooted teeth were used. After instrumentation, three artificial lateral canals were created on each mesial and distal surface (one on each third).
- The samples were then separated randomly into three groups : lateral condensation (Group 1), Tagger's hybrid technique (Group 2) and GuttaCore (Group 3).
- GuttaCore provided the best lateral canal sealing among the three techniques compared.

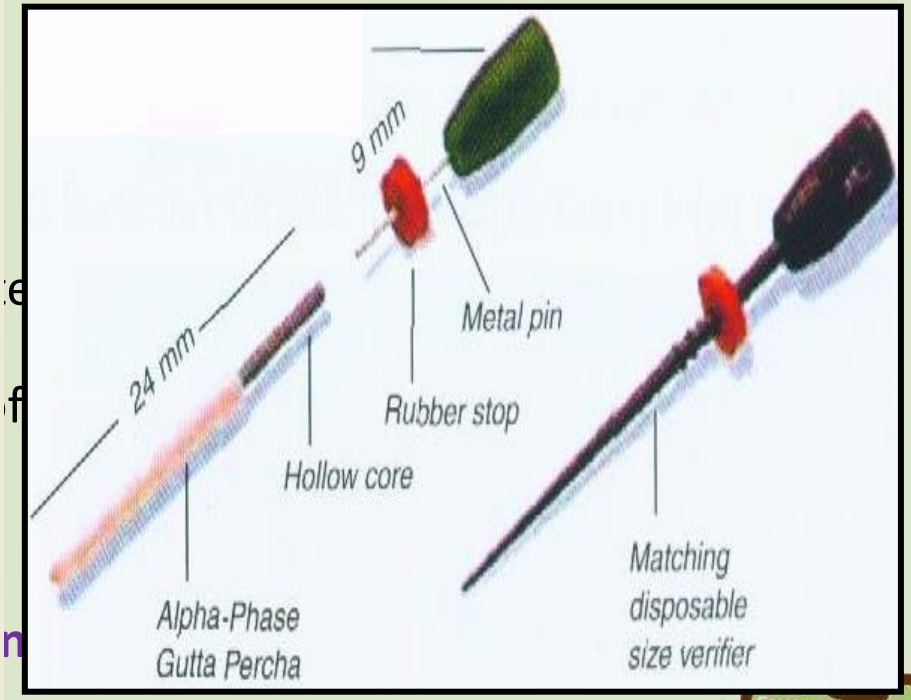
Pons M, Barriuso E, Frigola J, Ballester ML, Berástegui E.Micro-computed Tomography Assessment of Different Obturation Techniques for Filling Lateral Canals. J Clin Exp Dent 2017;10(7):702-708.

SOFT CORE





cept the **handle is attached to a**



ONE -STEP OBTURATORS

Cores

- *P*lastic
- Does not have a handle

Special tweezer

- Helps hold the obturator
- acts as a cutter, thus eliminating the need for a separate cutting bur.

One-step oven

- Halogen oven
- Temparature - **110 °C**

THREE DEE GP

- **It is 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 postspace preparation.

SOLID CORE CARRIER INSERTION

- **Densfil** is a carrier-based gutta-percha system with **both plastic and titanium carriers.**
- **SuccessFil** is a carrier-based gutta-percha system combined with the UltraFil thermoplasticizied injection system - marketed as the **Trifecta System (Hygenic/Coltene/Whaledent).**

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SOLID CORE CARRIER INSERTION

- **JS Quick-Fill** is an **alpha phase gutta-percha-coated titanium core in ISO sizes 15 to 60.** Designed to fit in slow speed handpieces. Plastification occurs from friction heat without any preheating or open flames.
- The carrier-based material is spun into the canal at low speed.
- Available in 21 & 25mm length

- **Wong AW et al. (2017)** conducted a systematic review to evaluate the clinical performance of core - carrier obturation in endodontic treatment.
- The success rate, short - term postoperative pain, overfilling and adaptation of core - carrier obturation from clinical studies were selected.
- 19 articles were screened in the systematic review.
- The pooled success rate of core - carrier obturation was 83% (95% CI: 69% - 91%).
- The pooled incidence of 1 - day and 7 - day short - term postoperative pain were 35% (95% CI: 15% - 62%) and 6% (95% CI: 1 - 35%).

Wong AW, Zhang S, Li SK, Zhang C, Chu CH. Clinical studies on core-carrier obturation: a systematic review and meta-analysis. BMC Oral Health. 2017;17(1):167.

- The pooled proportion of teeth with overfilling and adequate adaptation of the obturation material were 31% (95% CI: 18% - 50%) and 85 % (95% CI: 75% - 91%), respectively.
- The success rate of endodontic treatment using core - carrier obturation was 83%.
- Short - term postoperative pain was not uncommon (24%).
- Most teeth (85%) had adequate adaptation using core - carrier obturation material, but a considerable amount of teeth (31%) had overfilling.

Wong AW, Zhang S, Li SK, Zhang C, Chu CH. Clinical studies on core-carrier obturation: a systematic review and meta-analysis. BMC Oral Health. 2017;17(1):167.

COLD GUTTA PERCHA COMPACTION (GUTTAFLOW)

GuttaFlo at

consists gutta-

percha, s

- The ma r.
- The tec placing a single r
- The ma in 25-30 minute

Advantages

- No shrinkage.
- Allows great ease of handling as only one master point is needed (condensation is not required)
- Has excellent flow properties.
- Extremely biocompatible
- Allows good post preparation.
- Can be removed easily during retreatment.
- Ensures a very tight seal of the root canal.
- Radiopaque for excellent x-ray evaluation.

- Shilpa BH et al conducted a study to comparatively evaluate the Sealing Ability of three newer root canal obturating materials - Guttaflow, Resilon and Thermafil using silver nitrate dye and observing under stereomicroscope: An In Vitro Study.

- They found that Group II - Resilon with Epiphany sealer showed the least amount of microleakage when compared to Group I - GuttaFlow and Group III - Thermafil with AH-plus sealer.

Shilpa BH et.al .Comparative Evaluation of Sealing Ability of Three Newer Root Canal Obturating Materials Guttaflow, Resilon and Thermafil: An In Vitro Study. *J Int Oral Health* 2013; 5(1): 54–65.

APICAL THIRD FILLING

Carrier based system

Light speed Simplifill obturator

Fibrefill obturator

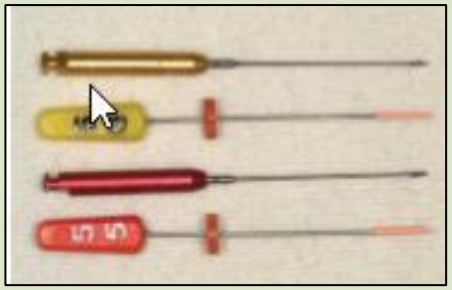
Paste system

Dentin chips

Calcium hydroxide

Mineral Trioxide aggregate

LIGHT SPEED SIMPLIFILL



- Originally developed by Senia at Lightspeed Technology.
- **Simplifill is gutta-percha or resilon** manufactured for use after canal preparation with **Lightspeed instruments.**
- The Apical GP Plug size is the same ISO size as the **Lightspeed "Master Apical Rotary" (MAR)**
- Stainless steel carrier to place and compact a 5 mm segment of gutta-percha into the apical portion of a canal .

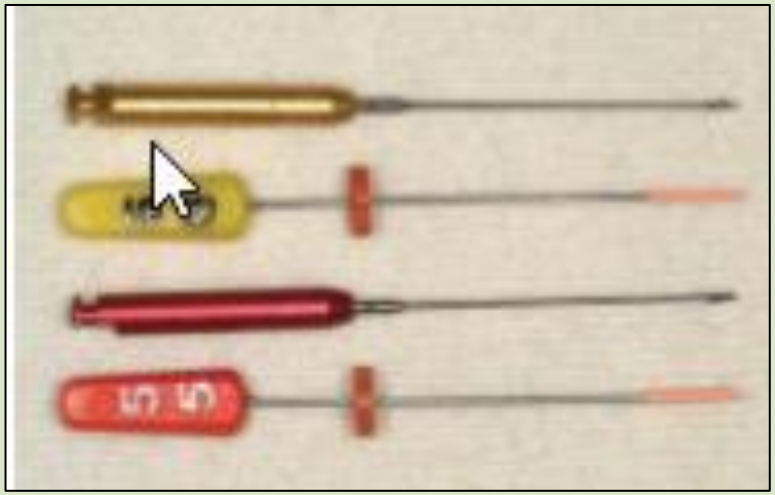
LIGHT SPEED SIMPLIFILL

Technique

- Trial fit an Apical GP Plug, without sealer, to ensure a correct apical fit.
- The technique involves fitting a carrier that is consistent with the master apical rotary file (lightSpeed Technology) to within 1 to 3 mm of the prepared length.
- The simplifill carrier is slowly advanced to the prepared length.
- With the plug at the corrected WL, the handle is quickly rotated with a **counterclockwise direction** to separate the shaft from the apical gutta-percha.

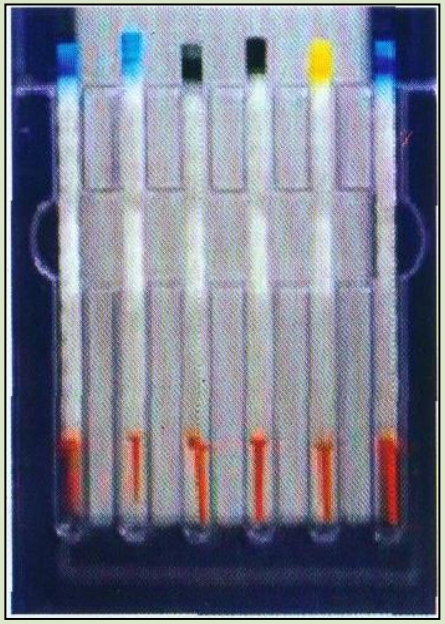
LIGHT SPEED SIMPLIFILL

- The coronal space can then be filled with gutta percha, **using lateral compaction or the warm thermoplastic technique.**
- When using the lateral compaction it is recommended that the first cone be the same size as the simplifill carrier.



0-52 SimpliFill fitted to 1 to 3 mm from the prepared length.

FIBERFILL



A combination obturation technique

- Combines a post and obturator in a single unit
- Apical 5 to 8 mm is gutta percha
- Coronal two thirds is a resin core post

  - Comprised of unidirectional fibers in an organic resin matrix

FIBERFILL

Fibrefill obturation system consists of

- Fibrefill obturators and fiberfill 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.

APICAL BARRIERS

- Apical barriers may be necessary in cases with immature apical development, cases with external root resorption, and cases where instrumentation extends beyond the confines of the root.
- **Dentin chips, Calcium hydroxide, MTA, Biodentine** have been advocated for placement as a apical barrier in canals exhibiting an open apex.
- The barriers are designed to permit obturation without extrusion of materials into the periradicular tissues but are often incomplete and do not seal the canal.

MINERAL TRIOXIDE AGGREGATE

- Mineral trioxide aggregate may be considered as **a paste filling material for the obturation of root canals.**
- **Because of its sealing ability, biocompatibility, and other desirable properties, it would seem to be a paste filling material that is indicated when more conventional core filling materials cannot be used.**
- MTA consists of **tricalcium silicate, tricalcium aluminate, tricalcium oxide, and silicate oxide,** with some other mineral oxides that were responsible for the chemical and physical properties of the aggregate.

- **Girish K et.al** conducted a study to evaluate the fracture resistance of simulated immature teeth, when the root canals were completely filled either with mineral trioxide aggregate or Biodentine, comparing with that of roots filled with apexification procedure.
- 60 mandibular premolar teeth with single, straight canals decoronated at cementoenamel junction were divided into five groups.
- Group 1 samples served as negative control, **Group 2 and 4 samples were filled with 5 mm of MTA or Biodentine apical plug and backfilling with gutta-percha using AH Plus sealer. Group 3 and 5 root samples were completely obturated with MTA and Biodentine, respectively.**
- Complete root canal obturation with MTA or Biodentine has shown significantly higher fracture resistance when compared to apexification with MTA or Biodentine.

Girish K, Mandava J, Chandra R R, Ravikumar K, Anwarullah A, Athaluri M. Effect of obturating materials on fracture resistance of simulated immature teeth. *J Conserv Dent* 2017;20:115-9

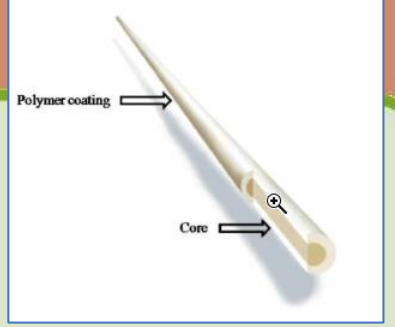
PASTES

- Pastes fulfill some of the criteria outlined by Grossman and can adapt to the complex internal canal anatomy

Disadvantages

- It can result in extrusion or incomplete obturation.
- The inability to control the material and when extrusion occurs it can corrected only by surgical intervention.
- Addition of paraformaldehyde results in severe toxicity.

C-POINT SYSTEM



- **The C-Point system (Endo Technologies, LLC, Shrewsbury, MA, USA)** is a **point-and-paste root canal filling technique** that consists of pre-made, hydrophilic endodontic C- points and an accompanying sealer.
- These points are designed in such a way that **it expands laterally without expanding axially.** It uses residual water from the instrumented root canal and moisture which is naturally present in the dentinal tubules for its expansion.
- Inner core of C-points is a mixture of two proprietary nylon polymers, **i.e., Trogamid T and Trogamid CX.** The polymer coating is a cross-linked copolymer of acrylonitrile and vinyl pyrrolidone.

C-POINT SYSTEM

Smartpaste Bio

- Resin based sealer which uses bioceramic as one of its constituents to improve the dimensional stability and render it non-resorbable inside the root canal.
- It produces calcium hydroxide and hydroxyapatite as byproducts of the setting reaction, rendering the material both antibacterial while setting and very biocompatible once set.
- The delayed setting time, and the hydrophilic nature of the cement makes this a perfect companion to use with self-sealing Propoints (SmartsealTM), allowing the point to hydrate and swell to fill any voids.

CONCLUSION

- Although many new methods are being developed for the obturation of the root canal that are faster and more effective.
- No one of these is without any disadvantages. It is upto the clinician to select each method according to the root canal anatomy presented by the root and use each method to its maximum benefit minimizing the disadvantages.

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