Ministry of Higher Education
and Scientific Research
University of Baghdad
College of Dentistry

Recent Concept of Obturation

A Project
Submitted to the Council of the College of Dentistry at the University of Baghdad Department of Conservative Dentistry in Partial Fulfillment of the Requirements for the B.D.S. Degree

By
Russal Duraid Maan

Supervised by
Dr. Samar Abdul Hamed
B.D.S., M.Sc.

2018 A.D. 1439 A.H.

Dedication

This work is dedicated to my family, my father and mother and my friends for their great support and for always believing in me.

To my supervisor for her guidance and Support

Thank you from all my heart.

Ibrahim

Certification of the Supervisor

I certify that this thesis entitled “**Recent Concept of Obturation”** was prepared by **Russal Duraid Maan** under my supervision at the College of Dentistry/ University of Baghdad in partial fulfilment of the requirements for the for the B.D.S. Degree.

Signature
Dr. Samar Abdul Hamed
B.D.S., M.Sc.
(The supervisor)

Acknowledgement

Thanks and praise to **Allah the Almighty** for inspiring and giving me the strength, willingness and patience to complete this work.

My deepest gratitude and sincere appreciation to **Prof. Dr. Hussain F. Al-Huwaizi**, Dean of the College of Dentistry, University of Baghdad, for his kind care and continuous support for the postgraduate students.

I would like to thank **Prof. Dr. Nidhal H. Ghaib**, Assistant Dean for Scientific Affairs, for her advice and support.

My sincere appreciation and thankfulness to **Prof. Dr. Adel Frahan**, Chairman of the Conservative Dentistry Department, University of Baghdad, for his keen interest, help, scientific support and encouragement.

A million words would be too short to express my genuine appreciation to my supervisor **Dr. Samar Abdul Hamed** who supported me throughout this project and introduced me to the wonders of science. Thank you for your invaluable guidance and for your tremendous effort to help me finish this thesis. Thank you for your time, advice, care and motivation during the entire research period. I am very grateful for your supervision and I owe you the greatest degree of respect and appreciation. Being your student was a privilege- I have learnt so much from you. Thank you for being the perfect mentor. I can never really thank you enough.

List of contents

List of Figures

Introduction

The success of root canal treatment depends upon proper diagnosis and treatment planning, Knowledge of canal anatomy and morphology, canal debridement, sterilization of canal and Obturation. Root canal obturation is defined as “the three- dimensional filling of the entire root canal system as close to the cementodentinal junction as possible. Minimal amounts of root canal sealers are biologically compatible, are used in conjunction with the core filling material to establish an adequate seal”[(1)] the obturation phase of root canal treatment receives a great deal of attention Historically, it has been accorded the role of the most critica step and the cause of most treatment failures. An early and often quoted report stated that most treatment failures could be attributed to inadequate obturation[(2)]. The ultimate objective of the root canal therapy is the three-dimensional obturation of the endodontic space after it has been completely cleaned, shaped and disinfected. The purpose of obturation is to seal all "portals of exit" to impede any sort of communication or exchange between the endodontium and periodontium It must therefore completely and durubly fill the root canal space, in which no empty spaces should remain at all. The surgical operating microscope and the advent of rotary nickel titanium instrumentation have both provided a quantum leap forward towards a higher standard of endodontics. Adhesion has done much the same for restorative dentistry blending the best of adhesion into endodontic obturation has now become reality. In the authors' opinion, adhesion in canal obturation represe another quantum leap forward for the specialty. [(3)]

Objectives of obturation

The objective of obturation is to create a complete seal along the length of the root canal system from the corona' opening to the apical termination.

The overall function of a root filling is to occupy the instrumented root canal space to allow proper healing of the periapical tissue.

Specifically it attempts:

(1) To prevent leakage of bacterial organisms, bacterial elements and nutritional elements from the oral environment to the root canal (coronal leakage).

(2) To restrain growth of any surviving bacteria in dentinal tubules and uninstrumented parts of the root canal space.

(3) To prevent release of bacterial elements in the other direction, i.e. from the root canal to the apical environment (apical leakage).

(4) To prevent leakage of nutritional elements from the periapical tissue to the canal space.

Timing of obturation

Various factors like patient symptoms, pulp and periradicular status and procedural difficulties affect the timings of obturation and number of appointment.

Patient symptoms

• If patient presents with sensitivity on percussion, it indicates inflammation in periodontal ligament space, canal should not be obturated before the inflammation has subsided.

• In case of irreversible pulpitis, obturation can be completed in single visit if the main source of pain, i.e. pulp has been removed.

Pulp and Periradicular Status

• Teeth with vital pulp can be obturated in same visit.

• Teeth with necrotic pulp may be completed in single visit if tooth is asymptomatic.

• Presence of even a slight purulent exudate may indicate possibility of exacerbation. If canal is sealed, pressure and subsequent tissue destruction may proceed rapidly.

When to Obturate?

– When canal is cleaned and shaped to an optimum size and dryness.

– Tooth is asymptomatic (i.e. no signs of active periapical pathology).

– No draining sinus.

– No foul odour from canals.

Extent of obturation

It has been found that obturation should be done at the level of dentinocemental junction.

Overfilling: is complete obturation of root canal system with excess material extruding beyond apical foramen.

Overextension: is extrusion of filling material beyond apical foramen but the canal may not have been filled completely.

Underfilling: It is a 3-dimensional partial/ semi/incomplete obliteration of the root canal with apical area of root canal space left unfilled.

Under extension: Filling material short of apex with loosely filled canal and apical area of root canal left unfilled.[4]

The ideal root canal filling

Various endodontic materials have been advocated for obturation of the radicular space. Most techniques employ a core material and sealer. Regardless of the core material a sealer is essential to every technique and helps achieve a fluid-tight seal.

The American Association of Endodontists' Guide to Clinical Endodontics outlines contemporary endodontic treatment.[1] Nonsurgical root canal treatment of permanent teeth “involves the use of biologically acceptable chemical and mechanical treatment of the root canal system to promote healing and repair of the periradicular tissues.” The process is accomplished under aseptic conditions with rubber dam isolation.

Regarding obturation, the guide states, “Root canal sealers are used in conjunction with a biologically acceptable semi-solid or solid obturating material to establish an adequate seal of the root canal system.” In this area the guidelines indicate that “Paraformaldehyde-containing paste or obturating materials have been shown to be unsafe. Root canal obturation with paraformaldehyde-containing materials is below the standard Assessment of nonsurgical treatment is based primarily on the posttreatment radiographic examination. The radiographic criteria for evaluating obturation include the following categories: length, taper, density, gutta-percha and sealer removal to the facial cementoenamel junction in anterior teeth and to the canal orifice in posterior teeth, and an adequate provisional or definitive restoration Quality assurance is accomplished through a careful evaluation of treatment procedures. Only by this approach can deficiencies be identified and corrected. Although the anatomy and morphology of the radicular space vary tremendously, the obturated root canal should reflect the original canal shape. Procedural errors in preparation, such as loss of length, ledging, apical transportation, apical perforation, stripping perforation, and separated instruments, may not be correctable. Errors in obturation, such as length, voids, inadequate removal of obturation materials, and temporization, may be correctable.

Radiographic interpretation may vary among clinicians because of differences in radiopacity in root canal sealer/cements, constituents in specific brands of gutta-percha, interpretation of voids in vivo versus in vitro,431 the overlying bony anatomy, radiographic angulation, and the limited two-dimensional view of the obturated root canal or canals.

Sealer

• Sealers are binding agents, used to fill the gap between root canal wall and obturating material.

• They also fills up the irregularities, discrepancies, lateral canals and accessory canals.[5]

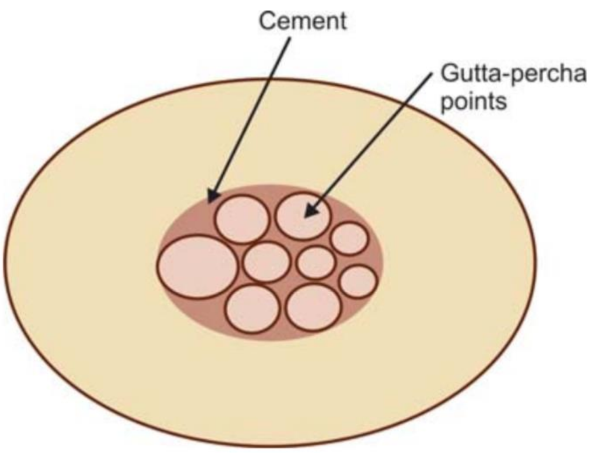


Figure 1: Sealer

Proprties of an Ideal Sealer

♦ Exhibits tackiness when mixed to provide good adhesion between it and the canal wall when set

♦ Establishes a hermetic seal

♦ Radiopaque, so that it can be seen on a radiograph

♦ Very fine powder, so that it can mix easily with liquid

♦ No shrinkage on setting

♦ No staining of tooth structure

♦ Bacteriostatic, or at least does not encourage bacterial growth

♦ Exhibits a slow set

♦ Insoluble in tissue fluids

♦ Tissue tolerant; that is, nonirritating to periradicular tissue

♦ Soluble in a common solvent if it is necessary to remove the root

Types of Sealers

- Zinc oxide euogenol sealer
- Calcium hydroxide sealer
- Non euogenol sealer
- Glass ionomer sealer
- Resin sealer
- Silicon sealer
- Bioceramic sealer

Glass lonomer

Endodontic formulations of glass ionomer" have been introduced recently. This material has the advantage of bonding to dentin, seems to provide an adequate apical and coronal seal, and is biocompatible.[6, 7] However, its hardness and insolu-9 bility make retreatment and post space preparation more difficult.$'OthersVarious luting agents and basing and restoration.[8]

Zinc Oxide Eugenol Sealer

Kerr Root Canal Sealer or Rickert's Formula. The original zinc oxide-eugenol sealer was developed by Rickert. This is based on the cement described by Dixon and Rickert in 1931. This was developed as an alternative to the gutta-percha based sealers (chloropercha and eucapercha sealers) as they lack dimensional stability after setting.[9]

Composition:

Powder

Zinc oxide 34-41.2 percent

Precipitated silver 25-30.0 percent

Oleo resins 30-16 percent

Thymol iodide 11-12 percent

Liquid

Oil of cloves 78-80 percent

Canada balsam 20-22 percent

Figure 2: Z.O.E Cement

Advantages

1. Excellent lubricating properties.

2. It allows a working time of more than 30 minutes, when mixed in 1:1 ratio.

3. Germicidal action and biocompatibility.

4. Greater bulk than any sealer and thus makes it ideal for condensation techniques to fill voids, auxilliary canals and irregularities present lateral to gutta-percha cones.

Disadvantage

The major disadvantage is that the presence of silver makes the sealer extremely staining if any of the material enters.

Calcium Hydroxide Sealers

Calcium hydroxide sealers were developed for therapeutic activity. It was thought that these sealers would exhibit antimicrobial activity and have osteogenic-cementogenic. Unfortunately, these actions have not been demonstrated. Solubility is required for release of calcium hydroxide and sustained activity. Inconsistent with the purpose of a sealer.[10]

Noneugenol Sealers

Developed from a periodontal dressing, Nogenol (Gc America, Alsip, IL) is a root canal sealer without the irritating effects of eugenol. The base contains zinc oxide, barium sulfate, and bismuth oxychloride.

Resin Based Sealers

Resin sealers have a long history of use, provide adhesion, and do nol contain eugenol. AH-26 is a slow-setting epoxy resin that was found to release formaldehyde when setting AH Plus is a modified formularion of AH-26 in which formaldehyde is not released a". The scaling abilities of AH-26 and AH Plus appear comparable. It exhibits a working time of approximately 4 hours EndoREZ (Ultradent Products, South Jordon, UT is a methacrylate resin with hydrophilic properties When used with EndoREZ resin-coated gutta- percha cones the dual cure EndoREZ sealer bonds to both the canal walls and the core material Diaket, a polyvinyl resin GM ESPE), consists of a powder composed of bismuth phosphate and zinc oxide and a liquid consisting of dichlorophen, triethanolamine, propionyl acetoph and copolymers of vinyl acctate, The enone material appears to be biocompatible.(11-14)

Figure 3: AH plus resin sealers

Silicone Sealers

Rocko Seal

It is silicon based root canal sealer with low film thickness, good flow, biocompatibility and low solubility. Its main constituent is poly dimethyl siloxane. Instead of showing shrinkage, Rocko seal shows 0.2 percent expansion on setting.

GuttaFlow (Coltène/Whaledent) is a cold flowable matrix that is triturated. It consists of gutta-percha added to RoekoSeal the material is provided in capsules for trituration. The technique involves injection of the material into the canal, followed by placement of a single master cone. The material provides a working time of 15 minutes and it cures in 25 to 30 minutes. Evidence suggests that the material fills canal irregularities with consistency 355 and is biocompatible, (15, 16, 17) but the setting time is inconsistent and may be delayed by final irrigation with sodium hypochlorite. Sealing ability appears comparable to other techniques in some studies and inferior in others.(18)

Advantages

- Easy to use
- Time saving
- Does not require compaction
- Does not require heating
- Biocompatible
- Can be easily removed for retreatment

Figure 4: GuttaFlow

Gutta flow 2 sealer

This is a modification of the original Gutta flow sealer which was available in the cartridge form. The excellent flow of this material made it the sealer of choice. However, the larger armamentarium required was a drawback. Of late, Gutta Flow 2 has been introduced which is available in the syringe form and has an excellent property of slight expansion after mixing which helps in better sealing.

Bioceramic

Bioceramic (BC) sealer is composed of zirconium oxide, calcium silicates, calcium phosphate monobasic, calcium hydroxide, and various filling and thickening agents. The material is available in a premixed syringe with calibrated intracanal tips. As a hydrophilic sealer it utilizes moisture within the canal to complete the setting reaction and it does not shrink on setting. It is biocompatible and exhibits antimicrobial properties during the setting reaction. (4)

Core material:

- Silver cone
- Gutta percha
- Active Gp
- Resilon
- Paste

Silver Points

They have been used in dentistry since 1930's but now a days their use has been declined, because of corrosion caused by them. Silver cones contain traces of metal like copper, nickel which add up the corrosion of the silver points. It has been seen that silver corrosion products are toxic in nature and thus may cause tissue injury.

Due to stiffness of silver cones, they are mainly indicated in round, tapered and narrow canals. They cannot conform with the shape of root canal because they lack plasticity; the use of silver points is not indicated in filling of large, triangular canals as in maxillary anterior teeth.

Silver cones do not possess adhering qualities, so a sealer is required to adequately seal the canal.[19]

Gutta percha

Gutta-percha is the most popular core material used for obtu Major advantages to gutta percha are its plasticity, ease of manipulation, minimal toxicity, radiopacity, and ease of removal with heat or solvents. Disadvantagesinclude its lack of adhesion to dentin and, when heated, shrinkage on cooling Gutta percha is the trans isomer of polyisoprene (rubber) and exists in two crystalline forms (a and B). In the unheated B phase the material is a solid mass that is compactable. When heated the material changes to the a phase and becomes pliable and tacky and can be made to flow when pressure is applied Gutta percha es consist of approximately 20% gutta-percha, zinc 65% oxide, 10% radiopacifiers, and 5% plasticizers (40) Attempts have been made to make gutta-percha more antimicrobial by the addition of materials such as iodoform, calcium hydroxide, chlorhexidene, and tetracycline The a form of gutta-percha melts when heated above 65° c. When cooled extremely slowly, the a form will recrystallize. Routine cooling results in the recrystallization of the B form Although the mechanical properties for the two forms are the same when a-phase gutta percha is heated and cooled it undergoes less shrinkage, making it more dimensionally stable for thermoplasticized techniques. The use of a phase gutta-percha for obturation has increased as themoplastic techniques have become more common 6.3. Active GP Activ GP (Brasseler USA) consists of gutta-percha cones impregnated on the external surface with glass ionomer.[20, 21]

Types of gutta_percha

- Gutta percha points: They have size and shape similar to ISO standardization.

- Greater taper gutta percha: They have taper other than 2%. They are available in 4%, 6%, 8% and 10 % sizes.

- Auxiliary points: They are non-standardized gutta cones. They perceive the shape of root canal.

- Precoated gutta percha: Metallic carriers are coated with gutta percha. Carriers used are stainless steel, titanium, or plastic materials. Eg: Thermafill.
- Gutta flow: In these powdered gutta percha is incorporated in resin based

Active GP

In this system glass ionomer is incorporated into the gutta-percha (8%).This is a highly radiopaque system used as a single cone technique with EndoSfequence system.

Active GP sealer is used. Highly active surface prepared to chemically adhere to the Activ GP glass ionomer sealer extended 12 minute working time.

The sizes of Active GP gutta-percha points are consistently accurate, and verified as such by laser-measurement to match your 0.04 or 0.06 tapered

EndoSequence* file system.

Active GP Plus employs calibration rings for easy depth measurement and a unique barrel handle which when placed using the placement instrument (transporter), facilitates easy placement into the canal Chemical and micromechanical adhesion between the canal walls, the Active GP sealer and the Activ GP gutta-percha points results in a Monobloc within the canal, completely sealing the canal from orifice to apex.(22)

Resilon

™, a new, synthetic resin-based polycaprolactone Polymer has been developed as a gutta-percha substitute to be used with Ephiphany®, (Pentron® Clinical Technologies, Wallingford, CT.) a new resin sealer in an attempt to form an adhesive bond at the interface of the synthetic polymer-based core material, the canal wall and the sealer. Advocates of this technique propose that the bond to the canal wall and to the core material creates a "monoblock." It is capable of being supplied in standardized ISO sizes and shapes, conforms to the configuration of the various nickel titanium rotary instruments, and is available in pellet form for injection devices. The manufacturer states that its handling properties are similar to those of gutta-percha and therefore it can be used with any obturation technique. Resilon contains polymers of polyester, bioactive glass and radiopaque fillers (bismuth oxychloride and barium sulfate) with a filler content of approximately 65% (Lofti)(23). It can be softened with heat or dissolved with solvents like chloroform. This characteristic allows the use of various current treatment techniques. Being a resin-based system makes it compatible with current.

Shipper et al, (2004)[24] discussed its ability to resist microbial leakage. They compared laterally and vertically compacted gutta-percha and sealer groups with Resilon and its sealer and their resistance to leakage with Streptococcus mutatis and Enterococcus faectlis and found that the Resilon groups were "superior to gutta-percha groups" in amounts of leakage allowed. (Teixeira et al)[24] Studied the fracture resistance under load in vitro of teeth obturated with lateral and vertical compaction of gutta-percha and that of those obturated with Resilon. They found that filling canals with Resilon increased the resistance to root fracture.

Figure 5: Resilon

Composition of Resilon system:

1-Resilon core material

A-organic part: Polycarpolactone (PCL): Thermoplastic synthetic polymer it is biodegradable with a low melting point of around this polymer is used as an additive for resins to improve their processing characteristics their end use properties (e.g., impact resistance)

B-Inorganic part: Bioactive glass: The biocompatibility of these glass materials include the original bioactive glass, Bioglass) has led them to be investigated for use as implant material in human body to repaired and replace diseased or damaged bone

Bismuth ride: chemical compound of bismuth, oxygen and chlorine will the formula Bioc Barium it is a solid that is nsoluble in water sulphate white crystalline exploited in e opaque appearance and its high density are main applications

2-Resilon Prinier With acidic or self-etching primer there is no need of rinsing after aci etching need for polymerization of the (Britto et al 2002)[25].

3-Resin sealer

A-(Epiphany RealSealer) scaler: is it is a dual cure, resin based composite sealer. The total filler conte approximately 70% by weight (Trope and Barnet, 2004) organic part: BisGMA, ethoxylated BisGMA, ctc. is dispensed.

Inorganie part: calcium hydroxide silica... etc the sealer immediate from an automix double barrel syringe. It can be light cured for coronal seal or it will self cure in approximately 4 minutes. Without hindering the B-RealSeal SE Sealer: This new self. etch sealer eliminate the primer step originally present in sealers performance, acidic resin monomers that are sealer dentin adhesive primers are now incorporated into the resin-based of an to render them self-adhesive to denun substrates The combination etchant a prmer,and a sealer into an alHin-one self atching, self-adhesive sealer is advantageous un that it reduces the application time as well as might occure during each bonding (Lawson et al.2008 and Pinna et al., 2008) [26]

4- Thinning Resin: The epiphany Thinning Resin may be used to modify the viscosity of the Epiphany Sealer. These materials have been shown to be biocompatible, non cytotoxic and non mutagenic.

The Monoblock Concept

An ideal endodontic filling material should create a“monoblock”. This term refers to a continuous solid layer that consists of an etched layer of canal dentin impregnated withresin tags which are attached to a thin layer of resin cement that is bonded to a core layer of resilon which makes up the bulk of the filling material. In other words the monoblock concept means the creation of a solid, bonded, continuous material from one dentin wall of the canal to the other.

One added benefit of the monoblock is that research has shown that it strengthens the root by approximately 20 percent.

Classification of Monoblock concept basedon number of interfaces present between corefilling materialand bonding substrate:

Primary: In this obturation is completely done with corematerial, for example, use of MTA for obturation in cases of apexfication

Secondary: In this bond is there between etched dentin ofcanal wall impregnated with resin tags which are attached to resin cement that is bonded to core layer, e.g. resilon based system.

Tertiary: In this conventional gutta-percha surface is coated with resin which bond with the sealer, which further bond tocanal walls, e.g. Endo Rez and Activ GP system.[27]

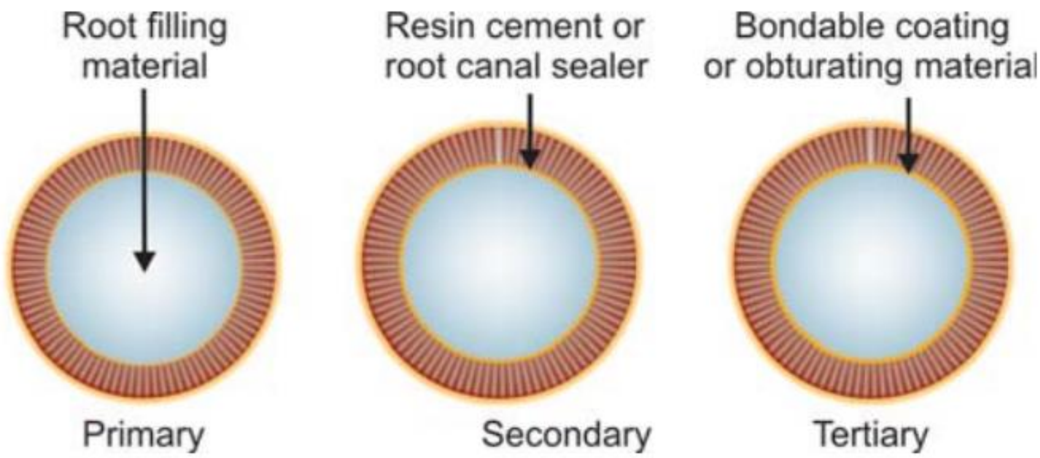


Figure 6: Monoblock Concept

Method of Use

1. Canal is prepared with normal preparation method.
2. Smear layer removal: Sodium hypochlorite should not be the last irrigant used within the root canal system due to compatibility issues with resins. Use 17 percent EDTA or 2 percent Chlorhexidine as a final rinse.
3. Placement of the primer: After the canal is dried with paper points, the primer is applied up to the apex. Dry paper points are then used to wick out the excess primer from the canal. The primer is very important because it creates a collagen matrix that increases the surface area for bonding. The low viscosity primer also draws the sealer into the dentinal tubules.
4. Placement of the sealer: The sealer can be placed into the root canal system using a lentulospiral at low rpm or by generously coating the master cone.
5. Obturation: The root canal system is then obturated by preferred method (lateral or warm vertical, etc.)
6. Immediate cure: The resilon root filling material can be immediately cured with a halogen curing light for 40 seconds.
7. Coronal restoration: A coronal temporary or permanent restoration should then be placed to properly seal the access cavity

Obturation Technique

1.A. Cold Lateral compaction:

This is the most commonly used obturating technique for most of the root canal system configurations Before obturation of the root canal, we should venry the completion of root preparation and ensure u dry and ymptom less tooth Not used in the severely curved canal or abnormal shape canal or in those with internal resorption Technkue: (Figure 12)

l-The master cone selected should have the same size of the MA F & ill should have the same length of the full working length

2-The master cone should need some force lo be seated inside the canal & some force is required to dislodge the master cone from the canal this is called Tug back. This resistance of removal of the master cone enhances the sealing ability at the apical area of the root canal

3 If the master cone goes to the full working length but it's loose inside the canal, we take a larger gutta percha cone or we remove l mm from the apical end of the master cone to increase the width of the master cone

4-verify the master cone position with a radiograph to ensure the optimum fitness

S-Mix the scaler & coat the wall by picking up sealer on M A.F& spin it counter-clockwise. Once the MA F, is rolated, there will painting of the walls with the scaler 6-Dip the tip of master cone in the sealer & seat it in the root canal 7-By the use of the spreader, the master cone is pushed laterally & apically providing room for auxiliary gutta percha point. The spreader should rotate 180o (to the right & left) until it becomes loose & pushed out-side

8- The spreader should penetrate the apical 113 (a rubber stopper should be placed to mark the length of penetration 2-3 mm from the tip of the master cone)

9-Place an auxiliary cone (which is smaller than the master cone after its tip is dipped in the sealer

10 Repeat the process by more gutta percha points and more spreading until the entire canal is filled when the spreader can't be placed beyond the cervical line of the root canal.

11- Take a radiograph to check the obturation mass.

12-A hot instrument is used to cut the percha to just below the cervical line. The instrument used as or no. 6 can be used in one motion If the instrument is not hot enough then it should be dislodged.

13-A plugger is used for vertical condensation to assure tightness of condensation

1. 4-All the sealer & gutta-percha should be removed from the pulp chamber by a round bur

Note some canals may be wider than the largest available gutla-percha points. In such cases u customized master point may be rolled using scveral large guua percha points. These are softened by heating in alame & rolled into a cone between two glass slabs

B.Warm Lateral compact on: This technique is de o cold lateral condensation in principle in the early stages After the master point and some accessory points are compacted, heat may be applied in a near carriers (Figure 13 may be heated in the flame (Figure and inserted in the mass of gutta percha in the canal gure 15, if possible to within about 2 mm of the working length (Figure 15) (Figure 14) Igure 13) After the initial plunge, the carrier is rotated through about 45 as it cools to prevent it from sticking to the gutta percha The carrier is then removed and the gutta percha cold condensed with a conventional ipreader to compensate for any contraction on cooling 14. [28]

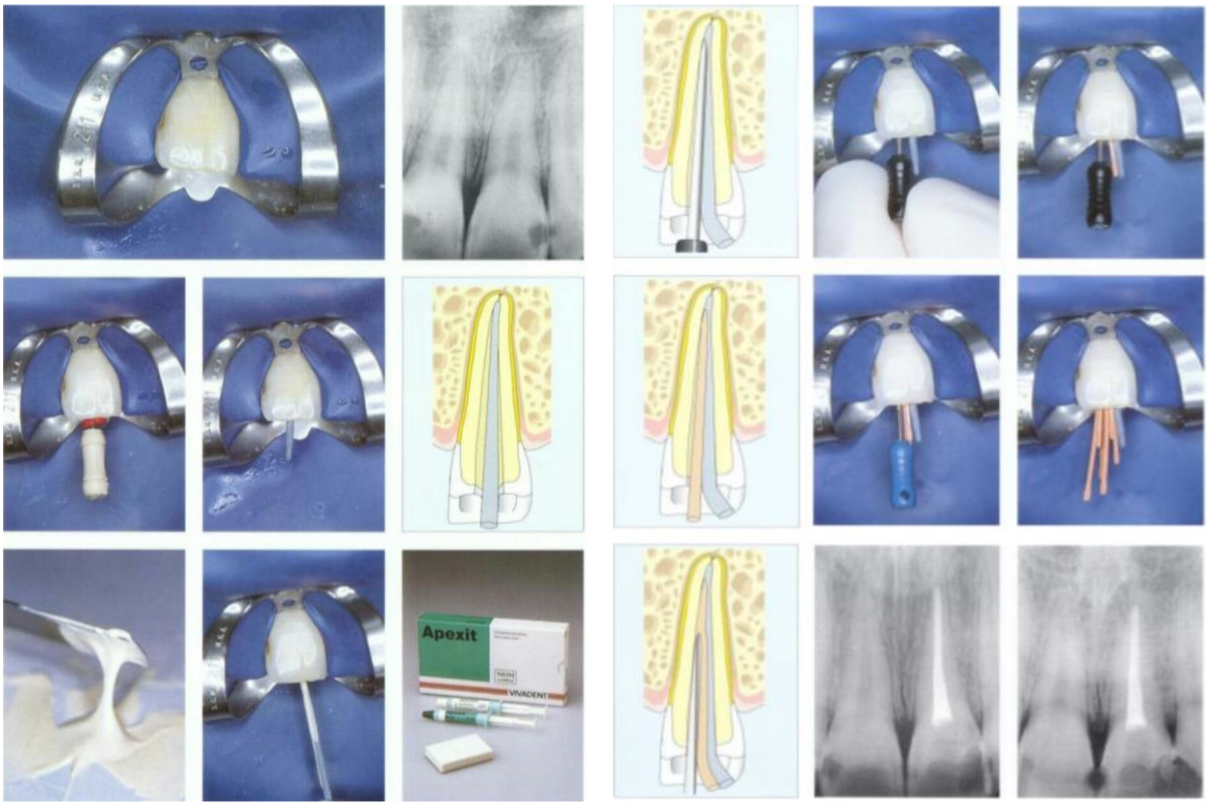


Figure 7: Lateral compaction

Advantages of Lateral Compaction Technique

1. Can be used in most clinical situations.

2. During compaction of gutta-percha, it provides length control, thus decreases the chances of overfilling.

Disadvantages

1. May not fill the canal irregularities efficiently.

2. Does not produce homogenous mass.

3. Space may exist between accessory and master cones.

Variation of lateral compaction technique

For Tubular Canals

• Tubular canals are generally large canals with parallel walls.

• Since these canals don't have apical construction, the main criterion of obturation is to seal the apical foramen in order to permit the compaction of obturation material.

• These cases can be obturated by tailor made gutta-percha or with gutta-percha cone which has been made blunt by cutting at tip.

For Curved Canals

• Canals with gradual curvature are treated by same basic procedure which includes the use of more flexible (NiTi) spreader.

• For these canals, finger spreaders are preferred over hand spreaders.

• For canals with severe curvature like bayonet shaped or dilacerated canals, thermoplasticized gutta-percha technique is preferred.

Blunderbuss/Immature Canals

• Blunderbuss canals are characterized by flared out apical foramen. So a special procedure like apexification is required to ensure apical closure.

• For complete obturation of such canals, tailor made gutta-percha or warm gutta-percha techniques are preferred.

Technique of preparing tailor made gutta-percha:

• Tailor made gutta-percha is made by joining multiple gutta-percha cones from butt to tip until a roll is achieved.

• This roll is then stiffened by using ice water or ethyl chloride spray.

• If this cone is loose fitting, more gutta-percha points are added to this.

• If this roll is large, it is heated over a flame and again rolled.

• For use in the canal, the outer surface of tailor made cone is dipped in chloroform, eucalyotol or halothane and then cone is placed in the canal. By this internal impression of canal is achieved.

• Finally, cone is dipped in alcohol to stop action of gutta-percha solvent.

Vertical compaction techniques include

A-sectional compaction

It has the ability to adapt gutta-percha to the irregular canal space and at the same time it uses more instruments and more complicated procedure.[29]

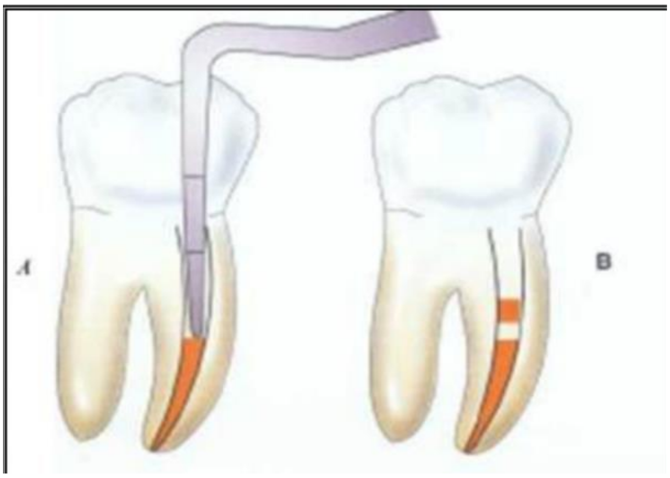


Figure 8: sectional compaction

Technique: Pluggers with flat ended tips are used to compact warmed gutta percha apically in steps, beginning with the apical portion and gradually backfilling the canal The series of pluggers of different sizes used graduated at 5mm ntervals, arcprefitted into the canal and sured The smaller plugger should reach within 5mm of the working length to achieve good apical compaction without extrusion Gutta percha is added inincrement is heated and softened incremen and packed vertically until the entire canal is filled The technique depend on the size of the plugger, so the plugger must be capturing the maximum cross sectional area of gutta-percha with the tip of the plugger pushing it apically without the plugger binding against the canal walls Too small plugger not effective through the gutta percha, while too wide plugger would bind against the canal walls and could split the root thewidth and rigidity of the pluggers necessitated in widely tapered canal preparation The technique is not widely to use in very curved canals, where the rigid pluggers may not reach the curvature and could result in apical voids

Advantage

- It seal the canal apicaly and lateral
- In case of post and core cases only apical section of canal is filled

Disadvantage

- Time consuming
- If canal is over filled, difficult to remove the gutta vpercha

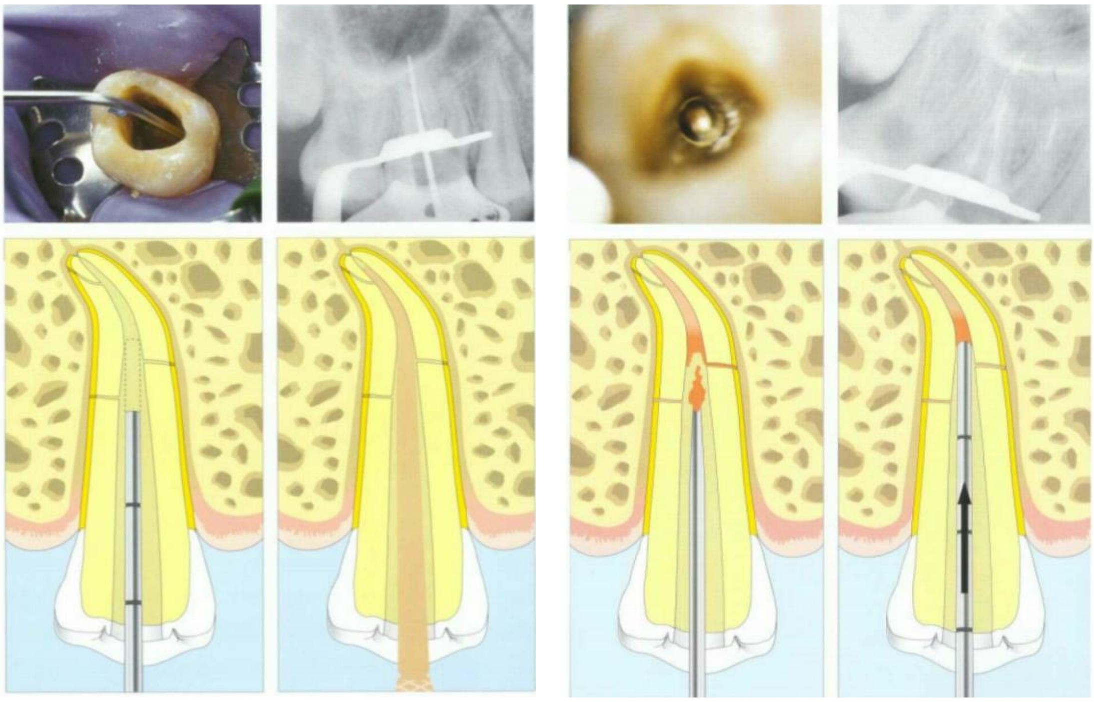
B-system B plugger technique

This new heat source (more rapid, simple, and more effective) the temperature at the tip of the heat carrier plugger, thus "delivering a precise amount of heat for an indefinitive time" In comparison study of adaptability used obturall to backfill extracted teeth filled by single step and the system B plugger filled by multiple steps they found that there was better adaptation of this mass when the system B plugger was used in three steps instead of one. [30, 31]

Figure 9: System B plugger technique

C-lateral/vertical compaction (hybrid technique)

Considering the ease and speed of lateral compaction, as well as thc supenor density achieved with vertical compaction of warm guita- percha this done by the Endontec u (a device that incorporates the qualities of both techniques lateralvertical is a battery powered heat controlled spreader plugger)



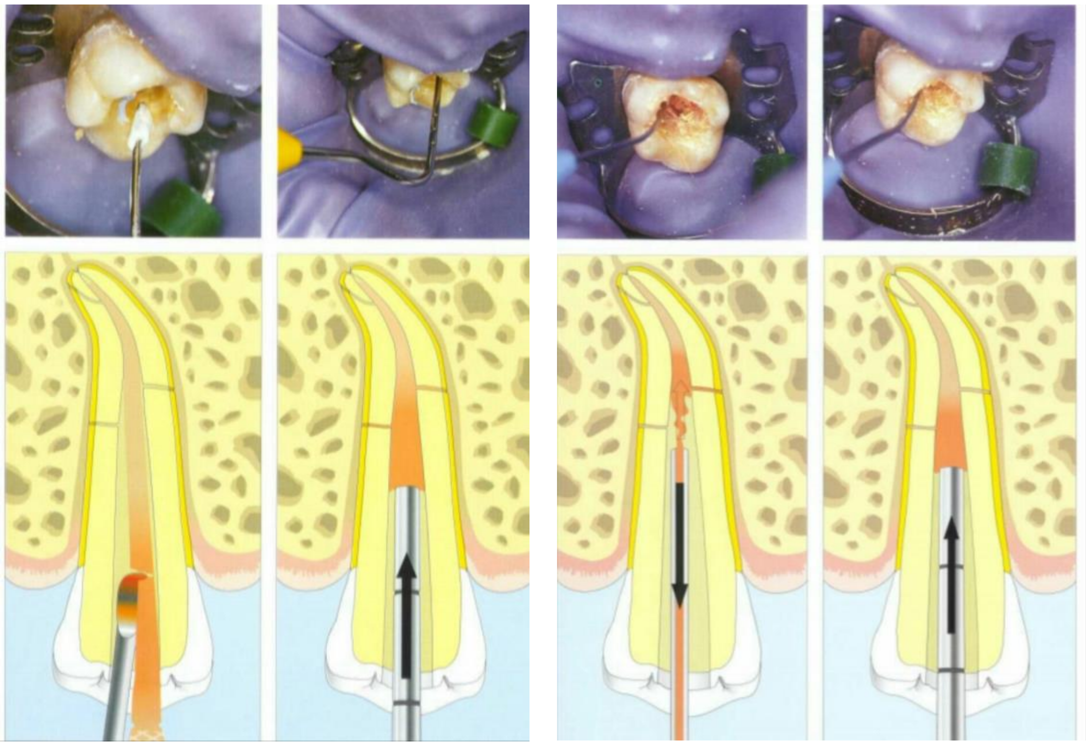


Figure 10: vertical compaction

Advantage

•3D Obturation of canal

Better sealing of accessory and lateral canal

Methods of use

l Canal cleaning and shaping for this technique is continuous taper design with a definite apical stop After the primary point is fitted to full working length the hand spreader and the Endotec pluggerspreader arc fitted as well

2-Drying of the canal, a limited amount of sealer is applied

3-The Endotec plugger is placed in the canal to full depth. The activator button is pressed and the heating plugger is moved in a clockwise motion.

4-It is now removed from the gutta-percha with a counterclockwise motion. This lateral compaction has formed a space for point to additional be added, after which the plugger is again clockwise ved for 10-15 sec, cooled and retracted counterclockwise.

5-the plugger can be used cold to compact the softened gutta-percha, followed again by warming and lateral space preparation for additional points. In this manner (lateral compaction with the heated plugger to provide space for additional gutta-percha, and the vertical compaction with the cooled plugger to condense the heat-softened gutta-percha the canal is entirely obturated.

Thermo mechanical techniques

In this technique friction between gutta-percha and the rotating "Reverse File" generates heat to soften the gutta-percha and force it apically. Thermo-compactors available have different designs which determine their properties.

1. New McSpadden nickel titanium thermocompacter
2. Maillefer gutta condenser
3. Zipperer [32]

1. MCSPADDEN COMPACTOR

A new concept of heat softening gutta-percha was introduced by McSpadden in 1979 using the McSpadden compactor.

It resembles a reverse H-file which fits into a latch type handpiece, rotates at 8,000-20,000 rpm and generates frictional heat that softens gutta-percha and forces the material apically and laterally. As canal is filled, the compactor is forced out coronally.[33]

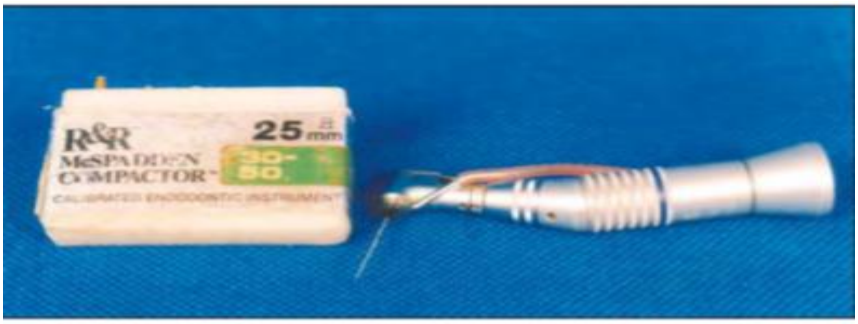


Figure 11: Mcspadden compactor

Disadvantages of this technique are:

1. Fragility of the instruments – Prone to fracture.

Hence cannot be used in curved canals.

2. Overfilling of the canals.

3. Difficulty in mastering technique

4. Overheating.

5. Resorption and ankylosis.

To overcome these disadvantages, different shapes and forms evolved McSpadden in the meantime modified the original design and introduced the NT condensers. They are supplied as an engine driven/ hand powered Ni-Ti instruments with following features.

- Increased number of compacting blades.
- Shallower grooves.
- Decreased sharpness.
- Made of NiTi for flexibility .

Procedure:

- Place primary gutta-percha cone in root canal.
- Select the appropriate size condenser, coat it wit gutta percha (heat softened) gutta-percha I (α) or gutta-percha II (β).
- The condenser is then spun in the canal at 1000-4000 rpm which flings the gutta-percha laterally and vertically.
- The speed is controlled by NT matic handpiece.

2. Maillefer gutta condenser

Maillefer modified the hedstrom type instrument as gutta condenser.

- It has less number of compacting blades.
- Increased sharpness.
- Deeper grooves

Used: For back filling of canals already filled at apical third by either

a. Warm vertical compaction.

b. Sectional compaction.

c. Cold lateral compaction.

3. Zipper Thermocompactor/ Engine Plugger

- This thermocompactor resemble an inverted K-file.
- Increased number of flutes
- Used for backfilling canals already filled at apical third
- In hybrid technique (Tagger).[34]

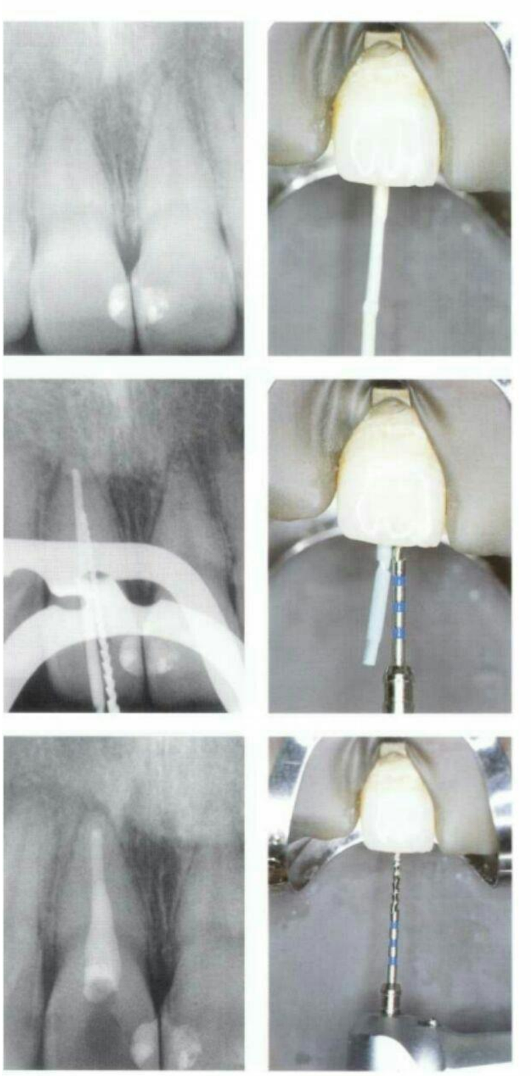


Figure 12: Thermomechanical

Thermoplastic Technique

This technique include injecting molten gutta-percha into canal space. Include

A-Obtura ll heated gutta percha system

B-Ultrafill system.

C-Inject-R fill

D-Solid-core carrier insertion (thermafill)[35]

A-obtura heated gutta-percha systtem

1-Digitally controlled temperatures ranging from 160oC to 2000C 2 Regular Beta-phase gutta percha or less viscous easy flow gutta-percha. This system consist of control unit and a pistol-grip syringe designed to accept gutta-percha pelletes available with the system .The pellets are placed in the barrel of the syringe, where they are heated to a temperature of 160°C.

When molten the gulla percha is extruded through disposable silver ncedles available in a range of :18.20.22 nd 25 gauge) The extruded gutta percha has temperature of 62-65C and may remon son For 3 minutes To prevent under extention the delivery needle should be placed within 3-5 mm o working length inadequate control of temperature can cause poor results As the gutta percha cools in the canal, it shrinks and therefore requires pressure to compensate for the shrinkage An incremental technique with vertical condensation gives a better result.[36]

Figure 13: Obtura heated gutta-percha systtem

B-Ultrafil system: This system heals gutta percha to 70C It consists of heater and a separate pistol grip injection syringe. In contrast to the obtura system the gun contain no heating element. The gutta percha is provided in prefill cannules, regular set white, endoset(green), and firm set (blue).

fim set(blue) Each with different firm set hardens rates of hardening and total shrinkage. The the least much faster the other two. The regular exhibits set ge on cooling The cannules have a standard needle which is equivalent in size to a No.70 No.2 Glidden drill. The needle tip place within 3-5 mm the working length means that wide canal of preparation is essential. may be curved if necessary taking The need to the flow. the heater for at least les are placed in 15 minutes to allow sufficient of the gutta percha. Once removed from a softening working the heater, cannule loses heat rapidly and has a time less than 1 minute. gun with the cannule should therefore The returned to the softening. The injection procedure is heater for further sensitive technique. should be sequeezed slowly and carefully The trigger otherwise can fracture the canuule or extrude excessive pressure which gutta percha through the back of the canuule

C Inject-R Fill.

This system consist of small metal be filled with guta percha and a backni attached. The technique allows for delivery of a single injection of gutta percha to the apical segment of the canal. [37]

Figure 14: Inject-R Fill

Technique

l- Apply a scaler prior to filling the region

2-The inject-R Fill must first be heated a name an an electronic heater in until gutta percha begin to extrude from the the open end

3-The wormed unit is then placed into the orifice of the canal For the device to fit, the canal orifice must be at least in diameter A push of 2mm of the handle toward the cana injects the heated gutta percha into the canal The carrier is then rotated to break it frec from the access, 4-Prc fitted hand of finger pluggers are subsequently used to compact the gutta percha and push the injected mass into contact with the apical segment. The plugger must be positioned in the center of the mass and pushed firmly toward the apex. (38)

D-Solid core carrier insertion (thermafil)

Thermafil A number of alpha-phase gutta percha techniques have recently been marked; the gutta-percha is heat softened and carried to the canal on a metal or plastic carrier. There are additional similar systems namely Densfil, Soft core, and Three Dee GP The Thermafil was found to exert less strain on the root when placing and compacting its gutta-percha core 20 when compared to obtura or Lateral compaction The good apical stop or constriction very important when using ThermaFil Soft-Core Three Dee GP Technique using Thermafil endodontic obturators: Alpha-phase gutta percha is essential to thc technique because it has better flow characteristics when thermoplasticized The gutta-percha has been shaped into a tapered cone to avoid wastage The coronal portion of the carrier has markings and a rubber stop to facilitate length control Blank plastic carrier are available to gauge the appropriate size for a canal(that mean matching of master apical file(MAF) that used). If the selected obturater is too small the carrier with the gutta-percha may be extruuded and if it is too large the root filling may end short.As in many obturation technique,the canal must be correctly Shaped and cleaned.The generally accepted flared preparation is suitable.Overflaring may cause poor coronal seal.The walls of the canal are coated with a sealer the gutta percha is soften in Therma Prep oven The beating ime is the the size of the core camer The use of the ov o m E manufacturers when the gutta-percha ukes on sheen and begins to expand and minimum times should be in the oven when the obturator is ready,it is seated in the canal to fall warding Weng without twisting or forcing As it is seated excess gura-percha collects a the canal orifice if the canal has a wide tapersome veri compact may be possible Metal carriers are prenouched for sep but plastic carriers may be cut with a heated instrument or a sharp stainlesss steel inverned cone bur in a conventional handpiece. (39)

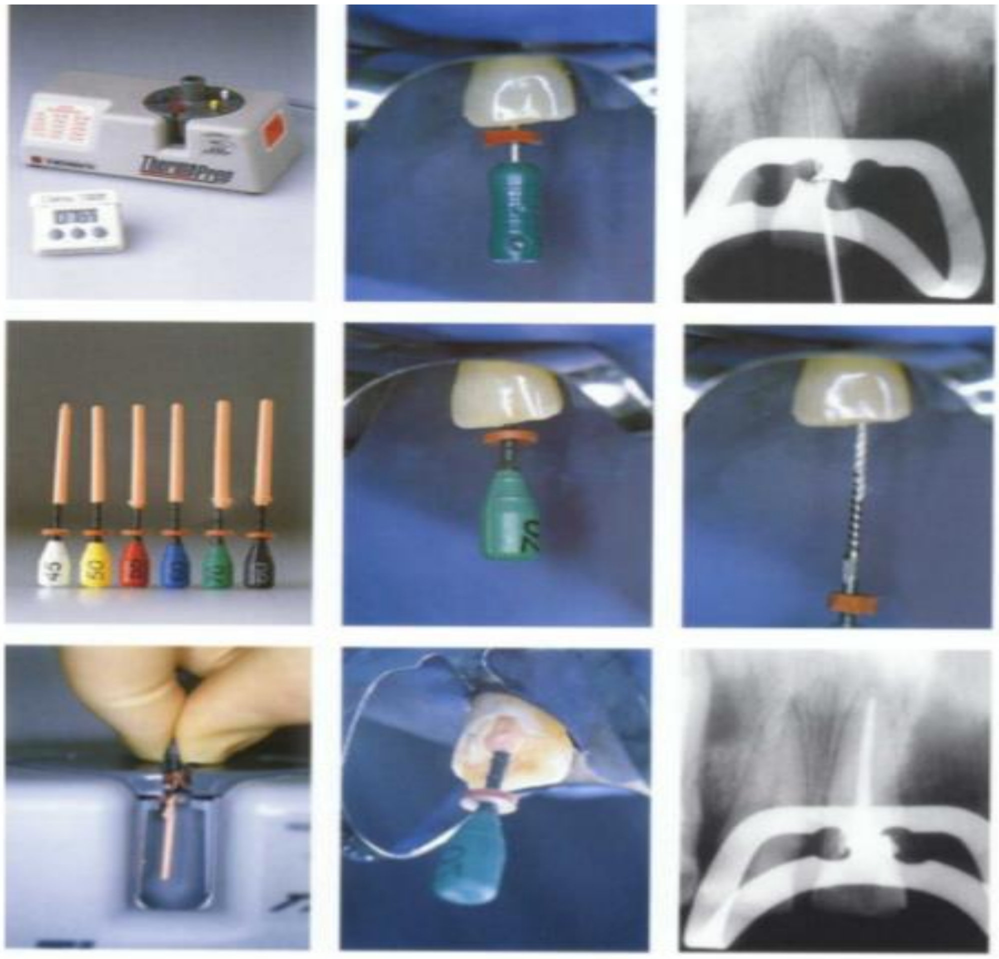


Figure 15: Thermafil technique

Figure 16: Therma Prep oven

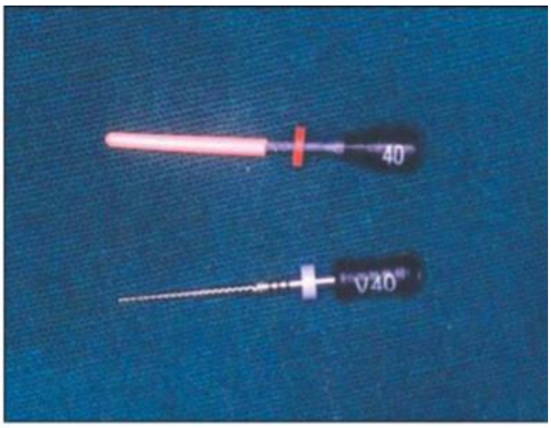


Figure 17: thermafill gura-percha

Pastes

Fulfiu some of the criteria outlined by Grossman 19ssar adapt to the complex internal canal anatomy. however, the flow characteristic can result in extrusion or incomplete obturation. The inabilir to control the material is a distinct disadvantage, and when extrusion occurs n can be corrected only by surgical intervention. In addition, pastes are sometimes used as a substitute for complete cleaning and shaping procedures, and the addition of paraformaldehyde results in severe toxicity.

Apical third filling include:

A.simple fill obturation technique
B.dentin chip apical filling
C-Calcium hydoxide Apical Filling.

A-Asimplifill obturation Technique

It has metal carrier that comes in Iso sizes 35-130 5 mm apical plug gu percha or res on the end It is used similar to a carrier system It has advantage of not leaving the carrier i the canal as i twisted off of e apical plug mpuFill

Advantages:

l-Helps conserve dentin because of the light speed instrumentation technique (less flaring)
2-eleminates additional internal forces since no spreader or plugger is used to compact the apical plug
3-No carrier is left in the canal.

Technique

l-Following the completion of canal preparation using rolary Light speed,the specially designed Apical GP Plug Carrier corresponding to the MAF is trial fitted without sealer into the dry canal.
2-Before insertion however ,the rubber stopper on the carrier,with it attached gutta percha,set 2mm short of the working length

3-The carrier is then inserted into the canal and slowly advanced,reaching the length indicated by the rubber stop(i.e. 2mm short of the working length)

4-Once the fit has been verified,the Apical Plug carrier is removed and the canal is coated with an appropriate sealer using MAF or a sealer saturated paper.

5.The G Plug is Ruhisequently coated with healet inserted in the canal and advanced until resistance about 2 ehon of tlie working length

6 Once the GP Plug is rittho GP Plug is released by rotating the carrier. handle counterclockwisc Step 1 Stup a

B-Denten chips apical filling

Dentine chips often occupy the apical portion of prepared and even sealed canals it has been well establish that dentine filling stimulate both osteo and cementogenesis all concluded that dentine chips act as apical barrier confined materials to the canal space and lead to quicker healing minimal inflammation and cemental deposition.

C-Calcium Hydroxide Apical Filling.

lt is used as a permanent obturating material has been mostly confined to the portion of the canal, Calcium hydroxide has been shown to encourage cementogenesis and osteogenesis and promotes apexification after thorough cleaning and shaping Due to its solubility,it has been used mainly as an apical obturation or a dentinal plug.(Weisen-seel et al Found less apical leakage with calcium hydroxide plugs and laterally compacted GP than without apical plug.

Obturation with mineral trioxide aggregation (MTA)

Mineral Trioxide Aggregate (MTA) MTA was developed by Dr Torabinejad in 1993 It contains Tricalcium silicate, Dicalcium silicate, Tricalcium aluminate, Bismuth oxide, Calcium sulfate and Tetracalcium

Advantages of MTA include its excellent biocompatibility, least toxicity of all the filling materials, radiopaque nature, bacteriostatic nature consider as apaste filling material for the obturation of root canal because of its sealing ability and biocompatibility its somewhat difficult handling characteristic,which may be overcome whith experience and its extended setting time of at least 3 hour or more .Proroot MtA introduced by (morabinejad et lil) in as root end illing material and as root perforation repair material.[40]

Figure 18: MTA

General notes

1.MTA l eaked significant than the other root end filling material tested (Tora Jad et al]

2.sealing ability of material important and showed that a4mm thikness of MTA was more effective in preventing protein leakage than lesser thickness of MTA[Valois]

3. In apical barrier, 5mm thikness of MtA was significantly harder than in 2 mm barrier and allowed significant less leakage (Matt et al,)

4.MTA showed the most favorable periapical tissue response and that there was neoformation of cemental coverage over MTA [BEAK etal,)

5.can support almoste complete regeneration of the periradicular periodontium when used as aroot end filling material on teeth that are not infected (Regan etal)

6.The application of moist cotton pellet significant reduce the leakage of MTA Used as apical barrier (matt et al,)

7.MTA capable of partially releasing its soluble fraction into aqueous environment over along period of time and it still maintain its high PH level of 11 to 12 over at least 78 day this soluble fraction is mainly composed of calcium oxide witch may be provide the alkalinity favorable for cell division and matrix formation for healing of periradicular tissue and for antimicrobial activity.(fridland et al)

8.placement of MIA in root canals and its gradual dissolution hydroxyapatite crystals nucleate and grow, filling the microscopic space between MTA and the dentin wall, This seal is first mechanical, but then they a thereactions between the apatit layer in the form of a between chemical bond, and a seal between MtA and dentin(sarker etalare)

Method of used

l. After cleaning shaping & removed of smear layer, the canal dried by paper point

2.Mixing of MTA with sterile water on glass slab with metal spatula

3.material inserted to root canal & packed with plugger or gutta percha (2mm) shorter than final working length

4-radiograph is taken to show the proper placement of MTA in the apical portion of canal

5-The additional MTA packed with large plugger & and filled the canal to CEJ

6.The wet cotton pellet placed over the MTA & then the tooth closed with temporary filling

7-Final radiograph is taken to evaluate the MTA inside the canal

References

1. Ammerican Assosiation of endodontic 1994 Glossary contemporary terminology for Endo 6Ed.
2. Ingle Beveridge E. Glick D Weichman J me Washingion study JL Philadelphia: Lea In Inge L Taintor ed Enidodonties Febiger: 1994 -53
3. Ingle, JL: Endodontics 3rd Edition, Lea and Febiger, Philadelphia, 1985 J Endod 2006: 32 963-6
4. Friedman S, Lost C, Zarrabian M, Trope M: Evaluation of success and failure after endodontic therapy using a glass ionomer cement sealer, J Endod 1995
5. Grossman L Endodonmies II ed, Philadelphia, Lea & Febiger 1988
6. Loest C, Trope M, Friedman s Follow-up of root canals obturated with glass onomer and epoxy resin root canal sealer. JEndod 1993, 19 201
7. Heling I: The antimicrobial effect within dentinal tubules of four root canal sealers. JEndod 1996, 22:257
8. Koch MU: Formaldehyde release from root canal sealers. influence of method Int Endod J 1999.
9. Spangberg LS, Barbosa SV, Lavigne GD: AH 26 releases formaldehyde. Endod 1993
10. Leonardo MIR, Bezerra da saliva LA , Filho MT, Santana da Saliva R:Release of formaldehyde by 4 endodontic sealers 1999,88,221
11. De Moor RJ,DE Bruyne MA : the long term sealing ability of AH26 and AH plus used with three gutta-percha obturation techniques.2004,35,326
12. Zielinski TM, Baumgartner JC , Marshall JC:An evaluation of Guttaflow and gutta-percha in the filling of lateral grooves and depressions. 2008,34,295

13. Eldeniz AU, Mustafa K.Orstavik D, Dahl JE:Cytotoxicity of new resin, calcium hydroxide and silicone based root canal sealers on fibroblasts derived from human gingiva and L929 cell lines. Int endod J 2007,40,329
14. Bouillaguet S, Wataha JC , TayFR, Beackett MG , Lockwood PE: initial in vitro biological response to contemporary endodontic sealers.J Endod 2006,32,989
15. Brackett MG, Martin R, Sord J ,et al :comparison of seal after obturation techniques using a polydimethyloxane-based root canal sealer.J Endod 2006,32,1188
16. Brothman P. A comparative study of the vertical and lateral condensation of gutta-percha. J Endod 1981;7:27.
17. Sousa CJ, Montes CR, Pascon EA, Loyola AM, Versiani MA Comparison of the intraosseous biocompatibility of AH Plus EndoREZ, and Epiphany root canal sealers. J Endod 2006;32(7):656-62.
18. Tay FR, Loushine RJ, Monticelli F, Weller RN, Breschi L Effectiveness of resin-coated gutta-percha cones and dualcured, hydrophilic methacrylate resin-based sealer in obturating root canals. J endod 2005;31:659-64
19. MK, Tigos E, Wesselink PR. An 18-month longitudinal study on a new silicon-based sealer, RSA RoekoSeal: a leakage study in vitro. Oral Surg oral Med Oral Pathol Oral Radiol Endod 2002;94:499-502.
20. Ingle j I.,Bakland L.K Endodontics Ed 6 principle and practice of endodontics.3Ed
21. Color Atlas of endodontolgy ,2000,Editors: Klaus H.Rateitschak and Herbert E Wolf.
22. J santosl, L Tjaderhane,C.ferrazl,A.Zaial,M.Alves,M.De Goes4 &m. Carrilho.
23. F .Sommal, G. Cretellal.M. Carotenutol, R pecci, R Beduni, M.De Biasi&D. Angerame.
24. A.C.M.Oliveira,j. M.G Tanomaru , N.Faria-jonior&M.Tanomaru-Filho.

25. Shipper G, Ørstavik D, Teixeira FB, Trope M. An evaluation of microbial leakage in roots filled with a thermoplastic synthetic polymer-based root canal filling material (Resilon). J Endod 2004;30:342–7.
26. Britto LR, Borer RE, Vertucci FJ, Haddix JE, Gordan VV. Comparison of the apical seal obtained by a dual-cure resin based cement or an epoxy resin sealer with or without the use of an acidic primer. J Endod 2002;28:721–3.
27. Pinna L, Brackett MG, Lockwood PE, et al. In vitro cytotoxicity evaluation of a self-adhesive, methacrylate resin-based root canal sealer. J Endod 2008; 34:1085−8.
28. Manal Farea, BDS; Sam an masudi, DDS,MS; and Wan zaripah Wan Bakar,BDS, DclinDent
29. Lofti, M. Resilon; A comprehensive literature review. JODDD, 7(3), 119-131.
30. Tay FR, Pashley DH. Monoblocks in root canals - a hypo 27thetical or a tangible goal. J Endod. 2007; 33: 391-398. doi: 10.1016/j.joen.2006.10.009 228
31. Hashieh I, Pommel L, Camps J: Concentration of eugenol apically released from zinc oxide-eugenol based sealers, JEndod 25:713, 1999
32. illagas JC, Yoshioka T, Kobayashi C, Suda H. Three step versus single-step use of system B: evaluation of gutta-percha root canal fillings and their adaptation to the canal walls. J Endod 2004;30:719-21.
33. Villagas JC, Yoshioka T, Kobayashi Ch, Suda H. Intracanal temperature rise evaluation during the useage of the System B: replication of intracanal anatomy: Int Endod J 2005;38: 21
34. Synthetic Polymer-Based Root Canal Filling Material (Resilon). Shipper et al., JOE, Vol. 30(5), May 2004.
35. Using a bacterial penetration protocol, the researchers found that Resilon/Epiphany(R/E) was more than 6 times more effective in preventing leakage to the apex.

36. Fracture Resistance of Roots Endodontically Treated with a New Resin Filling Material. Thompson et al. JADA, Vol. 135, May, 2004.
37. These researchers found that Resilon/Epiphany increased the fracture resistance of endodontically treated roots by more than 20%. Dent., Vol. 16(6), November 2004.
38. DUbrow H.SILVE Rpoint and gutta percha and role of root canal filling jAM Dent Endodontic ASSOSIATION 1976
39. Instruction for use cayahoga fall OH;COLTENE\WHAEDENT2006
40. Togger M evaluation of apical seal produce by hybrid root canal filling method combining lateral condensation and hermtic condensation 1984.