ENDODONTICS

Lecture 8 Dr. Alaa H Abbas

OBTURATION

After chemo-mechanical debridement of root canal system, the next step is complete (3 dimensional) obturation of root canal space to maintain the tooth functional within the dental arch.

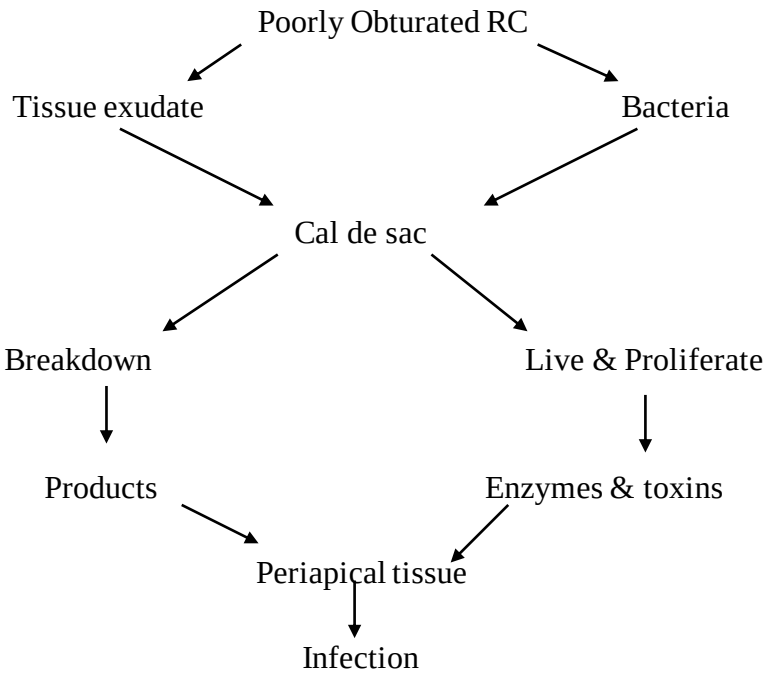
Objective of obturation (filling the root canal):

The objective is to create a fluid-tight seal along the length of the root canal system, from the coronal opening to apical termination (particularly at the apical foramen), to prevent an ingress of tissue fluid and bacteria & subsequently egress of irritants.

Ingress → inward movement of tissue fluid.

Egress → outward movement of irritants.

Fluid moves due to osmotic pressure to the empty space, in case of root canal, if it's left empty without filling, the tissue fluid might stay for a while & then fill this empty canal.



Due to no circulation & no lymphatic system, it undergoes degeneration & destruction then foreign body leaks again to the periapical area leading to inflammation, or bacteria may find a way in this space so live and proliferate and produce enzymatic toxins, then seep again to the periapical area and cause infection of the periapical area.

In obturation a solid or semisolid core material is used with a sealer to produce the fluid tight seal, by filling the main root canal(s), the accessory canals, voids, spaces and irregularities.

Aims of root canal obturation

1- The achievement of 3 dimensional obliteration of the root canal space to prevent ingress of bacteria and body fluids into root canal space, as well as egress of bacteria or their toxins out of the root canal.

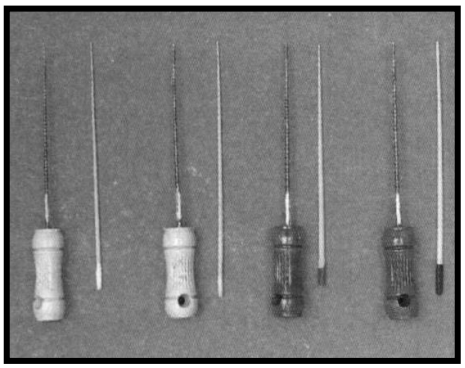
2- To provide fluid tight seal within all regions of root canal space to prevent microleakage.
3- The replacement of the root canal space filled with necrotic tissue by an inert filling material to create a favourable healing environment and avoid recurrent infection.
4- To provide adequate coronal seal with proper coronal restoration to obtain long term success of root canal therapy.

Criteria For Filling

1- Prepare the root canal in a manner that ensures the optimum access to apical area.
2- The tooth must be asymptomatic (no pain and tendereness).
3- The canal must be dry
4- Negative culture. This is controversial, some say that they need –ve culture, the other say no significance from it.

Materials used to obturate the root canal

1) Gutta-Percha

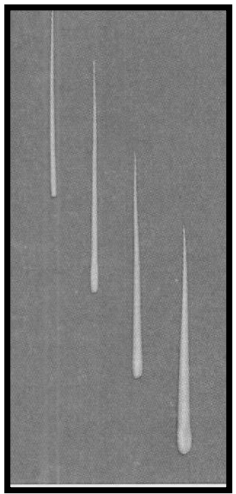


The most commonly used semi solid root canal filling material. Gutta percha is a natural material extracted as a dried coagulated from a Brazilian trees (Palaquium). Its molecular structure is close to natural rubber. Chemically gutta percha is available into two crystalline forms: alpha (α) and beta (β).
β-form is composed of the following:
Organic: gutta percha 20% + waxes and resins 3%
Inorganic: zinc oxide filler 66% + heavy metal sulfates as radioopacifiers 11%

Properties of gutta percha

1- Gutta percha expand on heating and increase volume which could be advantageous to compact into root canal spaces. However, Gutta percha shrink on cooling.
2- Heat sterilization is inapplicable with gutta percha. For disinfection, gutta percha points can be immersed in ethanol alcohol (96%) or sodium hypochlorite 5.25% for one minute prior to its use.
3- Because gutta percha has no adherence property, it should always be used with sealers to seal the root canal space.
4- Gutta percha can be dissolved in certain chemical solvent such as chloroform, eucalyptus oil, orang oil, etc. The chemically plasticized property of gutta percha is important in soften gutta percha points for better filling or in easily removal of gutta percha from the canal during re-endodontic treatment.

It's either standardized cone or non-standardized cone.



(a) Standardized Cone

It is designed to have the same size & tapering of the corresponding intra canal instrument as master cone.

(b Non-standardized Cone

This cone has greater tapering in which fine tip & heavy body, it's used

with master cone to aid it in obtrusion.

Advantages of gutta percha:

1. Compatibility: adaptation to the canal wall.
2. Inertness: do not interact with the tissue.
3. Tissue tolerance.
4. Dimensionally stable.
5. Radiopacity.
6. Plasticity: can be soften either with heat or using chemical solvent.

Disadvantages:

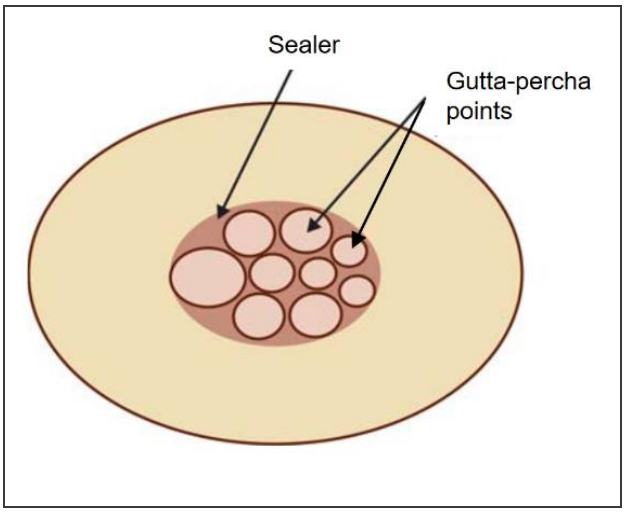
1. Lack of rigidity: can be bend easily with pressure which make its application difficult especially in narrow canals.
2. Lack of adhesiveness so it should always be used with sealers and cements.
3. Easily displaced by pressure.

2) <u>Silver Points</u>

These points are made from silver. They have the advantage of being rigid; therefore they are used in very narrow and severely curved canals. The main disadvantages are that silver cones are round in cross section, therefore they can not be used in oval cross sectioned canals, and silver cones may produce corrosion products which will be harmful to the periapical region.

3) <u>Sealer</u>

It is a paste mostly made of radiopaque zinc-oxide eugenol cement capable of producing a seal by filling irregularities between the gutta percha & the dentine walls. The sealer acts as lubricant facilitating placement of the gutta percha cone. It is supplied in two pastes or liquid and powder which are mixed to produce a thick, creamy consistency.



<u>Functions of the sealer</u>

1. Lubricate and aid the seating of gutta percha cones.
2. Bonding between gutta percha and root canal walls.

3. Filling gaps and anatomical spaces.
4. The sealer and primary filling effectively increase the fluid tight seal and prognosis of endodontic treatment. Some sealers (cements) that can be used as obturating material without gutta percha.
5. Antimicrobial agent: immediately after placement.
6. Radiopacity: identifying the auxiliary canals, resorption regions, root fracture, and the shape of apical foramen.

4) Absorbent Points

Points that are made of absorbent paper which are in the same standardized sizes as the root canal instruments. They are used to dry to the root canal.

Characteristics of an ideal root filling material

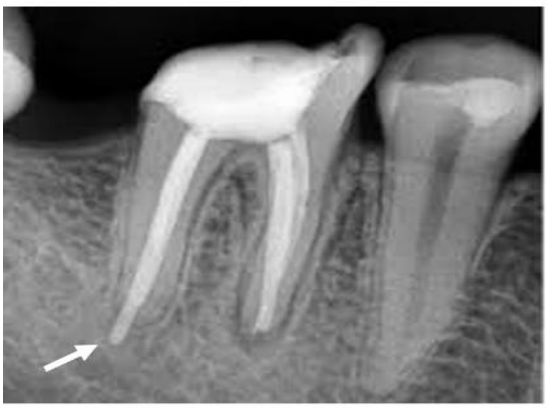
1. Easily introduced in the root canal.
2. Provide an apical and lateral sealing of the root canal.
3. Dimensionally stable after usage.
4. Impervious to moisture.
5. Bacteriostatic or at least should not encourage bacterial growth.
6. Radiopaque.
7. Non staining to tooth structure.
8. Non irritating
9. Sterile or easily sterilized.
10. Removed easily from canal if required.

Underfilling:

occur when the root canal filling is shorter that total root canal space. This definitely provide an environment for initiation, persistence or recurrence of periradicular infection..

Overfilling:

occur when the root filling material extended beyond the CDJ. According to Ng et al. 2007 the extrusion of root canal filling is considered to be acceptable within 2mm beyond the radiographical apex, if it is associated with 3 dimensional sealing of root canal system.



Techniques in root canal obturation

1) Lateral Condensation Technique with gutta percha.

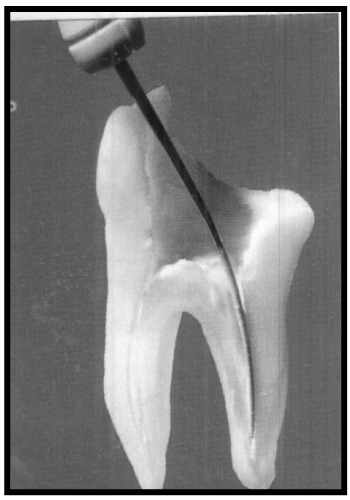
This is the most commonly used obturating technique for most of the root canal system configurations. Before obturation of the root canal, we should verify the completion of root preparation and ensure a dry and symptom less tooth.

Procedure of Master cone selection (the cone that occupies most of the root canal parts).

1- The master cone selected should have the same size of the M.A.F. & it should have the same length of the full working length.

2- The master cone should need some force to 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 1 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 fittness.

5- Mix the sealer & coat the wall by picking up sealer on M.A.F & spin it counter-clockwise. Once the M.A.F. is rotated, there will painting of the walls with the sealer.

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 180^{o} (to the right & left) until it becomes loose & pushed out-side.

8- The spreader should penetrate the apical 1/3 (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.

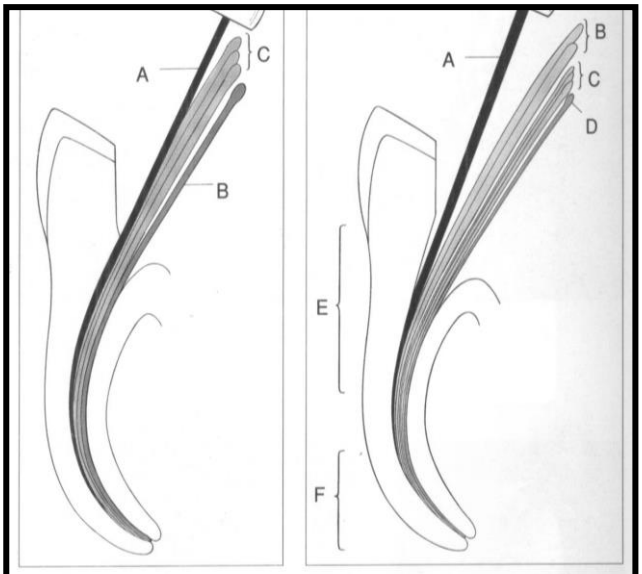
11- Take a radiograph to check the obturation mass.

12- A hot instrument is used to cut the excess gutta percha to just below the cervical line. The instrument used can be either an excavator or ash no. 6 and should be very hot to cut in one motion. If the instrument is not hot enough then the master cone might be dislodged.

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

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

15- The cement base material and a coronal restoration are placed in the tooth.



9.15 A= spreader; B = master point; C = accessory points

9.16 A = spreader; B = wide accessory points; C = narrow accessory points; D = master point; E = wide

Advantages of lateral compaction:

1. It can be used with the most routine clinical situations.
2. During lateral compaction, it provides length control with less chance of overfilling and post-operative pain.

Disadvantages:

1. May not sufficiently fill the irregularities within the canal.
2. Does not produce homogenous mass.
3. Voids and spaces may exist between accessory and master cones.

2) Warm vertical compaction technique

This technique was introduced to overcome the drawbacks of lateral compaction technique. It uses hot plugger with vertical pressure to compact the heat soften gutta percha to flow into canal irregularities.

The prepared canal that can be filled by this technique should have:

• A funnel shape with continuous tapering to the apex.

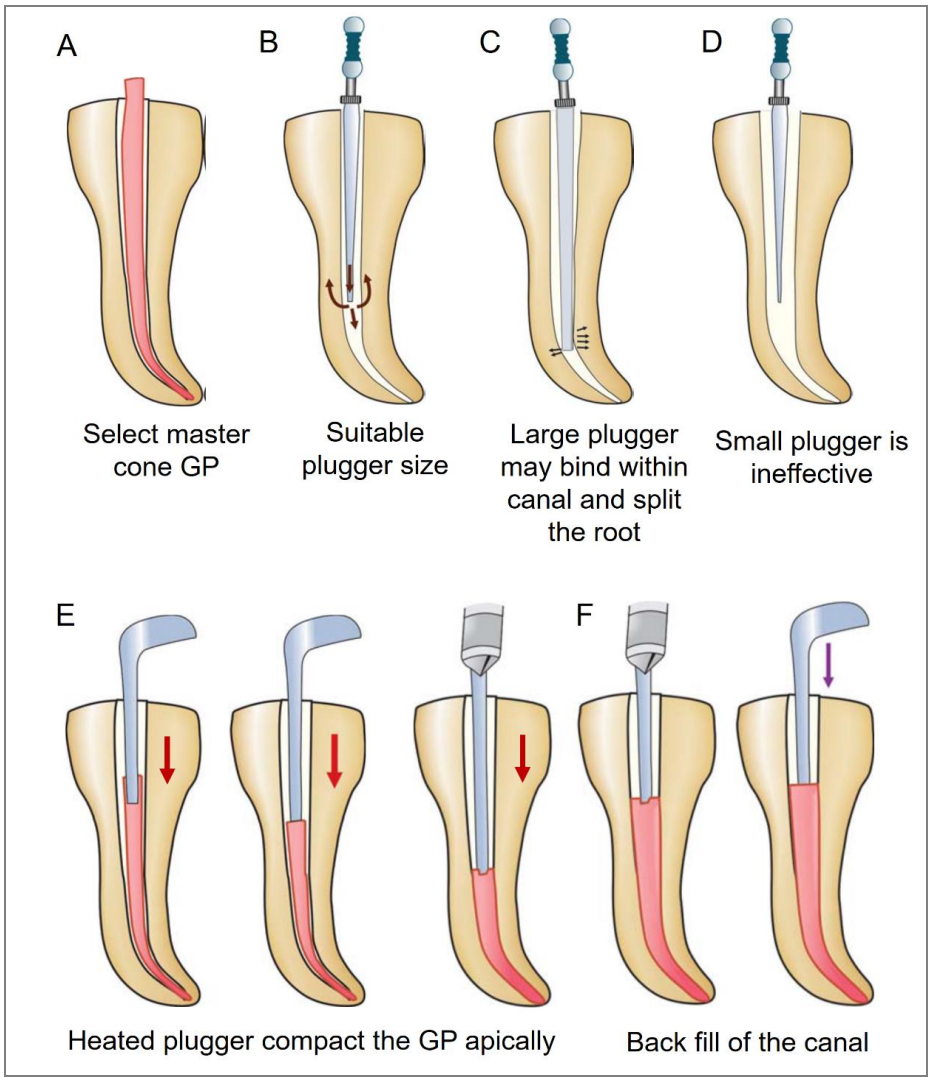
• Good apical stop region (apical constriction is as small as possible).

Procedure for vertical compaction obturation:

1. Select the master cone gutta percha which should fit the canal size and taper, and check its fitness by radiograph. The tugback is not necessary for the master cone.

2. Dry the canal completely with paper point.

3. Select the sizes of pluggers according to the size and taper of the canal. Pluggers should be prefitted at 5 mm intervals in order to capture maximum cross section area of the softened gutta percha
4. Coat the canal lightly with sealer by a paper point.
5. Cut the coronal end of the gutta percha cone at the incisal or occlusal reference point.
6. Use the heated plugger to vertically force the master cone into the canal. Fold the soften gutta-percha inward to fit apically and laterally. If the soften gutta-percha stuck into the plugger tip, just slight rotate the plugger to loosen it. This vertical compaction will free 2-3 mm of space coronally to allow adding more gutta-percha
7. After finish the apical filling, complete obturation by doing backfilling. This can be done by heating small segment of gutta-perch and carrying them into the canal using heated larger pluggers.
8. Be careful not to overheat the gutta-percha to facilitate its handling.
9. After completion, clean the pulp chamber from the excess of sealer and gutta-percha by a piece of cotton socked in alcohol then put the temporary or final restoration.



Advantages of vertical compaction:

Provide excellent sealing of the canal apically and laterally with filling of the lateral and accessory canals.

Disadvantages:

1. Increase the risk of vertical root fracture.
2. Overfilling and apical extrusion of the gutta-percha and sealer periapically.
3. Time consuming procedure.