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Methods of obturation: Review

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***Abstract*---**After irreversible pulpal pathosis, obturation of a root canal should result in a full closure from the coronal to the apical aspect, limiting the entrance of microorganisms and fluid and therefore eliminating the root system as a source of infection and inflammation to the apical periodontium. According to current studies, the goal of obturation is to achieve not only a fluid-tight but also an airtight closure of the root canal. For obturation, semi-solid filler materials like gutta-percha have been employed in combination with sealants for many years. Poor obturation, according to Dow and Ingle, is the root cause of endodontic treatment failure. Ingle and Beveridge (1961) found that incomplete root canal obliteration accounts for roughly 58.65 percent of root canal failures in a research done at the University of Washington on the success and failures in endodontics. As a result, several obturation procedures have been developed over time. Every approach has its own set of benefits and drawbacks. As a result, the obturation procedure differs from instance to case.

***Keywords*---**methods obturation, root canal, endodontic treatment.

Introduction

The quality of the root canal preparation determines the success of endodontic treatment (cleaning and shaping). A hermetic root canal filling and coronal repair ensure its longevity. Bacteria and their poisons enter through the exceedingly complicated apical zone. The filling must be threedimensional and hermetic in

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order to seal the whole root canal system, particularly in the last few millimetres of the apical region. Due to an excess of sealer, the obturation approach utilising a single-cone with low conicity imbedded in root canal sealer has poor sealing performance[1]. NiTi rotary root canal preparations are more conical than manual root canal preparations. In order to optimise the gutta-percha/root canal sealer balance, single tapered cones were brought to the market[2]. The quality of obturation would be greater to that of the standard single-cone approach if the diameter and conicity correspond perfectly to the final shaping tool. The conventional substance is warm gutta-percha filling, which takes longer and is more difficult to apply[3]. As a result, many dentists have turned to combination systems, such as BeeFill 2in1, Calamus, Elements, System B/Obtura II, which combine warm vertical condensation to produce an apical seal and injection of warm gutta-percha to fill the coronal two-thirds of the root canal. This strategy allows us to get the benefits of continual filling while avoiding the disadvantages[4]. The goal of this study was to compare the overall quality of a tapered single cone filling approach to a combination system. We hypothesised that using tapered cones with the same diameter and conicity as the last shaping tool would result in obturation quality similar to heated condensed gutta-percha. In terms of apical microleakage, master-cone adjustment, the presence or absence of root canal sealer, the number of voids, and the filling of lateral or accessory canals, this study compared the tapered single-cone Mtwo (VDW, Munich, Germany) technique and the BeeFill 2in1 (VDW, Munich, Germany) combined system; and finally, evaluated the root canal maintenance.

Obturation Techniques

There are several obturation procedures available, with no variation in long-term outcomes, and no approach that precludes leaking. [5,6,7]Warm vertical compaction appears to be preferable to lateral compaction, according to some studies.[5,8,9]Root Canal Obturation Techniques are classified as follows: Obturation techniques are classed based on how they are used in practise[10,11].

1. Single cone technique - Custom-made roll cone technique/tailor-made guttapercha - Prefabricated stainless steel file method
2. Multiple-cone technique - Cold and warm lateral condensation - Warm vertical compaction - Continuous wave of condensation - Thermo-mechanical compaction
3. Chemo-plasticized gutta-percha - Chloropercha - Eucapercha
4. Thermo-plasticized injectable gutta-percha obturation - Obtura II - Ultrafil 3D - Thermafil - Solid core carrier-based systems
5. Paste-only root fillings - Zinc oxide eugenol paste - Calcium hydroxide paste - Iodoform paste - Paraformaldehyde containing paste [11]
6. SPAD/resorcinol formaldehyde - Diaket - AH-26 - Lee-EndoFill - Hydron

Single Cone Technique

A larger taper cone of a certain size is used in this procedure to fit perfectly into the prepared canal. This method is frequently used in conjunction with specialised filing systems. The success of this procedure is dependent on the sealer, and a three-dimensional seal may not be possible. The apical section, however, should be well-fitting. By altering the particle size of the Glass ionomer

sealer to the nanoparticle level, the Active GP precision obturation system extends the working duration of the Glass ionomer sealer. Glass ionomer particles are coated at a thickness of 2m on the gutta-percha cones. It's critical to match the size of the canal preparation to the size of the cone that will be utilised to reduce the quantity of sealer needed and any potential shrinking. 19 Up to 49% of dentists favour this technique and laboratory evidence suggests that this is comparable to lateral compaction[5].

Cold Lateral Compaction

A master cone, coated with sealer and inserted into the canal, is used to match the size of the final canal preparation. With the use of spreaders, additional auxiliary cones are compacted laterally to the master cone. [12]

- Advantages Overfilling can be avoided and can be easily done in all kinds of root canal morphology.
- Disadvantages Gaps can exist if not compacted well and may not produce a homogeneous obturation. [12]

Variations of Lateral Compaction Technique

- Curved Canal
  Spreaders made of NiTi are utilised. The thermoplasticized gutta percha approach is preferable for extremely bent canals. [12]
- Blunderbuss Canals
  The absence of an apical stop, also known as an open apex, necessitates the use of an apexification technique to shut the apex. A customised gutta percha cone is made by combining many gutta percha cones from the butt to the tip until they can be rolled into a single cone and softened with ethyl chloride spray. The outside surface of the custom-made cone is soaked in chloroform, eucalyptol, or halothane before being inserted in the canal[12]. Obturation of blunderbluss canals. [12]

Warm Lateral

Use of a master cone which corresponds to the size of final canal preparation, smeared with sealer, placed into the canal and warm spreaders used for lateral compaction of the accessory cones. Some devices use vibration in addition to the warm spreader[12,13].

Warm Vertical Compaction

Use of a master cone that is the same size as the final canal preparation. At this length, the cone should be able to withstand displacement. The cone is then sealed, inserted into the canal, and compressed vertically with a heated plugger until the canal's apical 34 mm section is filled. To backfill the remaining canal space, a preheated molten form of gutta percha is employed. [14]

Advantage Excellent sealing of canal apically, laterally and accessory canals.
Disadvantages Vertical root fracture, overfilling, and a lengthy procedure Apart from employing a flame-heated instrument, there are other heating and obturating devices such as the "System B" and "Touch n Heat" devices that provide temperature control. They must be handled with caution since root surface heat more than 10oC might cause irreparable bone injury. [14]

System B/Continuous Wave

Buchanan created it to assist warm the gutta percha in the canal. It keeps track of the heat carrier pluggers' tip temperatures and so provides a precise quantity of heat. The canal should have an acceptable taper and the set temperature should not burn the gutta percha to obtain a successful three-dimensional obturation utilising system B.

Advantages With superb apical control, it ensures appropriate condensation into the main and lateral canals. It provides a single wave of heating and compacting, allowing for simultaneous compaction of filler material and heat softening. [14]

The Down Pak-3d Obturation With Heat And Vibration

The Down Pak is a new technology that uses heat and vibration to allow for three-dimensional obturation. It contains a vibrating spreader device that can be utilised for both warm vertical and lateral condensation of gutta percha, resilon, and hybrid resin filling materials. Down Pak provides a variety of NiTi and ultrasoft stainless steel tips. It guarantees that the root canal space is filled more densely and compactly. [14]

Lateral/Vertical Compaction Of Warm Gutta Percha Technique

Vertical compaction creates a three-dimensional obturation, whereas lateral compaction determines the length of the obturation. Endotec II combines the best features of both procedures. It comes with a battery that powers the plugger and spreader linked to it[12]. Endotec causes the gutta-percha to meld together into a solid, homogeneous mass. Cleaning and shaping canals with a continuous taper design and an apical stop are required by this device's approach[14].

Sectional Method

Also known as Chicago technique. This technique involves the use of small pieces of gutta-percha cones to fill the sections of the canal. Technique: A similar-sized GP cone is chosen and cut into parts (3 to 4 mm). A plugger that fits within 3 mm of W.L is chosen. A coat of sealer is applied. One end of the GP is attached to a heated plugger and taken into the canal, where apical pressure is applied and the plugger is rotated out of the way. To ensure that it fits, a radiograph is obtained. If all goes well, the remaining canal will be filled in the same way. [12]

Advantage Ideal in cases of post core where only apical portion of canal is to be filled.

Disadvantage Time consuming and difficult to remove the sections of gutta percha if there is overfilling[12].

Thermo-Mechanical Compaction (Mcspaddencompactor)

The Mac-spadden compactor, which resembles a reverse H-file, is utilised. A rotary device (running between 5,000 and 10,000 rpm) is used to frictionally warm, plasticize, and compact a cone coated with sealant that is put in the root canal. [14]

Advantages It requires less chair side time, dense three dimensional obturation is achieved. Disadvantages Because compactor blades frequently break, it's difficult to utilise in small and curving canals. This practise can potentially result in canal overfilling. [14]

Thermo Plasticized Gp Injection Technique

The highlight of this approach is heating gutta percha outside the tooth and inserting the material into the canal. Any extrusions should be handled by the physician[5]. This concept is used in Obtura II and III, Calamus, Elements, Hotshot, and Ultrafil 3D.

A. Obtura II (Obtura Spartan, Earth City, Mo.): In 1977, it was first presented at the Harvard Institute. It comprises of an electric control unit with pistol grip syringe and specifically developed gutta-percha pellets for obturation that are heated to roughly 365 – 3900 F (185 – 2000 C). The root canal space must be adequately prepared in order to achieve a smooth, continuous taper. Obtura II is employed in the obturation of roots with internal resorption or perforations, as well as in roots with straight or slightly curved canals[12].
B. The Calamus Flow Obturation Delivery System: (Dentsply-Tulsa Dental, Tulsa, OK): Includes a handpiece and an activation cuff for controlling the flow and temperature of gutta-percha into the canal. To halt the flow, the activation cuff is released. It works with single-use disposable catridges that have a filling substance indication. The thermoplasticized gutta-percha is extruded via the needle tip at temperatures ranging from 38 to 44 degrees Celsius. Depending on the viscosity, the gutta-percha can flow for 45 to 60 seconds[14].
C. The Elements Obturation Unit (Sybron Endo): In a motorised handpiece, it has a system B device and a gutta-percha extruder. The extruder tips are pre-bent and sized 20, 23, and 25 gauge. The disposable gutta-percha cartridges are heated fast, and the equipment shuts off automatically to prevent the material from overheating[14].
D. The Ultrafill 3D System (Hygienic- ColteneWhaledent): It is a low-heat (70°C) device that includes a sterilizable injection syringe, three different types of disposable guttapercha cannulas with pre-curved needles, and a portable heating unit. Its setting and solubility are unaffected by moisture or temperature. The substance swells slightly (0.2 percent), resulting in a good root canal closure[14].

Apical Third Filling

Classification

1. Carrier based: Simplifill obturator, Fiberfill obturator
2. Paste based system: Dentin chip filling, Calcium hydroxide, MTA

Carrier based gutta-percha[14]:

Thermafil (Dentsply-Tulsa Dental)

A heating device regulates the temperature of an alpha form of guttapercha coated on a plastic core. After heating, a clinician has around 10 seconds to put it into the canal without rotating or twisting it. After allowing the GP to cool for 2-4 minutes, the carrier is removed.

Advantage. Effective sealing of lateral and accessory canals
Disadvantage. Occasional extrusion of materials beyond apex [14]

Successfil (Hygienic-Coltene Whaledent)

Guttapercha is accessible in a syringe in this technique, and carriers (Titanium or Radiopaque plastic) are placed into the syringe to a predetermined canal length. The volume and form of guttapercha are determined by the pace of syringe withdrawal. Depending on the canal architecture, different pluggers can be used to compact the gutta-percha around the carrier. After that, a bur is used to sever the carrier slightly above the opening. [14]

Simplifill (Discus Dental, Culver City, CA)

It's used after Lightspeed instruments have been used to prepare the canal. As an apical stopper to the carrier, there is 5mm of guttapercha here. After canal preparation, the carrier is advanced within 1mm of the prepared canal length, pushed to the desired length using digital pressure, then severed by spinning the handle counter clockwise at least four times. Gutta-percha can then be used to fill the coronal gap. This sectional method is effective. [13,14]

Paste Based System
Dentin Chip Filling

It is also known as BIOLOGICAL SEAL. Here circumferential filing using H - file produces dentin debris which using butt end of a paper point is packed into the canal[12].

Advantage. Biocompatible and minimal chances of extrusion
Disadvantage. Infected pulp tissue may get packed at the apex with the dentinal mass.

Calcium Hydroxide

Apical barrier is another name for it. A plugger and amalgam carrier, injectable syringes, or lentulospirals are used to deposit moist calcium hydroxide in the canal. An amalgam carrier transports the dry form of Ca(OH)2 into the canal, which is subsequently packed with pluggers. Calcium hydroxide is biocompatible and encourages cementogenesis, hence it is employed as an apical barrier in the apexification method[12].

Mineral Trioxide Aggregate

Dr. Torabinejad created it in 1993. Tricalcium silicate, tricalcium aluminate, and tetracalcium aluminoferrite with bismuth oxide make up this material. It is hydrophilic and forms in a damp environment. Excellent biocompatibility, low toxicity, radio-opacity, bacteriostatic nature, and resistance to marginal leakage are only a few of the benefits[12].

Cold Gutta Percha Compaction Technique[4]

Gutta Flow (Coltene Whaledent)

In a polydimethyl siloxane matrix, it contains powdered guttapercha, silicon oil, paraffin oil, platinum dioxide, and nano silver. It must be heated or compressed before use.

Chemoplasticized

To soften gutta percha already in the canals, solvents such as chloroform or eucalyptol are used, as well as lateral compaction using spreaders and extra supplementary cones to cover vacant places.

Silver Cones

Teeth with curved and tortuous canals or calcified canals are ideal candidates for this treatment. It has the drawback of being difficult to recover and corrosive.

Conclusion

All canals must be found, cleaned & shaped, disinfected & sealed appropriately, not only in the apical but also in the coronal region of the root canal, to accomplish a successful endodontic therapy. The obturating substance and procedure should be chosen by the clinician based on his or her abilities, experience, and the morphology of the root canal, and the clinician should be remembered throughout the patient's life for his or her competent work on the patient's tooth.

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