Review Article

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Root Canal Sealing Materials: A Review

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ABSTRACT

Background: Obturating materials are imperative in Endodontics.Various obturation materials have been introduced over the past decade to improvise the seal of the root canal system.The aim of this review is to present various obturating materials used in daily endodontic practice from conventional to novel materials, and to compare their antibacterial properties, toxicity and biocompatibility.

Keywords: Root Canal, Sealents, Dentistry.

INTRODUCTION

For successful endodontic treatment obturation of root canal is the most important step. It is defined as the three dimensional filling of the complete root canal system as close to the cementodentinal junction as possible. The main concern is to obtain a tight seal at apical, lateral and coronal sections of root canal system. [1] There have been a huge shift of materials from past to present. As the nature of the disease in dental pulp is infectious [2], evolution of new obturating materials should be targeted at upgrading the ability and efficacy for endodontists to eradicate infections and prevent recontamination [3, 4]. Root canal infection, is predominantly a biofilm-induced disease [5, 6, 7]. Triad of thorough canal débridement, effective disinfection and obturation of the canal space resulted in the success of root canal treatment [8].

PRINCIPLES OF OBTURATING MATERIAL: The basic obturation is a amalgamation of sealer cement with a central core material, which until now has been almost exclusively Gutta Percha.[1]

PROPERTIESS OF IDEAL OBTURATING MATERIAL

"Grossman‟s Criteria" for ideal obturating material[9]

- Introduction into the canal should be easy.
- Sealing the canal laterally as well as apically.
- Insertion should not be followed by shrinkage.
- It should be impervious to moisture.
- Bacteriostatic.
- Radiopaque.
- It should not stain tooth structure.
- No periapical tissue irritation.
- It should be sterile, or quickly and easily sterilized before insertion.
- Removal should be easy from the root canal if necessary.

OBTURATING MATERIALS

Gutter Perch

It is a material with minimal toxicity, minimal tissue irritability and is least allergic when kept within canal [10]. Hence, Gutta-percha is the favoured choice as a solid, core filling material for canal obturation.

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At room temperature, Gutta-percha is contemplated in beta phase. In this phase, it is solid, nonsticky, brittle, compactible and can be elongated. Gutta-percha changes to Alpha phase when heated to 42o - 49o C. In this phase, it is reverse to that in alpha phase. Commercially available form is beta form. [1]

Different types Gutta-percha availability [1]

- Gutta-percha points: They have size and shape is similar to ISO standardization (2% taper from sizes No 15 to 140).
- Greater taper Gutta-percha: They have taper other than 2%. They are available in 4%,6%,8% and 10% sizes.
- Variable taper Gutta-percha: They have points suiting the taper of variable taper shaping instruments like protaper F1, F2 and F3.
- 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, e.g. Thermafill.
- Gutta flow: In these powdered gutta percha is incorporated in resin based sealer. Syringe system: Low viscosity gutta-percha is used, e.g. Successfil.
- Gutta-percha pellets/bars: Available in small pellets and are utilized for thermoplasticized gutta percha obturation, e.g. Obtura syatem.
- Gutta-percha sealers: Gutta-percha is dissolved in chloroform or eucalyptol .
- Medicated gutta-percha: Calcium hydroxide, iodoform or chlorhexidine carrying gutta-percha points.

Advantages of Gutta-percha [1]

- Compressibility
- Inertness
- Dimensional Stability
- Tissue Tolerance
- Radio-opacity
- Becomes plastic when warmed
- Dissolves in solvents - chloroform and xylene
- Can be elongated when fresh, brittle when old

Disadvantages of Gutta-percha [1]

- Lack of rigidity
- Lack of length control
- Easily displaced by pressure
- Lacks adhesive quality

Constituents of commercial Gutta-percha (Friedmann et al):

Material	Percentage	Function
Gutta percha	18-22	matrix
Zinc oxide	59-76	filler
Waxes resins	1-4	plasticizers
Metal sulphates	1-18	radiopacifiers

Resilon

It is a new synthetic resin based polycaprolactone polymer which is a biodegradable aliphatic polyster with filler particles consisting of bioactive glass, bismuth oxychloride and barium sulphate [12]. It has some antibacterial and antifungal properties along with nontoxic, nonmutagenic and biocompatible behaviour. There is an uncertainty in sensitivity of this material to hydrolytic enzymes. Therefore further studies are required to advocate this material as an alternative to gutta-percha.

Silver Points

Insertion in narrow and curved canals is easier compared to gutta-percha with the help of silver points because of its quality of being flexible but quite stiff. Silver points handling and placement were considered to be easy. But, its use is diminished as it does not produce an acceptable three dimensional seal of the root canal system and tends to corrode over a span which compromises the apical seal [13]. Therefore, silver points are currently not used as an obturating material in clinical practice.

Mineral Trioxide Aggregate (MTA) [1]

It contains tricalcium silicate, dicalcium silicate, tricalcium alumniate, bismuth oxide, calcium sulphate and tetracalcium aluminoferrite. MTA is hydrophilic and is available in Grey and White colour. White colour lacks tetracalcium aluminoferrite.

Advantages of MTA

- Excellent biocompatibility,
- Reduced toxicity,

- Radiopacity,
- Bacteriostatic nature
- Resistance to marginal leakage.

Properties of MTA

- PH is 12.5.
- Setting time is 2 hours and 45 minutes.
- Compressive strength is 40 MPa promptly after setting and 70 MPa after 21 days.
- It produces hard setting nonresorbable
- Hydrophilic.
- Low solubility.
- Resistance to marginal leakage.
- Reduces bacterial migration.
- Excellent biocompatibility.

Indications

- Pulp capping material
- Repair of root canals as an apical plug during apexification
- Mends root perforations during root canal therapy
- Repair of root resorptions
- Root end filling material

Coated Cones [1]

Two types of coating gutta-percha are available. Ultradent consist of gutta percha surface coated with a resin. The other one available is with coating of glass ionomer on gutta-percha and is designed for use with their glass ionomer sealer. It is called Active GP Plus.

Gutta Flow [1]

Its eugenol free, radiopaque form consisting of polydimethyl siloxone matrix filled with powdered gutta-percha, silicon oil, paraffin oil, platinum dioxide and nano silver. Compaction or heating of gutta percha is not required.

Sealers [1]

The sealers act as fillers for canal asymmetry and minor disparity between the root canal wall and core filling material. They act as lubricant, enhance the possible attainment of an impervious seal and can aid in infection control of root canal walls.

Classification of presently used root canal sealers (Grossman)

- Zinc oxide eugenol based sealers
- Calcium hydroxide based sealers
- Glass ionomer based sealers
- Resin based sealers
- Materials with calcium hydroxide
- Silicone-based sealers

RECENT ADVANCES

To overcome the drawbacks of conventional root canal filling materials, there is a need to introduce recent materials over the past decade. The property of microleakage causes infection to reoccur due to poor seal. Newer materials are found to prevent infection by better root canal sealing. Some of them are:

Resilon- to overcome the drawbacks of Gutta Percha like shrinkage and its inability to bind physically to the sealer this material was introduced.

EndoREZ- It is a hydrophilic sealer whose radiopacity is equal to that of the gutta percha and is used with EndoREZ Points and/or gutta-percha for the filling the root canals.

Activ GP- It is the material where gutta percha is coated with glass ionomer.

Smartseal- This system based on polymer technology. The principle behind this technology is to fill the voids and spaces by expansion due to hydrophilic nature.

Realseal- It is the obturating material that has radiopaque and bioactive fillers. It reduces microleakage and increases strength.

MTA like recent materials- to improve the working characteristics, light cure MTA was introduced.

Bioaggregate- It is the modified form of MTA which is biocompatible.

Endosequence root repair material- It is a ready to use root end filling material which is available in putty and paste form.

iRoot BP Plus- It is a biocompatible material which is synthetic water based bioceramic cement.

New resin cement- It is accessible in powder and liquid system which has good initial biocompatibility.

EndoBinder- It is a cement which contains calcium aluminate and has properties indistinguishable to MTA but the drawbacks are not same.

Biodentine- It is available in powder and liquid form as bioactive cement.

Capasio- This material has the ability to penetrate the dentinal tubules and has mineralization similar to MTA.

Epoxy resin and Portland cement (EPC) - It is formed by the combination of epoxy resin and Portland cement with reduced microleakage and good radiopacity.

Tetrasilicate cements- It is a recently introduced material for root end filling and has property similar to MTA.[14]

CONCLUSION

Over the past decade, improvisation of obturating material have been done to improve the seal of the root canal system.[12] Without any uncertainity, root canal sealing three-dimensionally bestowes to the favourable outcome of root canal treatment considering proper selection of materials.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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