

Modern obturation materials – a comparative evaluation

5th year

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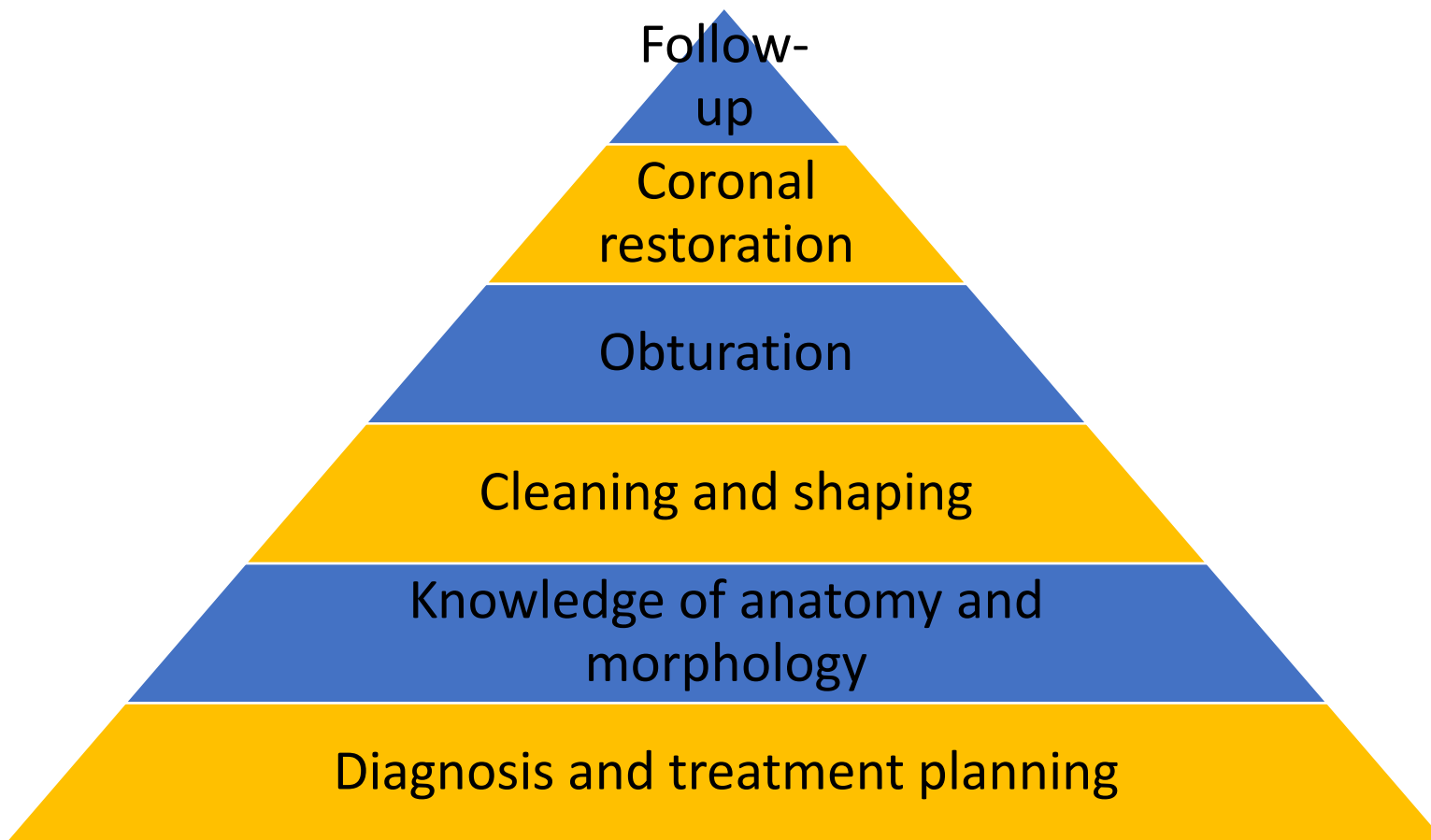
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Importance of RCT steps



Necessity of root canal obturation

- ❖ Primary etiology of pulpal and periradicular pathosis: bacteria
- ❖ Pulpal remnants
- ❖ Necrotic tissue
- ❖ Bacteria
- ❖ Bacterial by-products



Necessity of root canal obturation

- aim is to eliminate „dead space” for colonisation of microorganisms
- Prevent re-infection by new microorganisms
- Prevent entry of periradicular tissue fluid



The essence of obturation

- Treatment of endodontic pathosis:
 - cleaning and shaping -> chemomechanical cleaning is responsible for reversing the infection process and for stimulating healing.
- Long-term success:
 - Well-compacted and well-adapted root canal filling that provide a hermetic seal (no leakage)



Requirements for an ideal obturation material

| Technical | Biological | Handling |
|---|--|--|
| <p>No shrinkage</p> <p>No solubility in tissue fluids</p> <p>Good adhesion/adaptation to dentine</p> <p>No pores and water absorption</p> <p>No tooth discoloration</p> | <p>No general health problems or allergies for patients</p> <p>No irritation of local tissues</p> <p>Sterile</p> <p>Antimicrobial</p> <p>Stimulation of the periapical healing process</p> | <p>Radiopaque</p> <p>Setting in an adequate time, allowing sufficient time for obturation and x-ray control</p> <p>Easy to apply and easy to remove using solvents, heat or mechanical instrumentation</p> |



Effect on the bone tissue

Relevant materials should influence the bone tissue

- ***osteoconductive effect***: serve as a scaffold for the ingrowth of precursor osteoblasts
- ***osteoinductive effect***: inducing new bone formation by differentiation of pluripotent local connective tissue cells into bone forming cells



Controversies of biological properties

antibacterial effect \longleftrightarrow cytotoxicity

Antibacterial substances from the sealer should not compromise its physical properties such as stability and sealability



Types of root canal filling materials

- Cones:
 - prefabricated root canal filling materials of a given size and shape
- Sealers:
 - Pastes and cements

! Combinations of the two !



Cones

- Gutta-percha cones
- Silver cones:
 - high corrosion, tooth discoloration, tissue reactions
- Titanium cones:
 - Titanium-aluminium-vanadium alloy
 - No corrosion
 - low radiopacity, poor adaptation to the canal wall



Gutta-percha cones

- The most common cone material used for root canal filling
- High-molecular-weight polymer based on the isoprene monomer



Typical composition of gutta-percha cones

- Zinc oxide - 66%
- Metal sulfates – 11%
- Gutta-percha – 20%
- Additives - 3%



Properties of gutta-percha cones I.

- Flexible at room temperature
- Become plastic at about 60 °C
- Soluble in organic solvents (eucalyptus oil)
- Does not adhere to the canal walls



Properties of gutta-percha cones II.

- Radiopacity
- No systemic-toxic reactions
- Allergic reactions are extremely rare
- Easy to use
- Do not colour tooth
- Dimension stable



Sealers

- Heterogenous group of materials
- Sealers are used to fill voids and minor discrepancies of fit between the gutta-percha cones and the root canal wall

Classification of root canal sealers

- Zinc oxid and eugenol (ZnOE)
- Polyketone
- Epoxy resin
- Glass ionomer cement
- Calcium hydroxide



Composition of a ZnOE sealer

- POWDER:
 - Zinc oxide – 42%
 - Staybelite resin – 27%
 - Bismuth subcarbonate – 15%
 - Barium sulphate – 15%
 - Sodium borate, anhydrous – 1%
- Liquid:
 - Eugenol (4-allyl-2-methoxyphenol)



Zinc oxide-eugenol sealers

- Have been used for many years.
- Sealing ability and biological properties are in general inferior compared with other root canal sealers.
- Formaldehyde containing types shouldn't be used because of their toxicity potential.
- Adhesion to guttapercha cones is sufficient.
- Relatively high solubility.
- Easy to handle.
- slow setting time.
- Removal with organic solvent.
- Good radiopacity.
- Endomethasone, N2 Universal



Polyketone sealer

- Polyketone sealer has good mechanical and sealing properties
- No effects on general health
- Relatively short period for setting may be a problem (5-6 min)
- The material is moderately toxic and dose not stimulate the healing of apical tissues
- Diaket

Composition of a polyketon sealer

- Powder:
 - Zinc oxide – 97%
 - Bismuth phosphate – 3%
- Liquid:
 - Propionylacetophenone – 76%
 - Copolymers of vinyls – 23,3%
 - Dichlorophen – 0,5%
 - Triethanolamine – 0,2%



Properties of polyketon sealer

- Good adhesion to dentine
- Low shrinkage
- Sufficient strength
- No systemic-toxic or allergic effect
- **Short setting time**
- Radiopacity is sufficient



Composition of epoxy resin sealers

- Powder:
 - Bismuth (III) oxide – 60%
 - Hexamethylene tetraamine – 25%
 - Silver – 10%
 - Titanium dioxide – 5%
- Liquid:
 - Bisphenol-A-diglycidylether (BADGE)



Epoxy resin sealers

- Comparatively good mechanical and sealing properties
- No effects on general health
- Allergic reactions are rare
- Antimicrobial properties are good
- Cytotoxicity is moderate to low



Epoxy resin sealer: AH 26

- AH 26 may lead to tooth discoloration (because of silver)
- The setting reaction lasts about 1-2 days
- Excellent adhesion to dentine, AH 26 is able to flow into dentinal tubules



Epoxy resin sealer: AH Plus

- It contains a different catalyst
- It is set after about 8 hours
- AH Plus does not release formaldehyde



Epoxy resin sealers

- These sealers have been used for more than 40 years worldwide
- Their handling properties are considered to be good
- Radiopacity is sufficient
- Non-soluble even for organic solvents
- These material must be used with gutta-percha cones



Antibacterial effect of epoxy resins

Epoxy resins are microbiologically active only during the setting period (relatively short)

For a short period residual bacteria may be killed (toxicity is accepted).

In the long run the material is not toxic, leaving time for the surrounding tissues to heal.



Composition of GIC sealer

- Powder:
 - Ground silicates: calcium-sodium-fluor-phosphor silicate
- Liquid:
 - Polyacrylic acid
 - Malenic acid
 - Tartaric acid



Glass ionomer cement sealer I.

- The main problems are related to leakage
- Moisture sensitivity during setting
- Another problem: formation of pores
- Possibility to strengthen the root due to chemical binding to dentine



Glass ionomer cement sealer II.

- Good adaptation, chemical adhesion
- KetacEndo shows great dye penetration
- No systemic-toxic or allergic reaction
- Too much or too little moisture leads to insufficient setting



Glass ionomer cement sealer III.

- Antimicrobial activities may be due to the initially low pH and the fluoride release
- Handling seems uncomplicated
- Working time is limited to 7 min
- Radiopacity is sufficient
- It cannot be removed from the canal



Composition of calcium hydroxide sealers

Base paste

- Calcium hydroxide 32%
- Colophony 32%
- Silicon dioxide 8%
- Calcium oxide 6%
- Zinc oxide 6%
- Others 16%

Catalyst paste

- Disalicylates 36%
- Bismuth carb. 18%
- Silicon dioxide 15%
- Colophony 5%
- Tricalcium ph. 5%
- Others 21%



Calcium hydroxide sealers I.

- These sealers have inferior technical properties compared with others
- Inconsistent results, less sealing quality
- Calcium hydroxide sealers are very favorable
- Antimicrobial activity



Calcium hydroxide sealers II.

- CH sealers stimulate apical healing and hard-tissue formation (root-end formation)
- Radiopacity is regarded as sufficient
- The material can be removed with rotary instruments from the canal



Calcium hydroxide sealers I.

- CRCS:
 - Calcibiotic Root Canal Sealer
- Sealapex

Adhesive obturation systems

- Resilon material is a thermoplastic synthetic polymer-based root canal filling material.
- Based on polymers of polyester, Resilon material contains bioactive glass and radiopaque fillers.
- It performs like guttapercha, has the same handling properties, and for retreatment purposes may be softened with heat or dissolved with solvents such as chloroform.



Adhesive obturation systems

- Similar to gutta-percha, Resilon master cones are available in all International Organization for Standardization (ISO) sizes and accessory cones are available in smaller sizes.
- Resilon and other chemically similar products can be substituted for any gutta-percha technique. The material may bond to a properly prepared canal by using a dual-cure composite resin sealer, such as Epiphany SE Self-Etch Sealer

The necessity of follow up

The obturation should be checked on a ruled, and
regular basis



Thank you for your attention!

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