Obturation of the Root Canal System: cold and warm techniques

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Based on Cohen's Pathways of the Pulp 10th edition, Chapter 10
# CHAPTER OUTLINE

**IMPORTANCE OF EFFECTIVELY SEALING THE ROOT CANAL SYSTEM**

**HISTORICAL PERSPECTIVES**

**TIMING OF OBＴURATION**
- Vital Pulp Tissue
- Necrotic Pulp Tissue

**LENGTH OF OBＴURATION**

**PREPARATION FOR OBＴURATION**

**THE IDEAL ROOT CANAL FILLING**

**TYPES OF SEALERS**
- Zinc Oxide and Eugenol
- Calcium Hydroxide Sealers
- Noneugenol Sealers
- Glass Ionomer Sealers
- Resin
- Silicone Sealers
- Bioceramic
- Medicated Sealers

**SEALER PLACEMENT**

**CORE MATERIALS**
- Silver Cones
- Gutta-Percha
- Activ GP
- Resilon
- Custom Cones

**METHODS OF OBＴURATION**
- Lateral Compaction
- Warm Vertical Compaction
- Continuous Wave Compaction Technique
- Warm Lateral Compaction
- Thermoplastic Injection Techniques
- Carrier-Based Gutta-Percha
- Thermomechanical Compaction
- Solvent Techniques
- Pastes
- Immediate Obturation

**CORONAL ORIFICE SEAL**
The necessity of obturation

• Pulpal remnants, necrotic tissue, bacteria, and bacterial by-products remaining - initiate a lesion
• Cannot be completely cleaned and disinfected

• Obturation reduces coronal leakage
• seals the apex
• entombs the remaining irritants
Ideal root canal filling

- Core material + sealer
- Obturated root canal should reflect the original canal shape
- Radiographic interpretation
Function of the Sealer

• to seal the space between
  • the dentinal wall and the obturating core
  • gutta-percha points
• To fill voids and irregularities in the root canal, lateral and accessory canals
• lubricants
Ideal sealer (Grossman)
At present no sealer satisfies all the criteria.

Properties 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 canal filling
Types of Sealers

- zinc oxide–eugenol
- calcium hydroxide sealers
- glass ionomers
- resins
Zinc Oxide and Eugenol

- Long time usage, still on the market
- slow setting time, shrinkage on setting, solubility, discoloration
- antimicrobial activity
Calcium Hydroxide Sealers

- Antimicrobial activity, osteogenic–cementogenic
- Solubility
Glass Ionomer Sealers

- dentin-bonding – difficulties to treat apical and middle thirds with preparatory bonding agents
- Retreatment?
- minimal antimicrobial activity
Resin

• AH-26 (Dentsply), epoxy resin with formaldehyde, slow-setting
• AH Plus, no formaldehyde, 4 hours.
• Diaket, a polyvinyl resin (3M ESPE)
AH Plus (gold standard)

  - Low solubility
  - High stability
  - Slighty Thixotrop
  - Adhesion to dentin, good penetration
  - Good sealing
  - Slight expansion
- Disadavantage:
  - No bonding to guttapercha
EndoREZ (Ultradent Products, South Jordon, UT), methacrylate resin, hydrophilic properties. EndoREZ resin-coated gutta-percha cones
Epiphany/resilon RealSeal (Kerr?) 2004

“monoblock”
Silicone Sealers

• RoekoSeal (Colténe/Whaledent, Germany) is a polyvinylsiloxane, expand slightly on setting

• GuttaFlow (Colténe/Whaledent) cold flowable gutta-percha added to RoekoSeal, single master cone, 25 to 30 minutes.
Bioceramic, calcium silicate-based endodontic sealers

- zirconium oxide, calcium silicates, calcium phosphate monobasic, calcium hydroxide, and various filling and thickening agents.
- hydrophilic sealer it utilizes moisture
- within the canal to complete the setting reaction
- no shrinkage
- biocompatible
- antimicrobial
- master guttapercha cone (piston, synchronized)
Sealer Placement

- master cone, files, reamers
- lentulo spirals
- injection
- ultrasonics.
Core Materials

- Silver Cones
- Gutta-Percha
- Activ GP
- Resilon
- Custom Cones
Silver Cones

- Rigidity - easy to place, predictable length control
- Difficult to remove
- Inability to fill the irregularly shaped root canal
- Corrosion - cytotoxic
- Today is considered to be below the standard of care
GUTTA-PERCHA – AN UNTOLD STORY

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ABSTRACT

“GUTTA-PERCHA” was first introduced as a restorative material and later developed into an indispensable endodontic filling material. It has become the “soul” of endodontics, in its development as a specialty.

Many articles have dealt about the various techniques of usage of Gutta-percha, but the present article deals briefly with its history, source, chemistry, commercial manufacture, its revolution and its use as a filling material, with Gutta-percha fa (Sapotaceae család, Palaquium gutta, Isonandra gutta, Dichopsis gutta)

INTI

“GETAH” - gumi
“PERTJA” - fa neve (Maláj nyelven)

1656 - John Tradescant hozta először Angliába távol keletről
1867 - Bowman - gyökértömés.
1887 - S.S White cég – első guttapercha poén
1959 – Ingle és Levine - standardizálás
**Gutta-percha**

- *trans* isomer of polyisoprene (rubber)
- Gutta-percha cone: 20% guttapercha, 65% zinc oxide, 10% radiopacifiers, 5% plasticizers
- two crystalline forms
  - α……natural form, runny, tacky and sticky, lower viscosity, THERMOPLASTIC FILLING
  - β……most common commercial form solid, compactible and elongatible, higher viscosity
  - γ phase - amorphous
  - Slow cooling result in α form rapid cooling result in β form

Heat:  
- Heat to 42-49°C → α phase
- Heat to 56-62°C → γ phase

Aging-oxidation, brittleness → rejuvenation

β phase  

- Heat to 42-49°C → α phase  
  - Expansion 1-3%

Rapid cooling  

Slow cooling  

Shrink
Gutta-percha

- plasticity,
- Ease of manipulation
- minimal toxicity
- Radiopacity
- ease of removal with heat or solvents.
- Disadvantages: lack of adhesion to dentin
- shrinkage on cooling
Gutta-percha
Gutta-percha

- Sterilization before use: placing the cones in 5.25% NaOCl for 1 minute
Activ GP

Activ GP (Brasseler USA, Savannah, GA)
glass ionomer–impregnated gutta-percha cone + glass ionomer external coating + a glass ionomer sealer
Resilon

- Self-etch primer
- Resin sealer (25 minutes, +light cured)
- Lateral compaction or warm vertical compaction, or thermoplastic injection
- Excellent sealing, resistant to fracture, “prevent” periodontitis versus GP+Ahplus
- Biocompatible

Resin matrix of bisphenol A-glycidyl methacrylate [Bis-GMA], ethoxylated Bis-GMA, urethane dimethacrylate [UDMA], and hydrophilic difunctional methacrylates and fillers [70%] of calcium hydroxide, barium sulfate, barium glass, bismuth oxychloride, and silica.)
Custom Cones

- open apical foramen or large canal
Obturation technique

• To date little evidence exists to support one method of obturation as being superior to another and the influence of treatment technique on success/failure has yet to be determined.

• Aqrabawi JA: Outcome of endodontic treatment of teeth filled using lateral condensation versus vertical compaction (Schilder’s technique). J Contemp Dent Pract 7:17, 2006

Lateral Compaction

• most clinical situations
• length control during compaction
• with any of the acceptable sealers
• Only a few instrumentum (cheap spreaders)

• may not fill canal irregularities
Lateral compaction
Step by step

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1. Filing (+apical last mm: rotation)
2. Incrementally reducing the working length when using larger and stiffer instruments
3. More tapering: Avoid procedural error, easier rinsing, compactable filling, better copying the non-rounded cross-section
4. Cons: procedural error still occur, apical dentin plug

Step-back technique

ISO file

0.05

0.30 mm

MF: 0.25 mm

1 mm

Standardized diameter ISO

20 25 30 35 40 50 60
Objective: fill the canal with gutta-percha points (cones) by compacting them laterally against the sides of the canal walls.

Two main types of spreading instruments
- long handled spreaders
- finger spreaders

- Finger spreaders provide: better tactile sensation & less likely to induce fractures
• “Gold standard”

Advantage:
• Excellent length control

Limitations:

➢ However, this technique may not fill canal irregularities
➢ Gutta-percha cones never merge into a homogeneous mass, but they slip and glide and are frozen in a sea of cement
Schilder introduced warm vertical compaction
- a continuously tapering funnel
- keeping the apical foramen **as small as possible.**
Pluggers
Continuous Wave Compaction Technique: Temperature control instruments
Thermoplastic injection technique: Backfill
Carrier-Based Gutta-Percha
Thank you for your attention!