Clinical Endodontics III

PATHWAYS OF THE PULP, *COHEN* 10TH EDITION

CLEANING AND SHAPING OF THE ROOT CANAL SYSTEM, CHAPTER 9.

OBTURATION OF THE CLEANED AND SHAPED ROOT CANAL SYSTEM, CHAPTER 10.

THIS IS A READING GUIDE FOR THE ASSIGNED REFERENCE

Lecture Outline

2

- Cleaning and shaping of root canal system

1. Cleaning and Shaping: Clinical Issues
2. Canal Preparation Techniques
3. Canal Cleaning Techniques

- Obturation of the cleaned and shaped root canal system

1. Timing of Obturation
2. Length of Obturation
3. The Ideal Root Canal Filling
4. Types of Sealers
5. Core Materials
6. Methods of Obturation

- Temporization of endodontically treated tooth

10/15/2014

Cleaning and Shaping: Clinical Issues

3

- A primary aim of all endodontic procedures, and most notably of cleaning and shaping, is to remove canal contents, specifically infective microorganisms and necrotic tissues.
- Endodontists widely agree that a major biologic aim of endodontic therapy is to eliminate apical periodontitis by disinfection and sealing of root canal systems.
- "shaping and cleaning" more correctly reflects the fact that enlarged canals direct and facilitate the cleaning action of irrigants and the removal of infected dentin.

Basic Objectives in Cleaning and Shaping

4

The primary objectives in cleaning and shaping the root canal system are to:

1. Remove infected soft and hard tissue
2. Give disinfecting irrigants access to the apical canal space
3. Create space for the delivery of medicaments and subsequent obturation
4. Retain the integrity of radicular structures

Biologic & Mechanical Objectives

5

The preparation shape and antimicrobial efficacy are intimately related through the removal of infected dentin and the delivery of irrigants.

Full incorporation of the original canals into the prepared shape

Leave as much radicular dentin as possible so as not to weaken the root structure

10/15/2014

Biologic & Mechanical Objectives

6

Endpoint of apical preparation

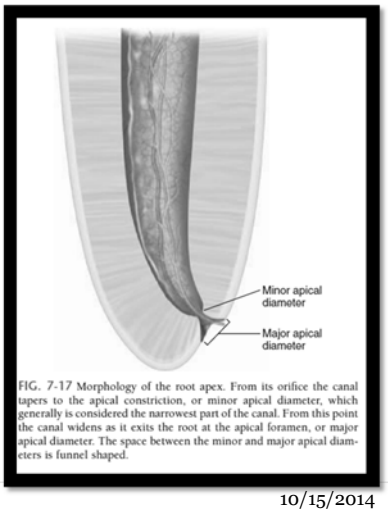


FIG. 7-17 Morphology of the root apex. From its orifice the canal tapers to the apical constriction, or minor apical diameter, which generally is considered the narrowest part of the canal. From this point the canal widens as it exits the root at the apical foramen, or major apical diameter. The space between the minor and major apical diameters is funnel shaped.

10/15/2014

Biologic & Mechanical Objectives

7

A *patency file is a small* K-file (usually a size #10 or #15) that is passively extended just through the apical foramen.

Biologic & Mechanical Objectives

8

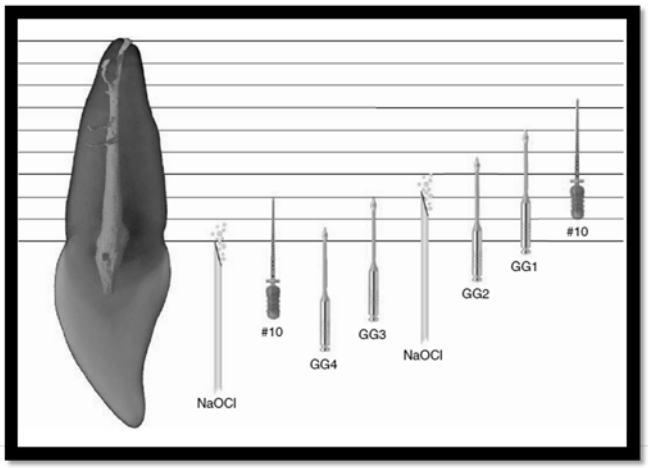
Apical diameter

Root Canal Preparation	Benefits	Drawbacks
Narrow Apex	Minimal risk of canal transportation and extrusion of irrigants or filling material Can be combined with tapered preparation to counteract some drawbacks	Little removal of infected dentin Questionable rinsing effect in apical areas during irrigation Possibly compromised disinfection during interappointment medication Not ideal for lateral compaction
Wide Apex	Removal of infected dentin Access of irrigants and medications to apical third of root canal	Risk of preparation errors and extrusion of irrigants and filling material Not ideal for thermoplastic obturation

Canal Preparation Techniques

9

Coronal enlargement



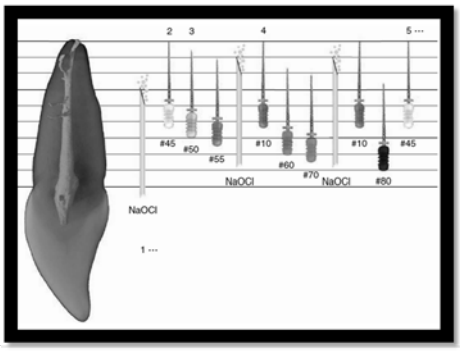
10/15/2014

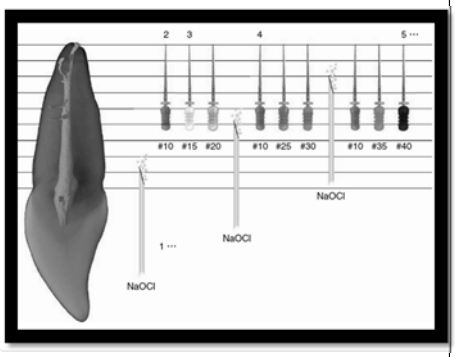
Canal Preparation Techniques

10

Hand Instrumentation

1. *Standardized Technique*
2. *Step-Back Technique*
3. *Step-Down Technique*





10/15/2014

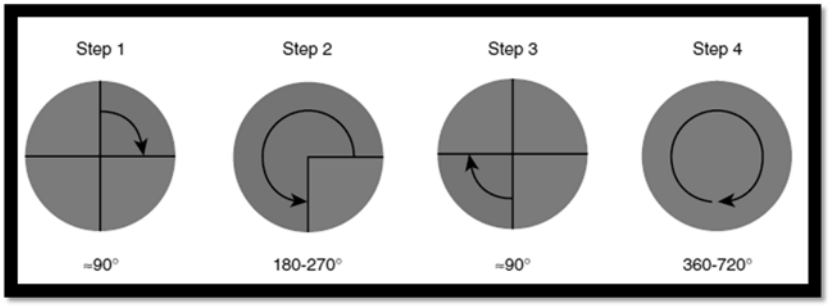
Canal Preparation Techniques

11

Hand Instrumentation

4. Crown-Down Technique

5. Balanced Force Technique



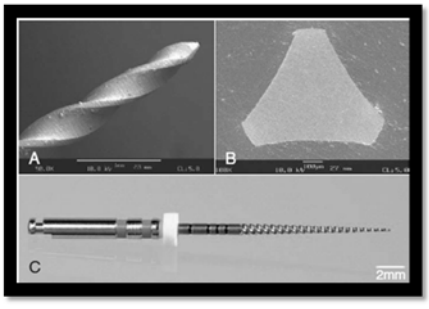
10/15/2014

Canal Preparation Techniques

12

Rotary Instrumentation

ProFile instrument



No. of instruments/ set	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
Orifice Shapers: 6	20-80	10; from 60: 20	150 to 350, low apical force, torque to fracture and working torque dependent on instrument size	19 mm
ProFile .06: 6	15-40	5		21 mm, 25 mm, some 31 mm
ProFile .04: 9	15-90	5; from #45: 15; from #60: 30		
ProFile .02: 6	15-45	5		
Profile Series 29	13-100	Varies, 29%		21 mm, 25 mm

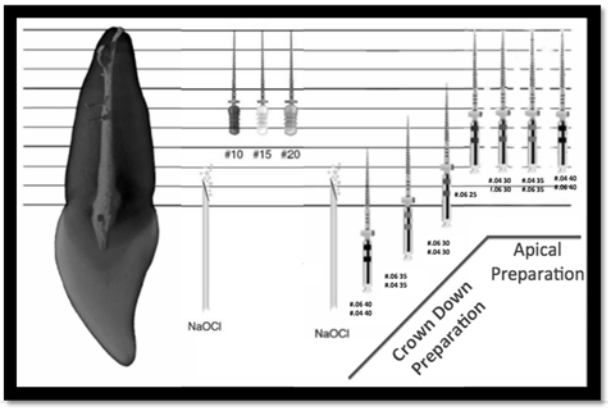
10/15/2014

Canal Preparation Techniques

13

Rotary Instrumentation

ProFile instrument

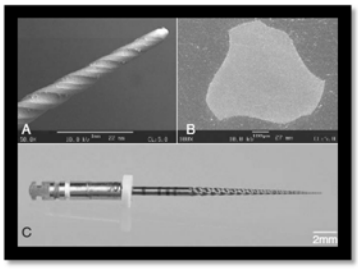


Canal Preparation Techniques

14

Rotary Instrumentation

K3 instrument



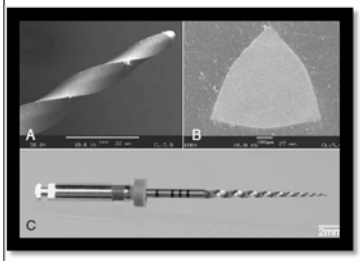
No. of instruments/ set	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
27	15-45 with .02 taper; 15-60 with .04 and .06 taper	5	300 to 350, minimal axial force	21, 25, 30 mm

Canal Preparation Techniques

15

Rotary Instrumentation

ProTaper instrument



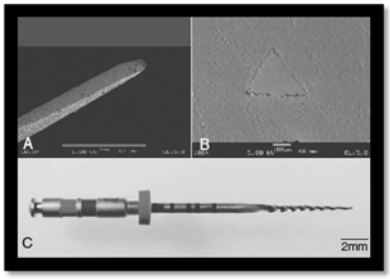
No. of instruments/ set	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
6 (3 shaping files; SX, S1, S2; 3 finishing files; F1, F2, F3)	19-30	Vary along the working part of an individual instrument	150 to 350 minimal axial force, low to medium torque to fracture, varying working torque	19, 21, 25 mm

Canal Preparation Techniques

16

Rotary Instrumentation

Twisted File (TF) instrument



Number of instruments/ sets	Tip sizes	Size increments	r.p.m. (recommended)	Lengths
3*	25, tapers .04-.12	None	500 rpm	23 and 27 mm

Fracture Mechanisms

17

- Torsional fracture occurs when an instrument tip is locked in a canal while the shank continues to rotate, thereby exerting enough torque to fracture the tip. This also may occur when instrument rotation is sufficiently slowed in relation to the cross-sectional diameter.
- Flexural fracture occurs when the cyclic loading leads to metal fatigue. NiTi instruments can withstand several hundred flexural cycles before they fracture.

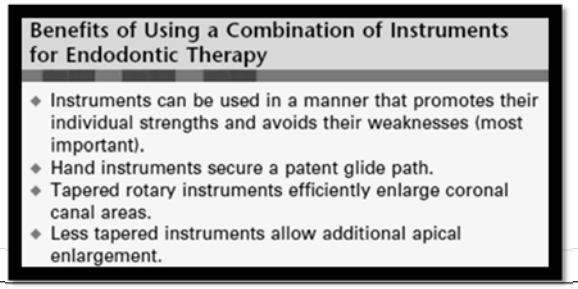
10/15/2014

Canal Preparation Techniques

18

Hybrid Techniques

- Combining various NiTi preparation systems have been suggested to address certain shortcomings of current instruments.
- The technique involves the use of a variety of instruments:GG drills and K-files for establishing straight-line access; ProTaper instruments for body shaping and apical preenlargement; NiTi K-files or LightSpeed instruments



10/15/2014

Canal Cleaning Techniques

19

Benefits of Using Irrigants in Root Canal Treatment

- Removal of particulate debris and wetting of the canal walls
- Destruction of microorganisms
- Dissolution of organic debris
- Opening of dentinal tubules by removal of the smear layer
- Disinfection and cleaning of areas inaccessible to endodontic instruments

10/15/2014

Canal Cleaning Techniques

20

Properties of an Ideal Irrigant for Root Canal Treatment

The irrigant should:

- Be a highly effective disinfectant
- Be nontoxic locally and nonallergenic
- Differentiate between necrotic and vital host tissue
- Retain its effectiveness with dental hard tissue and when mixed with other irrigants

10/15/2014

Canal Cleaning Techniques

21

1. *Sodium Hypochlorite (NaOCl)*
2. *Chlorhexidine (CHX)*
3. *Iodine Potassium Iodide (IKI)*
4. *MTAD (mixture of tetracycline, acid, and detergent)*
5. *Ethylenediamine Tetra-Acetic Acid (EDTA)*
6. *Calcium Hydroxide (Ca(OH)2)*

- The tissue-dissolving and disinfecting properties of NaOCl currently make it the irrigant of choice. EDTA should be used at the end of a procedure to remove the smear layer, followed by another flush with NaOCl for maximum cleaning efficiency.

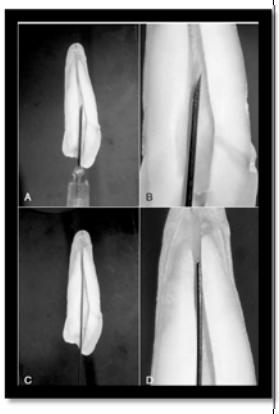
Canal Cleaning Techniques

22

Irrigation Modes and Devices

1. *Syringe Delivery*
2. *Manually Activated Irrigation*
3. *Sonically Activated Irrigation*
4. *Ultrasonically Activated Irrigation*

- The difference lies in the oscillating movements: sonic devices range between 1500 Hz and 6000 Hz, and ultrasonic equipment requires vibrations greater than 20,000 Hz.
- *Passive ultrasonic irrigation* is defined as activation of the rinsing agent without simultaneous preparation of the root canal walls.



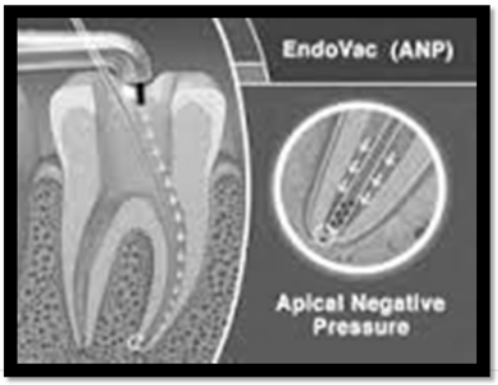
Canal Cleaning Techniques

23

Irrigation Modes and Devices

5. Negative- and Positive-Pressure Irrigation

EndoVac



RinsEndo system

10/15/2014

Obturation of the cleaned and shaped root canal system

24

- Three-dimensional obturation of the radicular space is essential to long-term success. The canal system should be sealed apically, coronally, and laterally.

Timing of Obturation

Factors influencing the appropriate time to obturate a tooth include:

1. Patient's signs and symptoms,
2. Status of the pulp and periradicular tissue,
3. Degree of difficulty, and
4. Patient management.

10/15/2014

Obturation of the cleaned and shaped root canal system

25

Timing of Obturation

Vital Pulp Tissue

- When pain occurs as the result of irreversible pulpitis, obturation can occur at the initial visit.

Necrotic Pulp Tissue

- When patients present with acute symptoms caused by pulp necrosis and acute periradicular abscess, obturation is delayed until the patient is asymptomatic.
- Obturation can be performed after cleaning and shaping procedures when the canal can be dried and the patient is not experiencing swelling.
- Difficult cases may require more time for preparation and can be managed in multiple appointments.
- Patients may require multiple short appointments because of medical conditions.

Obturation of the cleaned and shaped root canal system

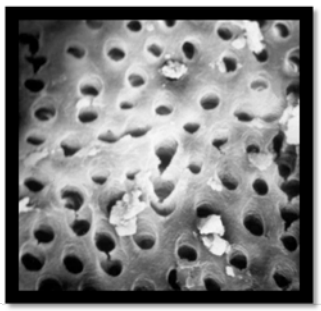
26

Length of Obturation

- Apical point of termination has been approximately 1 mm from the radiographic apices as determined by radiographs.

Preparation for Obturation

- Smear layer removal



Obturation of the cleaned and shaped root canal system

27

The Ideal Root Canal Filling

Obturation of the cleaned and shaped root canal system

28

Types of Sealers

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

Obturation of the cleaned and shaped root canal system

29

Types of Sealers

- Zinc Oxide and Eugenol (Rickert and Dixon, Pulp Canal Sealer and Pulp Canal Sealer EWT, Procosol, Roth's Sealer , Tubli-Seal, Wach's sealer)
- Calcium Hydroxide Sealers (Sealapex, Apexit and Apexit Plus
- Noneugenol Sealers
- Glass Ionomer Sealers (Ketac-Endo, Activ GP)

10/15/2014

Obturation of the cleaned and shaped root canal system

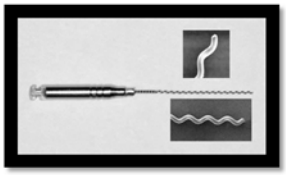
30

Types of Sealers

- Resin (AH-26, AH Plus, EndoREZ, Diaket, Epiphany and RealSeal)
- Silicone Sealers (RoekoSeal, GuttaFlow)
- Bioceramic

Sealer Placement

- Master cone,
- Lentulo spirals,
- Files and reamers,
- Ultrasonics.



10/15/2014

Obturation of the cleaned and shaped root canal system

31

Core Materials

Properties of an Ideal Obturation Material

- Easily manipulated and provides ample working time
- Dimensionally stable with no shrinkage once inserted
- Seals the canal laterally and apically, conforming to its complex internal anatomy
- Nonirritating to the periapical tissues
- Impervious to moisture and nonporous
- Unaffected by tissue fluids—no corrosion or oxidization
- Inhibits bacterial growth
- Radiopaque and easily discernible on radiographs
- Does not discolor tooth structure
- Sterile
- Easily removed from the canal if necessary

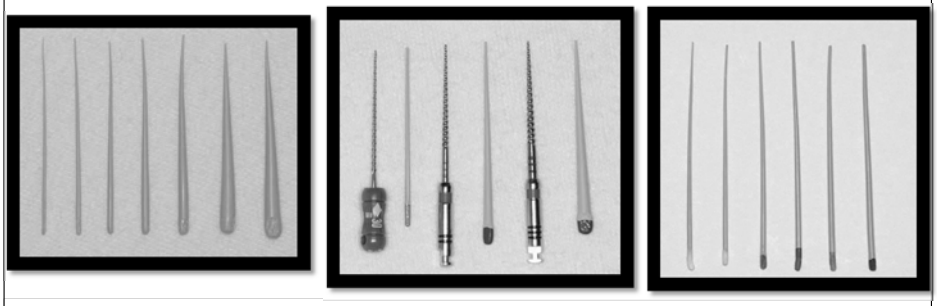
10/15/2014

Obturation of the cleaned and shaped root canal system

32

Core Materials

- Silver Cones
- Gutta-Percha (20% gutta percha, 65% zinc oxide, 10% radiopacifiers, and 5% plasticizers)



10/15/2014

Obturation of the cleaned and shaped root canal system

33

Core Materials

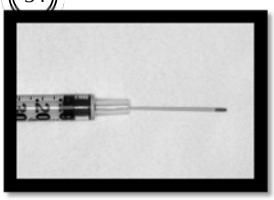
- Activ GP: Single cones are used with a glass ionomer sealer.
- Resilon: The resin sealer bonds to a Resilon core, and attaches to the etched root surface.

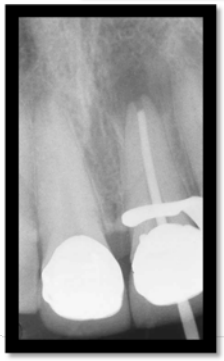
10/15/2014

Obturation of the cleaned and shaped root canal system

34

- **Custom Cones**





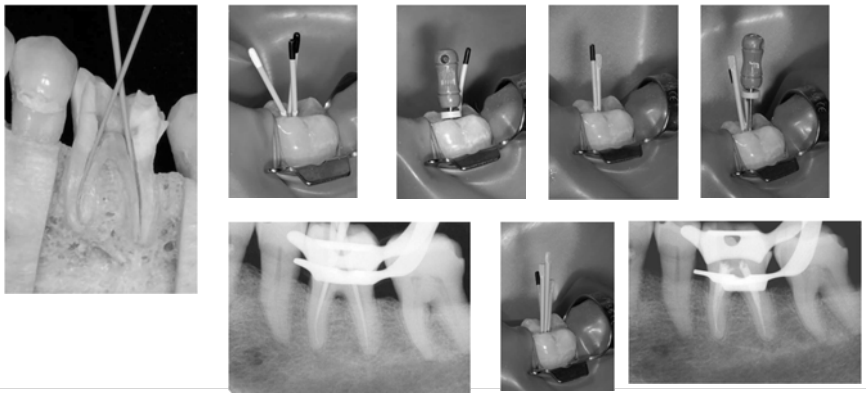
10/15/2014

Obturation of the cleaned and shaped root canal system

35

Methods of Obturation

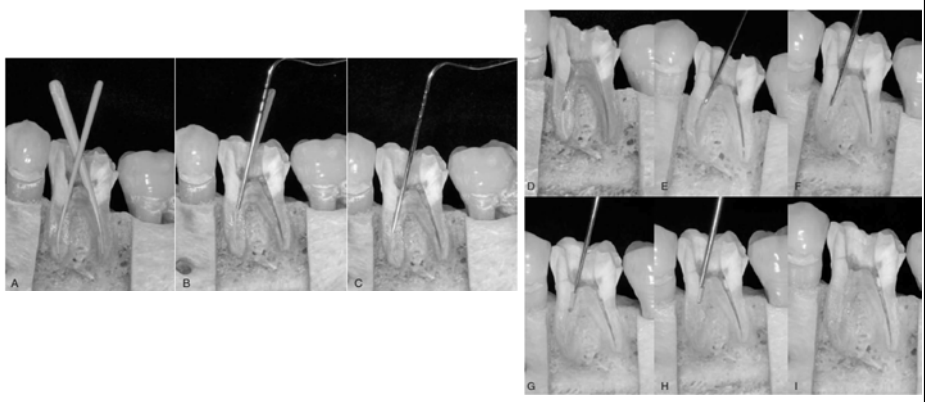
Lateral Compaction



Obturation of the cleaned and shaped root canal system

36

Warm Vertical Compaction



Obturation of the cleaned and shaped root canal system

37

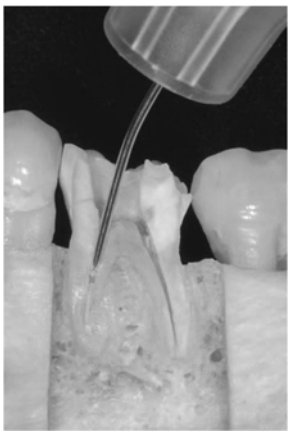
Continuous Wave Compaction Technique

10/15/2014

Obturation of the cleaned and shaped root canal system

38

Continuous Wave Compaction Technique



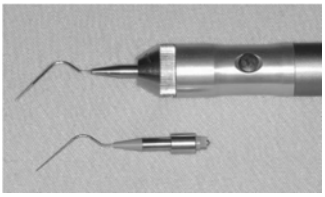
10/15/2014

Obturation of the cleaned and shaped root canal system

39

Warm Lateral Compaction

- An appropriate-size Endotec II tip is selected.
- The sizes consist of #.02/20 and #.02/40. The device is activated and the tip is inserted beside the master cone to within 2 to 4 mm of the apex, using light pressure.



Obturation of the cleaned and shaped root canal system

40

Thermoplastic Injection Techniques

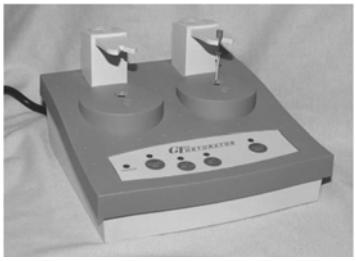
- The Obtura III, Calamus , Elements, HotShot, and Ultrafil 3D

Obturation of the cleaned and shaped root canal system

41

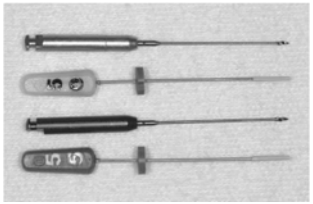
Carrier-Based Gutta-Percha

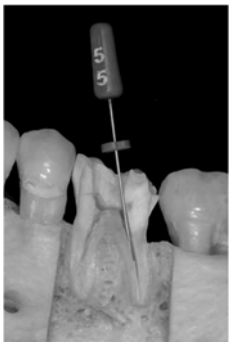
- *Thermafil, Profile GT Obturators, GT Series X Obturators, and ProTaper Universal Obturators*



10/15/2014

42





10/15/2014

Obturation of the cleaned and shaped root canal system

43

Thermomechanical Compaction

- McSpadden Compactor, with flutes similar to a Hedström file but in reverse.When activated in a slow-speed handpiece the instrument would generate friction, soften the gutta-percha, and move it apically.

10/15/2014

44

- Dentin chips
- Calcium hydroxide
- Immature teeth exhibiting pulp necrosis or teeth with apical resorption were treated with calcium hydroxide to establish an apical barrier (apexification) before obturation.
- MTA

10/15/2014

Coronal Orifice Seal

45

- Cavit
- A resin-modified glass ionomer cement

10/15/2014

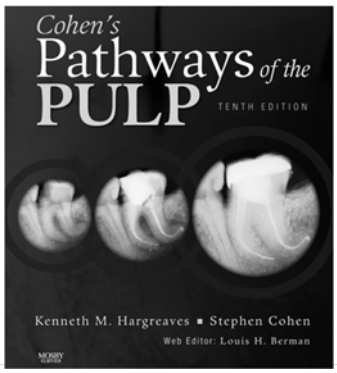
THIS IS A READING GUIDE FOR THE ASSIGNED REFERENCE

46

Pathways of the Pulp, *Cohen* 10th edition

Cleaning and Shaping of the Root Canal System, Chapter 9.

Obturation of the Cleaned and Shaped Root Canal System, Chapter 10.



10/15/2014