Introduction to Endodontic instruments

Restorative dentistry (Endodontics)

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Second lecture

Fourth week

Introduction

- Instruments play a very important role in the success of a root canal treatment. Therefore a basic knowledge of endodontic instruments is essential. Different instruments to remove both pulp chamber and root canals.

- General guidelines exist for root canal preparation , but due to the complex and varied canal anatomy , each case presents unique challenges.

- A variety of instruments are thus available for this purpose.

CLINICAL CLASSIFICATION

1. INSTRUMENTS USED FOR DIAGNOSIS

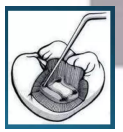
Vital / non-Vital

The first step in root canal treatment

And the most important step

1. Endodontic Explorers

Exploring pulp orifices at floor level



2. Tooth Slooth

Separate the 2 pieces of fractured tooth (Expose dentin) → sensitive

Patient comes with sever pain while opening → the tooth (cracks area) will be exposed to the oral environment → passing of saliva (pressure) toward the dentin → moving of fluids in dentinal tubules → stimulation for nerve fibers in the pulp

his mouth → Cracks → difficult to be seen by human eyes

" needs special investigations or magnifications "

3. Dental Transilluminator

RCT needs magnification and ↑

4. Pulp Vitality Tester

- Thermal
  - Hot
  - Cold
- Electrical

Does the patient responses to the stimulus ?

Response:

- Short → Vital tooth (Hypersensitivity)
- Long → Vital "inflammed"
- no response → Necrotic pulp "Dead"

* After achieving the diagnosis and the pulp needs to be treated "removed" we start "Accessing the cavity" passing through enamel and dentin to reach the pulp chamber → that should be removed totaly And all this : Access cavity + pulp chamber removal

Done by

Dental burs

Parts of bur

Shank → – Inserted inside the handpiece

Neck

Head.

Diamond carbide

Head Design

Round
-common

Pear

Straight
Fissure

Tapered
Fissure
-common

Inverted
cone

An access cavity is the opening prepared in the crown of a tooth to allow access to its pulp chamber and root canals for root canal therapy this cavity while preserving as much healthy tooth structure as possible. The design of the access cavity varies based on the tooth type, as well as the anatomy of the pulp chamber.

CLINICAL CLASSIFICATION

2. INSTRUMENTS USED FOR ACCESS OPENING

Removing pulp chamber

1. Diamond Rose Head Burs

2. Tapered Fissure

3. Carbide Burs

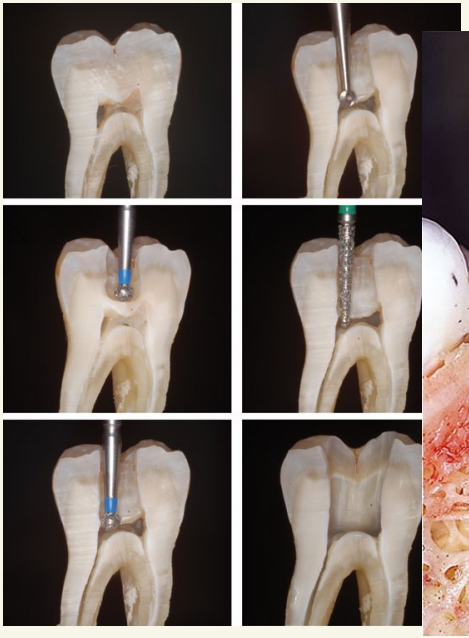
4. Safe End Long Burs

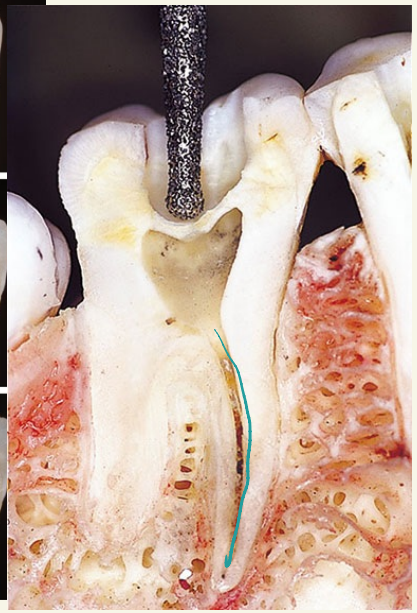
5. Endo Z Bur

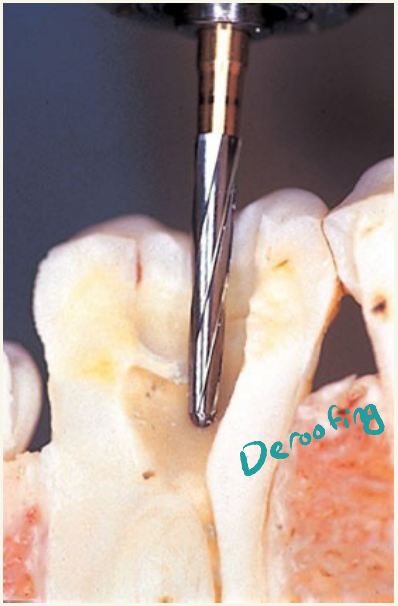
Has safety tip. and both for Deroofing

Carbide Burs: Made from tungsten carbide, a very hard metal, these burs have sharp blades that cut by shearing.

- **Diamond Burs**: These are made by bonding small diamond particles to the bur's surface, creating a grinding effect rather than a shearing action.






Deroofing

Removing of radicular pulp "pulp inside canals"

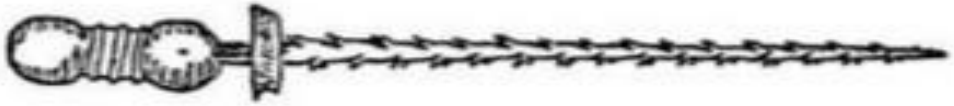
CLINICAL CLASSIFICATION

3. INSTRUMENTS USED FOR CANAL PREPARATION:

a) INSTRUMENTS USED TO REMOVE PULP TISSUE:

- Pushed into the canals
- sharp projections
- Removes pulp tissue as one piece

i. Barbed Broaches



i. Endodontic Excavators

To excavate/remove all infected Pulp tissue inside pulp chamber "preventing microorganisms to leaks to canals when opening it.

a) INSTRUMENTS USED FOR ROOT CANAL PREPARATION

Burs deal with pulp chamber

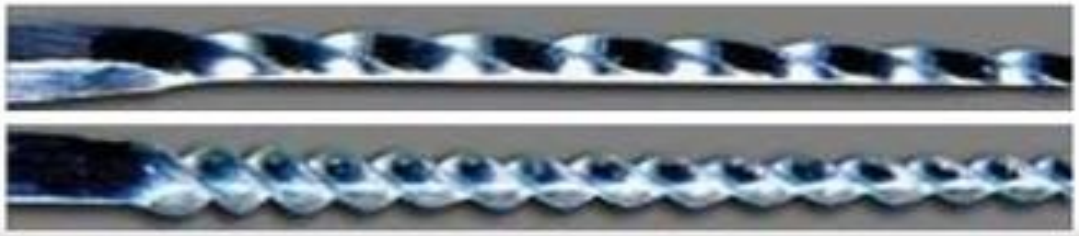
Files deal with root canals

i. Reamers

They differ in design and cutting mechanism

ii. Files → we use these more

Both used for root canals cleaning and shaping



Final Step

CLINICAL CLASSIFICATION

4) INSTRUMENTS USED FOR ROOT CANAL OBTURATION:

i. Lentulo spirals
(Placement of intra canal medicaments)

ii. Spreaders
(Lateral compaction of gutta percha)

iii. Pluggers
(Vertical compactions of gutta percha)

iv. Condensors
(Vertical compactions of gutta percha)

v. Heat carriers

vi. Thermomechanical compactors

- First standardization is about the size
- Second standardization is about color coding
- Third standardization is about the taper

STANDARDIZATION OF ENDODONTIC INSTRUMENTS

- Before 1958, endodontic instruments were manufactured without benefit of any established criteria.
- The numbering (1 to 6) was entirely arbitrary. An instrument of one company rarely coincided with a comparable instrument of another company.

Conventional instruments	*Standardized instruments*
0	10
1	15
2	20
3	25
4	30, 35
5	40, 45
6	50, 55

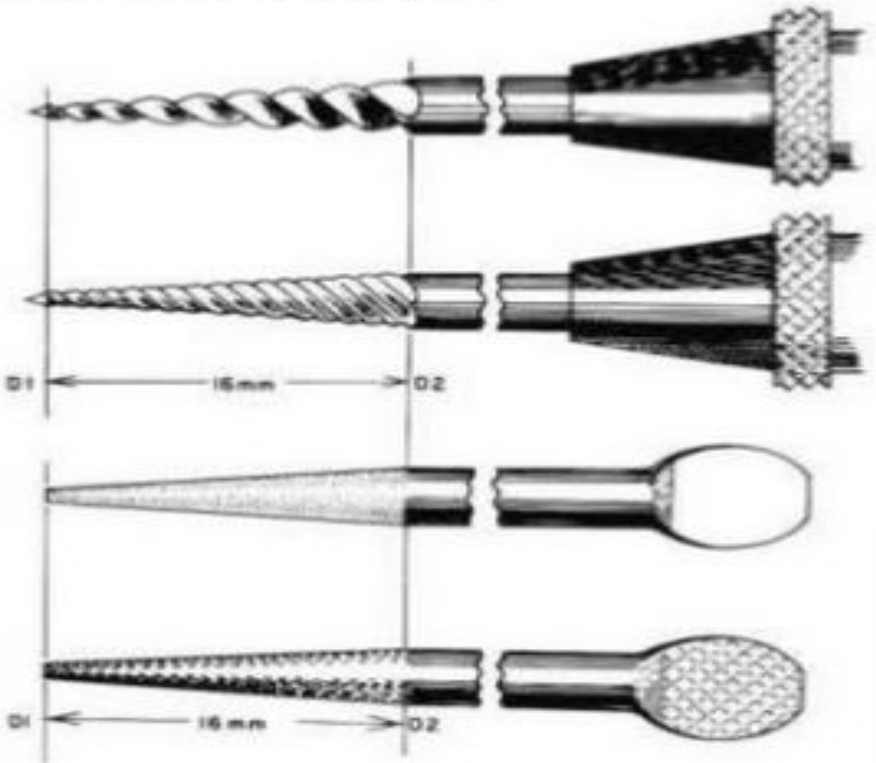
- First standardization is about the size
- Second standardization is about color coding
- Third standardization is about the **taper** → Means increasing in diameter gradually from one end to another or decreasing in diameter from the opposite end.

How mm increase in diameter per 1 mm in length ?

STANDARDIZATION OF ENDODONTIC INSTRUMENTS

Ingle's Original Recommendation

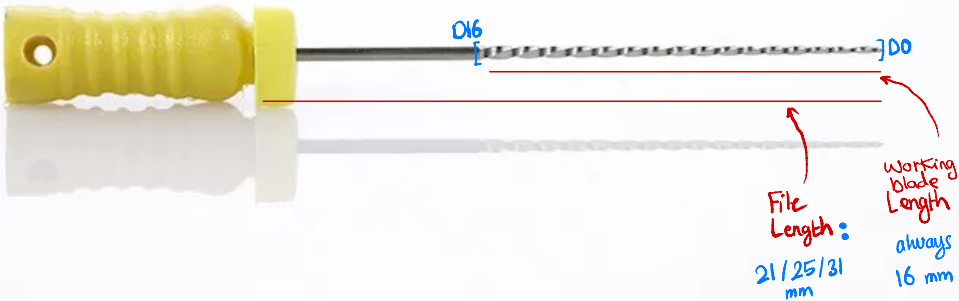
- Cutting blades 16 mm in length
  4 %. / 6 %. → In Rotary system
- 2 % Taper. → $\frac{2}{100}$ = 0.02 mm for each 1 mm in Length
- The diameter of the instrument at tip (D1) is determined by size in hundredths of millimetres.
- Diameter 2 (D2) is uniformly 0.32 mm greater than D1.
- Length- 21, 25, 31 mm. (Fourth standardization)



1) cutting blade (16 mm)
   * The twested wire "flutes"

2) whole file length.
   21 / 25 / 31 → In Long root (canine)
   Short / intermediate / Long

SANI


D16
D0
File Length :
21/25/31 mm
Working blade Length :
always 16 mm

- First standardization is about the size
- Second standardization is about color coding
- Third standardization is about the taper

STANDARDIZATION OF ENDODONTIC INSTRUMENTS

ISO-COLOR CODING

With the exception of Pink, Gray and Purple, all the colors are repeated every six instruments

#06	PINK ONLY AVAILABLE IN #06	
#08	GRAY ONLY AVAILBLE IN #08	
#10	PURPLE ONLY AVAILBLE IN #10	
#15	#45	#90
#20	#50	#100
#25	#55	#110
#30	#60	#120
#35	#70	#130
#40	#80	#140

MAKE OF ENDODONTIC INSTRUMENTS

METALLURGY

Alloys are mixtures of two or more metals, or a metal and another element, that are combined to enhance certain properties. The resulting material often has improved characteristics such as strength, durability, corrosion resistance

Alloys Used for Manufacturing Endodontic Instruments

for all dental instruments

CARBON STEEL

Hard

- These alloys contain less-than 2.1 percent of carbon. 98% → steel

STAINLESS STEEL

- Aluminum / carbon / chromium .....

- These are corrosion resistant instruments.
- They contain 18 percent chromium, 8-10 percent nickel and 0.12 percent carbon.

NICKLE - TITANIUM

55 45

- These instruments contain 55 percent nickel and 45 percent titanium.

METALLURGY OF ENDODONTIC INSTRUMENTS

CARBON STEEL

98% steel

ADVANTAGES

- Higher hardness than stainless steel instruments.

DISADVANTAGES

Rusting and corrosion

- Prone to corrosion, so cannot be autoclaved. for sterilization
- Prone to rust. *single use.

e.g. Barbed Broach

METALLURGY OF ENDODONTIC INSTRUMENTS

STAINLESS STEEL

ADVANTAGES

- Corrosion resistance

DISADVANTAGES

- Stiff in nature
- Prone to fracture
- Prone to distortion

Example: K-file,

METALLURGY OF ENDODONTIC INSTRUMENTS

NICKLE-TITANIUM

* overcome all disadvantages of SS and carbon alloys.

ADVANTAGES

- Shape memory → Return to its straight normal shape after taking the canal's shape.
- Super elasticity → Pass toward most curved root
- Low modulus of elasticity property of materials that quantifies their stiffness or resistance to deformation under applied stress (يتحمل يطمح)
- Corrosion resistant
- Softer than steel
- Good resiliency : Resist any force without fracture.
- Biocompatibility : Doesn't affect the human tissues (not irritant or sensitive)

DISADVANTAGES

- Poor cutting efficiency. → To overcome that we use it in rotary device
- NiTi files do not show signs of fatigue before they fracture. Sign of fatigue ? shiny straight, no flutes (Must read the instructions of each company to each canal can be prepared)
- Poor resistance to fracture as compared to stainless steel.

HyFlex CM NiTi Files

Thank you for your patience