THE DENTAL PULP

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LET'S BEGIN!

Use your arrows to move from one slide to another

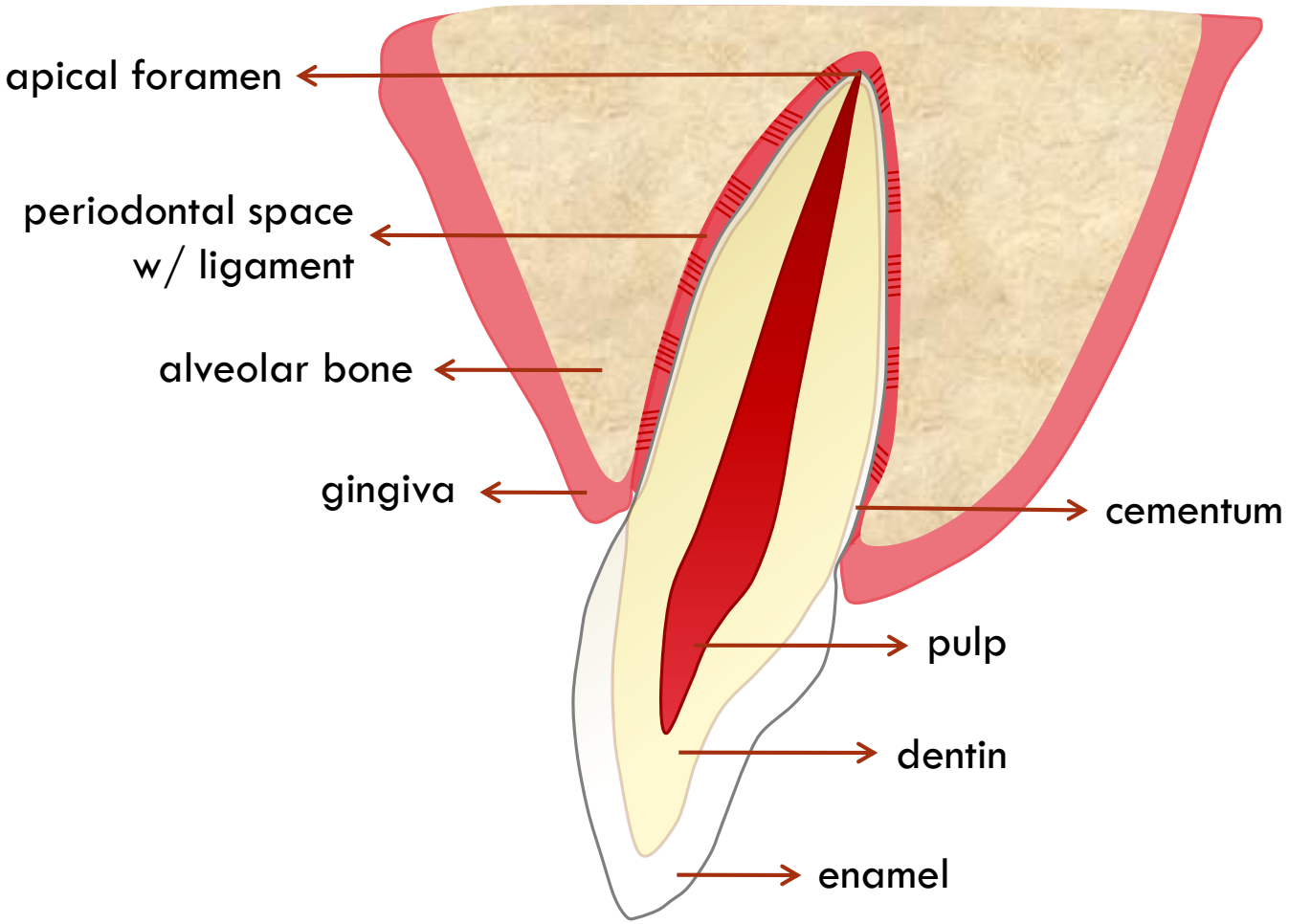
LEARNING OBJECTIVES

At the end of this presentation, you should be able to:

1. Identify the dental pulp and the parts of the pulp cavity.
2. Explain the functions of the dental pulp.
3. Describe the dental pulp anatomy of the different types of teeth.

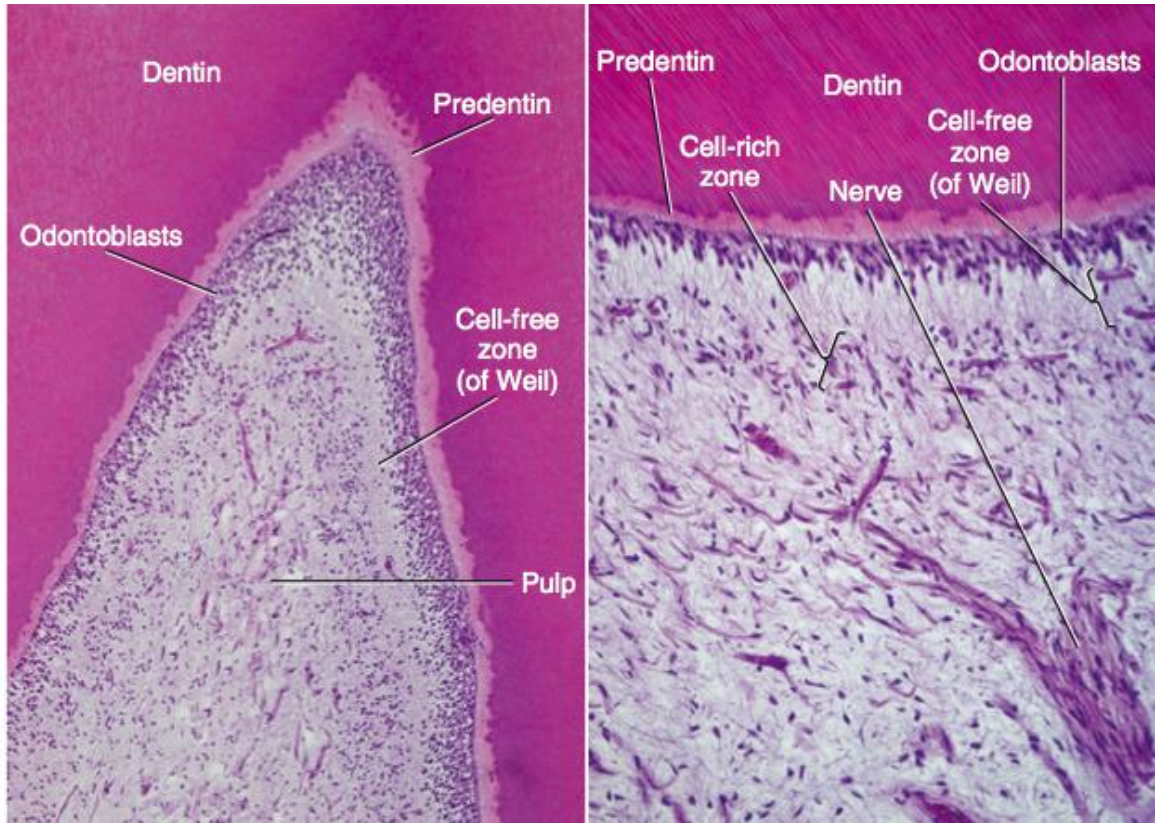
THE DENTAL PULP

PARTS OF THE TOOTH AND SURROUNDING STRUCTURES



THE DENTAL PULP

- It is the soft tissue component of the tooth that occupies its internal cavities
- Origin: mesenchyme
- Includes:
  - **Odontoblasts** responsible for dentin formation
  - **Nerves** and **blood vessels** responsible for the nourishment and sensory function



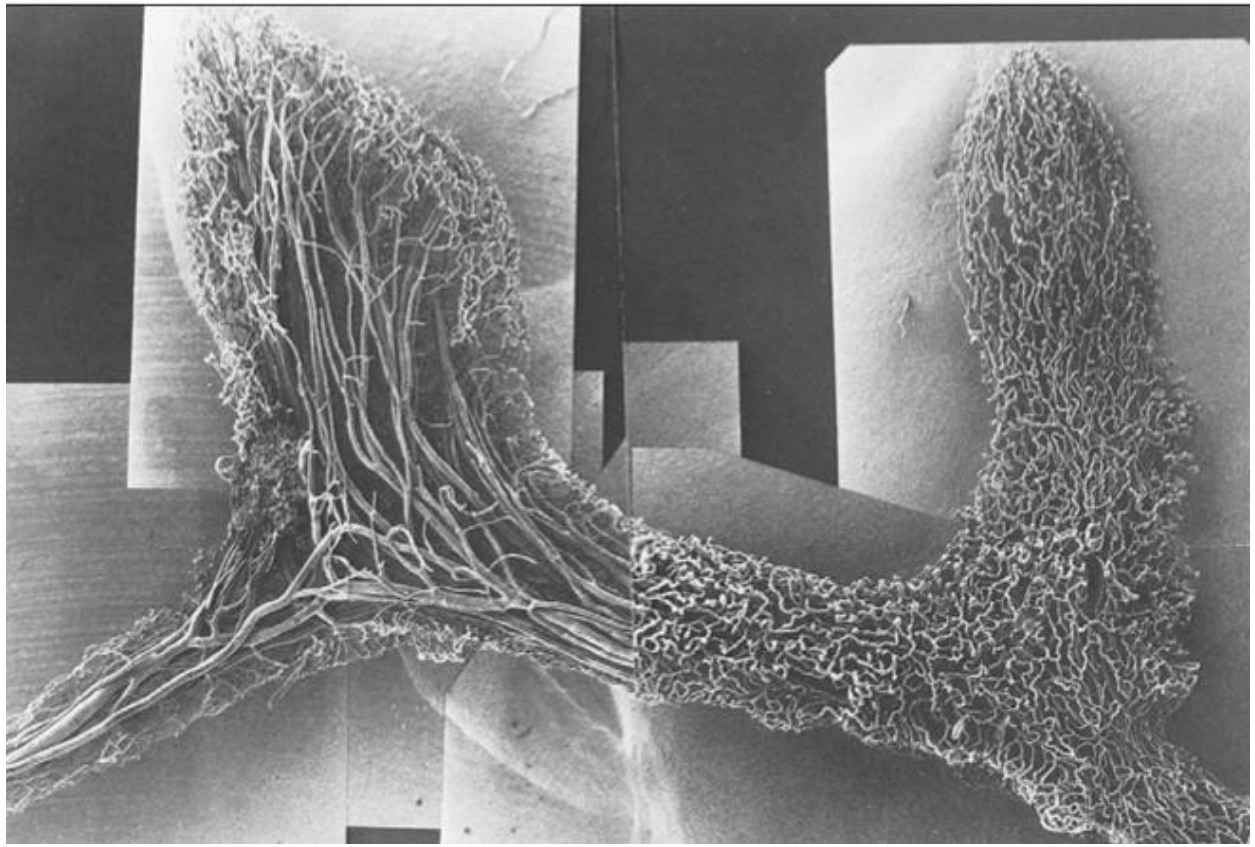
* Slide courtesy of DR SUSAN SOTELO

THE DENTAL PULP

LOOK!

The dental pulp is the reason the tooth is alive. This image shows the vasculature of the dental pulp, from the main branch (left) to the peripheral branches.

Notice how highly vascularized the pulp is?



* Slide courtesy of DR SUSAN SOTELO

FUNCTIONS

- Formative
  - Primary function: formation of dentin through odontoblasts
- Defensive
  - Formation of secondary or reparative dentin as a response to irritation (mechanical, thermal, chemical or bacterial)
- Sensory
  - Complex sensory system is responsible for mediation of the sensation of pain and control blood flow
- Nutritive
  - Keeps the organic components of the adjacent mineralized tissues moist and nourished

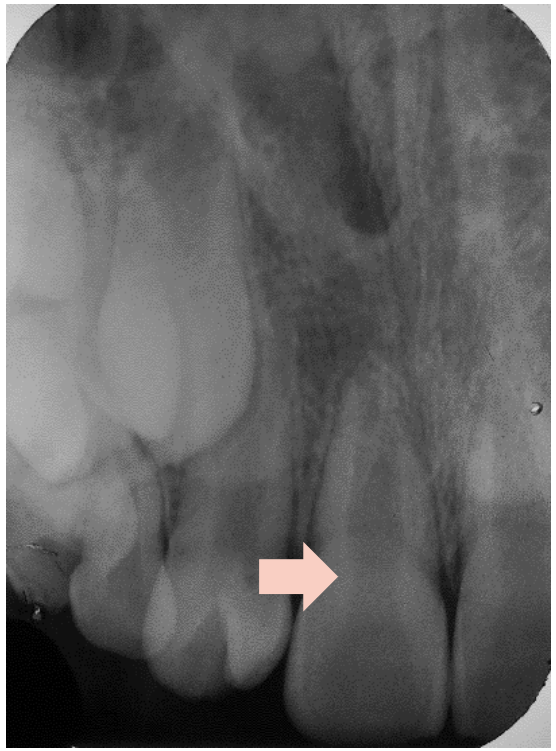
THE PULP CAVITY

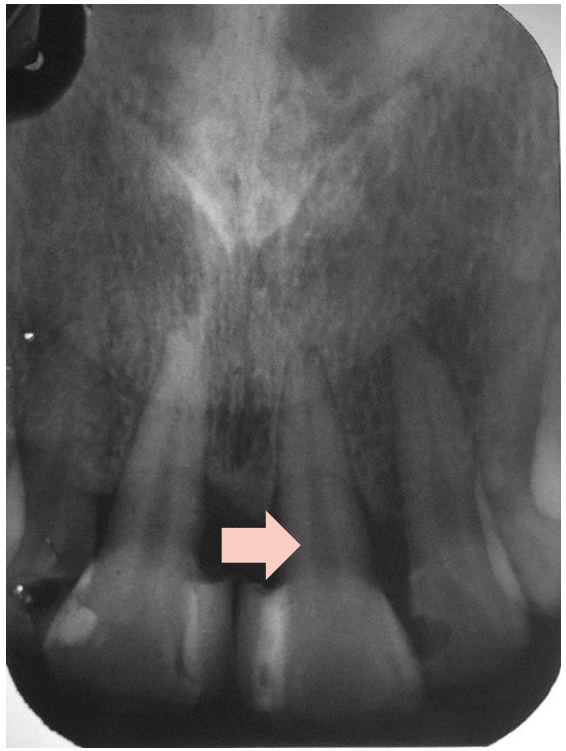
PULP CAVITY

- Cavity in the central portion of the tooth containing the pulp
- Outline is dependent on the external outline of the tooth

PULP CAVITY

- Size is dependent on
  - Age of tooth
    - Secondary dentin is formed throughout life as long as tooth is vital
    - Larger in younger individuals

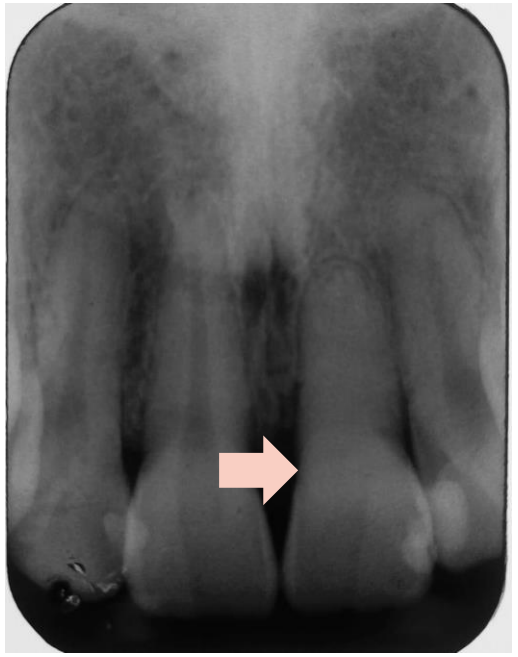




LOOK!
Compare the pulp chamber on the left vs on the right. The left picture is from a 9 y/o patient while the right is from a 40 y/o patient. See the difference in the size of the chambers?

PULP CAVITY

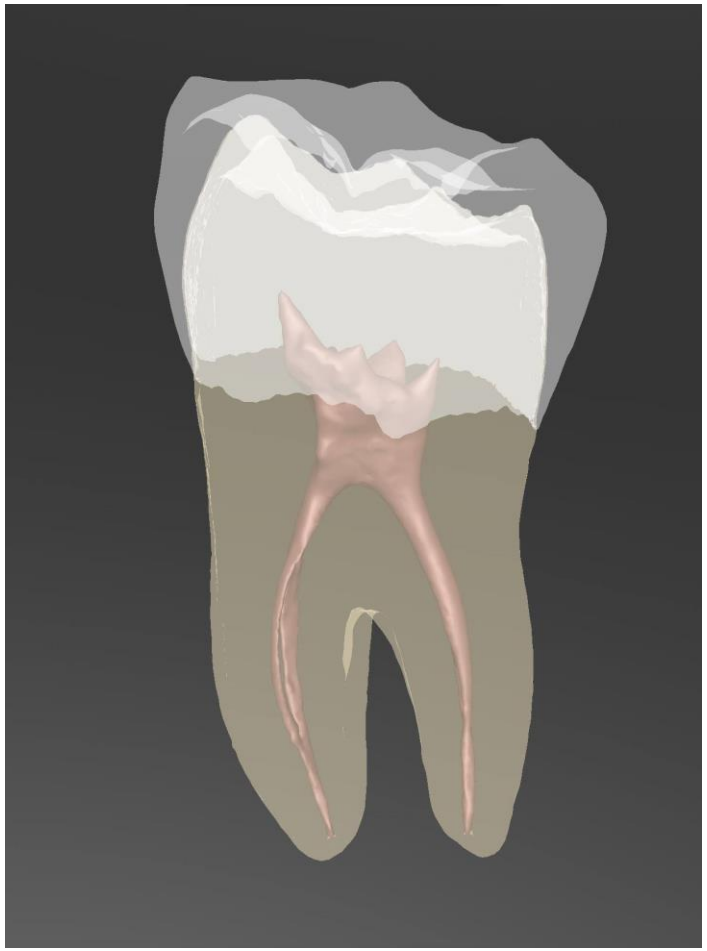
- Size is dependent on
  - History of trauma
    - Irritation or reparative dentin is formed as a response to certain stimulus
    - Limits the space of the pulp



LOOK!
Notice how the pulp cavity on the left picture is right below the radiolucency. As a response to the bacterial invasion, the pulp shrunk. Compare to the lack of the pulp cavity on the picture on the right. Tooth had a history of trauma that resulted in the complete obliteration of the pulp cavity.

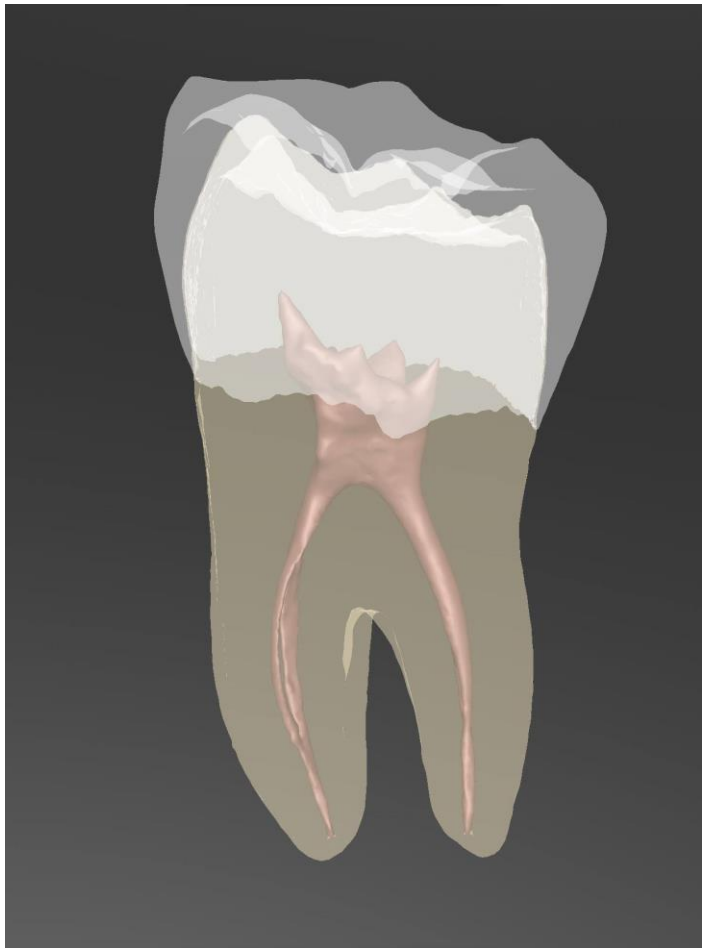
DIVISIONS OF THE PULP CAVITY

- Pulp chamber – shape of crown
  - Roof
  - Floor
  - Walls
  - Horn – projections in the roof of the pulp chamber

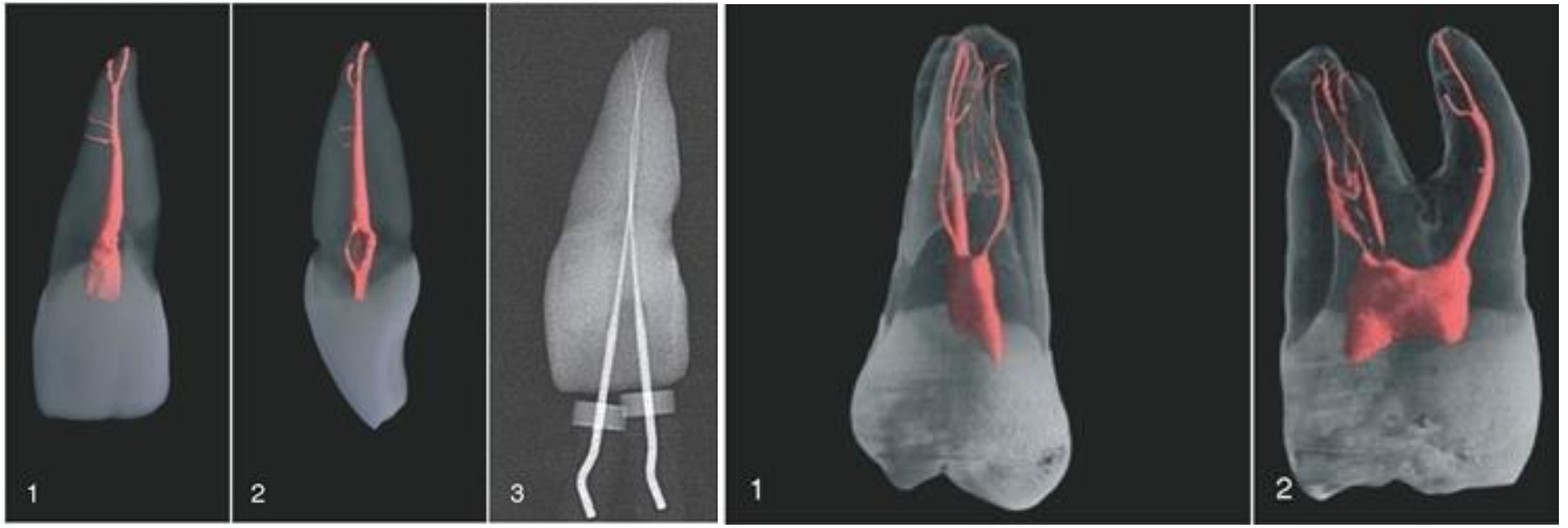


DIVISIONS OF THE PULP CAVITY

- Root canal – shape of roots
  - Orifice – entrance to the root canal
  - Apical foramen – terminal end of the pulpal space
  - Lateral/accessory canals – canals that branch off from the main root canal

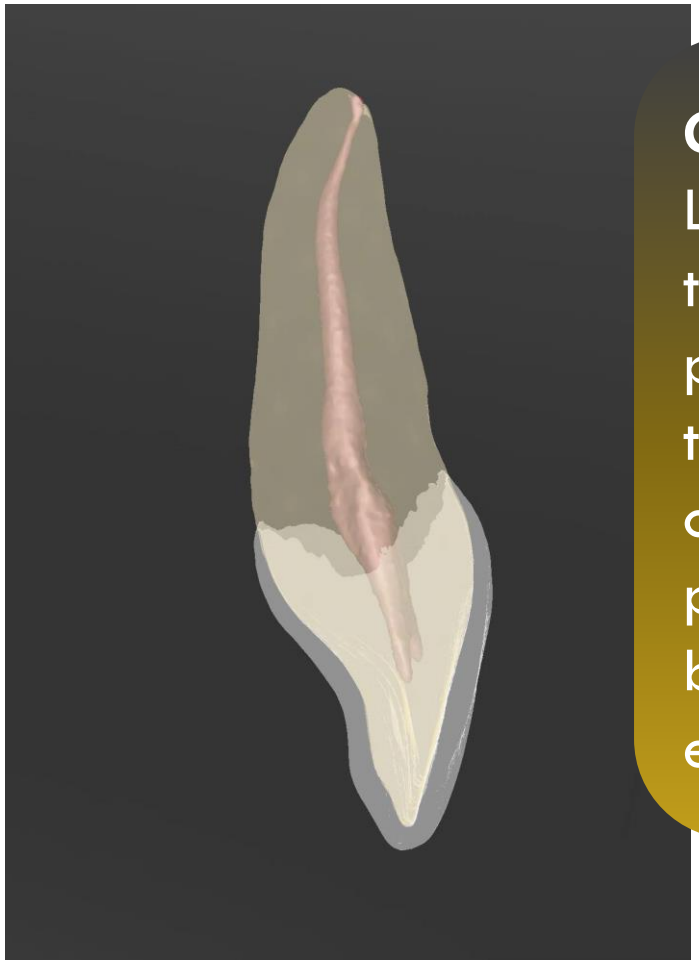


LATERAL OR ACCESSORY CANALS



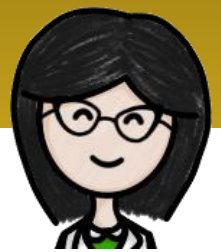
* image taken from WHEELER'S

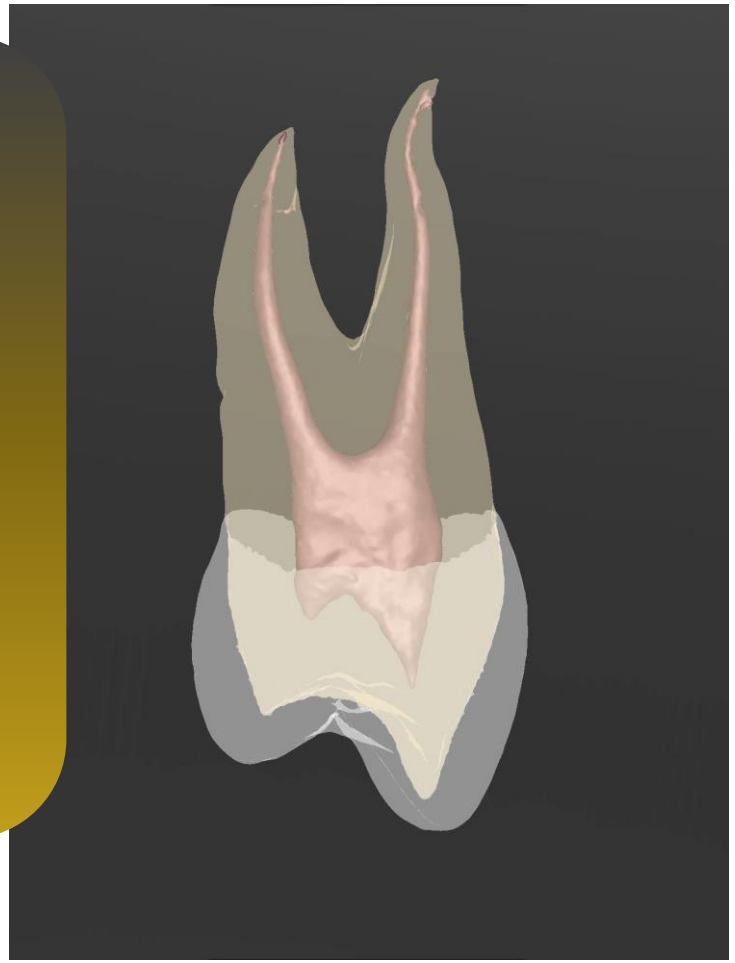
DEMARCATION OF PULP CHAMBER AND CANAL



OBSERVE

Look at the transition of chamber to canal on the central vs the premolar. There is no definite transition from chamber to canal on the central as oppose to the premolar where the chamber breaks off into the pulp canals of each root.





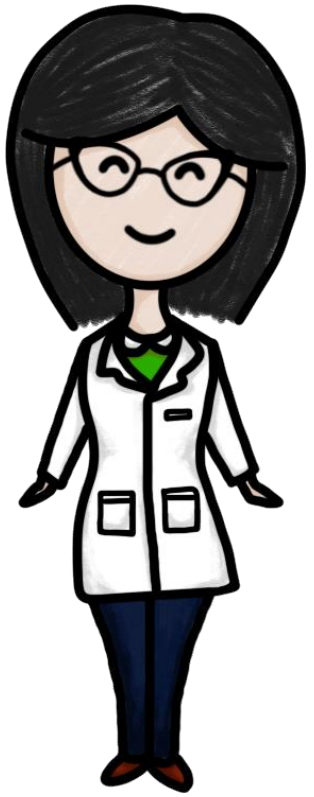
RADIOGRAPHS

- Three-dimensional object is compressed in a two-dimensional image
- Bucco-lingual aspect only

CLASSIFICATIONS OF ROOT CANAL MORPHOLOGY

CLASSIFICATIONS OF ROOT CANAL MORPHOLOGY

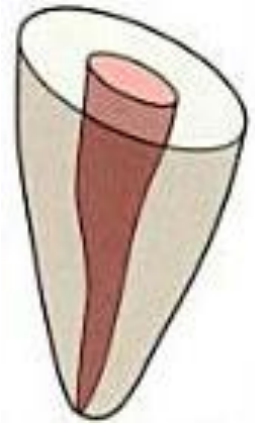
The two classifications shown here are not the only classifications for root canal morphology. However, these are the ones that are being taught in your higher subjects.



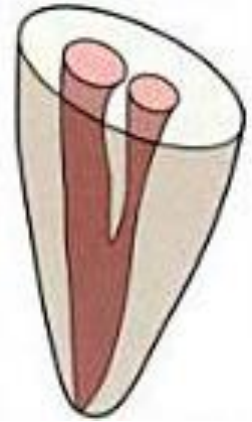
It is not yet critical that you memorize everything. But I want you to appreciate the fact that with root canals,
what you see, is not always what you get.

WEINE'S CLASSIFICATION

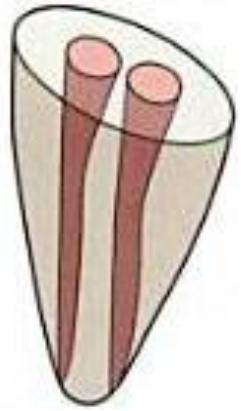
- **Type I (1-1)**
  - One orifice
  - One root canal
  - One apical foramen



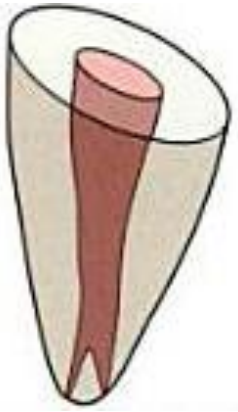
- **Type II (2-1)**
  - Two orifices
  - Two root canals
  - One apical foramen



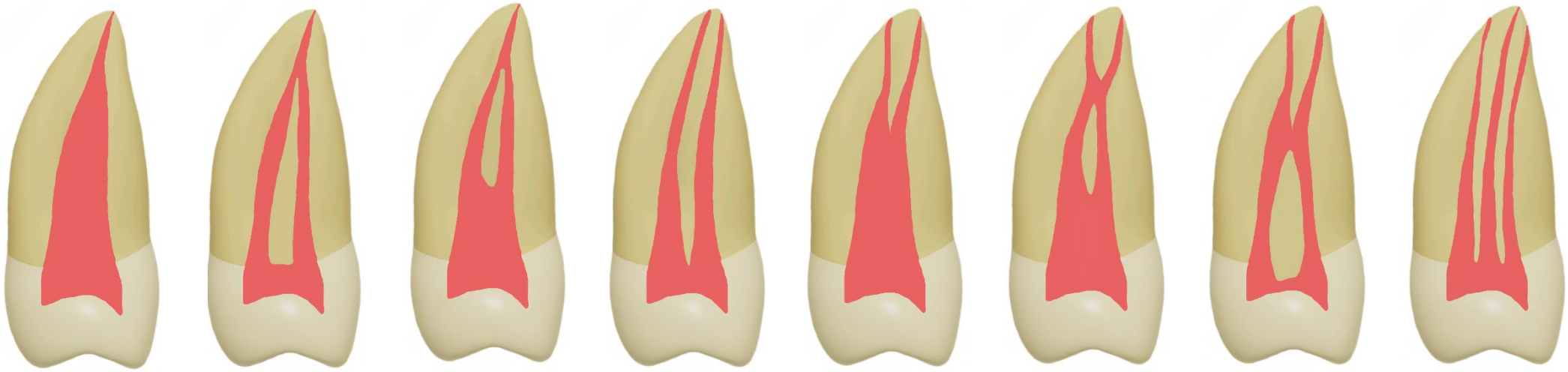
- **Type III (2-2)**
  - Two orifices
  - Two root canals
  - Two apical foramina



- **Type IV (1-2)**
  - One orifice
  - Two root canals
  - Two apical foramina



VERTUCCI'S CLASSIFICATION



Type I Type II Type III Type IV Type V Type VI Type VII Type VIII

A
One canal at apex

B
Two canals at apex

C
Three canals at apex

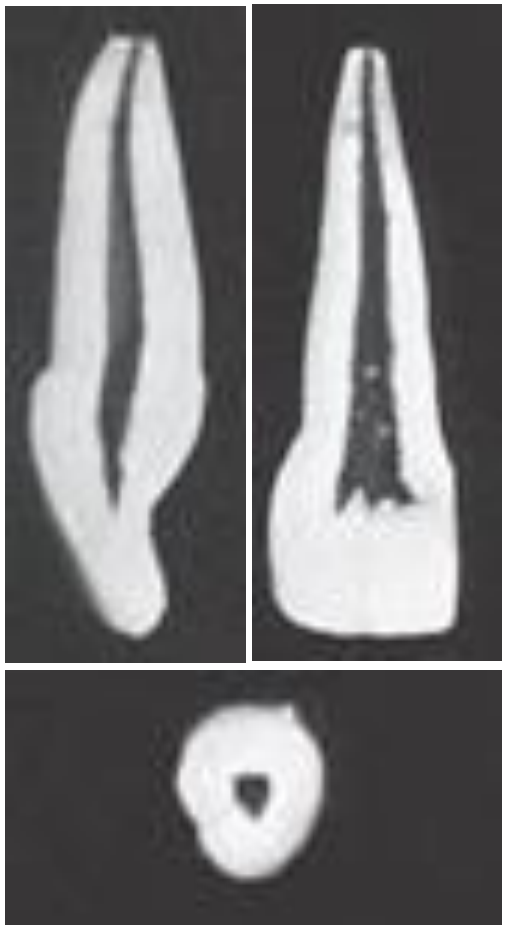
PULP CAVITIES OF PERMANENT TEETH

Images on the slides on this section were taken from Wheeler's and Woelfel

MAXILLARY TEETH

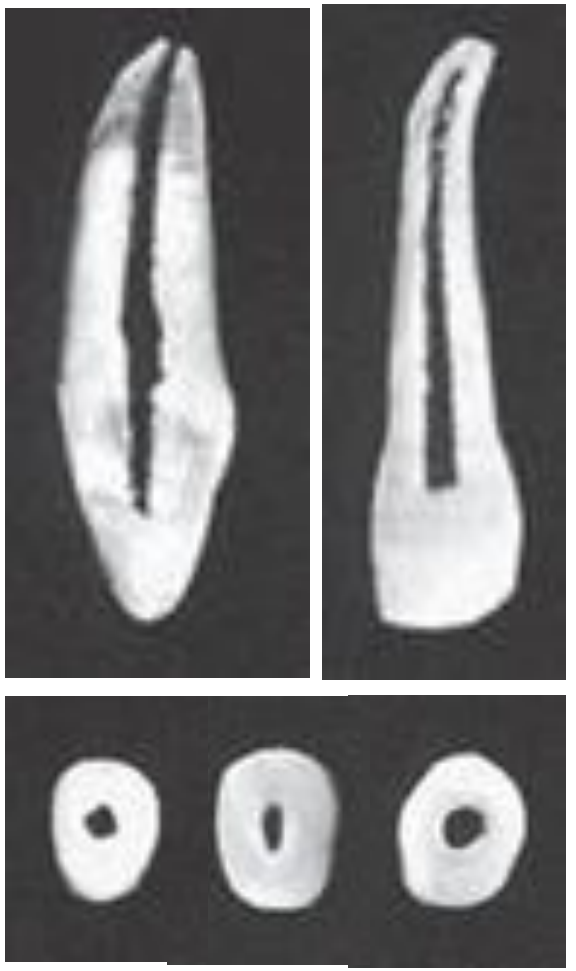
MAXILLARY CENTRAL

- Sometimes the chamber is partially or completely obliterated by secondary or tertiary dentin
- Gradually tapers from the cervical to the apical
- Usually a **Type 1** configuration
- Exit is slightly off center or deviate drastically from the tip
- Has a **triangular** outline form at the cervical level



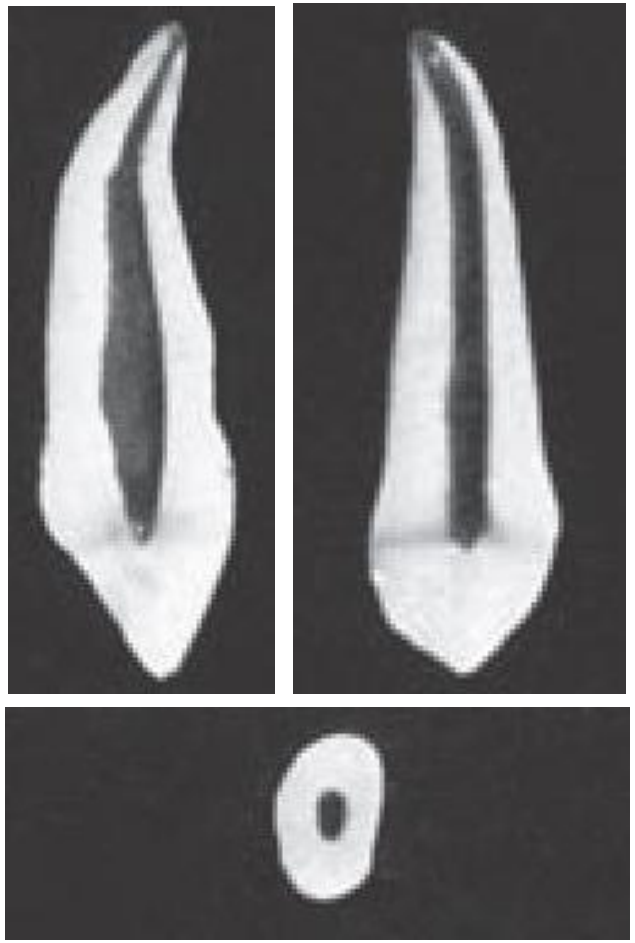
MAXILLARY LATERAL

- Anatomy is similar to centrals
- Chamber and root canal gradually tapers toward the apex which often demonstrates a curve in the apical region
- Usually a Type I configuration
- Outline form of the root is triangular, oval or round



MAXILLARY CANINE

- May have **the largest pulp chamber** in the mouth because of the size of the labiolingual dimension of the root
- Has the **longest root**
- Some canines possess a severe curve at the apical region
- Usually a Type I configuration
- Outline form is **oval, triangular, or elliptical**

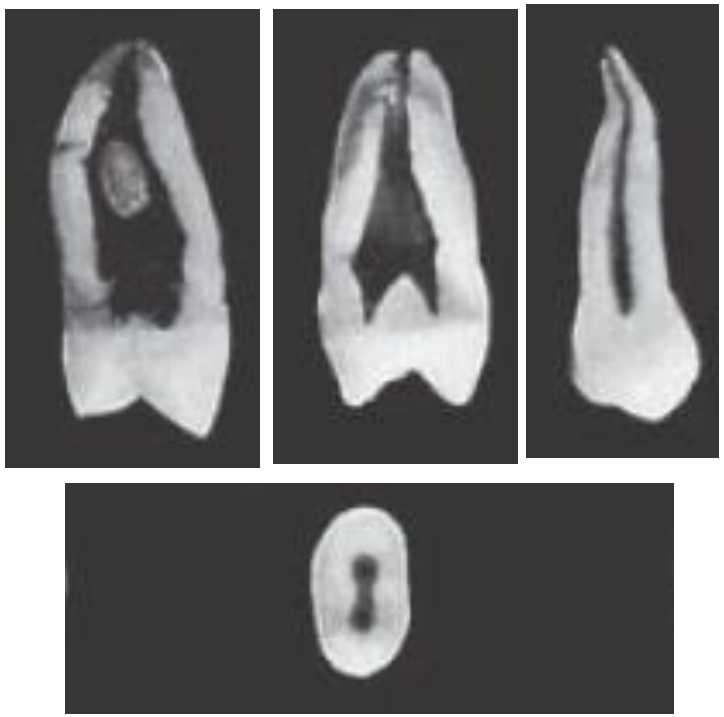


MAXILLARY FIRST PREMOLAR

- The **buccal pulp horn is usually longer** than the lingual pulp horn
- Has two well-developed roots or two separate projections not fully separated or 1 broad root
- The chamber floor is below the cervical level
- Can be a Type I, II or III but majority is a Type I
- Outline form is **kidney-shaped**

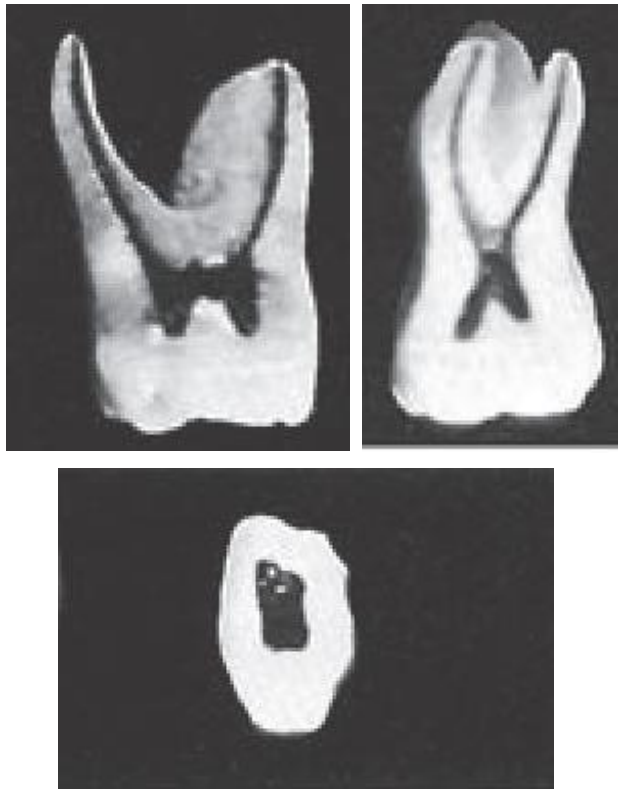
MAXILLARY SECOND PREMOLAR

- Usually have only one root and one canal (Type I) but Type II and III are common
- Pulp cavity abruptly narrows at the apical third
- Some have **DENTINAL ISLANDS** in the apical third
- Some bifurcate at the apical third
- Buccal and lingual pulpal projections or **FINS** may be present at the level of the CEJ instead of a constriction
- Outline form is usually **oval**, some are **kidney-shaped**



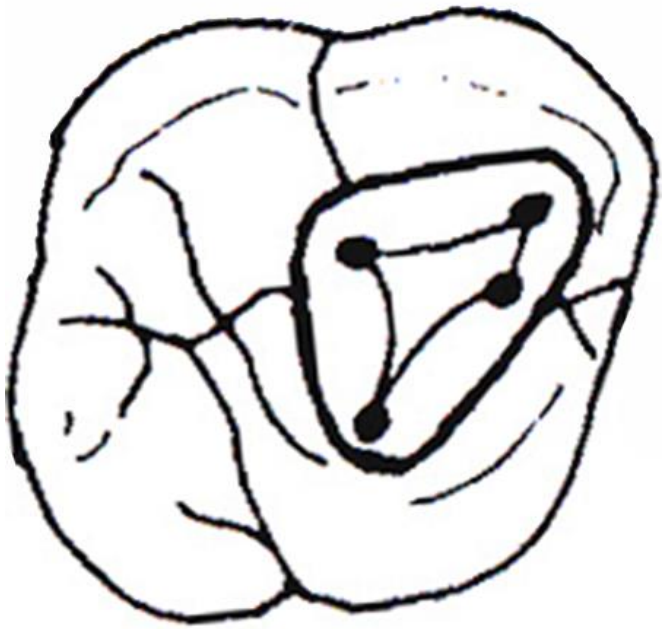
MAXILLARY FIRST MOLAR

- Impossible to remove the entire pulp because of the **complexity** of the root canal system
- 3 roots, 3 canals
- Root canal dimension: **P > DB > MB**
- Palatal root and canal usually curves to the buccal at the apical third
- MB root is usually wide buccolingually and often possess an accessory canal (Type III)
- Outline form is usually **rhomboidal** at the cervical



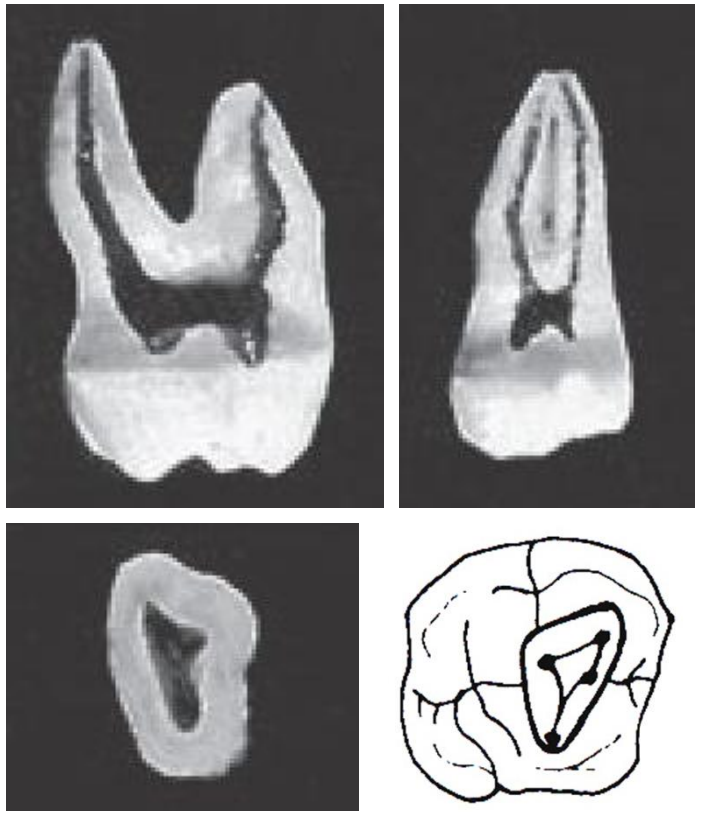
MAXILLARY FIRST MOLAR

- Orifices form a triangular pattern
  - P: centered lingually, beneath the MLC
  - MB: slightly mesial and beneath MBC (extreme corner)
  - MB accessory: palatal to MB
  - DB: near the angle formed by the buccal and distal walls of the chamber



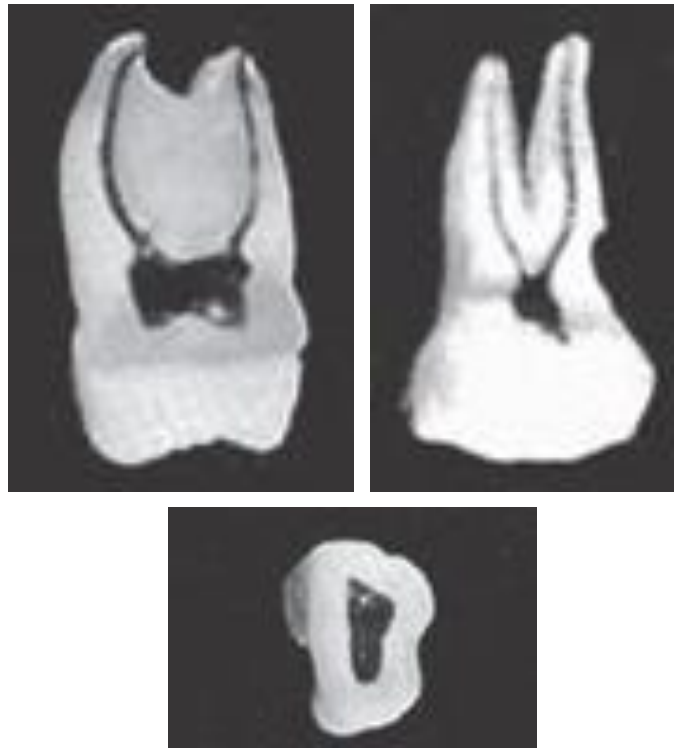
MAXILLARY SECOND MOLAR

- Buccal roots are straighter with a **tendency for root fusion**
- MB canal is not very wide but still has a tendency for 2 canals
- Root curvature: MB pulp canal > DB pulp canal
- Usually has 3 roots and 3 canals (Type I)
- Orifices are closer together due to tendency of fusion



MAXILLARY THIRD MOLAR

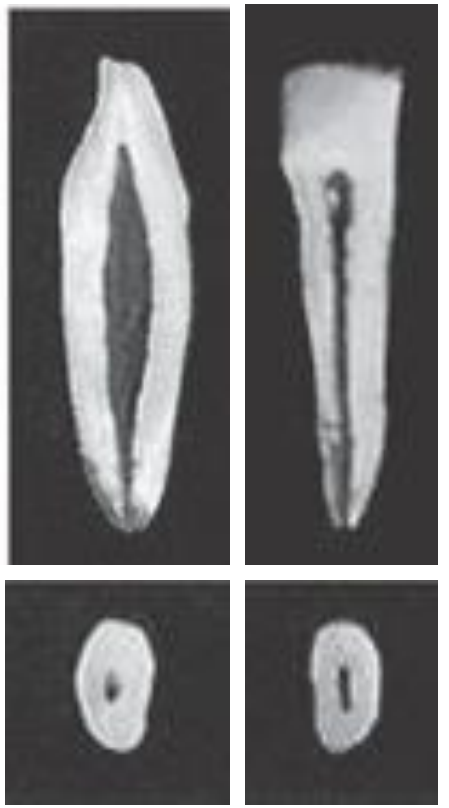
- Has the most variable anatomy among maxillary teeth
- Pulp chamber is usually large due to lesser secondary dentin
- Higher incidence for root malformation



MANDIBULAR TEETH

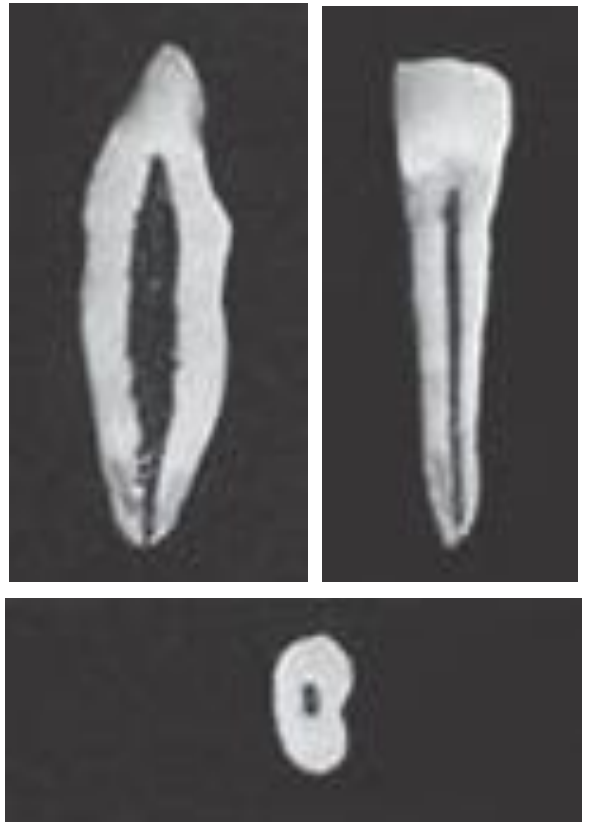
MANDIBULAR CENTRAL

- Smallest tooth
- Usually with 1 canal but 2 canals are frequent
- Secondary or tertiary dentin formation may interfere with endodontic treatment
- Tapers gradually to the apex or sometimes narrow abruptly labiolingually 3-4mm from the apex
- Dentinal islands may be present
- Outline form is **round, oval or elliptical**



MANDIBULAR LATERAL

- Identical to central but slightly larger
- Usually Type I but Type II is frequent
- Outline form is oval to elliptical, similar to mandibular canines



MANDIBULAR CANINE

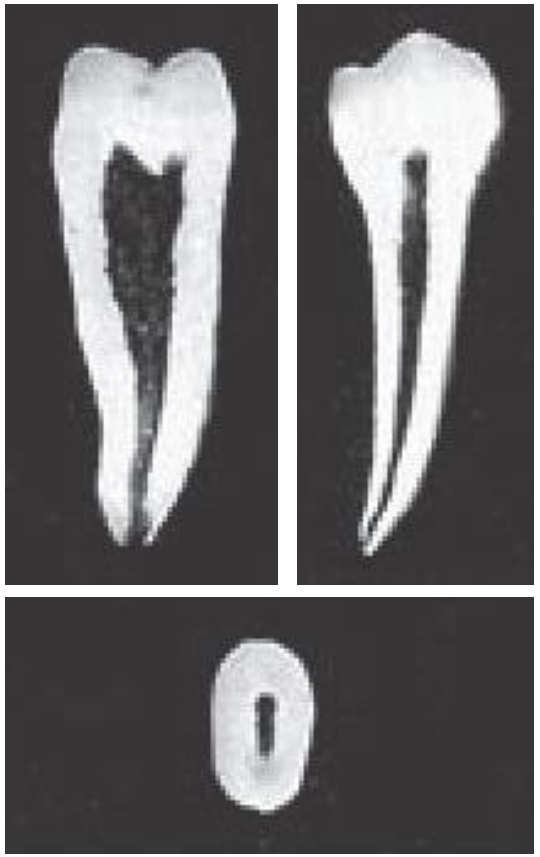
- Pulp cavity is similar in size and shape to maxillary canine
- Usually 1 root but **2 roots or 2 canals are not uncommon**
- Presence of 2 canals is hard to detect radiographically and must therefore be ruled clinically
- Dentinal islands are possible for those with wide labiolingual dimension
- Root canal curves to the mesial at the apical
- Outline form is **oval or triangular**

MANDIBULAR FIRST PREMOLAR

- Similar to mandibular canine
- Majority has 1 canal but 2 canals are possible
- Buccal pulp horn may be prominent, **lingual pulp horn is small to non-existent**
- Access preparation is along the long axis of the tooth (**towards the cusp**) similar to mandibular canine
- Outline form is **oval, rectangular or triangular**

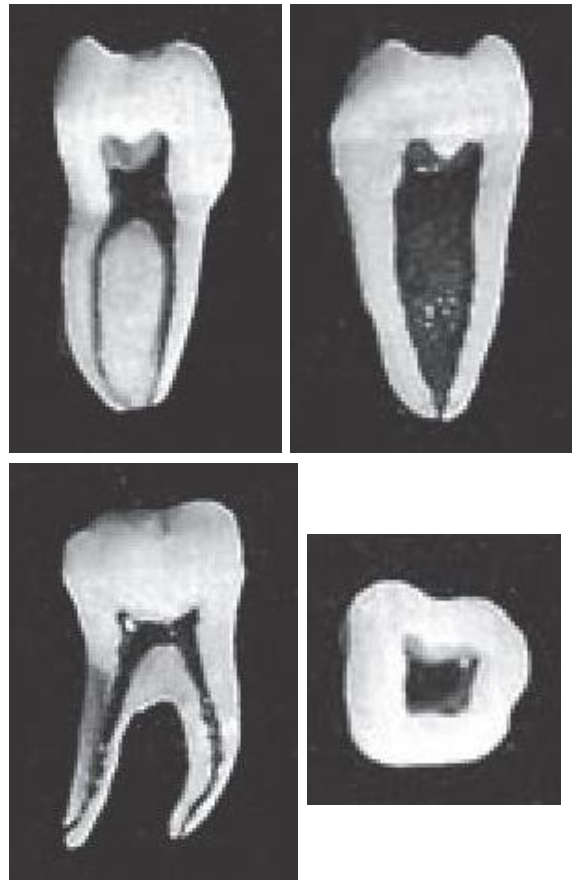
MANDIBULAR SECOND PREMOLAR

- Bigger than 1st premolar; pulp horns are more prominent
- Access preparation is similar to mandibular 1st premolar but more **perpendicular to the occlusal** surface
- Usually 1 root, 1 canal
- Root sometimes curves to the distal
- Outline form is **rectangular, oval or triangular**



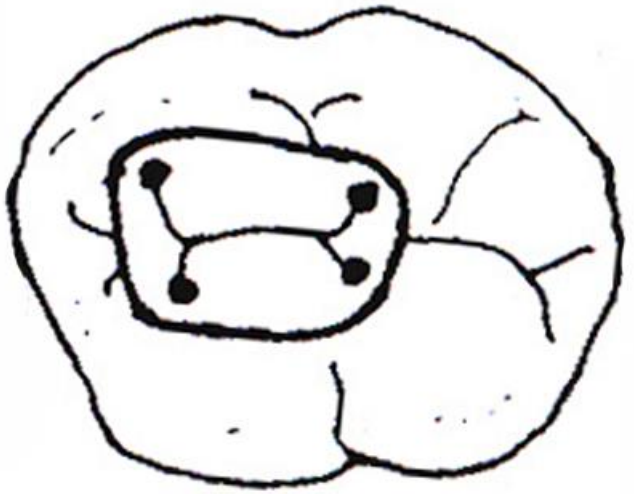
MANDIBULAR FIRST MOLAR

- Usually 2 roots with 3 or 4 canals (2 canals on M root, 1-2 canals on D root)
- 4th canal on a 3rd root is possible
- Mesial canals may be severely curved
- Type II is possible on M root
- Distal root is larger, straighter and shorter and exit on the distal aspect of the root



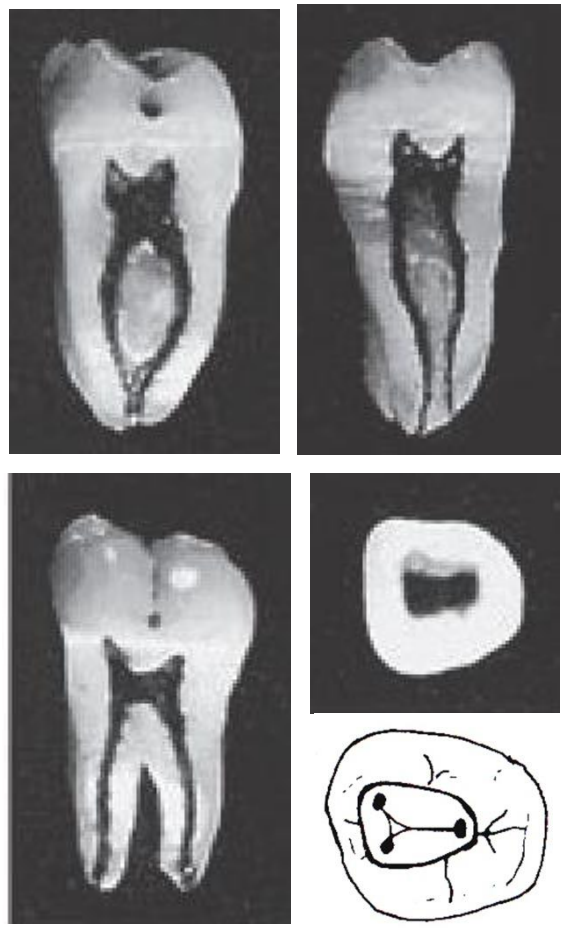
MANDIBULAR FIRST MOLAR

- Orifices form a rectangular pattern:
  - MB: slightly mesial and close to MB cusp tip
  - ML: lingual to MDG of MMR, more central location
  - D: usually large orifice, just distal to the center of the crown



MANDIBULAR SECOND MOLAR

- Usually has 2 roots with 3 canals (2 canals on M root, 1 canal on D root)
- Mesial canals are either Type II or III
- Roots tend to be straighter and closer together
- Orifices form a **triangular** pattern due to smaller dimensions



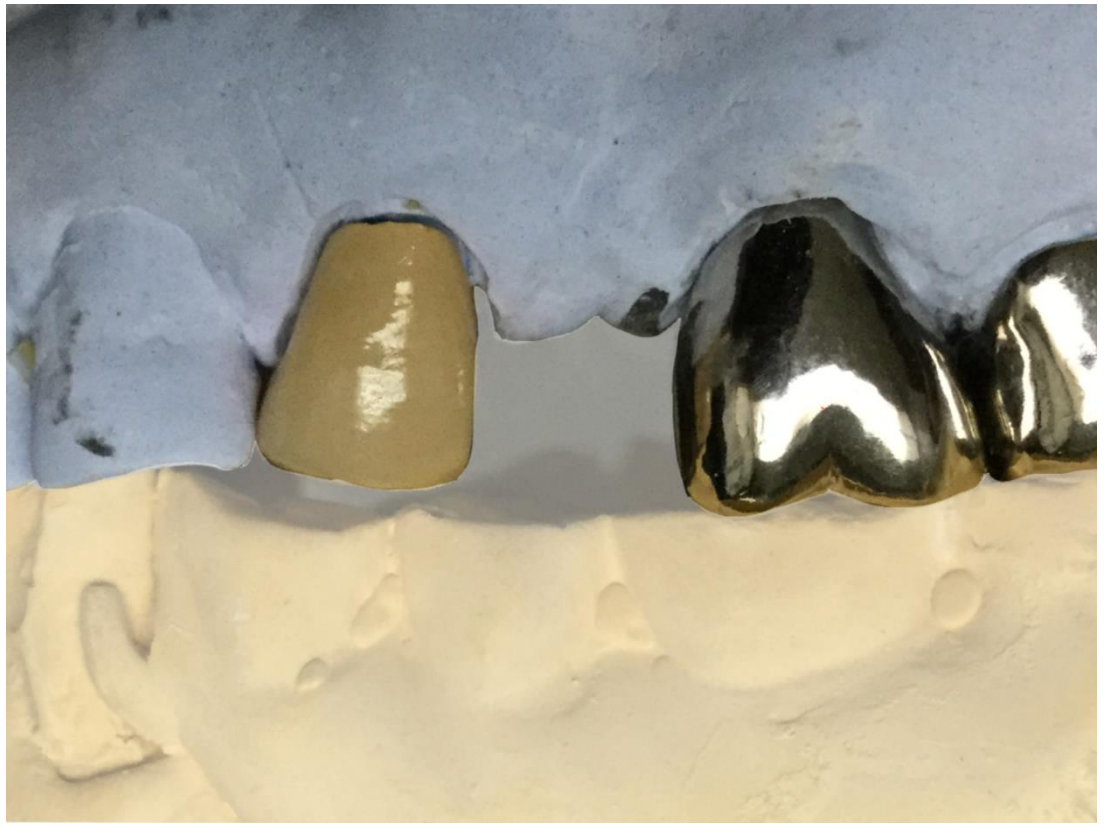
MANDIBULAR THIRD MOLAR

- Crown looks too large for root
- Similar to mandibular second molar
- Not much restorative value due to short roots
- Sometimes 1 root with 2 canals

CLINICAL APPLICATIONS

OPERATIVE DENTISTRY

Aspect of dentistry that is involved in the prevention and treatment of defects in the enamel and dentin of individual teeth



OPERATIVE DENTISTRY

"It is also essential that the clinician be aware of the location and the size of pulp cavities during operative procedures to prevent unnecessary encroachment on the pulp."

- Dr Stanley J. Nelson

OPERATIVE DENTISTRY

IMAGINE THIS…

A patient comes to you complaining of sensitivity on her molar tooth. You then proceed to examine the tooth. You find out that there's a huge cavity.

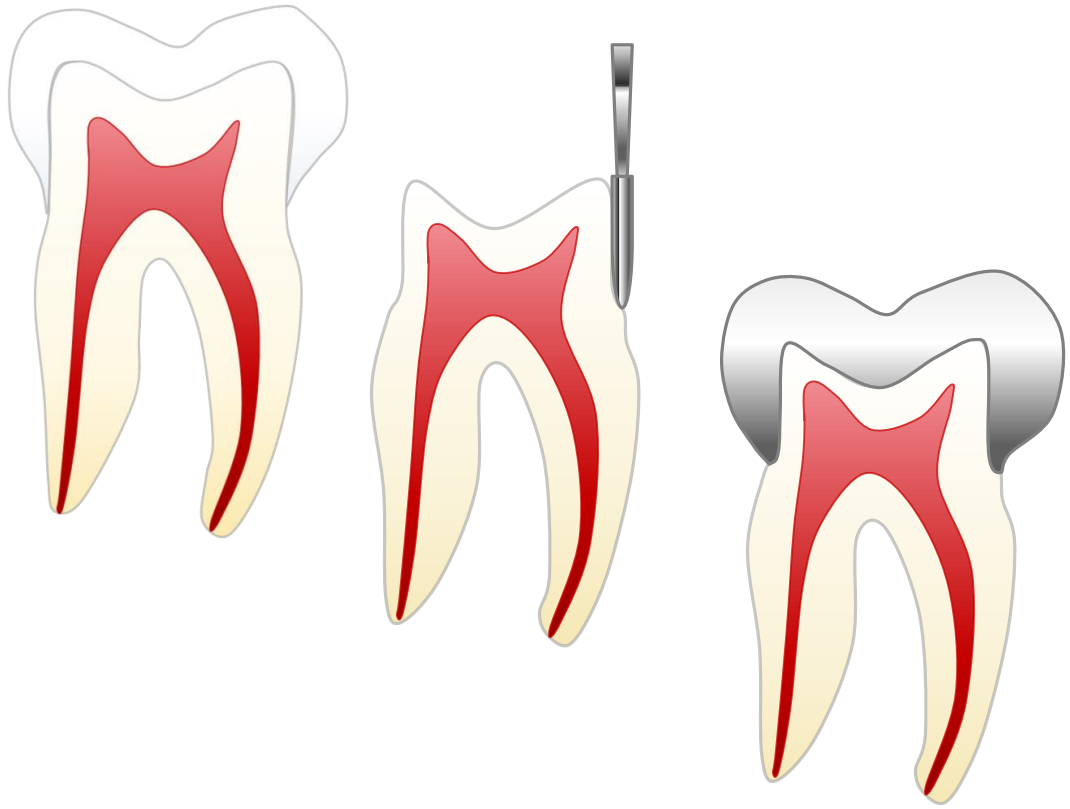
After determining that the tooth can be restored without removing the pulp, you must prepare the tooth in a way that you will not damage or disturb the pulp. It is essential that you know where to expect the chamber to be so that you can avoid perforating it while trying to restore the tooth.

It is better if you can take a radiograph but there will be instances that the patient will not agree to having a radiograph taken. So your knowledge of the anatomy of the pulp will help you complete your task successfully.

OPERATIVE DENTISTRY

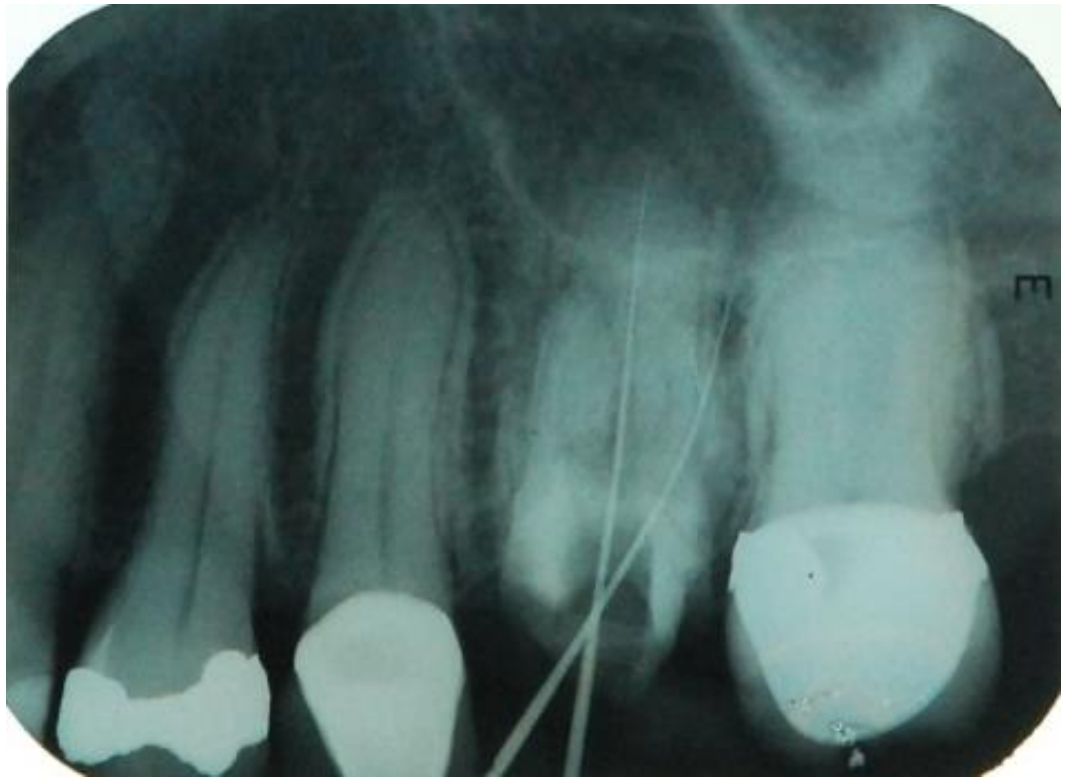
IMAGINE THIS…

When you're preparing the tooth for a crown, you will be grinding tooth structure extensively. You must proceed cautiously when doing your crown preparations so as not to encroach on the pulp chamber.



ENDODONTICS

Is the branch of dentistry that deals with the etiology, diagnosis, treatment planning and prognosis of pulpal and periapical diseases.

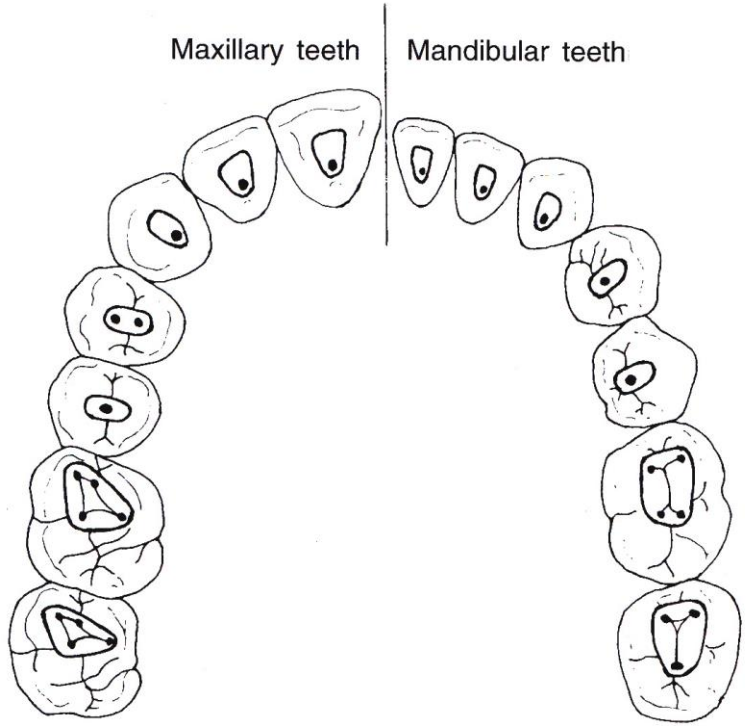


ENDODONTICS

What you need to know

- ❑ Average length of the tooth
- ❑ Location, size and shape of the pulp chamber
- ❑ Location and types of canal
- ❑ Canal curvatures
- ❑ Canal constrictions
- ❑ Presence of lateral and accessory canals
- ❑ Location of apical foramen/foramina

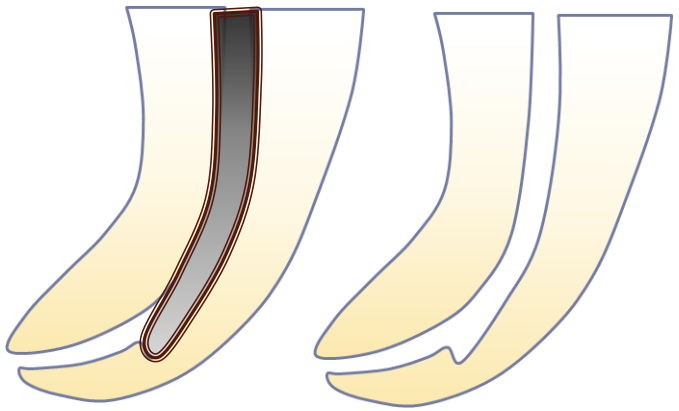
Endodontic Access Openings



ENDODONTIC ERRORS

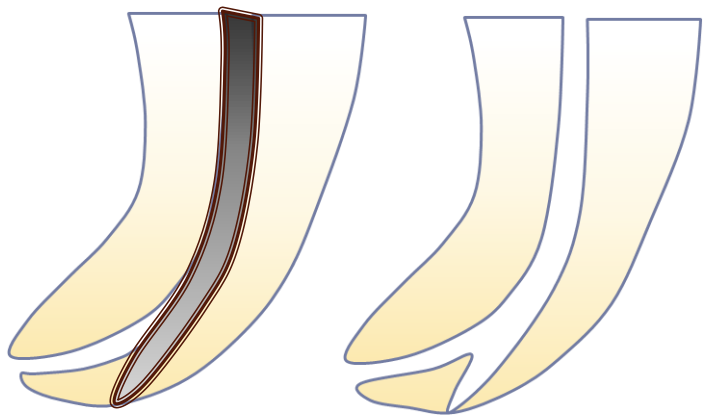
Ledges

- Steps created on the dentinal wall



Apical Transportation

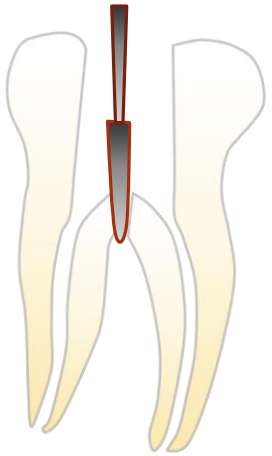
- Moving the position of the canal's physiologic terminus to a new iatrogenic location



ENDODONTIC ERRORS

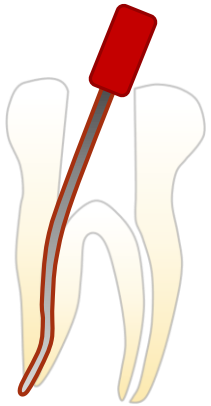
Perforation

- Creation of an artificial opening from the pulp cavity toward the periodontium



Overinstrumentation

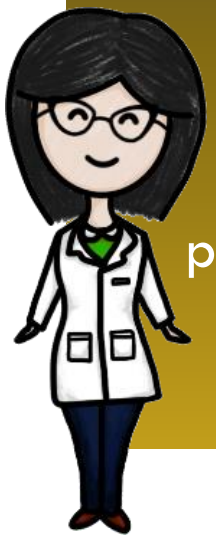
- Perforation beyond the apical foramen resulting in the widening or obliteration of the minor constriction



PERFORATION

OBSERVE…

Look at where the arrow is pointing at. Notice how the gutta percha (radiopaque structure) doesn't seem to follow the shape of the mesial root?



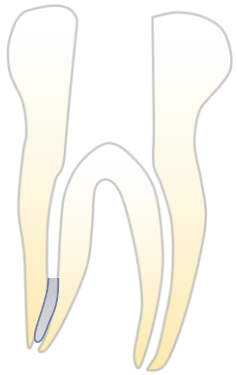
I referred this case to Dr Tina Morales, an endodontist. Upon examination, she found a perforation on the mesiobuccal orifice near the furcation area. Fortunately, the tooth was still saved and the perforation was plugged.

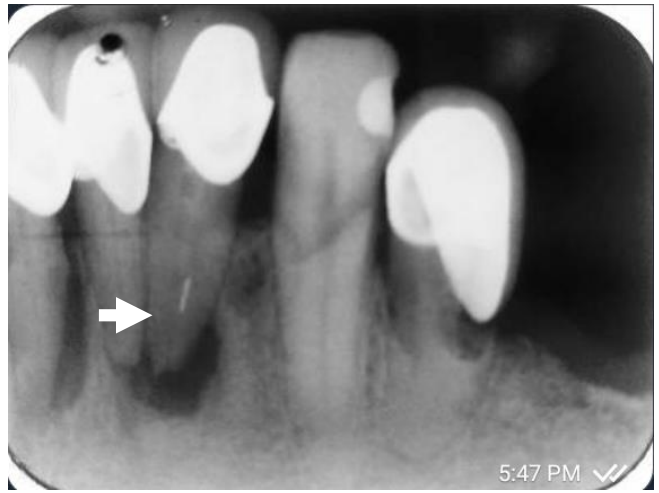
Case managed by Dr Tina Morales

ENDODONTIC ERRORS

Broken Instrument

- Part of an endodontic instrument breaks off and gets lodged in the canal





OBSERVE

Look at the pin-like structure mid-root of tooth #32. Patient was not aware that the tooth was endodontically-treated nor that a file was broken and left in the canal. Tooth was completely asymptomatic and the condition was only discovered after a pre-operative radiograph was taken for the extraction of #34.

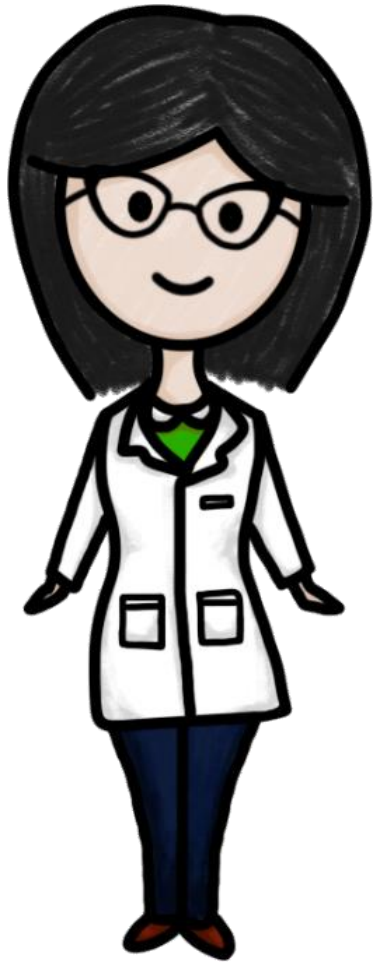
I referred this case to Dr Emabel Jugo, an endodontist. The file was retrieved and the endodontic treatment was completed successfully.

Case managed by Dr Emabel Jugo

YOU SURVIVED!

That was a lengthy topic! I'm glad you survived. Don't stress too much on this. You will encounter it again in your higher subjects. However, I do hope you still remember it by then.

One thing I'd like you to take away from this though,
when in doubt, refer.



REFERENCES

- Wheeler's Dental Anatomy, Physiology and Occlusion 10th Edition
- Dental Anatomy: Its Relevance to Dentistry 5th Edition by JB Woelfel and RC Scheid