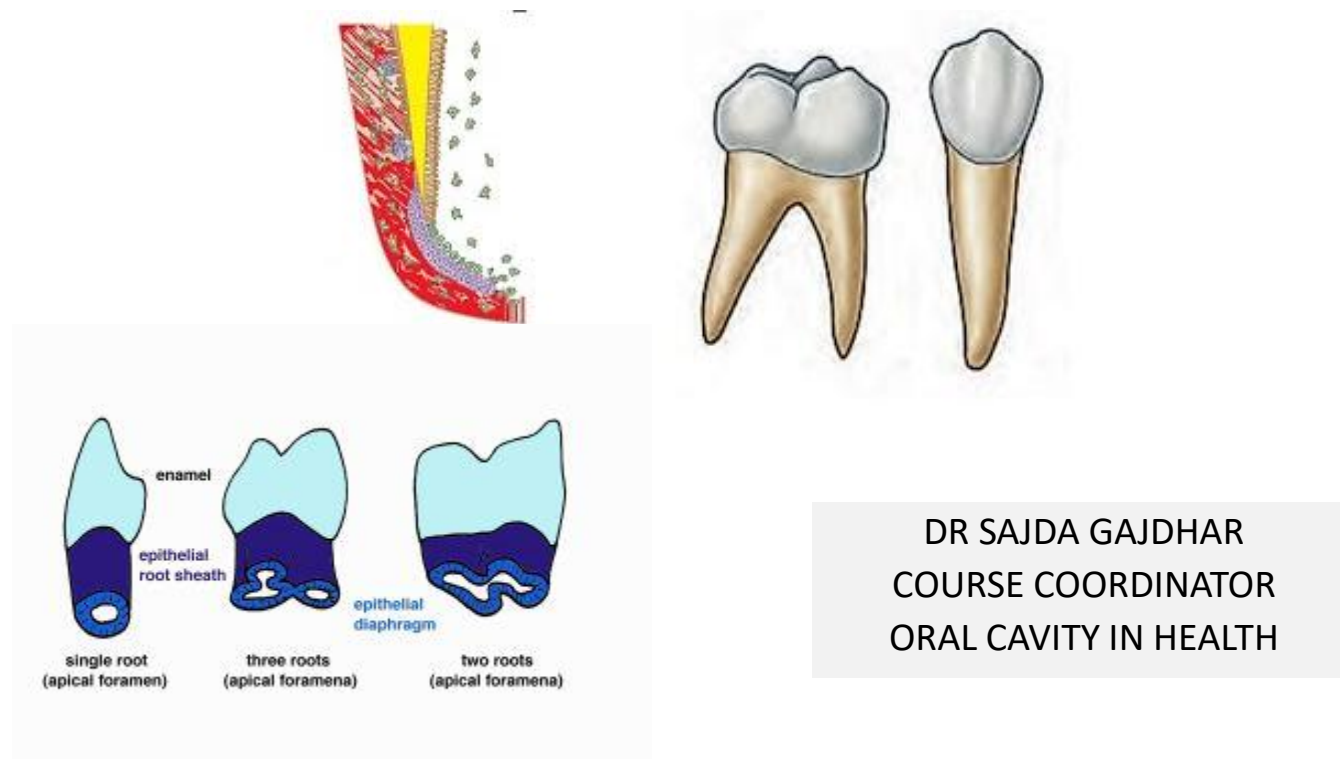


Development of tooth

Part-4

Root formation



Lecture learning outcome

By the end of this lecture, students should be able to:

1. Explain the steps in development of root
2. Describe the Hertwig Epithelial Root Sheath. (HERS)
3. Discuss the fate of HERS
4. Discuss clinical considerations

Reduced Enamel Epithelium (REE)

- After enamel formation is complete, the cells of the enamel organ (especially ameloblasts) undergo changes:
- Ameloblasts + stratum intermedium + stellate reticulum + outer enamel epithelium all collapse and flatten.
- These layers fuse together → forming a thin membrane = Reduced Enamel Epithelium.
- It Protects the enamel from **resorption** and **connective tissue invasion** before eruption.

WHEN ROOT FORMATION STARTS?

**The process of root development
takes place once the enamel
and dentin reach the future**

CEJ

Root Formation

Cervical loop

**Hertwig's epith.
root sheath**

**Odontoblast
differentiation**

Dentin formation

**Disintegration
of root sheath**

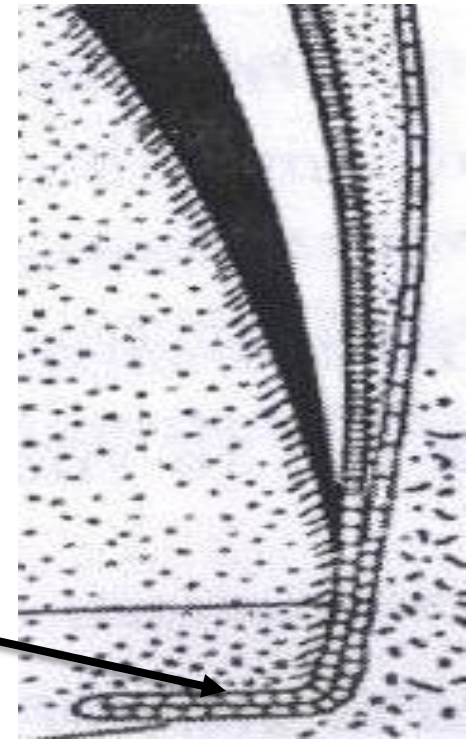
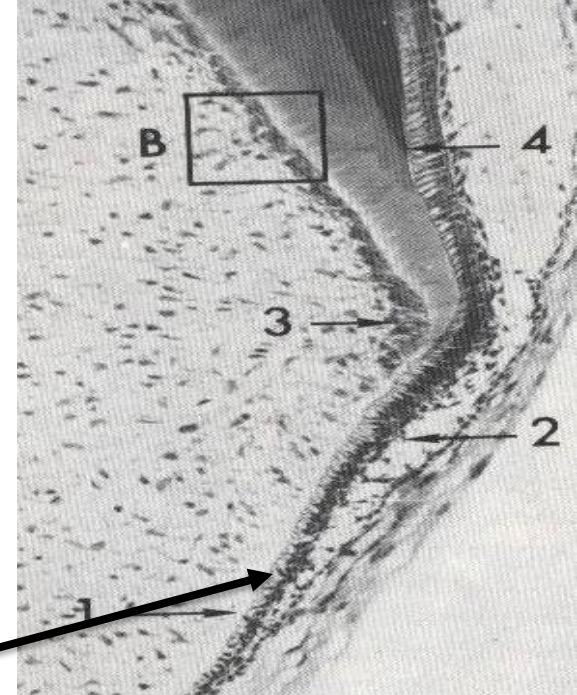
**Cementoblast
differentiation**

Root formation

1-Begins when the enamel & dentin formation reaches the future **cemento-enamel junction**.

2-The epithelial cells of inner & outer enamel epithelium proliferate from the cervical loop to form a double epith. membrane known as **Hertwig Epithelial Root Sheath. (HERS)**

3* It bends forming obtuse angle to the enamel organ at the future cemento-enamel junction to form the **epithelial diaphragm**. (that cause a primary narrowing of the apical foramen)





Function of the epithelial root sheath :

- 1- It shapes the root
- 2- Induce the dentin formation in the root area by the odontoblasts differentiated from the dental papilla

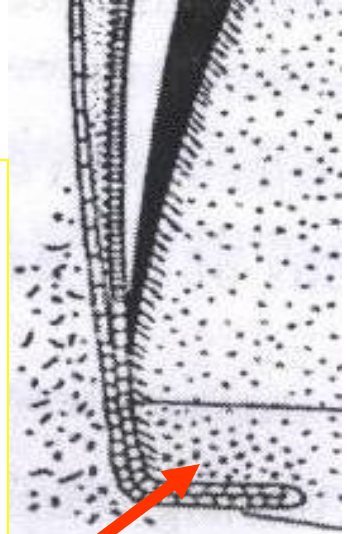
Root formation

4- The inner enamel epithelium in the **epithelial root sheath of Hertwig**, will induce undifferentiated ectomesenchymal cells of the dental papilla to differentiate into Odontoblast which form the 1st layer of **root dentin**.

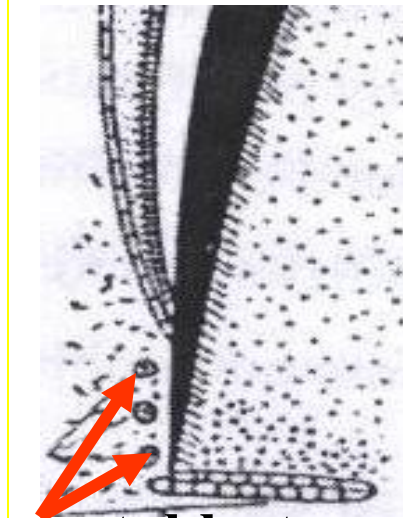
5- The Epithelial root sheath of Hertwig degenerates and their remnants are called **epithelial rests of Mallassez**

6- The formed dentin that come in contact with the dental follicle, induces the differentiation of U.M.Cs. in the dental follicle in to **cementoblasts** which lay down cementum.

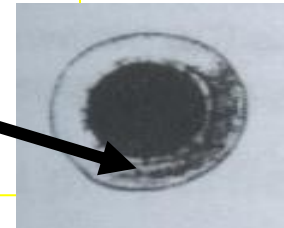
* This occurs in the formation of single rooted tooth.



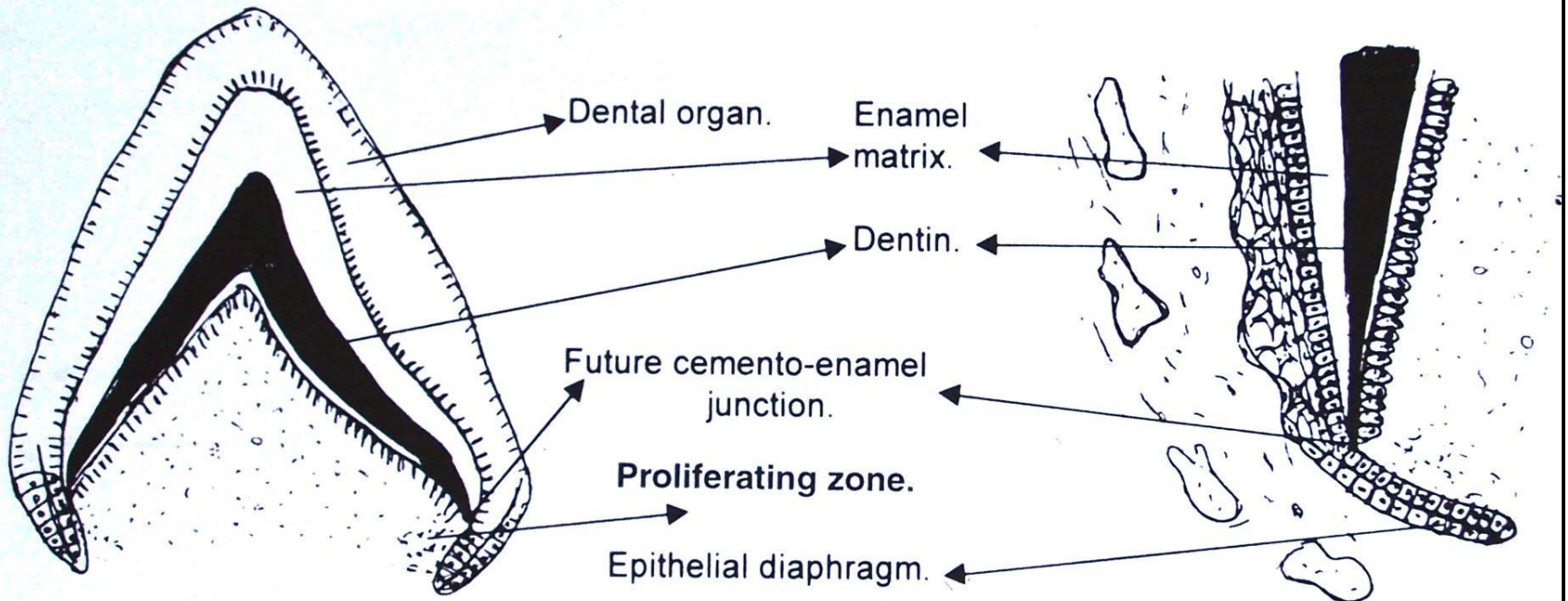
Proliferation zone



cementoblasts



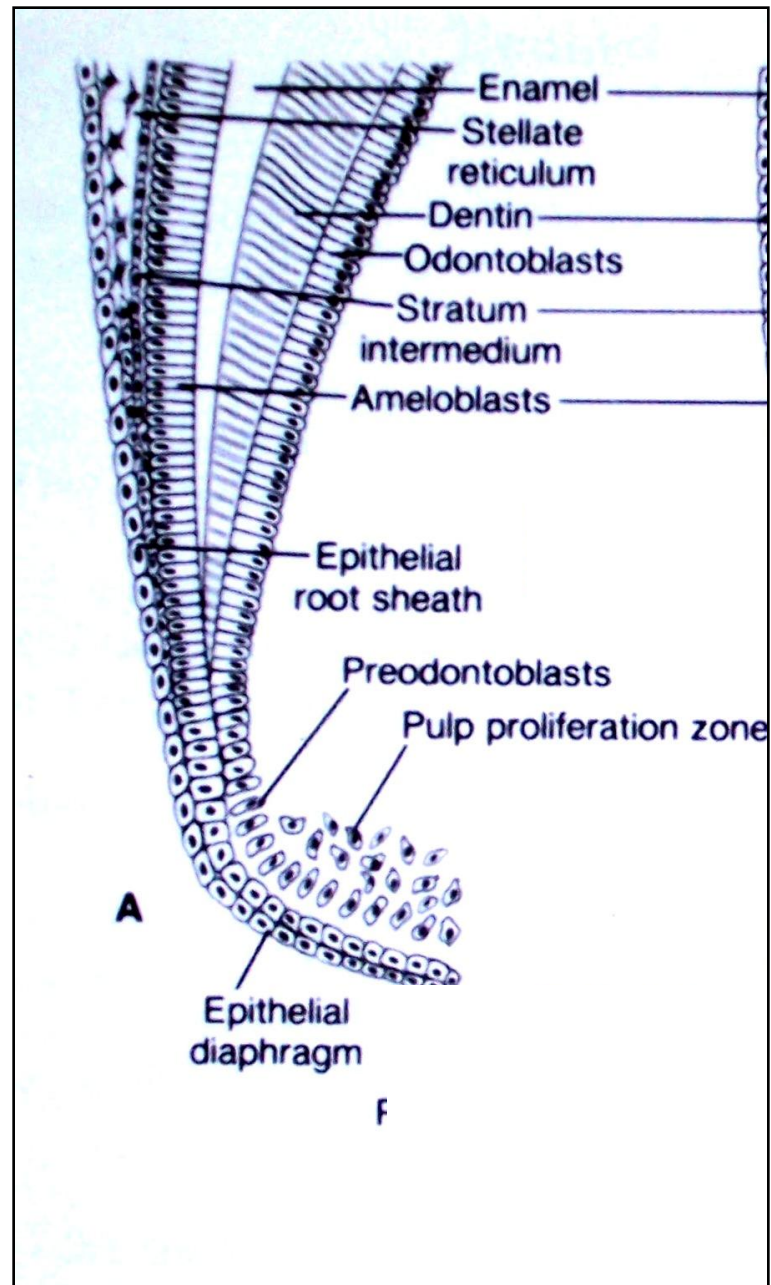
Stages of root formation.



Cervical loop

**Hertwig's epith.
root sheath**

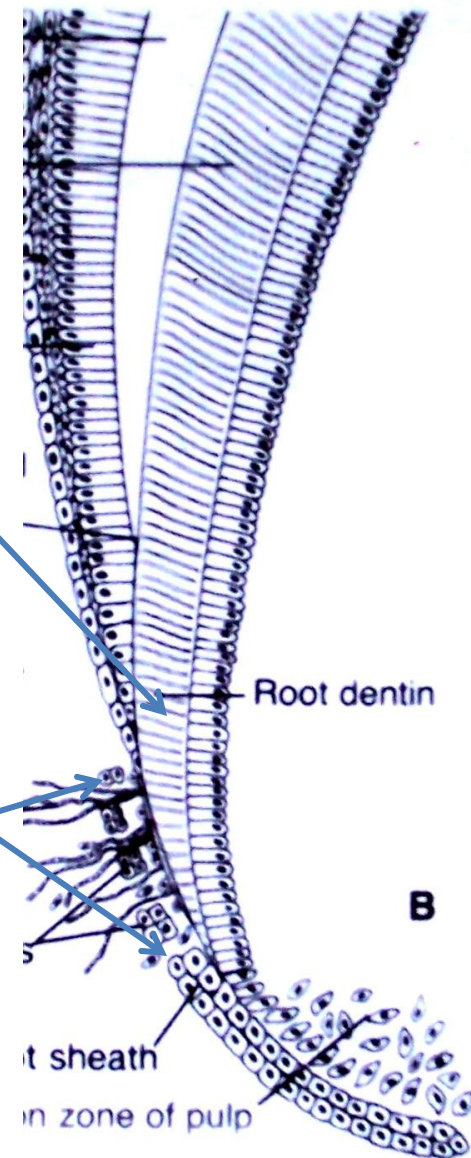
Odontoblast differentiation

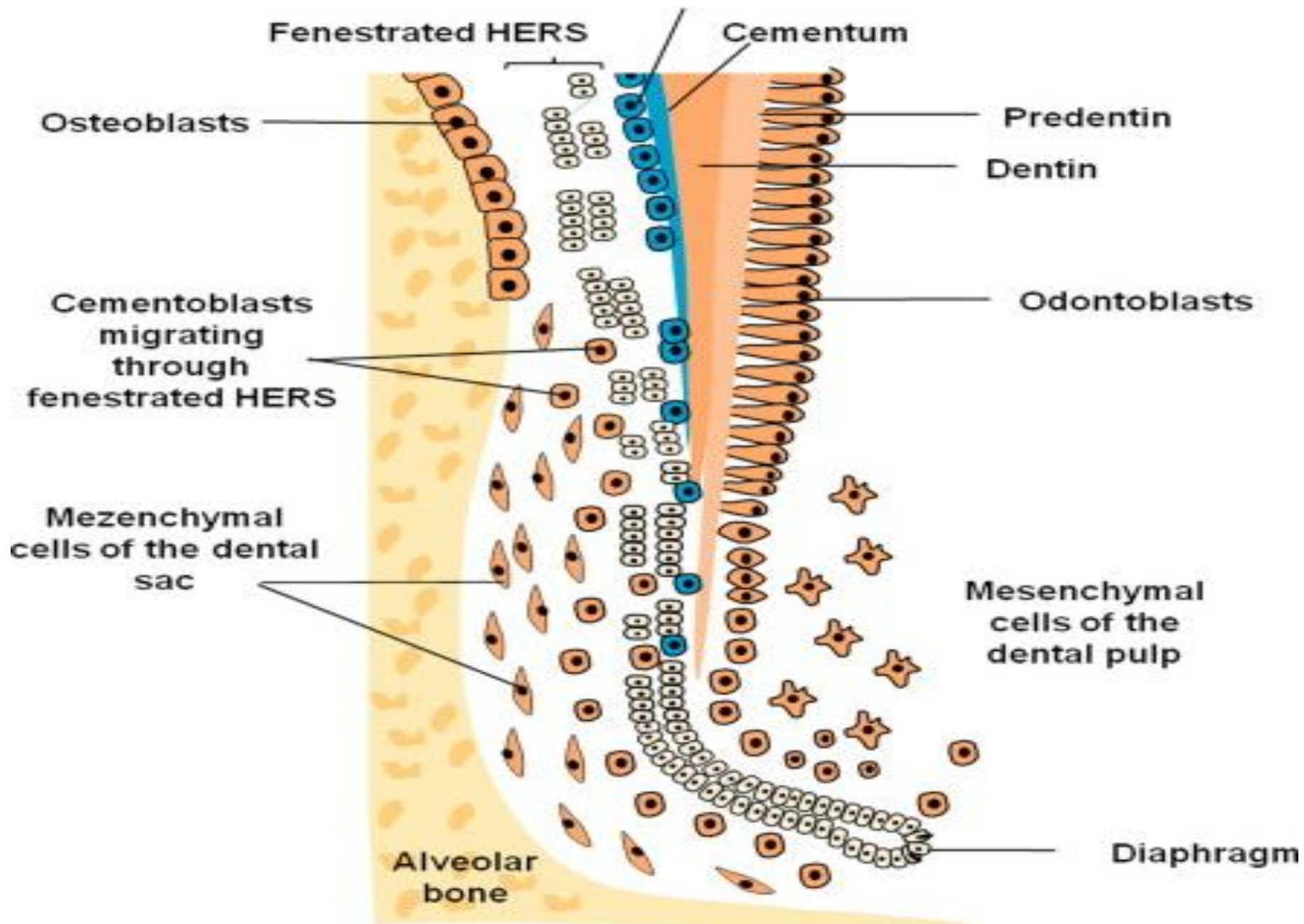


Dentin formation

**Disintegration
of root sheath**

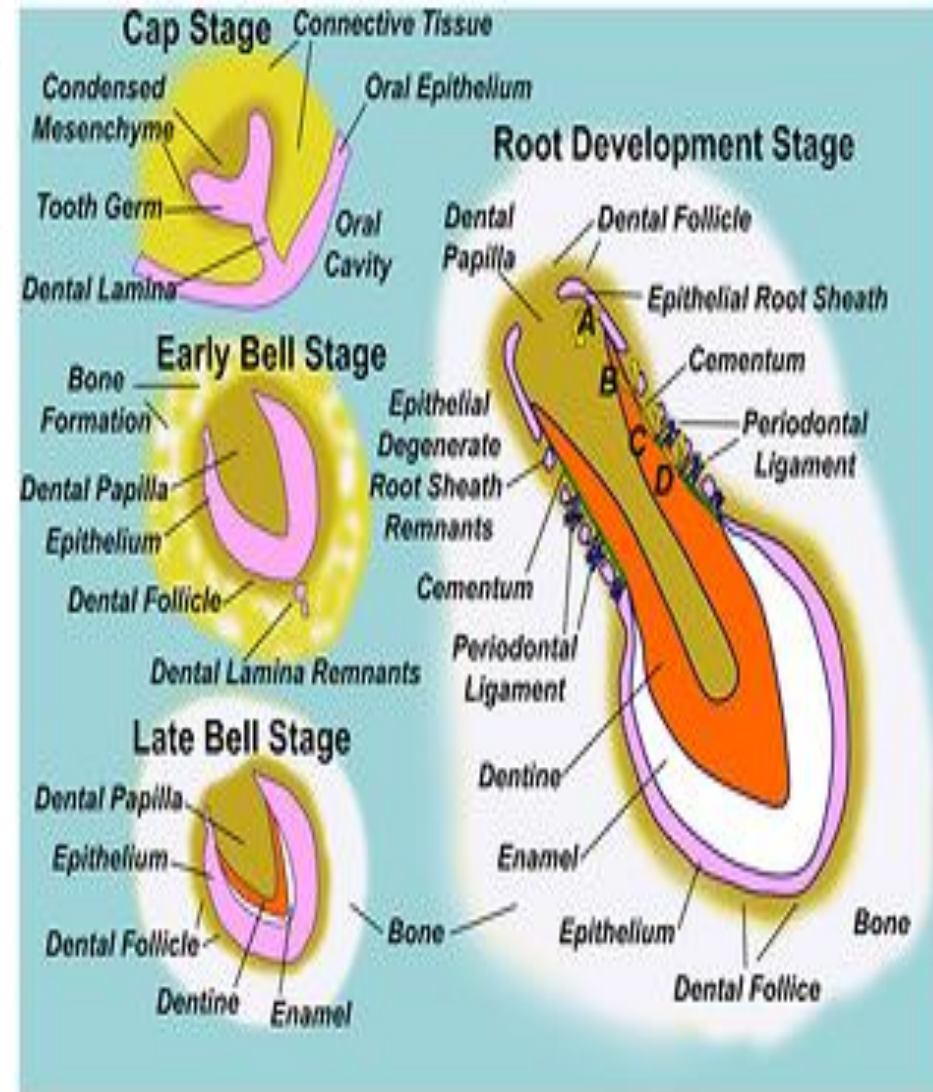
**Cementoblast
differentiation**



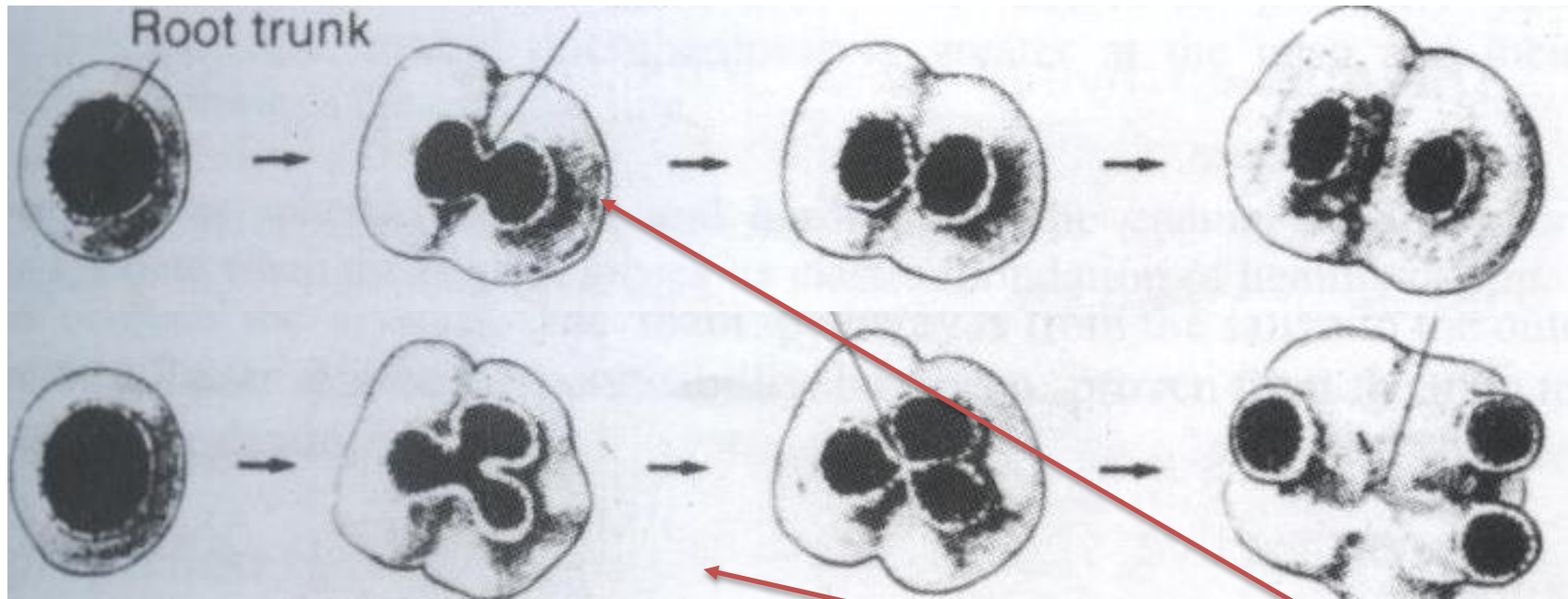


EPITHELIAL DIAPHRAGM

- The wide apical foramen is reduced first to the width of the diaphragmatic opening itself & later is further narrowed by opposition of dentin & cementum to the apex of the root



Formation of multi- rooted teeth

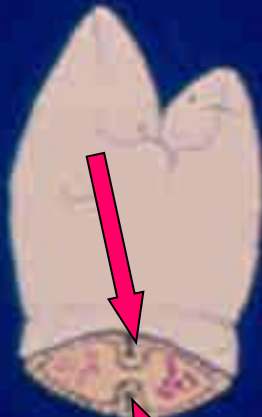


- * The root trunk of molars is formed like single rooted tooth.
- At the bifurcation area, the epithelial diaphragm produces 2 or 3 tongue- like processes in case of 2 rooted & 3 rooted teeth.
- * The processes grow towards each other & fuse dividing the wide root trunk into 2 or 3 roots.
- * Each one of these roots proceeds in development as in single rooted tooth.

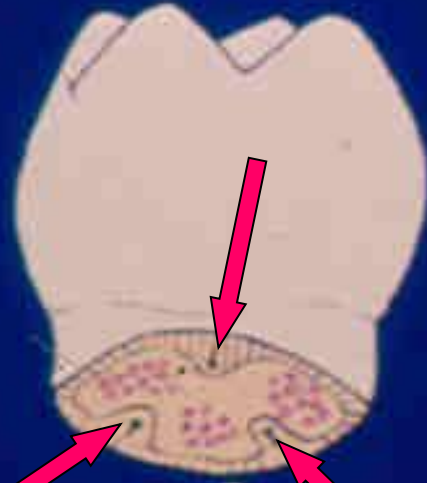
The formation of a single-rooted tooth (A), a two-rooted tooth (B) and a three-rooted tooth (C).



A



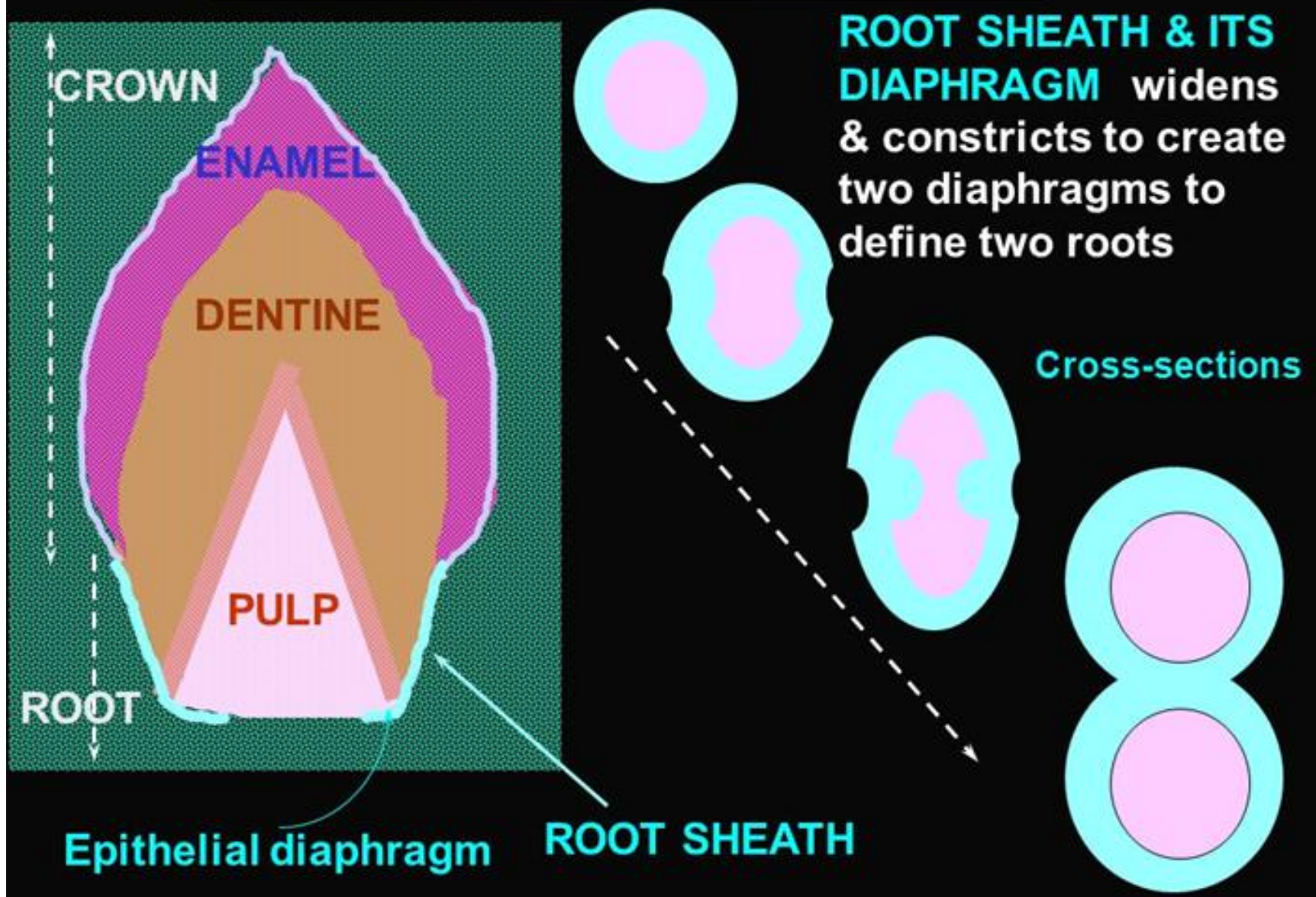
B



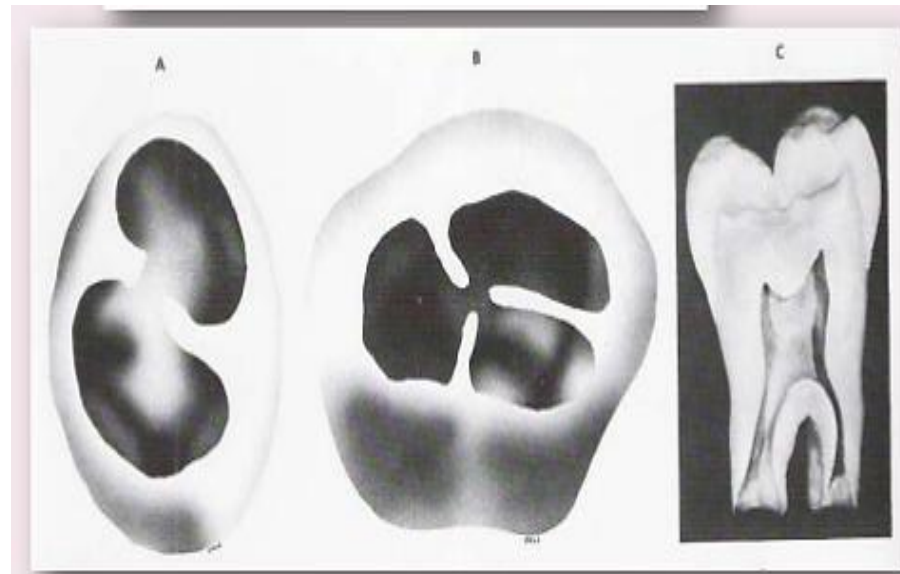
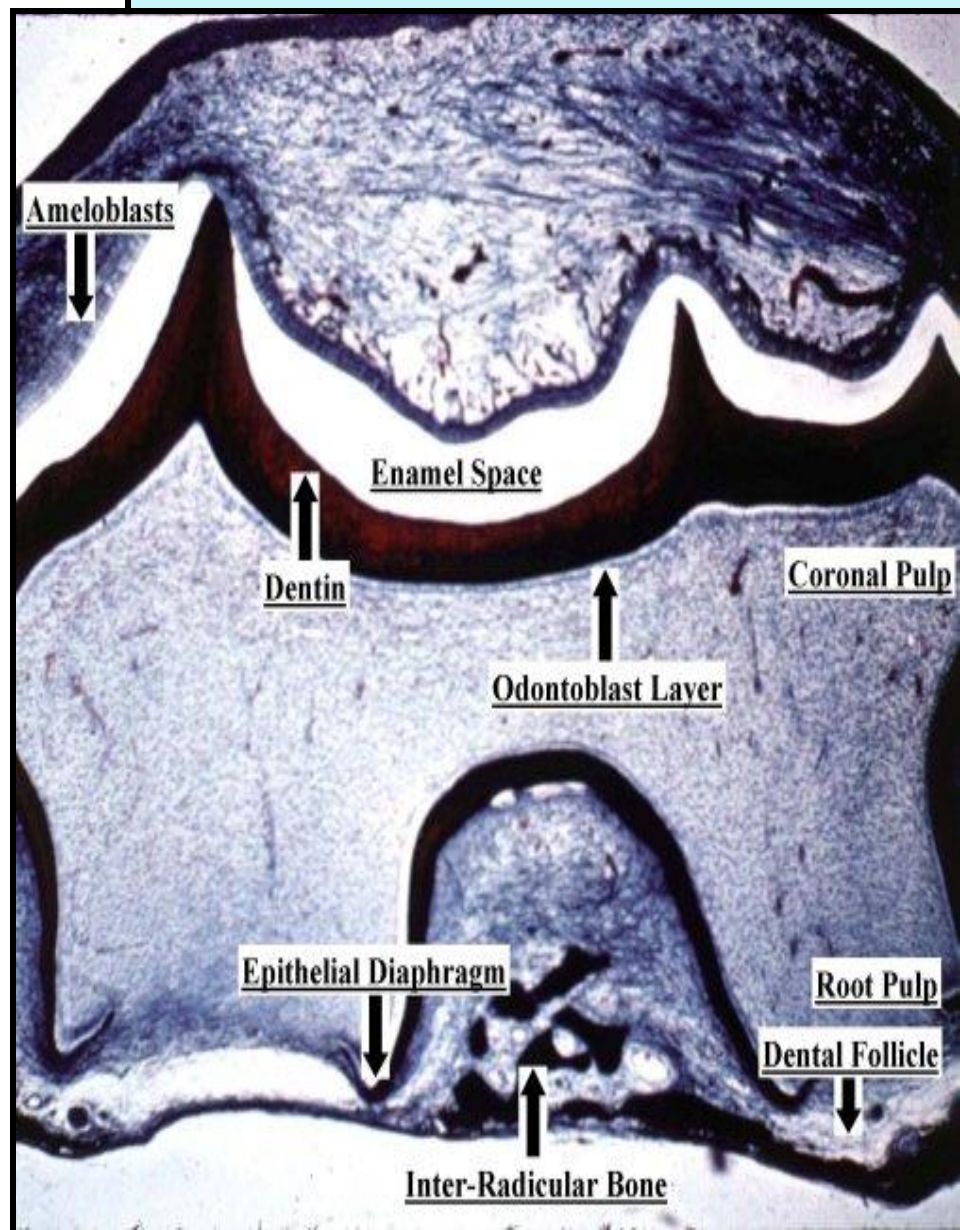
C



ROOT FORMATION: Multirooted



MULTI-ROOTED TOOTH





Fate of epithelial root sheath

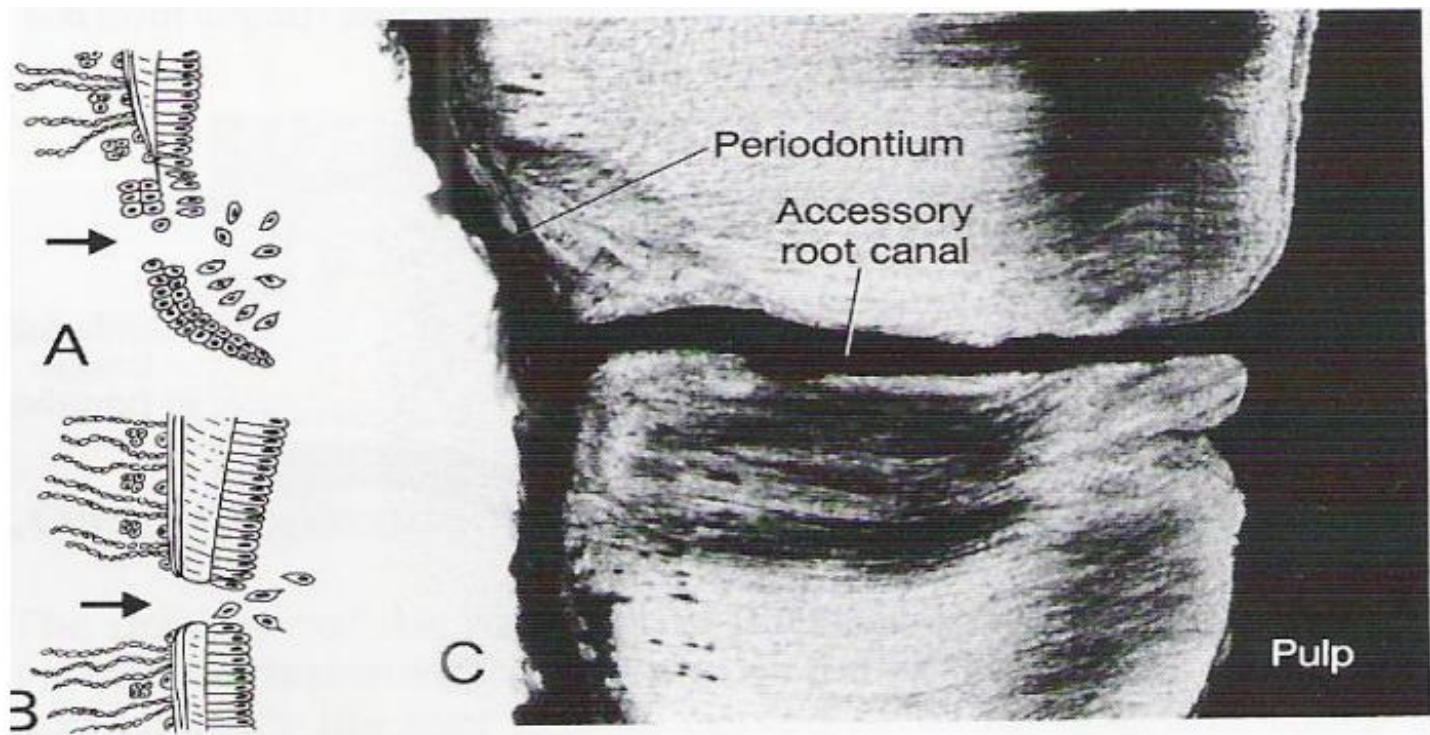
- The epithelial sheath (HERS) disintegrates as root formation progresses, and remains intact only at the advancing root edge where cell division takes place and the process of root induction continues until the root is complete.
- As the root sheath fragments, it leaves behind a number of **discrete clusters of epithelial cells**, known as the **epithelial cell rests of Malassez**.
- The epithelial rests of Malassez are found in the **periodontal ligament(PDL)** through out the life.
- Sometimes when there is chronic inflammation the epithelial cell rest of Malassez proliferate into **cysts and tumours**.

Clinical consideration

Formation of accessory root canals :

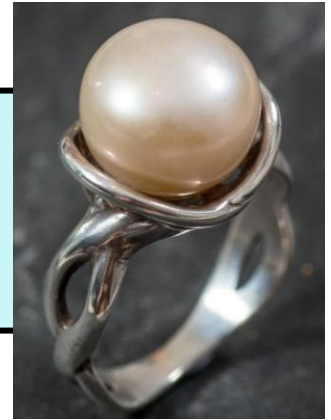
Causes:

- 1) When the Hertwig's epithelial root sheath (HERS) loses its continuity **before odontoblastic differentiation & dentin formation.**
- 2) If a large **blood vessel** is present and disturb the continuity of the epithelial root sheath.



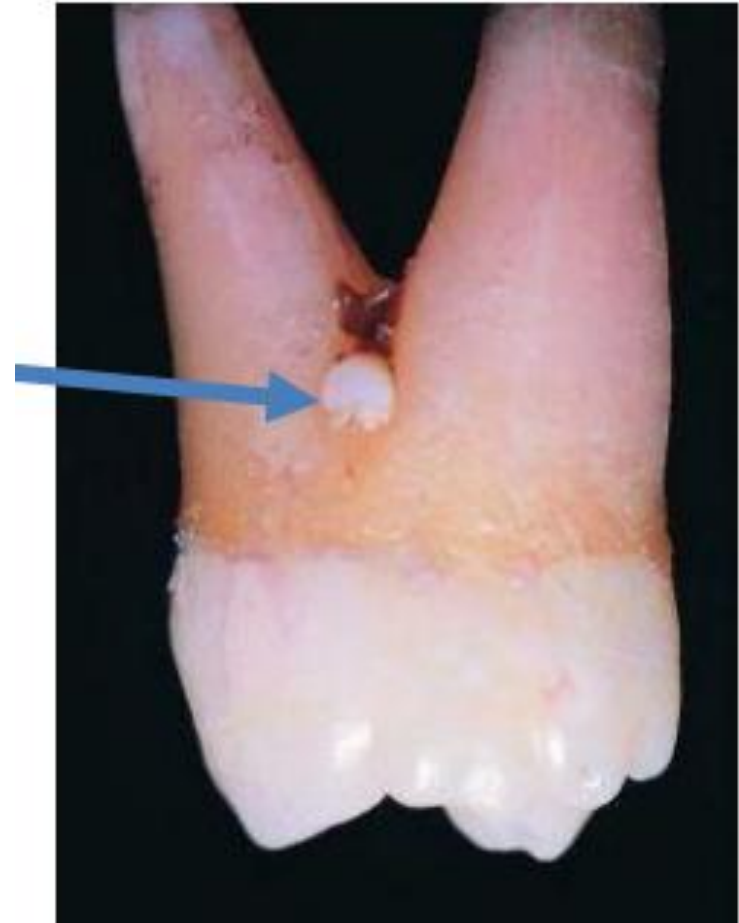
Clinical consideration(cont.)

ENAMEL PEARL



Enamel pearls

They appear as small, spherical enamel projections especially at the cemento-enamel junction (CEJ) or in the furcation area in molars, if the epithelial root sheath of Hertwig remains adherent to the dentin surface, its inner enamel cells may differentiate into ameloblasts and produce enamel.





Clinical consideration(cont.)

Dilaceration

Dilacerations: If the HERS dislocated after partial root mineralization, the remaining of the root may eventually be bent or twisted resulting in a condition called "dilacerations" or root distortion. This seen in permanent teeth usually.



1. HERS?
2. Steps in root formation
3. Fate of HERS
4. Clinical considerations



Any
Question?



REFERENCES

- ORBANS's Oral HISTOLOGY AND AND EMBRYOLOGY (page no 24-47)
- TEN CATE'S ORAL HISTOLOGY



THANK YOU!