



جامعة البصرة

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Lec. 9 Root Development

oral histology 2nd stage

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Root Development

Cervical loop

**Hertwig's epith.
root sheath**

**Odontoblast
differentiation**

Dentin formation

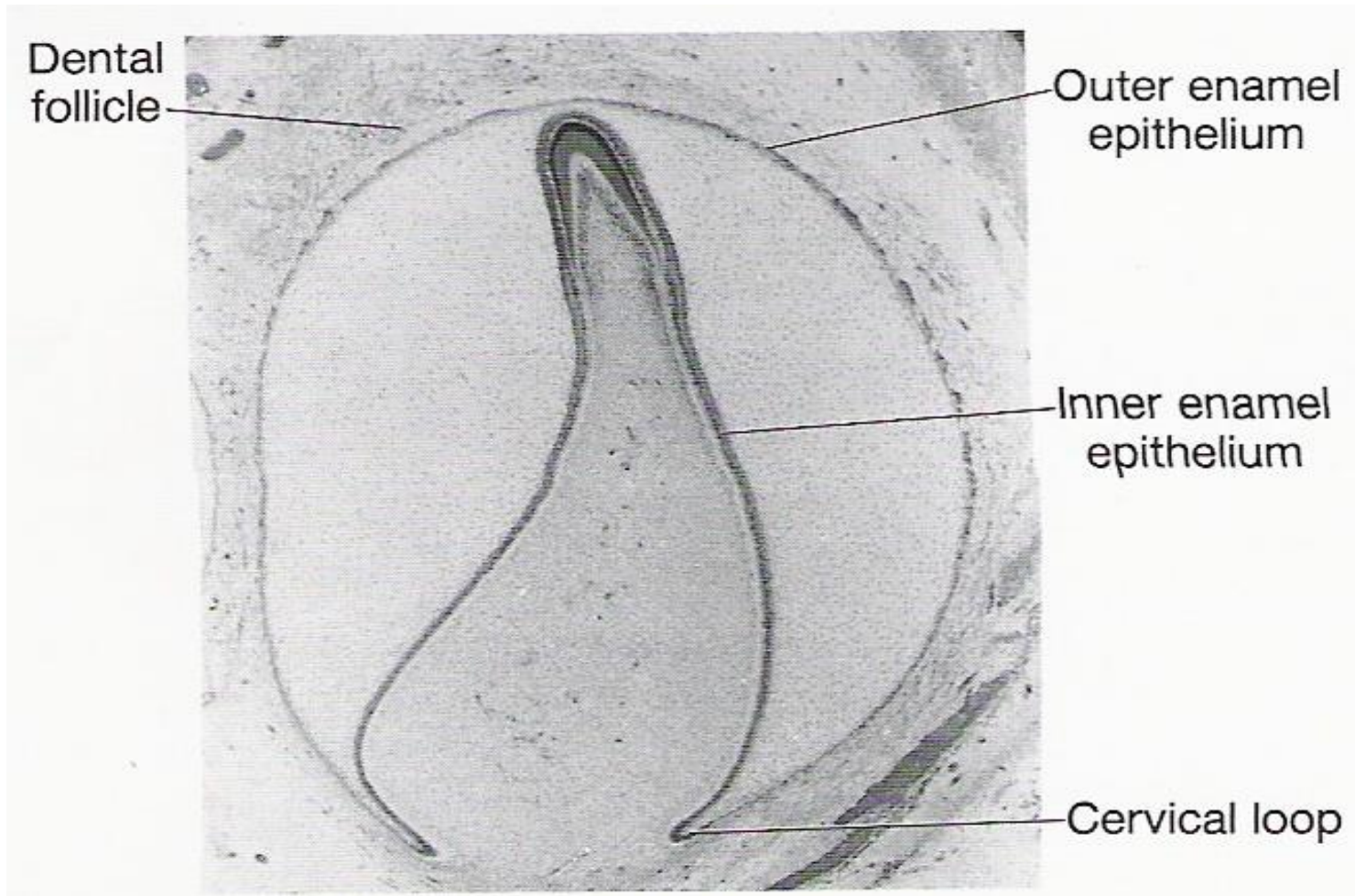
**Disintegration
of root sheath**

**Cementoblast
differentiation**

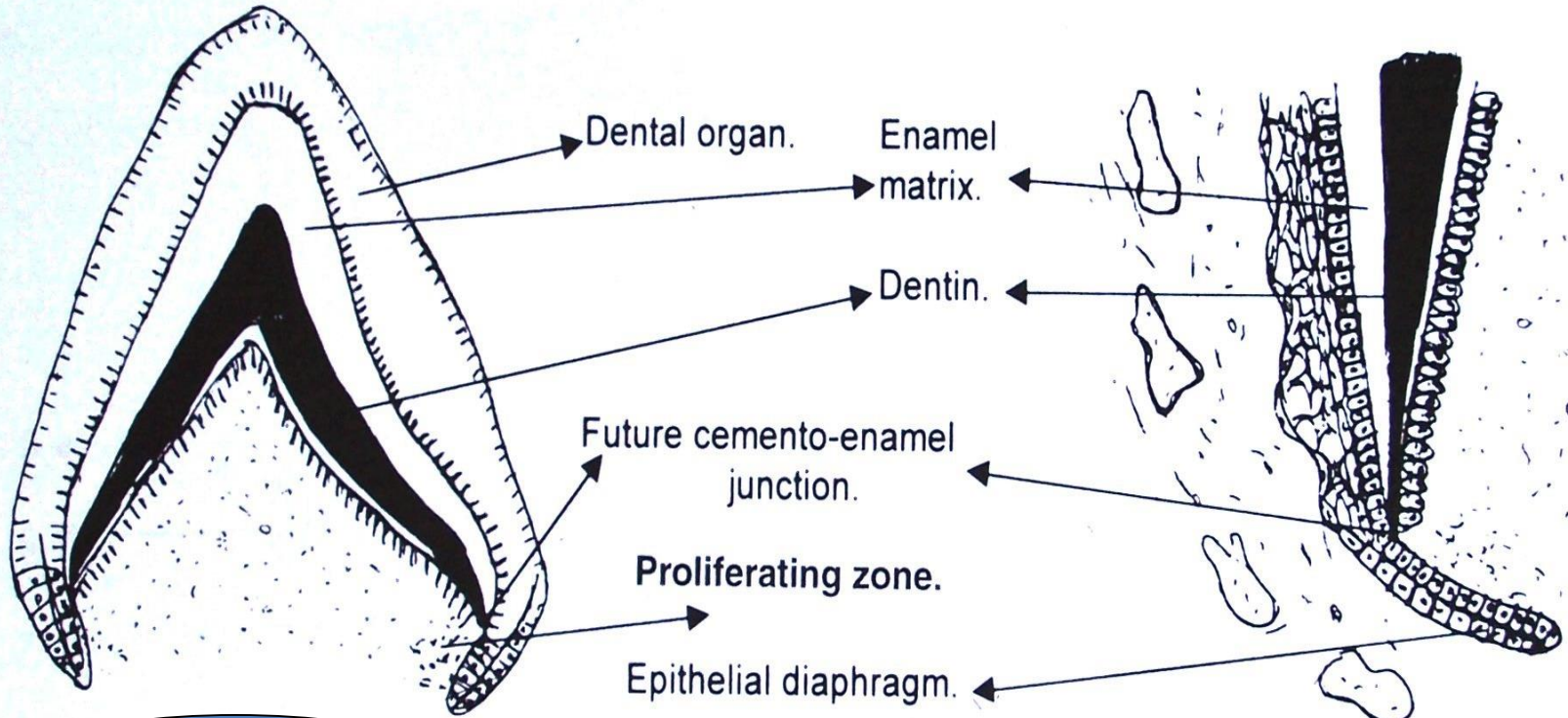
1- Root sheath development

- ❑ The development of the roots begins after enamel and dentin formation has reached the future cementoenamel junction.
- ❑ Once crown formation has completed, epithelial cells of the inner and outer enamel epithelium proliferate from the cervical loop of the enamel organ to form a double layer of cells known as ***Hertwig's epithelial root sheath (HERS)***.
- ❑ This sheath initiates formation of dental root and determines the number, shape, length and dimensions of the roots.
- ❑ At the future CEJ, HERS turn inwardly to a horizontal plane forming the **epithelial diaphragm**.
- ❑ The epithelial diaphragm will maintain constant size of the primary apical opening which finally becomes the ***apical foramen***.

Bell stage

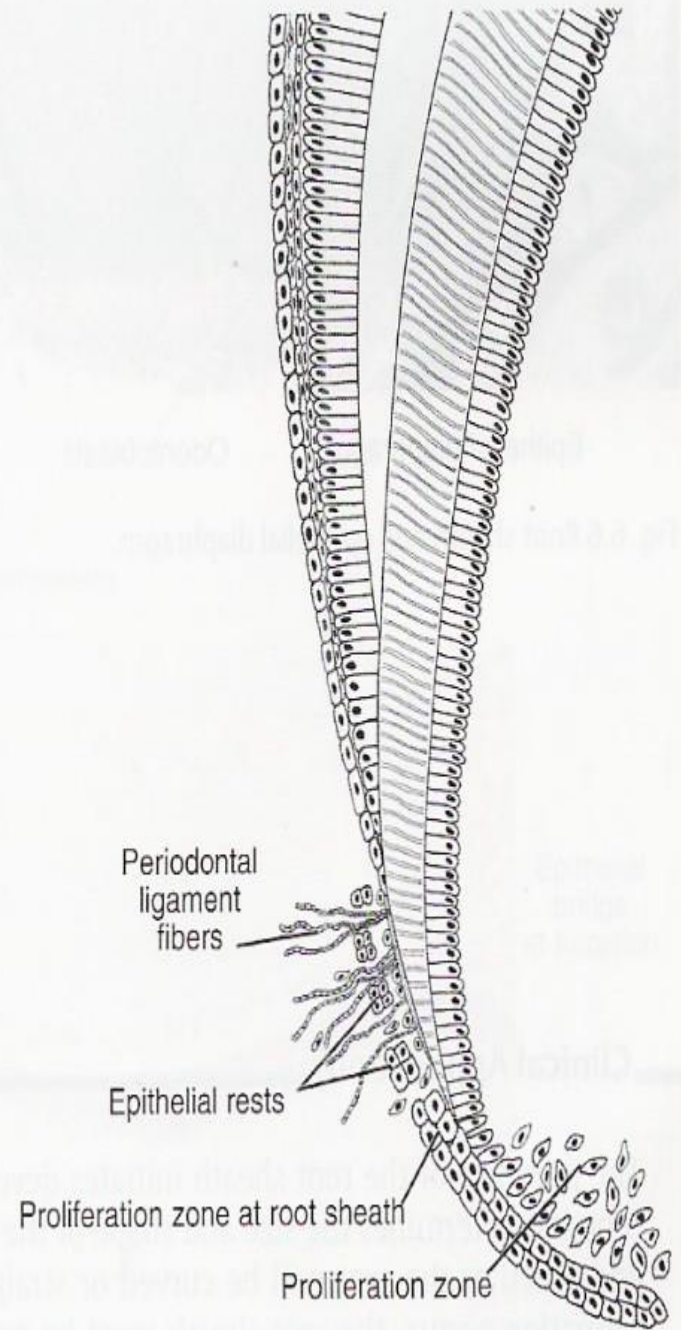
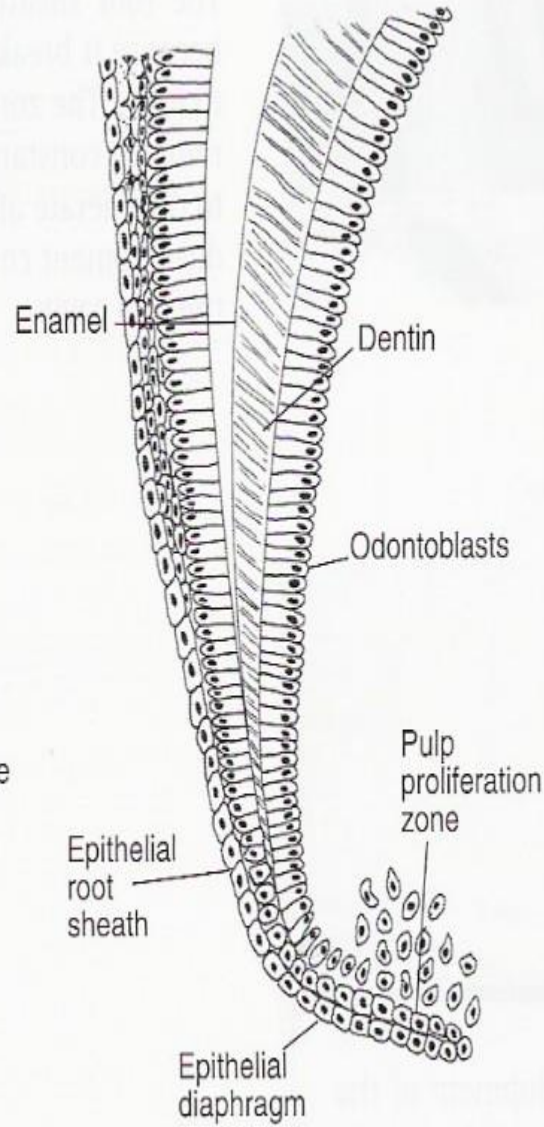
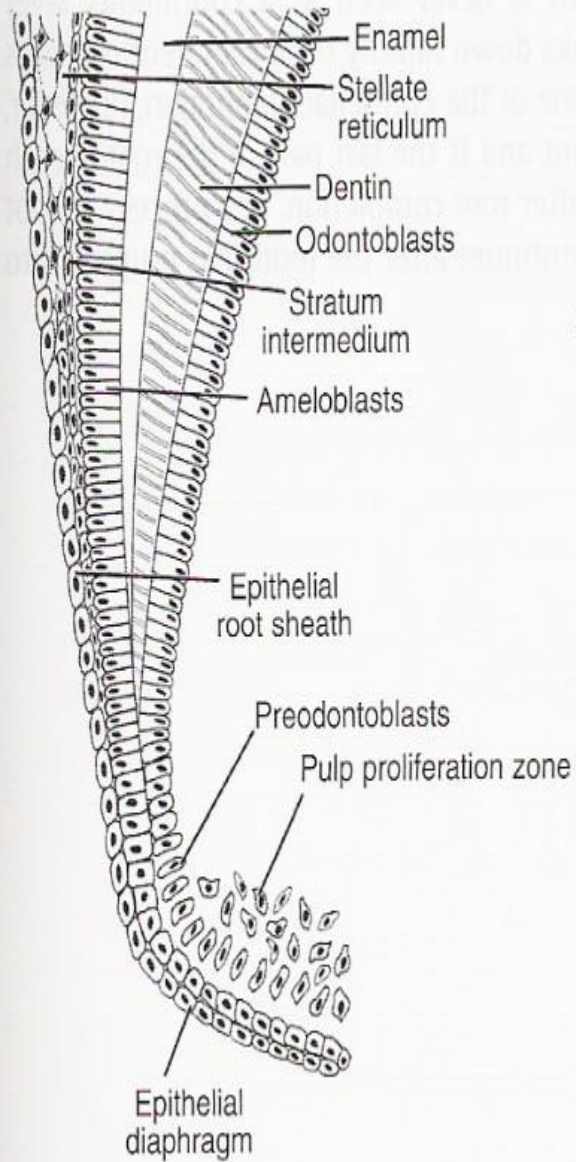


Stages of root formation.



Cervical loop

**Hertwig's epith.
root sheath**



A

6

B

C

Reduced enamel
epithelium

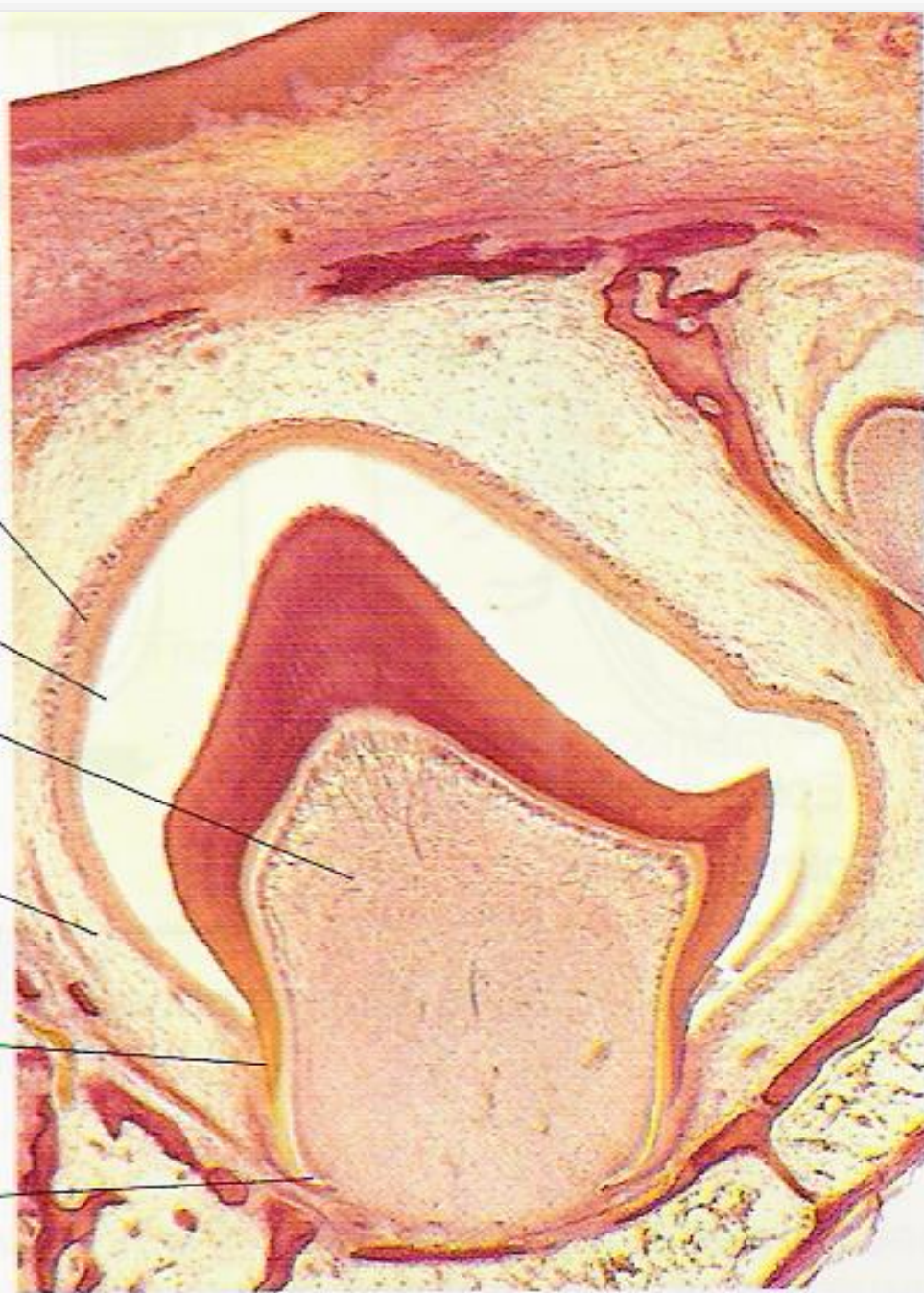
Enamel space

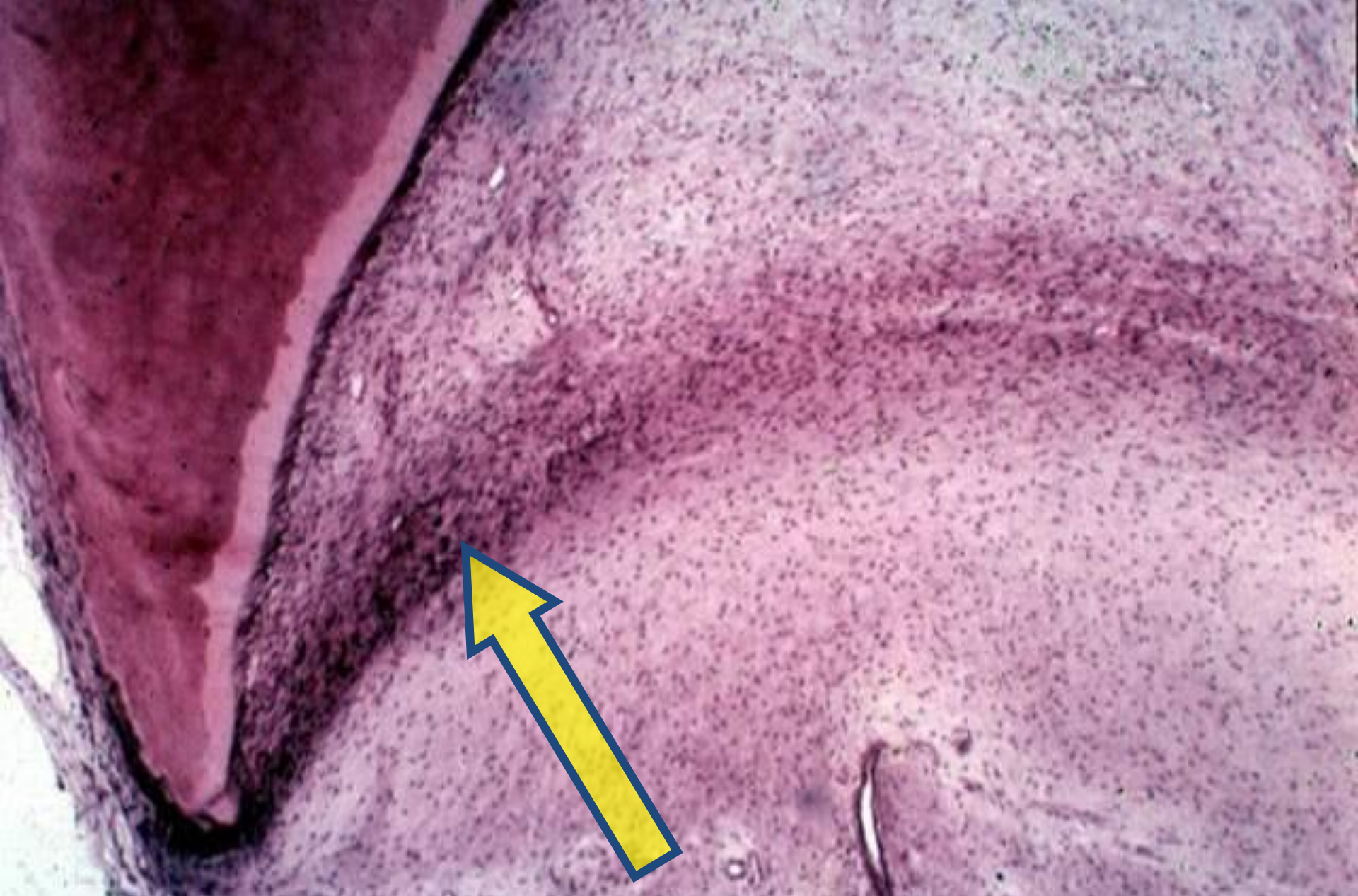
Dental pulp

Dental follicle

Epithelial
root sheath
cells

Epithelial
diaphragm

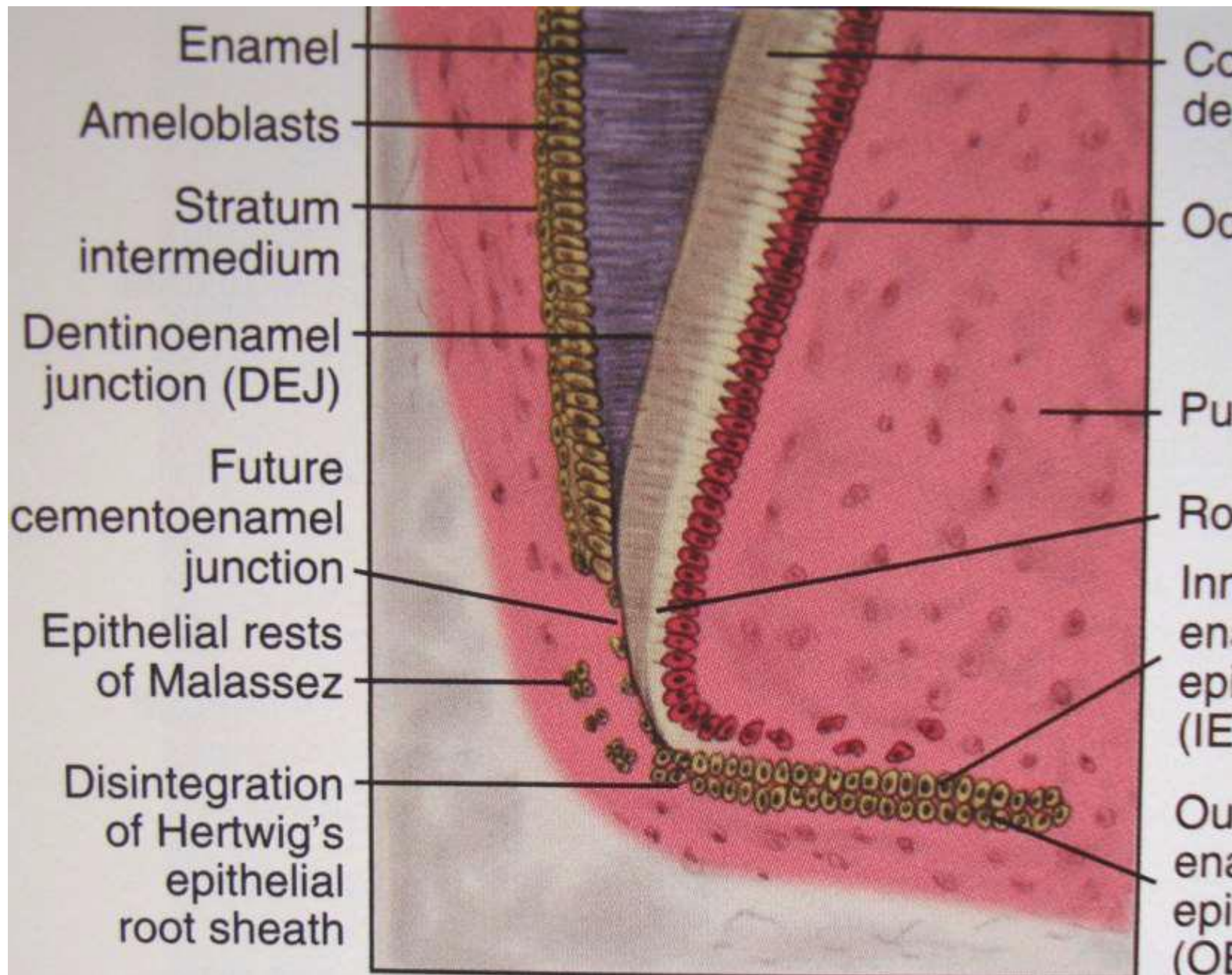




Epithelial diaphragm

2- Formation of Root

- ❑ Proliferating cells of epithelial diaphragm induce proliferation and differentiation of cells of dental papilla to odontoblasts and form root dentin.
- ❑ at the same time the connective tissues of the dental sac surrounding the root sheath proliferates and divides the continuous double epithelial layer into a network of epithelial strands.
- ❑ As the root sheath lengthens the crown moves occlusally.
- ❑ Degradation of the HERS allows contact of the dental follicle cells with the dentin surface and they differentiate into cementoblasts.
- ❑ The cementoblasts cover the root dentin and undergo cementogenesis – laying down cementoid
- ❑ Dentinogenesis continues until the root is completed ; the tooth moves upward to make space for further root growth.



Single root formation:

Growth of HERS like a cuff or tube around the cells of dental papilla



Cells of dental papilla to differentiate into odontoblasts



Formation of root dentin



HERS cells separate from the surface of root dentin



HERS cells then begins to migrate away from the root surface



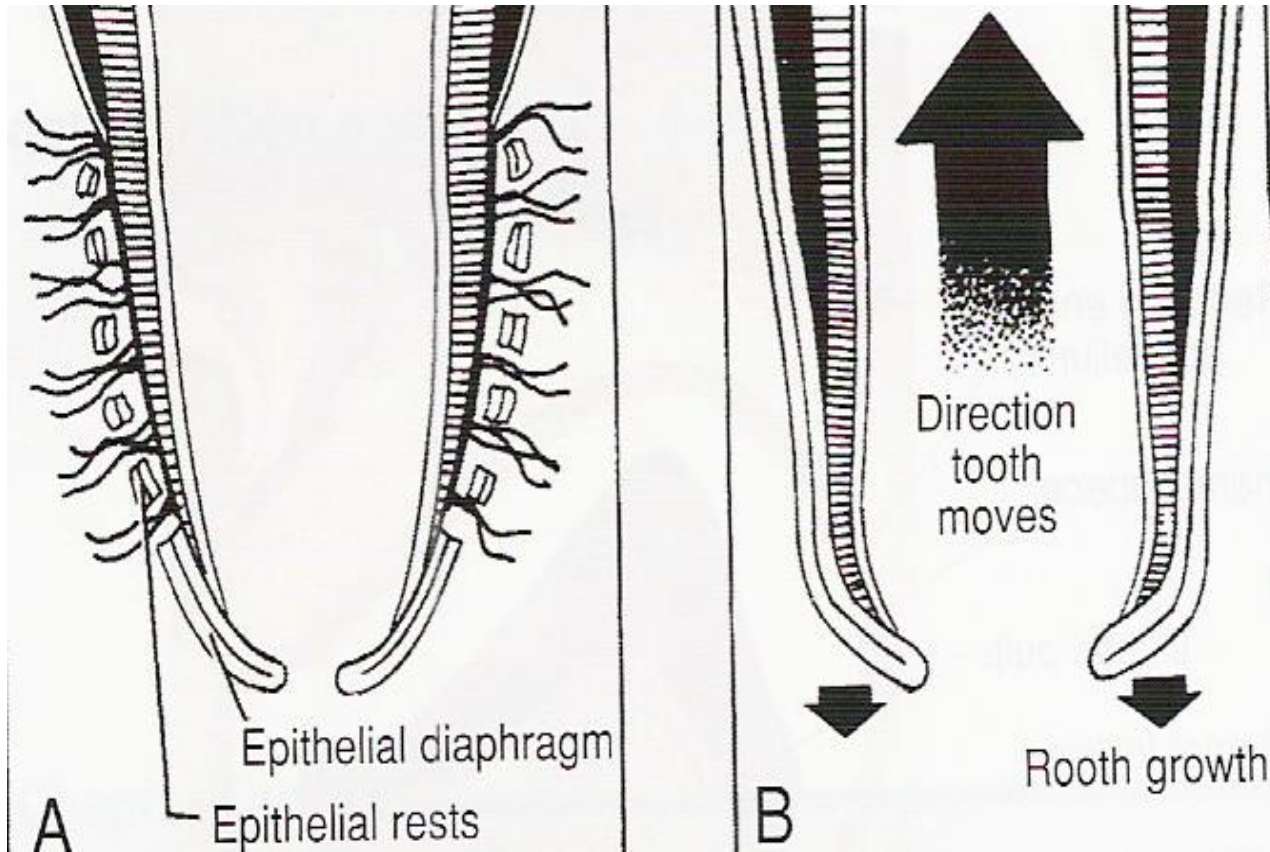
Cells differentiate into cementoblasts and secrete cementum



Root elongation continues progressively with proliferation of remaining root sheath cells at the base of dental papilla and dental sac



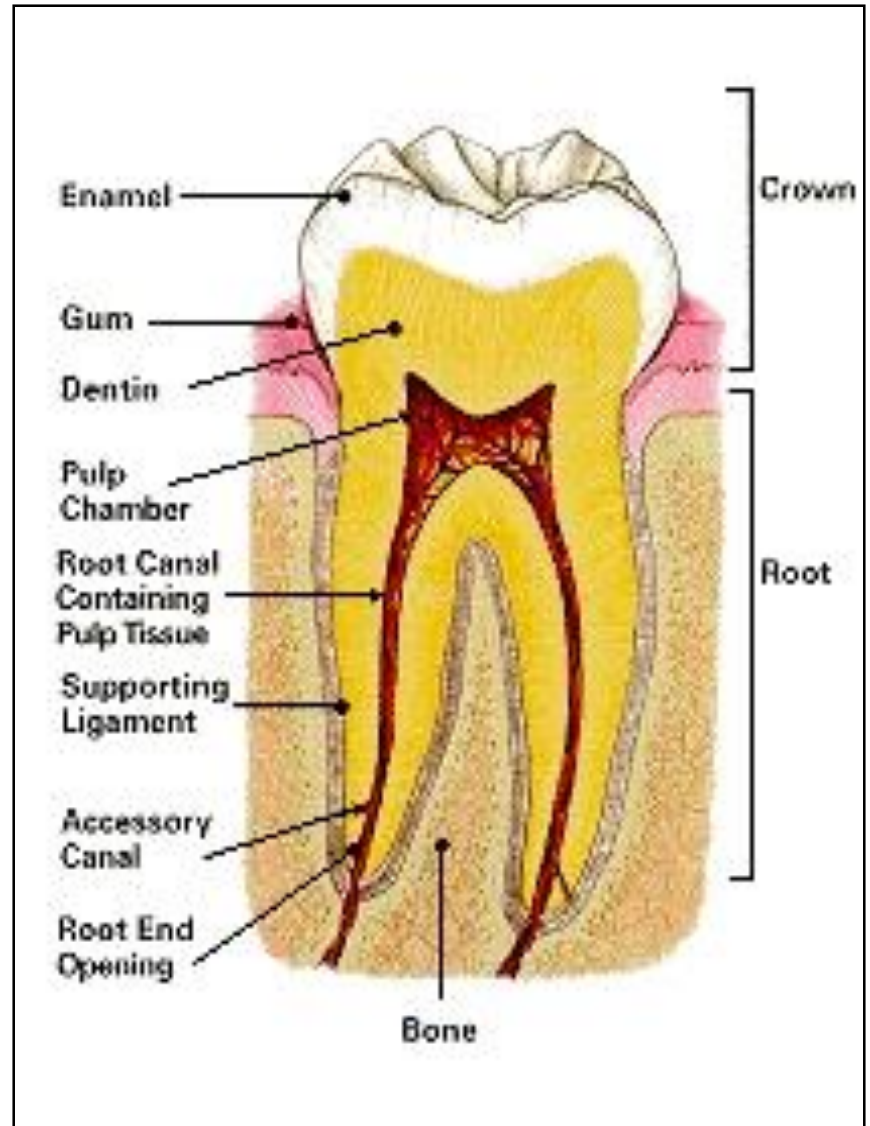
As the root lengthen, the compensatory movement of eruption provides space for further root development.



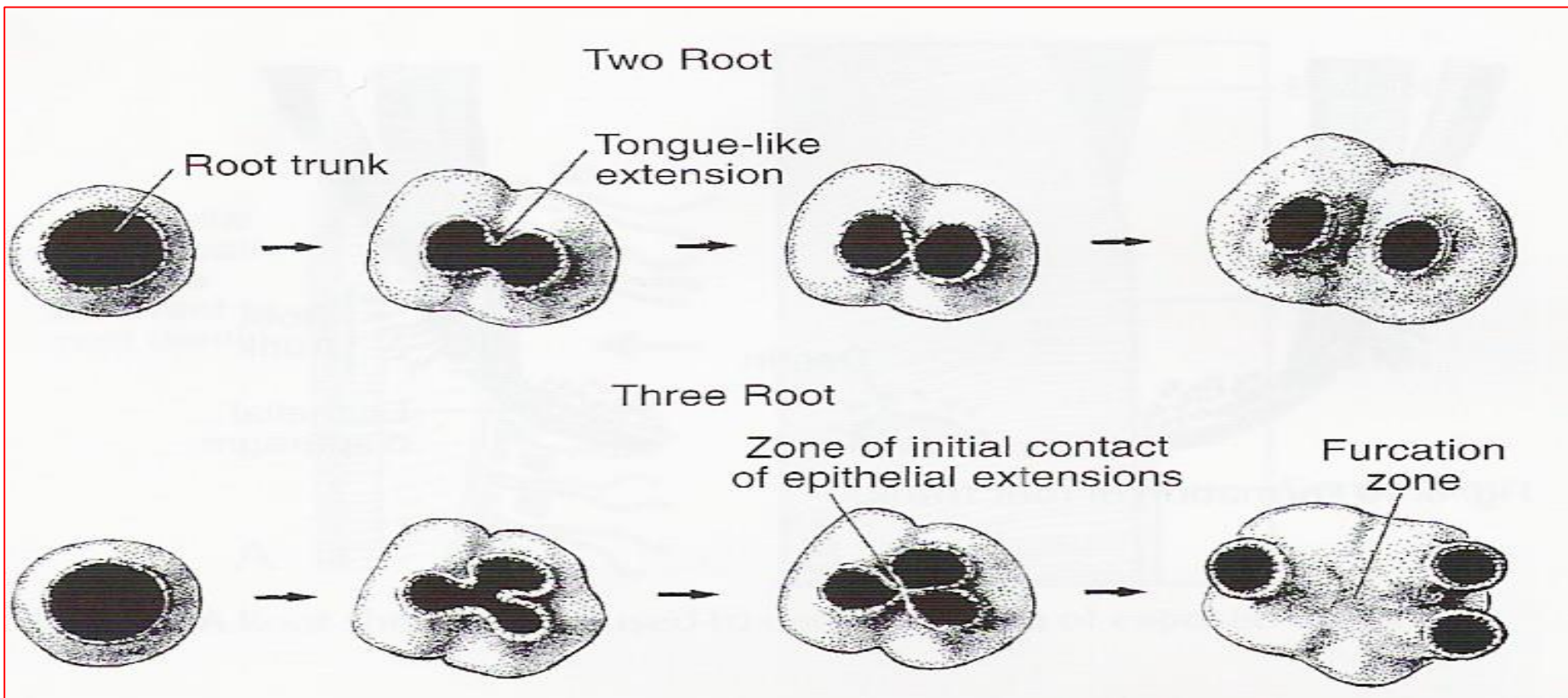
A. Root elongation.

B. Tooth eruption

MULTI-ROOTED TOOTH



Formation of multi-rooted teeth



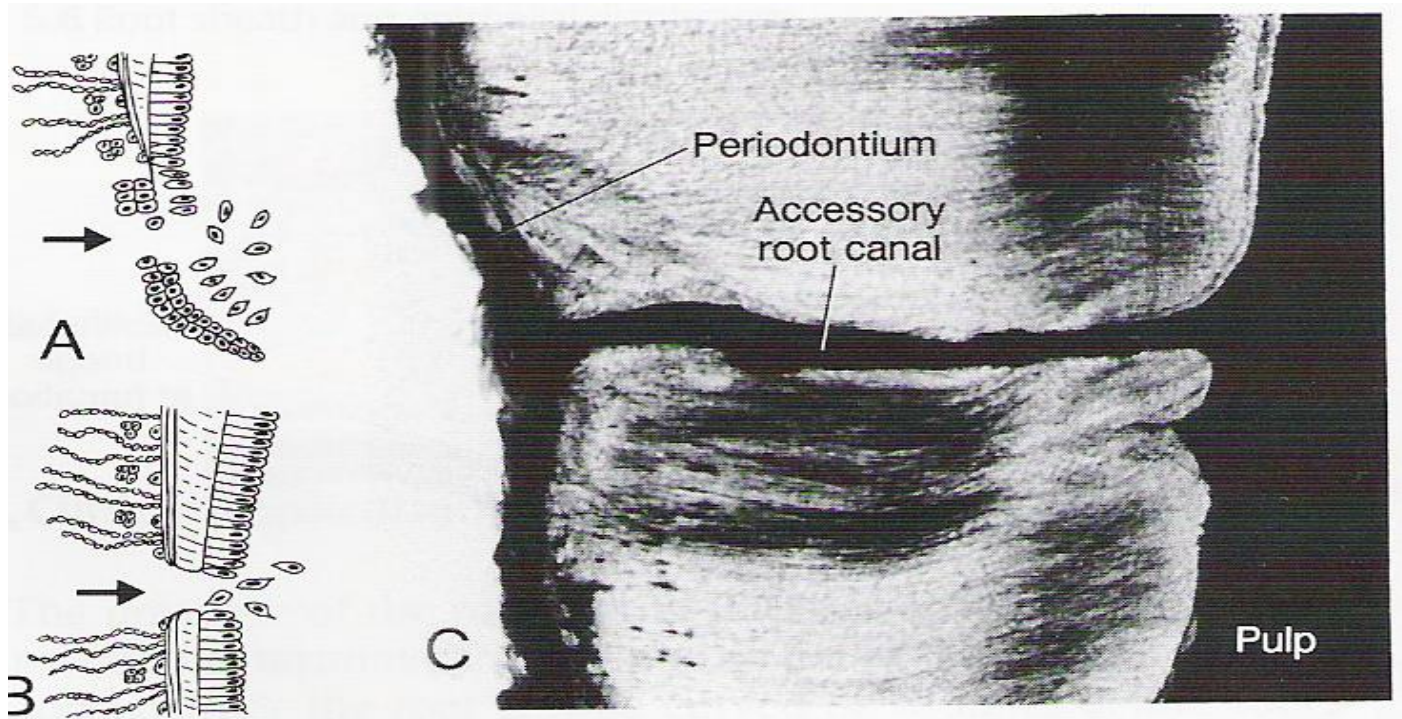
- * The root trunk of molars is formed like single rooted tooth.
- * At the bifurcation area, the epithelial diaphragm produces 2 or 3 tongue- like processes in case of 2 rooted & 3 rooted teeth.
- * The processes grow towards each other & fuse dividing the wide root trunk into 2 or 3 roots.
- * Each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

3- Fate of epithelial root sheath

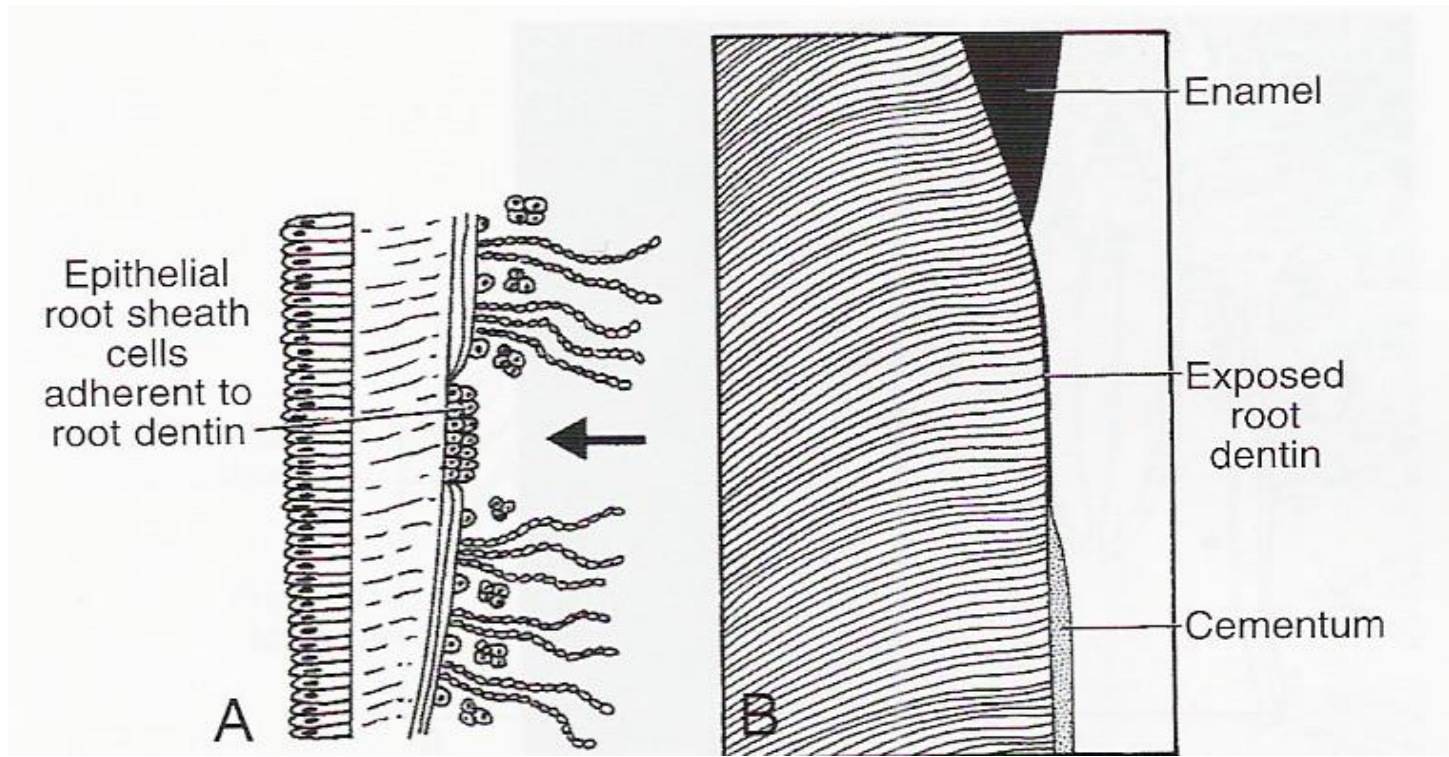
- The epithelial sheath (HERS) disintegrates as root formation progresses, and remains intact only at the advancing root edge where cell division takes place and the process of root induction continues until the root is complete.
- As the root sheath fragments, it leaves behind a number of discrete clusters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

Root formation Anomalies

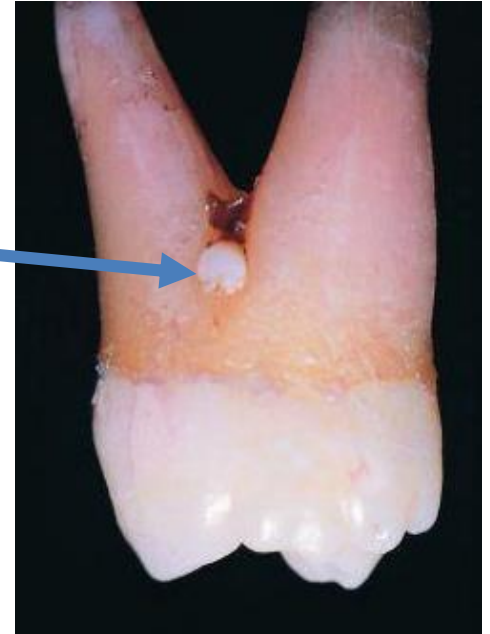
1. Lateral canals: If continuity of HERS were broken before dentin formation, result in defective or missing epithelial cells. Odontoblasts would then not differentiate and dentin would not form apposite to the defect in the root sheath, this result in small lateral canal connecting PDL with main root canal called an **accessory root canal** which may occur in the apical third, furcation area of multi rooted teeth.



2. Exposed dentin: If HERS does not degenerate at proper time remains adherent to dentin, mesenchymal cells of follicle will not come in contact with dentin so no cell differentiate to cementoblasts, no cementum formation will occur, result in expose dentin, particularly in cervical region and may cause cervical sensitivity later in life.



3. Enamel pearls: HERS may also remain adherent to the dentin in the cervical area near the furcation zone, the inner cells of HERS may differentiate into functional ameloblasts and produce enamel droplets known as *E. pearls* found between the roots of permanent molar.



4. 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.

