Lecture 4: Shedding of Deciduous Teeth

By

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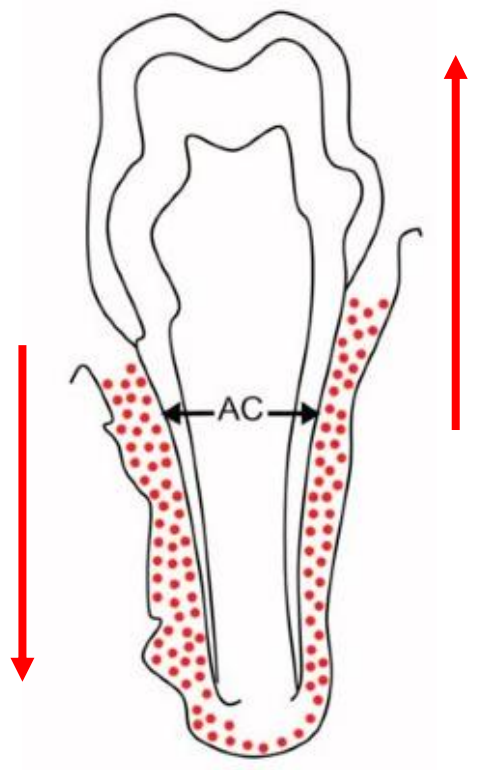
Mechanisms of tooth eruption (Theories)

1. Root formation theory

- The proliferating root encounters a **fixed structure**
- **Exert force** downward (apically)



The apically directed force is converted into a **reactive occlusal** force that causes coronal movement of the erupting tooth

Limitation of the root formation theory

- Rootless teeth can erupt
- Teeth continue to erupt even after completion of root formation
- Teeth erupt even when the tissue forming the root is removed
  ↳ HERs

2. Cushion Hammock theory

- The cushion hammock ligament (at the base of the socket from one bony wall to the other like a sling).
- Is responsible for tooth eruption
- However, the cushion hammock ligament is only the pulp delineating membrane that runs across the apex of the tooth and has no bony insertion.
- It cannot act as a fixed base
- And cannot help in tooth eruption

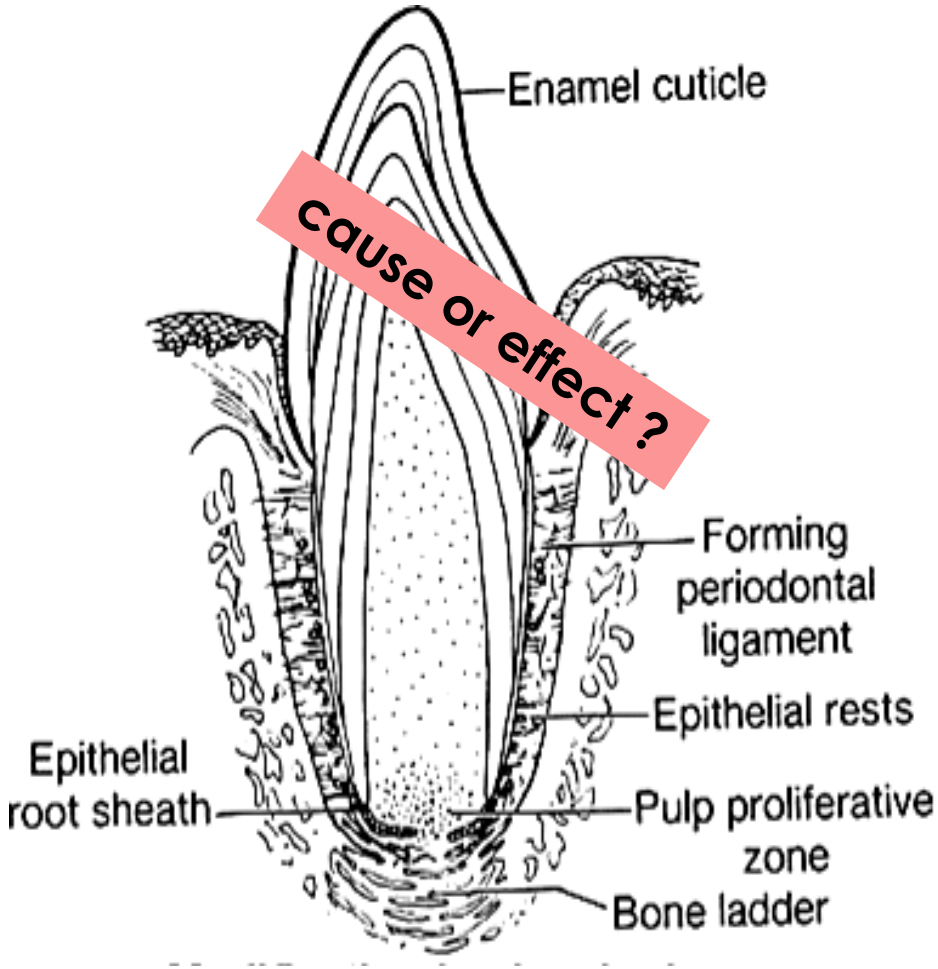
Cushioned Hammock ligament
(Pulp delimiting membrane)

3: Bone Remodeling Theory

- Bone remodeling (that is i.e. Bone resorption that occur coronally and deposition that occur apically cause tooth eruption.

- Whether the bone remodeling that occurs around teeth causes or it is the effect of tooth movement is not known

· without remodeling → The tooth doesn't erupt.



3: Vascular Pressure Theory

- Local increase in tissue fluid pressure in the **periapical region** is sufficient to move the tooth.
- However, experimental **elimination** or isolation of the periapical vasculature does **not prevent** tooth eruption.
- Tissue fluid pressure as an eruptive force must always **be considered** as pressure exists below and above an erupting tooth has been reported.

4: Dental Follicle & Reduced Enamel Epithelium Theory

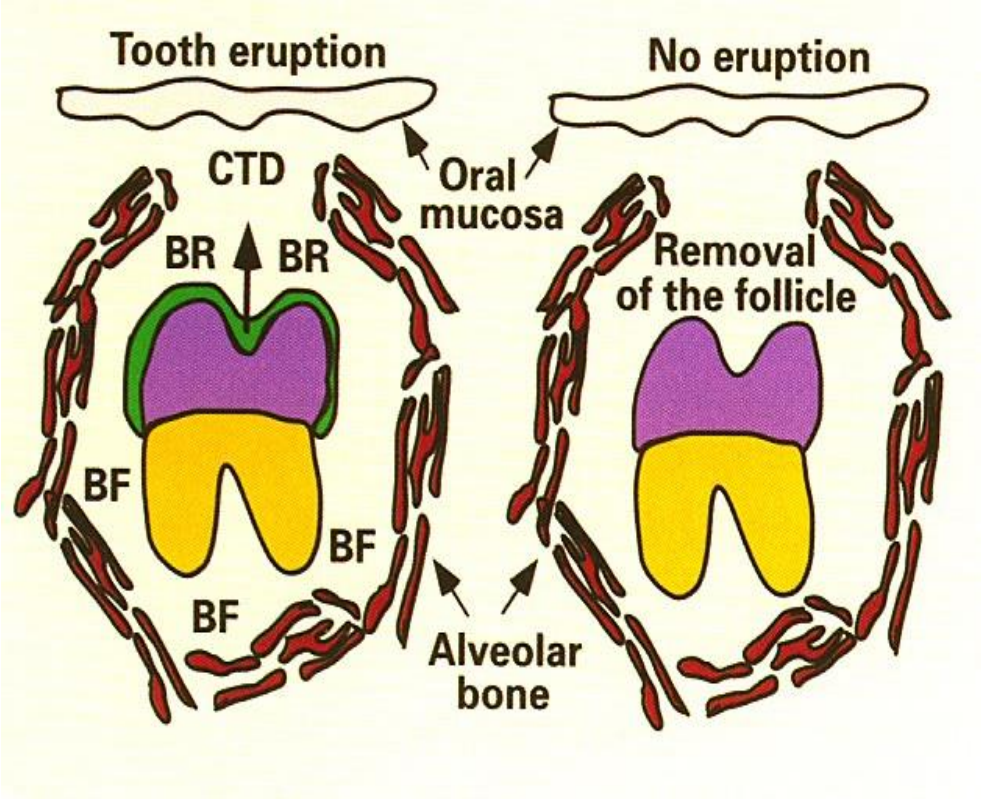
- This theory states that dental follicle causes tooth eruption because it helps in the **formation of an eruptive pathway**

- **Experiment:** No dental follicle, NO eruption

  - **Reduced enamel epithelium forming eruption pathway:**

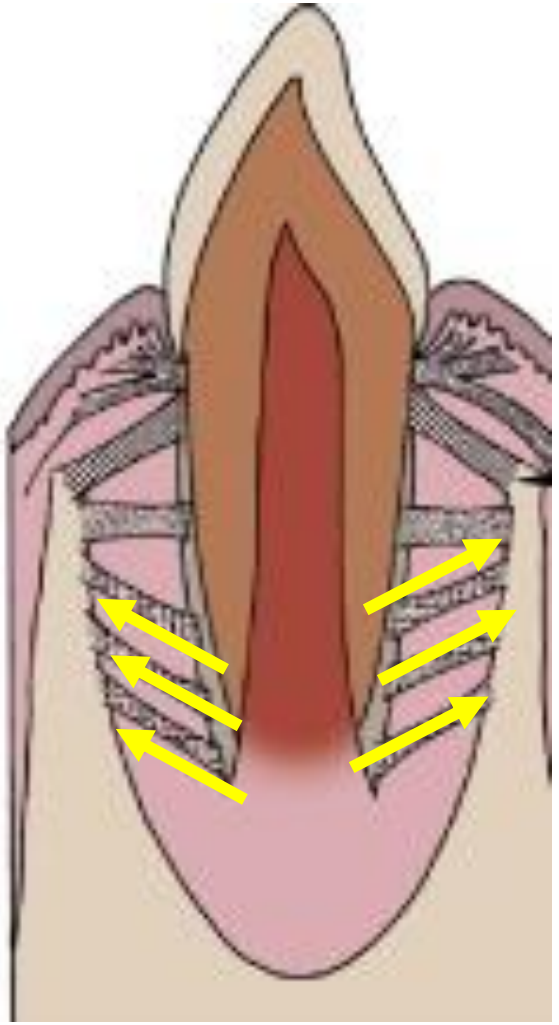
A- It initiates a cascade of intercellular signals that **attract osteoclasts** to the follicle (for bone remodeling)

B- It **secretes proteases** which assist in the breakdown of the connective tissue above the tooth to produce a path of least resistance

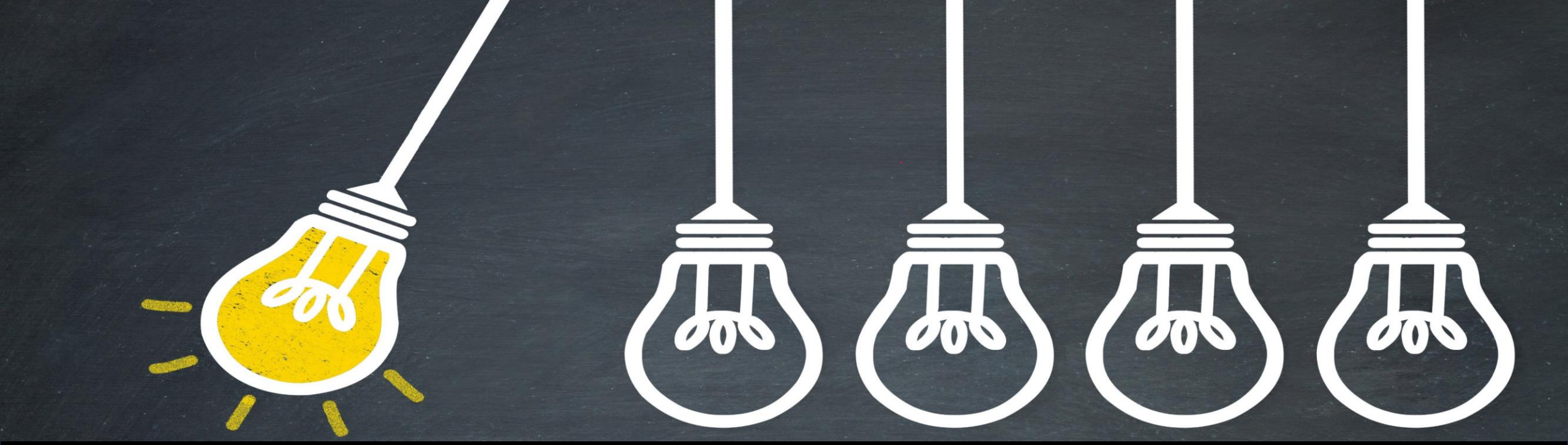


5: Periodontal Ligament Traction Theory

- This theory proposed that the cells and fibers of PDL **pull the tooth into occlusion**.
- The fibroblast cells of the PDL have **contractile filaments** (Actin + myosin) and are in contact with **one another** **and collagen** fibers extra-cellular (**fibro nexuses**)
- The eruptive movement is brought about by **a force initiated by the fibroblast**
- This **force is transmitted** to the extracellular compartment via fibro nexuses and to collagen fiber bundles, which are aligned in an appropriate position to bring the tooth movement.



From your point of view, what is the most accepted theory?



Learning Outcomes

- Define shedding of deciduous teeth
- Describe pattern of shedding
- Understand mechanism underlying shedding
- Understand clinical importance

What is Shedding (Exfoliation)?

- Literal meaning "**falling off**"
- Falling of hair, feathers, skin, or other covering or parts by **natural process**.

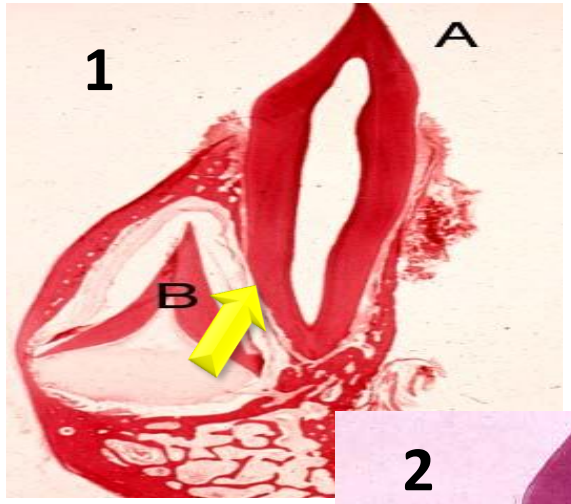
- In dentistry, **shedding is the physiologic elimination of the deciduous tooth**
- Prior to the eruption of permanent teeth

Patterns of Shedding

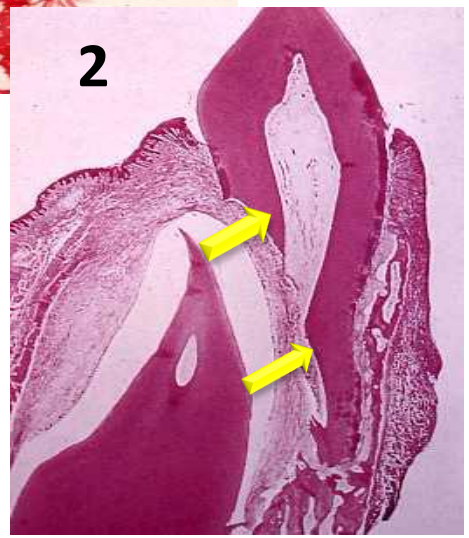
- Shedding is **symmetrical** for the right and left side
- **Mandibular** primary teeth shed before maxillary except 2nd Molar
- **Girls** before the boys
- The sequence is generally **from anterior to posterior** teeth in both arches
- However, in the maxilla, the first molar **(D)** exfoliates before the canine **(C)** thus disrupting the sequence
- **Pressure** from the eruptive **successional** tooth helps to determine the pattern of deciduous tooth resorption.

Pattern of shedding in anterior teeth

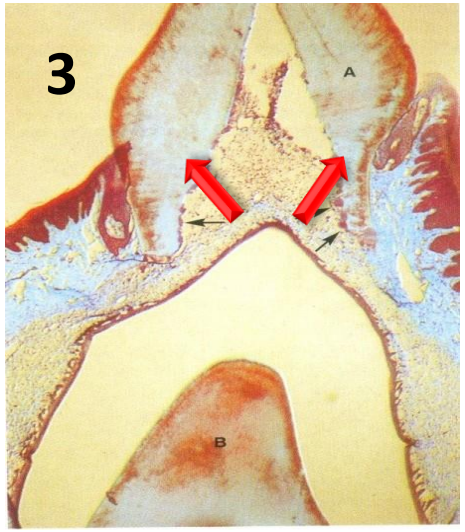
- Pressure against the **bone** separating the **socket** of the deciduous tooth and the crypt of the permanent tooth



- Resorption starts at the **lingual apical** areas of the roots of primary teeth

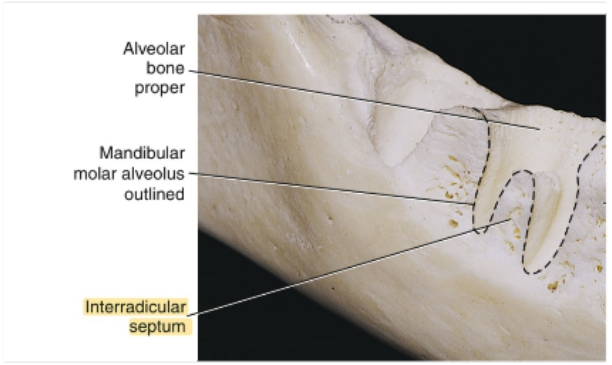


- Proceed **horizontally** in an incisal direction, causing the primary root to exfoliate and the permanent ones to erupt in their places.

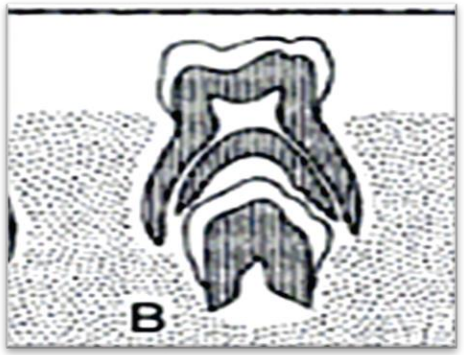


Pattern of shedding in posterior teeth (Molars)

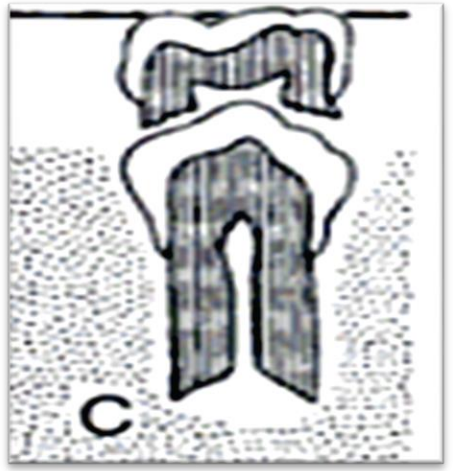
- Permanent premolars develop between the divergent roots of deciduous molars and erupt in an occlusal direction.



- Resorption of roots of deciduous molars first begins on their **inner surfaces**



- Finally, resorption of the **root**, **interradicular bone** with some resorption of the pulp chamber, coronal dentin, and sometimes enamel.

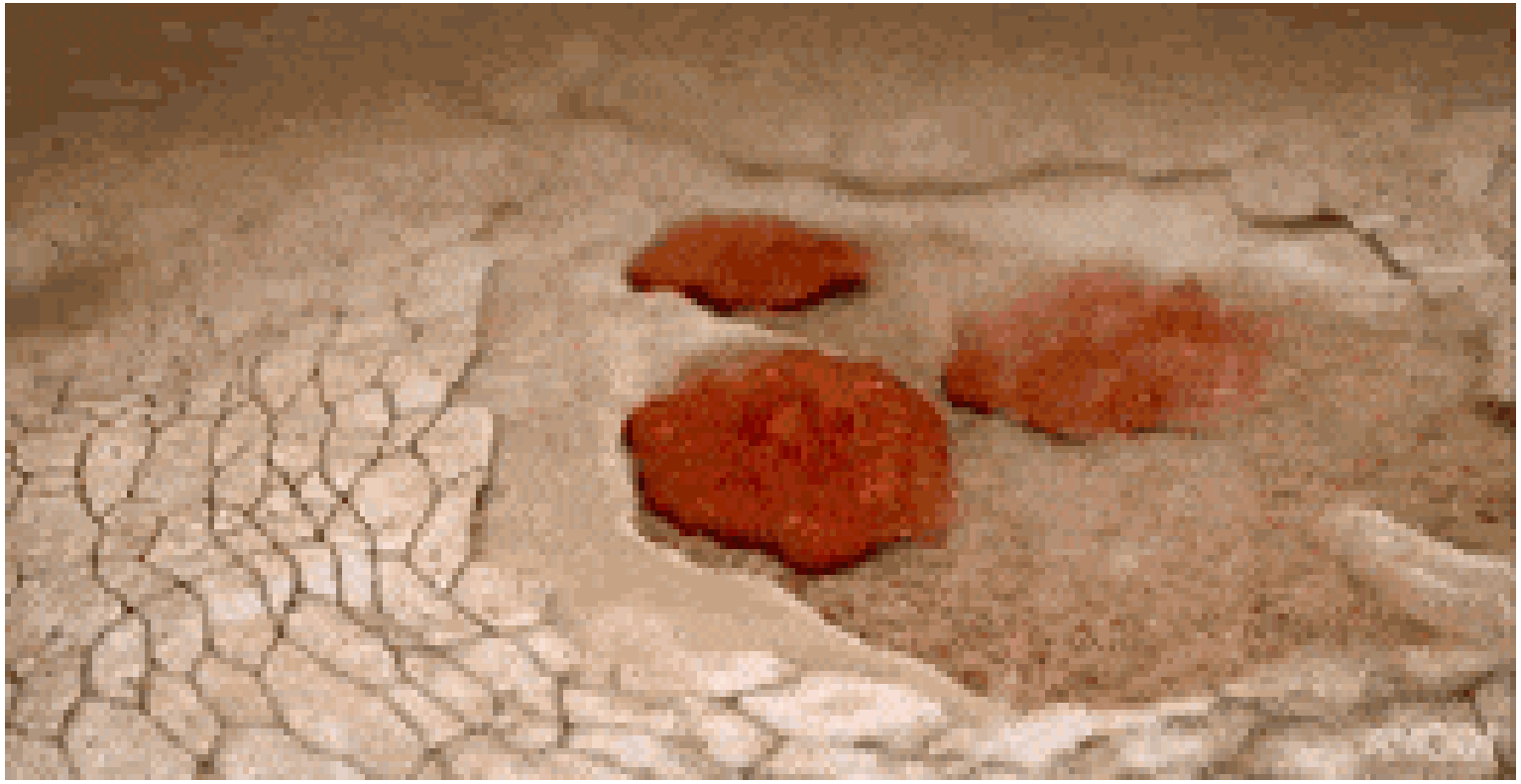


Histology of Tooth Shedding

A. Resorption of dental hard tissue
B. Histological changes in PDL
C. Histological changes in pulp

Resorption of Dental Hard Tissues

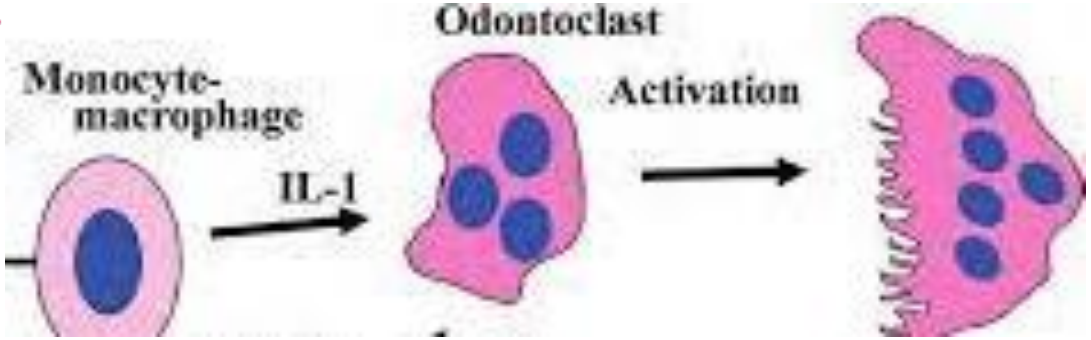
- The cells responsible for the removal of dental hard tissue are called **odontoclasts**.



- The odontoclasts can resorb all the dental hard tissue including enamel.

Odontoclasts

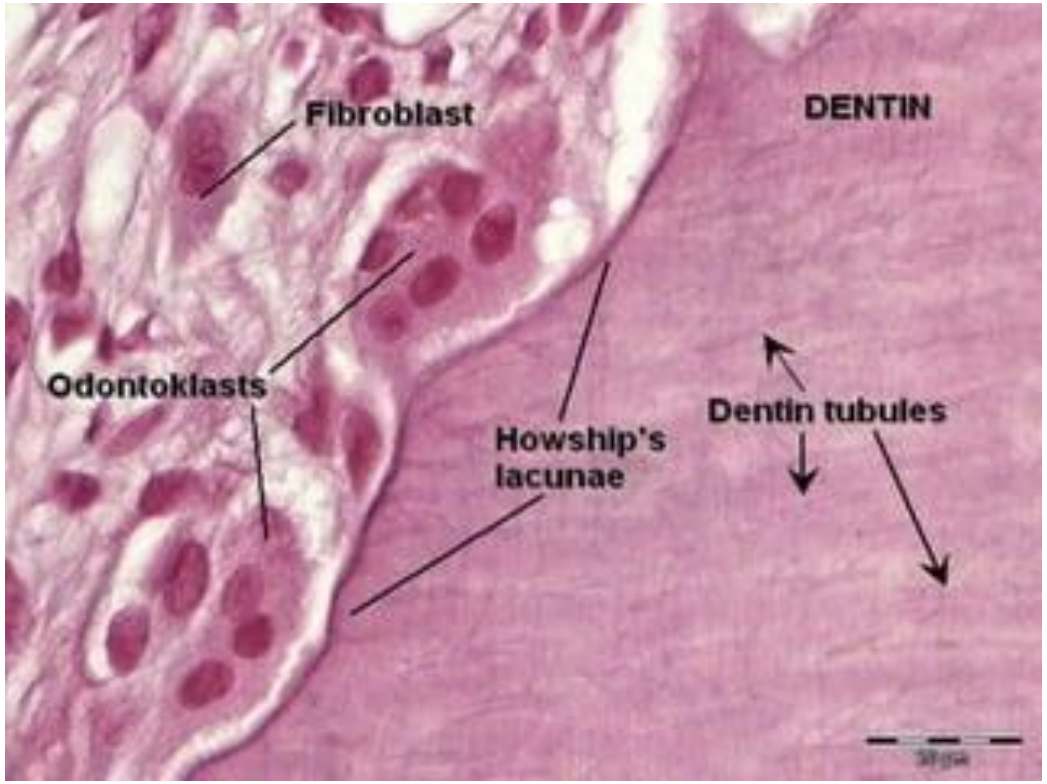
- Origin: Originate from fusion of circulating monocytes in the dental pulp or PDL
- Alternatively, it is believed that they originate from undifferentiated mesenchymal cells
- They're multinucleated giant cells



- Distribution: Commonly found on the root surface
- Occasionally, odontoclasts can also be found in pulp chambers and root canals, especially in the multi-rooted teeth

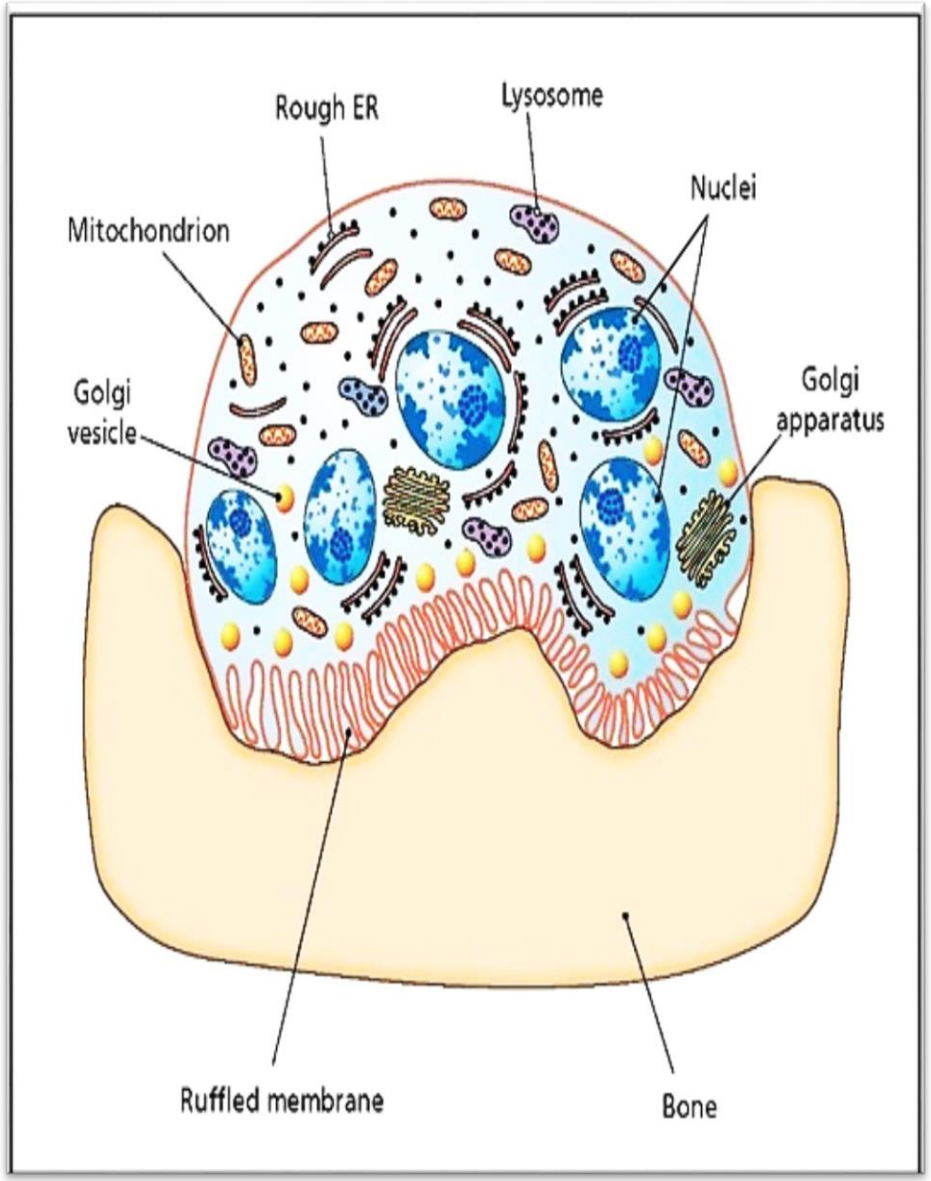
Odontoclasts Morphology

- Under the light microscope, odontoclasts appear **similar to osteoclasts** except that they are smaller
- They are large, multinucleated
- Cytoplasm is eosinophilic vacuolated
- They are easily recognized, in clusters and occupying hollowed-out, shallow depression know as **Howship's lacunae**



Odontoclasts Morphology

- When seen under the electron microscope, they appear as **large** cells with **multiple nuclei**
- **Foamy appearance** due to high concentration of vesicles and vacuoles Containing lysosomes
- At the site of dentin resorption, the odontoclasts form a specialized membrane called **a ruffled border** or brush border
- The cytoplasm adjacent to the brush border is devoid of cell organelles but rich in **actin and myosin filaments**. Help in attachment to dentine surface

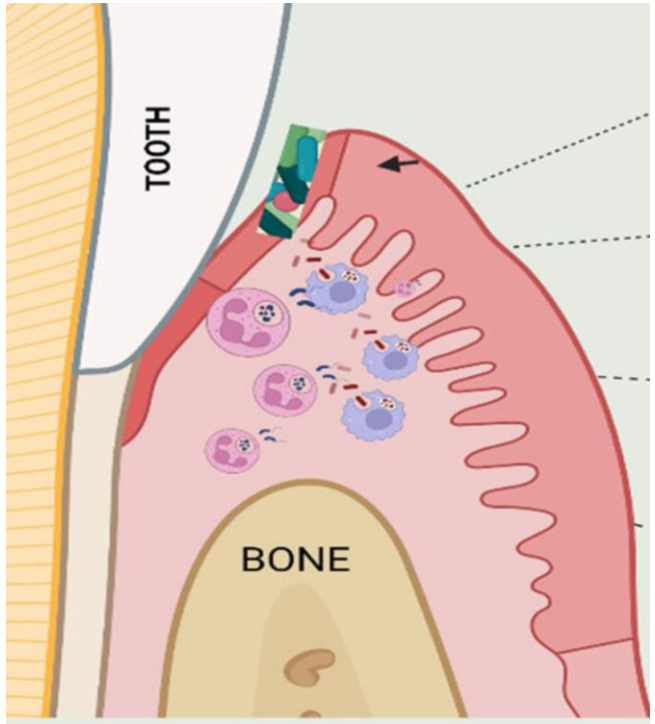


Odontoclasts Morphology

- The odontoclast has a high level of **acid phosphatase activity**.
- Acid phosphatase helps in the **dissolution of the hydroxyapatite matrix** of dental hard tissues that contain calcium and phosphate ion $Ca_{10}(PO_4)_6(OH)_2$
- These ions are absorbed into the vesicles in the odontoclast and then eventually **released into the extracellular fluid**
- As a result, levels of **calcium and phosphate are increased in the blood during resorption**

Histological changes in PDL

- **Loss** of PDL fibers is **programmed** and occurs at specific ages (Programmed cell death or apoptosis)
- That's why, it is believed that shedding is a genetically controlled process



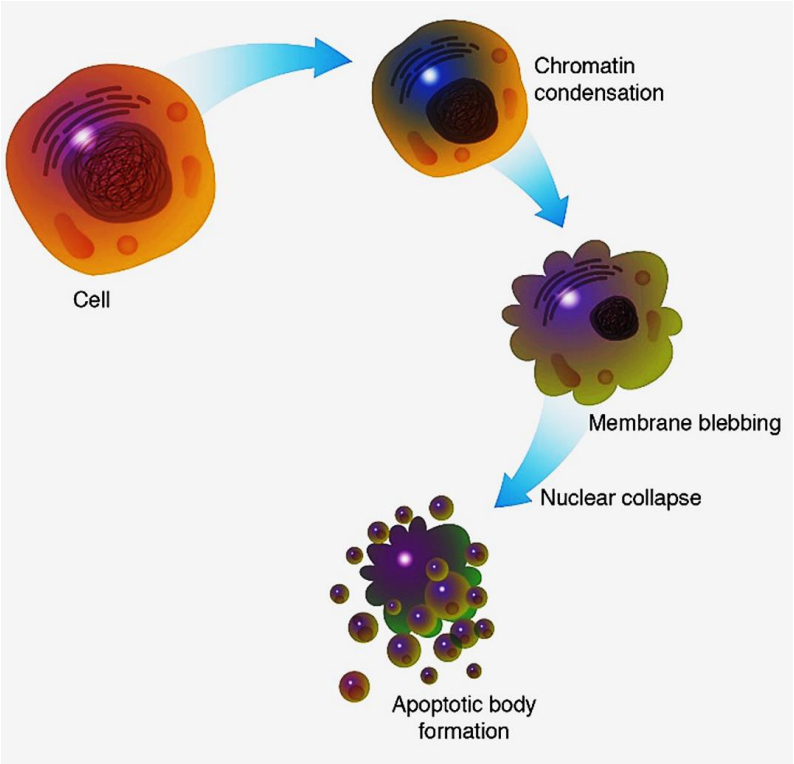
- Cell death in PDL occurs **without inflammation** and shows at least two forms:

Histological changes in PDL

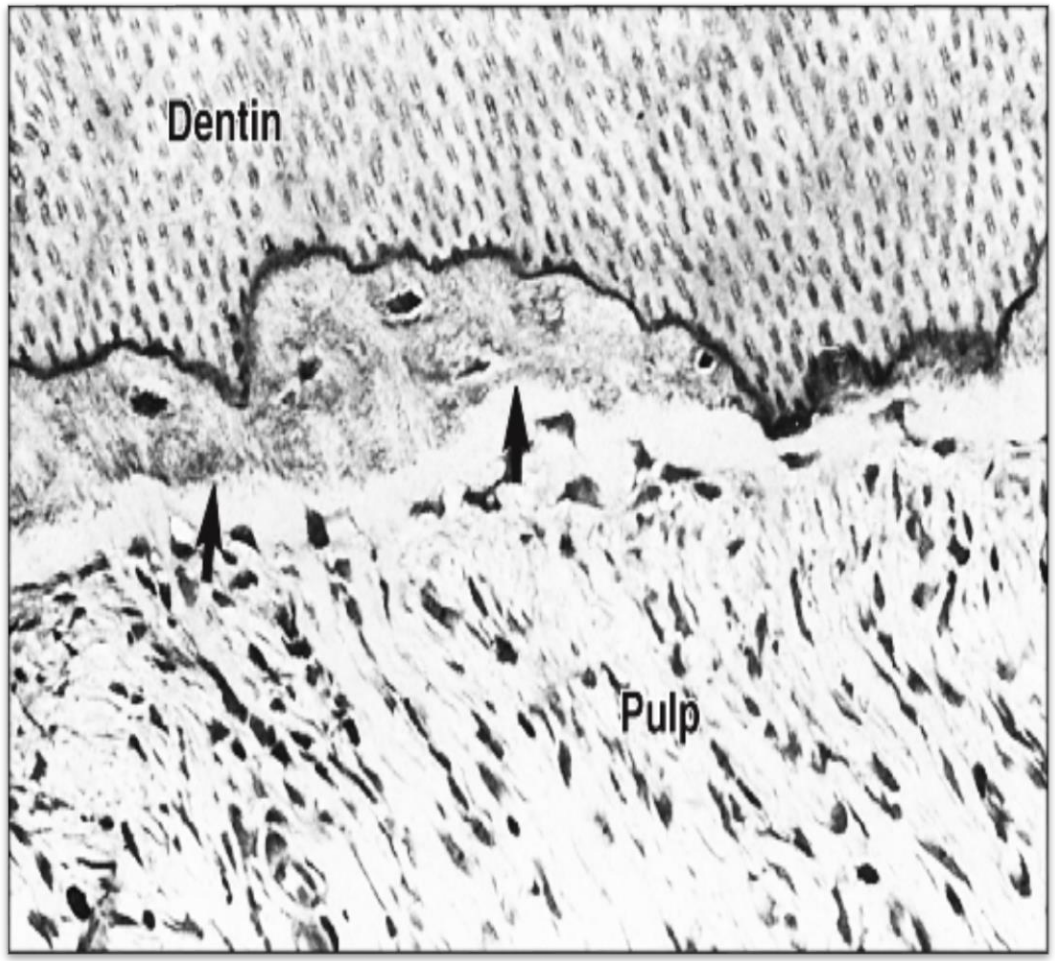
"Apoptosis"

1: The **fibroblasts** show signs of **cytotoxic alteration** as well as changes in their normal cellular function as secretion of collagen that eventually leads to cell death.

2: The **fibroblasts** show features of **physiologic cell death** including condensation or shrinkage so that they can be phagocytosed by neighboring cells (**macrophages or adjacent fibroblasts**).



Just **before exfoliation**, **resorption stops** as odontoclasts migrate away from dentin & remaining pulp cells deposit **cement-like tissue** on it



The process of shedding the primary tooth is intermittent

Histological changes in Pulp

- Pulp plays a **passive role** in tooth shedding/resorption
- During active root resorption, **coronal pulp** tissue appears **normal** & odontoblasts still line the predentin surface
- Tooth may shed with some pulp tissue still intact

Factors affecting tooth shedding

A: Genetic factors (80%)

- The occurrence of **apoptotic cell death** in the resorbing PDL suggests that the shedding of teeth is a **programmed** developmental event
- This conclusion is also obtained from a study of tooth eruption **in twins**, which indicates that the pattern of tooth eruption is mostly **(80%)** determined by genetic factors.

B: Local Factors Affecting Tooth Shedding

1: **Pressure** from the erupting **permanent** tooth -> most important role

2: **Growth of the face and jaws** and Enlargement of the masticatory **muscles** increase the force on the deciduous teeth and therefore cause shedding

3: **Loss of bone** and supporting tissue (PDL) during resorption leads to the weakening of the tooth in the socket

Clinical Considerations (Abnormal Behavior of Primary Teeth)

1- Retained primary teeth

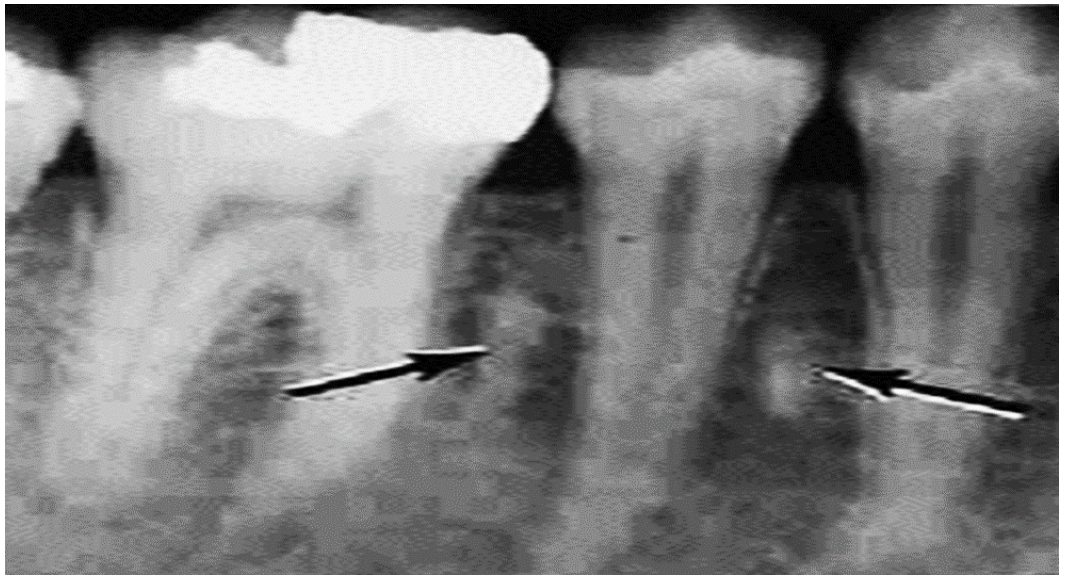
- Causes of retained primary teeth are absence or **impaction of the permanent successor.**

- The teeth most often affected are
  - Upper lateral incisors
  - Lower second molars
  - Lower central incisors. (Least affected)

- **remain functional** for many years among the permanent teeth before they are **lost through the resorptio**n of their roots.

2- Remnants of deciduous teeth

- **Parts of the roots of deciduous teeth,** not in the path of erupting permanent teeth may escape resorption.



- They are **asymptomatic** and, if observed on X-ray, should not be disturbed.
- Root remnants may **exfoliate** if they are near the surface of the jaw, or they may undergo **resorption** and become **replaced by bone**

- the mesiodistal diameter of lower 5 is smaller than the distance between the roots of lower E, so part of the roots found deep in the bone

3- Submerged primary teeth (ankylosed)

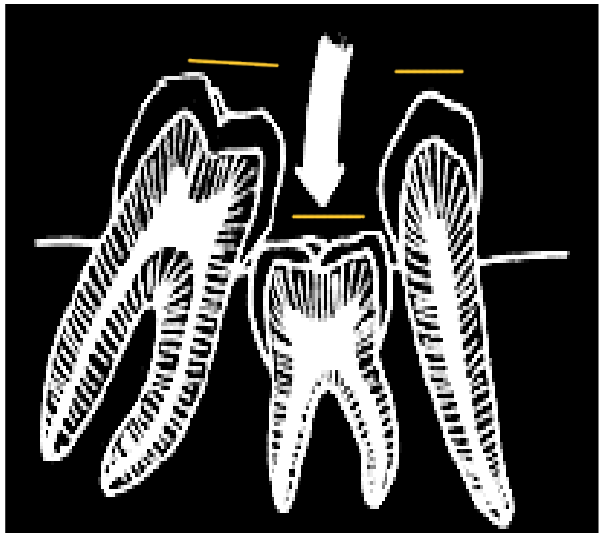
- due to **trauma**.

- prevented from active eruption and become ankylosed in the alveolar bone **as a result of** the continued eruption of adjacent teeth and increase in height of the alveolar ridge.

* . cementum is directly attached to bone. without PDL.

❑ Submerged primary teeth should be

- **Removed as soon as possible** if their permanent successors are present.
- If their successors are not present, **crowns are necessary** to be the same as their neighboring teeth.



4- Preprimary (Prenatal) teeth

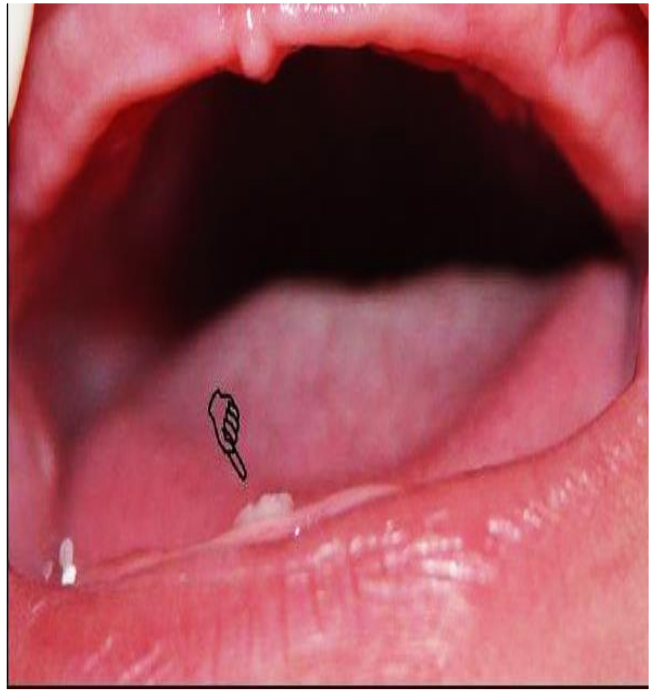
- In **very rare** cases in **newborn** or neonatal infants

- They are **commonly** found on the alveolar ridge of the mandible in the incisor region and are usually **two or three** in number

- Because they **possess no roots**, they are not firmly attached

- Frequently, they are shed during the first few weeks of life

- They **should be removed** as soon as possible, to prevent discomfort to both the mother and the baby during suckling



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