1. To know the Pattern of shedding of anterior deciduous teeth
2. To know the Pattern of shedding of deciduous molars
3. To understand Histology of shedding
4. To explain the Mechanism of Resorption and shedding
   (A) Resorption of hard dental tissues
   (B) Resorption of dental soft tissue
5. To understand clinical consideration, abnormalities and factors may affects in shedding
Definition
1. Pattern of shedding of anterior deciduous teeth
2. Pattern of shedding of deciduous molars

Histology of shedding
Function of odontoclast
Mechanism of resorption and shedding
Resorption of hard dental tissues
Resorption of dental soft tissue

Retained Deciduous Teeth
Remnants of Deciduous Teeth
Ankylosis and submerged deciduous teeth

Factors that determine the pattern and rate of deciduous teeth shedding
1. Genetic Factors
2. Local Factors
   a) Local pressure
   b) Masticatory forces

Clinical considerations
Retained Deciduous Teeth
Remnants of Deciduous Teeth
Ankylosis and submerged deciduous teeth
Definition:
Shedding is the physiologic exfoliation of the primary teeth caused by progressive physiologic resorption of their roots and their supporting tissue at specific age to be replaced by its permanent successor.
1- **Loss of root.** Pressure from growing and erupting permanent teeth induce the differentiation of odontoclasts, which result in resorption of the primary roots. Resorption shorten the roots and causes loss of attachment fibers of the periodontal ligament.

2- **Loss of bone.** Weakening of supporting tissues of the primary teeth occur as a result of root resorption and modification of the alveolar bone.

3- **Increased the masticatory forces.** Increase masticatory forces on the weakened teeth are a result of muscular growth. This amplifies compression of the periodontal ligament and promotes resorption of teeth and alveolar bone.
The resorption process is initiated by the **odontoclast**, the **osteoclast** and the **fibroblast** cells.

During resorption, the pressure of the erupting permanent tooth is directed to the bone separating the crypts of the permanent tooth from the alveolus of the primary tooth.

After this area is resorbed, the eruptive force is directed at the root of the primary tooth, which results in resorption of the cementum and dentine.
The fact that **programmed cell death** is seen in the **PDL** during shedding that occurs at specific ages is consistent with the concept that shedding is a genetically determined process.

It should be emphasized that the **pulp tissue** in teeth undergoing shedding appears histologically **normal** except that **neural elements** seem to be missing. Thus the pulp does not contribute to the process of shedding and **plays a passive role in this process**.
Odontoclasts:
Odontoclasts:

Odontoclasts are similar to osteoclasts, they originate from the fusion of circulating blood monocytes.

Under light microscope:

- Multinucleated cells with a clear attachment zone and ruffled border.
- Occupying resorption bays (Howship's lacunae).
- Their cytoplasm is vacuolated.
Under electronic microscope:

- Extensive folding of the cell membrane with mineral crystallites ions seen within the depth of these invaginations.
- Mitochondria and many vacuoles.
Four regions can be seen:

1. Ruffled border.
2. A clear zone (no organelles – only granular cytoplasm).
3. Vesicular region.
4. Basal region (containing the cytoplasmic organelles).

1. Histochemically
   A high level of activity of enzyme acid phosphatase, occurs within their vacuoles.
- Odontoclasts are found on the surfaces of:
  1. Resorbed roots.
  2. In root canals.
  3. Pulp chambers.
  4. Replacing the odontoblast layer.

- Tooth resorption is not continuous.
- Loss of PDL fibers.
- Apoptotic fibroblasts death occurs at specific times.
Odontoclasts
Root Resorption

- Resorbing alveolar bone
- Resorbing root dentin
- Osteoclasts
Root Resorption

- Osteoclasts
- Dentin of root
Resorption of hard tissue occurs in two phases:

- **Extracellular Phase**: involves initial breakdown of small area of hard tissue into partially dissolved fragments.

- **Intracellular Phase**: where odontoclasts appear to ingest and complete the dissolution of breakdown products.

Clast cells act by isolating an area of hard tissue (bone, cementum, dentin or even enamel) using clear cytoplasmic areas (no organelles) and through plasma membrane associated enzymes that act as proton pumps, add H+ to that area. The isolated area's pH is lowered making it acidic.

This acidity breaks down the hydroxyapatite crystals of the inorganic content and also denature the collagenous organic matrix. Essentially denaturing makes the tightly assembled collagen fibrils looser. The proteolytic enzymes (cathepsin K, matrix metaloprotease) both secreted and within lysosomes in the clast cells are then able to break down this collagenous organic matrix.
It begins at 4-5 years for the incisors and 6 years for the canine.

At this time the crowns of permanent teeth are completed and situated in their own crypts lingual to the apical third of the roots of the corresponding primary teeth.

The eruptive movement proceeds first in an incisal and labial direction.
Pressure is first directed at the bone separating the crypts of the permanent successors and the alveolus of the primary roots then directed at the primary roots.

Thus, resorption of the primary anterior teeth first occurs along the lingual surfaces of the apical third of the root.

When the permanent tooth crown lie directly below the deciduous tooth, resorption proceeds horizontally in an incisal direction.
Sometimes, particularly in the region of the **mandibular incisors**, the labial movements of the permanent teeth do not cause complete loss of the primary roots.

This may result in the primary **incisor remaining in the jaw and attached to the labial alveolar bone**. Then when the crown of the permanent incisor emerges through the gingival, they appear lingual to the primary ones that is still in place.

Removal of the primary crown and remaining root assist the permanent ones in correcting their position.
RESORPTION PATTERN OF THE POSTERIOR PRIMARY TEETH
The growing premolar crown is initially located between the roots of the primary molar teeth.

The first signs of resorption around these crowns occur in the supporting interradicular bone. This is followed by resorption of the adjacent surfaces of the primary tooth roots.
The premolars continue to erupt as the primary molars further resorb, and these teeth then exfoliate. The premolars then erupt in place of primary molars.
The pattern of shedding is symmetric for the right and left sides.

Mand. primary teeth are shed before their max. counterparts (except 2nd. molars).

Exfoliation occurs in girls before boys.

The sequence of shedding in the mandible follows the ant. to post. order.

In max., the first molar exfoliates before canine.
Shedding is an intermittent process with periods of resorption involving alveolar bone, cementum and root dentin resorption by clast cells, osteoclasts and odontoclasts, respectively.

This is followed by recovery periods when osteoblasts and cementoblasts replace part of the resorbed tissues. Eventually more resorption takes place and when the tooth loses its supporting periodontal tissues, it is shed.

During this process the primary teeth become loose during the periods of resorption and tighten during the brief periods of apposition.

A, Reversal line; B, Cementoblasts; C, Cementocyte.
Deciduous dentition (milk teeth) (names of teeth are here followed by the usual age of eruption)

Upper teeth

4 First molar (12th–16th month)
3 Canine (15th–20th month)
2 Lateral incisor (8th–12th month)
1 Central incisor (6th–8th month)

5 Second molar (20th–40th month)

6 Replacement of deciduous teeth (milk teeth) by adult teeth (deciduous teeth are indicated with a heavy line)

6a 5 years
6b 8 years
6c 9 years
6d 11 years
6e 13 years
6f Adult

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1 - Retained primary teeth:

Causes: absence or impaction of the permanent successor.

The teeth most often affected are the upper lateral incisors; followed by the lower second premolars; the teeth least often affected are the lower central incisors.

Retained primary teeth often remain functional for many years among the permanent teeth before they are lost through resorption of their roots. Their loss is believed to be contributed to the continued active eruption and progressive elongation of the clinical crown of such teeth at the expense of root length.
Retained primary first molar
Retained deciduous teeth.
2- **Submerged primary teeth (Ankylosis):**

It is defined as *fusion of cementum or dentin to alveolar bone due to cellular changes in the periodontal ligament caused by trauma and other pathologies.* Such teeth are prevented from active eruption and become submerged in the alveolar bone as a result of the continued eruption of adjacent teeth and increase in height of the alveolar ridge.

**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 as the same as their neighboring teeth.

*The major difference between retained and submerged primary teeth is that latter are fused to the alveolar bone* (ankylosed), where the former are not.
The most commonly affected teeth are mandibular primary first molar, mandibular primary second molar, maxillary first molar and maxillary primary second molar in that order.

Ankylosis can lead to:
1- Loss of arch length
2- Extrusion of teeth of the opposite arch
3- Interference with the eruption of succedaneous teeth
submerged deciduous tooth
Submerged tooth
Alveolar bone

Cementum

Ankylosis

Alveolar bone
Ankylosis of primary first molar
3- Remnants of primary teeth:
 Remnants of primary teeth are parts of the roots of the primary teeth that escaped resorption during the process of shedding. They are most frequently seen in their interdental septa in the region of the lower second premolars. The lower E have widely divergent roots, where the mesiodistal diameter of lower 5 is smaller than the distance between the roots of lower E
 They are asymptomatic; and if observed on X-ray, should not be disturbed.
 Fate:
    a- Surrounded by cellular cementum.
    b- Ankylosed to bone.  e- Resorbed.  d- Exfoliated
Retained deciduous root tips
Physiologic resorption of deciduous second molar in the absence of the second premolar.

Resorption of a deciduous tooth can occur even in the absence of an underlying permanent tooth.

However, the resorption may be delayed.
4- Congenitally Missing Teeth

- Hypodontia - usually a single tooth missing
- Frequency: 2-9%
- The most commonly missing tooth is third molar followed by lateral incisor and second premolar.
- Key to diagnosis - count the teeth!!!

Missing teeth!!!
Absent permanent teeth
Supernumerary tooth
**Undermining resorption:** If the root of the primary tooth is resorbed by neighboring permanent tooth instead of the respective successor.

This occurs more frequently in the upper than in the lower jaw and more often in boys than in girls.

In descending order, this may occur to:

a) the distal roots of the upper second primary molars by the first permanent molars
b) the lateral primary incisors by the permanent central incisors
c) the primary canines by the lateral incisors, more rarely by the permanent first bicuspids.

**Causes:**

*Lack of space or unfavorable inclination of the erupting teeth.*

The consequences of undermining resorption are similar to those of premature loss of the primary tooth: tooth migrations, tipping, rotations, i.e., lack of space in the front teeth segment or in the buccal segment (Stuetzzone).
5- Preprimary teeth:

In very rare cases preprimary teeth appear in the oral cavity of **newborn or neonatal infants**.

They are commonly found on the **alveolar ridge of the mandible in the incisor region**, and usually two or three in numbers.

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 during suckling**.

Sometimes, the teeth seen in the mouth of a newborn baby are **premature primary teeth**. Thus, they are not replaced after they fall out, and their place remains patent until the corresponding permanent teeth erupt.
Premature Eruption
Abnormal tooth movement

- **Systemic factors** may delay tooth eruption such as:
  - endocrine deficiency (Hyperthyroidism or Cretinism),
  - nutritional deficiency,
  - Hereditary (Cleidocranial dysplasia and gingival fibromatosis).
  - Idiopathic.

- **Local factors** interfering with eruption include:
  - early loss of deciduous tooth,
  - eruption cyst,
  - crowding.
Delayed Eruption In Gingival Fibromatosis
Delayed Eruption
Delayed Eruption in Gingival Fibromatosis
Eruption Problems

- Impaction
- Ankylosis
- Misdirected Teeth
Impaction is defined as a cessation of eruption of a tooth caused by a clinically or radiographically detectable physical barrier in the eruption path or by an ectopic position of the tooth.

Primary retention (unerupted and embedded teeth) is defined as a cessation of eruption before gingival emergence without a recognizable physical barrier in the eruption path or ectopic eruption.

Secondary retention is termed as cessation of eruption after emergence, without evidence of a physical barrier either in the eruption path or as a result of an abnormal position.
Impacted tooth
Horizontal Impaction

Vertical Impaction

Angular Impaction
Dentigerous Cyst
Eruption Cyst or eruption hematoma is a bluish, translucent, elevated, compressible, asymptomatic, dome-shaped lesion of the alveolar ridge associated with an erupting primary or permanent tooth. If left untreated, the cyst will spontaneously rupture. The cyst may be marsupialized or punctured to facilitate eruption.
Eruption Hematoma is a bluish, opaque, asymptomatic lesion which overlays an erupting tooth. The swelling is due to the accumulation of blood, tissue fluid, or both in the dilated follicular sac around the erupting crown. It can be differentiated from an eruption cyst by transillumination. Treatment is not indicated, although incision is sometimes performed to facilitate eruption.
Dentigerous Cyst (Follicular Cyst)

Most common developmental odontogenic cyst (20% of all jaw cysts)
Develops due to an accumulation of fluid between the crown of the tooth and reduced enamel epithelium (follicle), with the reduced enamel epithelium eventually forming the epithelial lining of cyst.
Increase in size due to increased osmolarity as result of passage of inflammatory cells and desquamated epithelial cells into cyst lumen results in centrifugal growth of cyst (slow process)
Eruption cyst

Eruption hematoma

Ectopic eruption
Diverse oral anatomical locations can infrequently be the site of an ectopic tooth eruption.

Such locations include the nasal cavity, chin, mandibular condyle, coronoid process, and palate.

One of the sites for an ectopic tooth in a nondental location is the maxillary sinus.

Impaction of a tooth in the maxillary sinus can be asymptomatic. Such teeth are often discovered accidentally on radiographs of the skull or teeth.
Thank you!