Oral histology
lec4

TOOTH DEVELOPMENT

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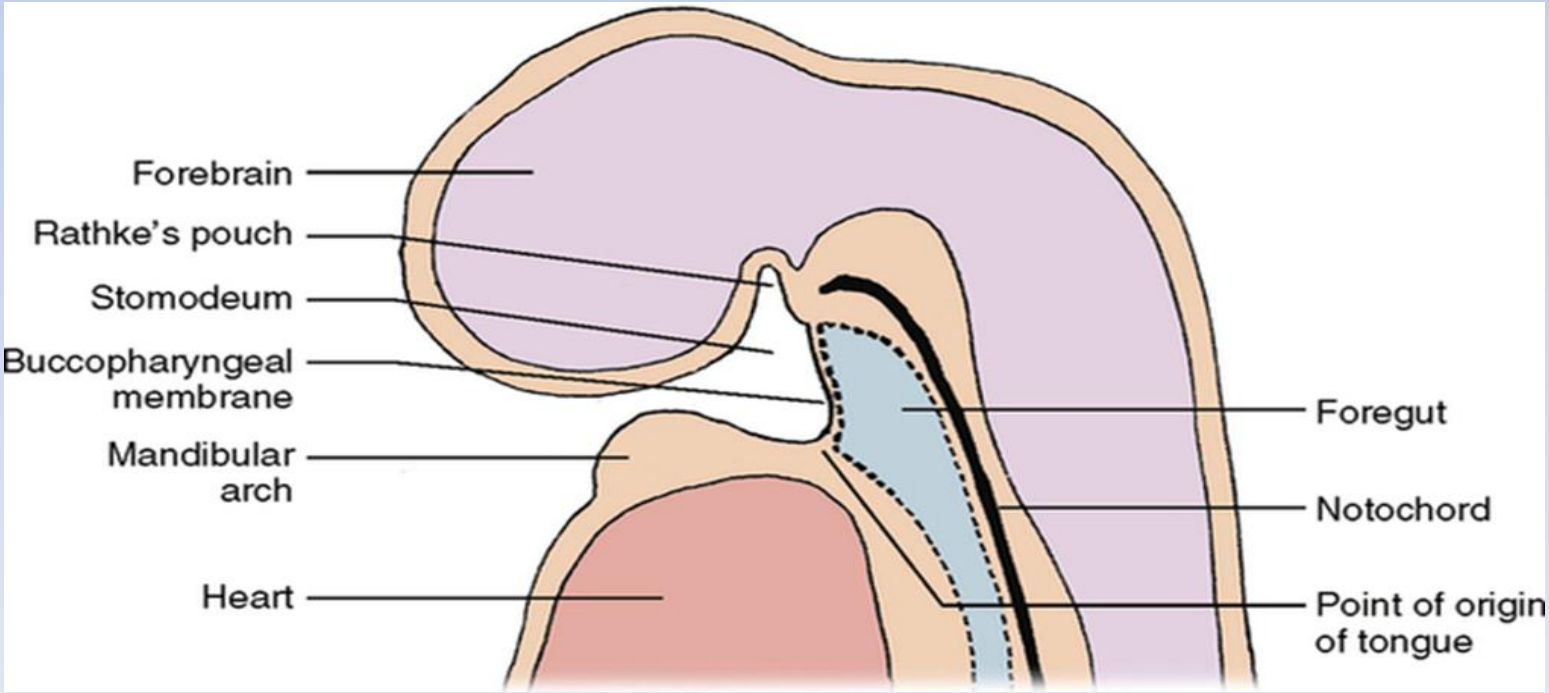
- A process is also known as **odontogenesis**.
- **Tooth development** is the complex process by which form **teeth** from **embryonic cells, grow**, and **erupt** into the **mouth.** It is started at **6th week** of gestation.
- **Odontogenesis** involves the development of primary (**deciduous**) and (**permanent**) secondary dentition.
- Two embryonic tissues are responsible for the development of a tooth:
- **1. Ectomesenchymal** tissues (neural crest in origin) which give rise to the **dentin**, pulp, periodontal ligament, cementum and part of alveolar bone
- **2. Oral epithelium** (ectoderm) which gives rise to **enamel** of the tooth.

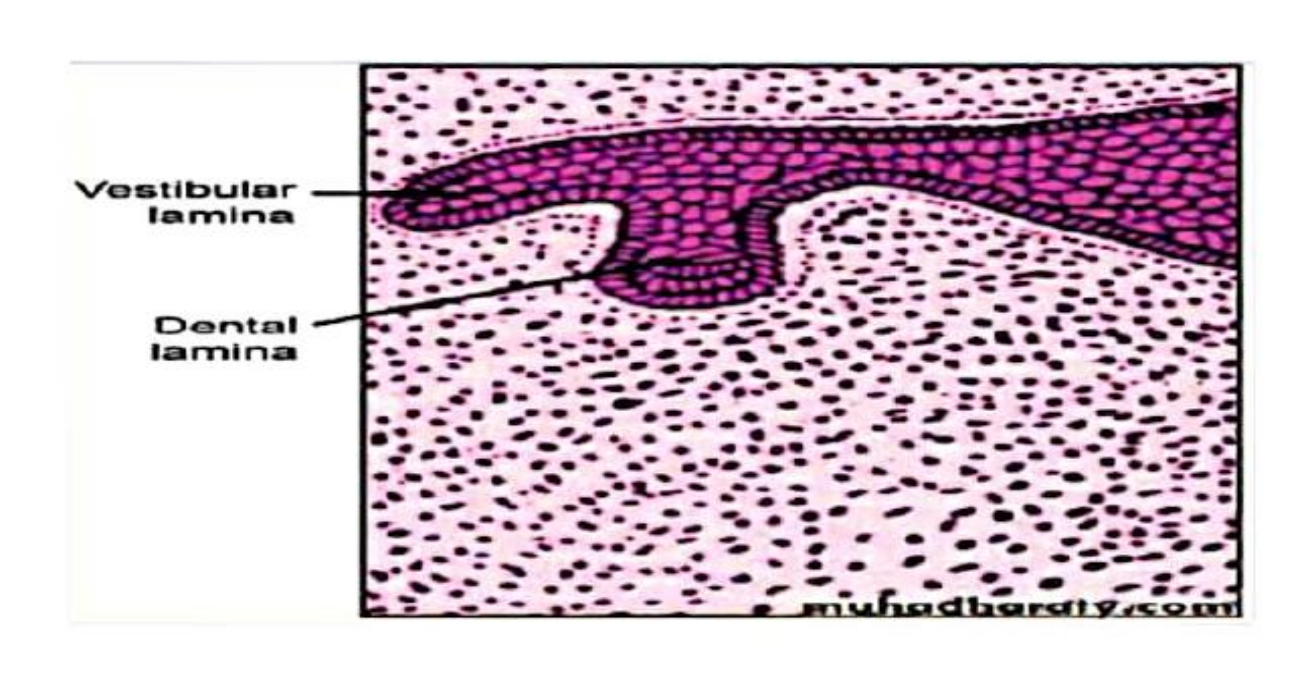
- Two or three weeks after the rupture of the buccopharyngeal membrane, when the embryo is about 6 weeks old, certain areas of basal cells of the oral ectoderm leads to the formation of the Primary epithelial band which is a band of epithelium that has invaded the underlying ectomesenchyme along each of the horseshoe-shaped future dental arches



FORMATION OF PRIMARY DENTITION

- **Stages of development:**
- **1- INTIATION STAGE**:
- The first sign of tooth development is appearance of condensation of ectomesenchymal tissue and capillary network beneath the probable dental epithelium. Certain areas of basal cells of oral ectodermal epithelium proliferate more rapidly than do the cells of the adjacent areas, to form the **primary epithelial band**

- At about 7th week the primary epithelial band divides into an inner (lingual) process called **Dental lamina** and an outer (buccal) process called **Vestibular lamina.** The dental laminae serve as the primordial for the ectodermal portion of the deciduous teeth.



- The **dental lamina,** which is a band of epithelium, invades the ectomesenchymal cells along each of horse shoe-shaped future dental arch in a form of **small rounded swellings.** From its free edge to its base where the lamina is attached to the mouth epithelium. These epithelial swellings of the lamina are the **enamel organs** which represent the **tooth buds** of deciduous teeth. The developments of enamel organs of permanent molars arise directly from a distal backward extension of the dental lamina of the second molar.
- **They arise according to the following sequence:**

1- The first permanent molar is initiated at 4th month in utero.

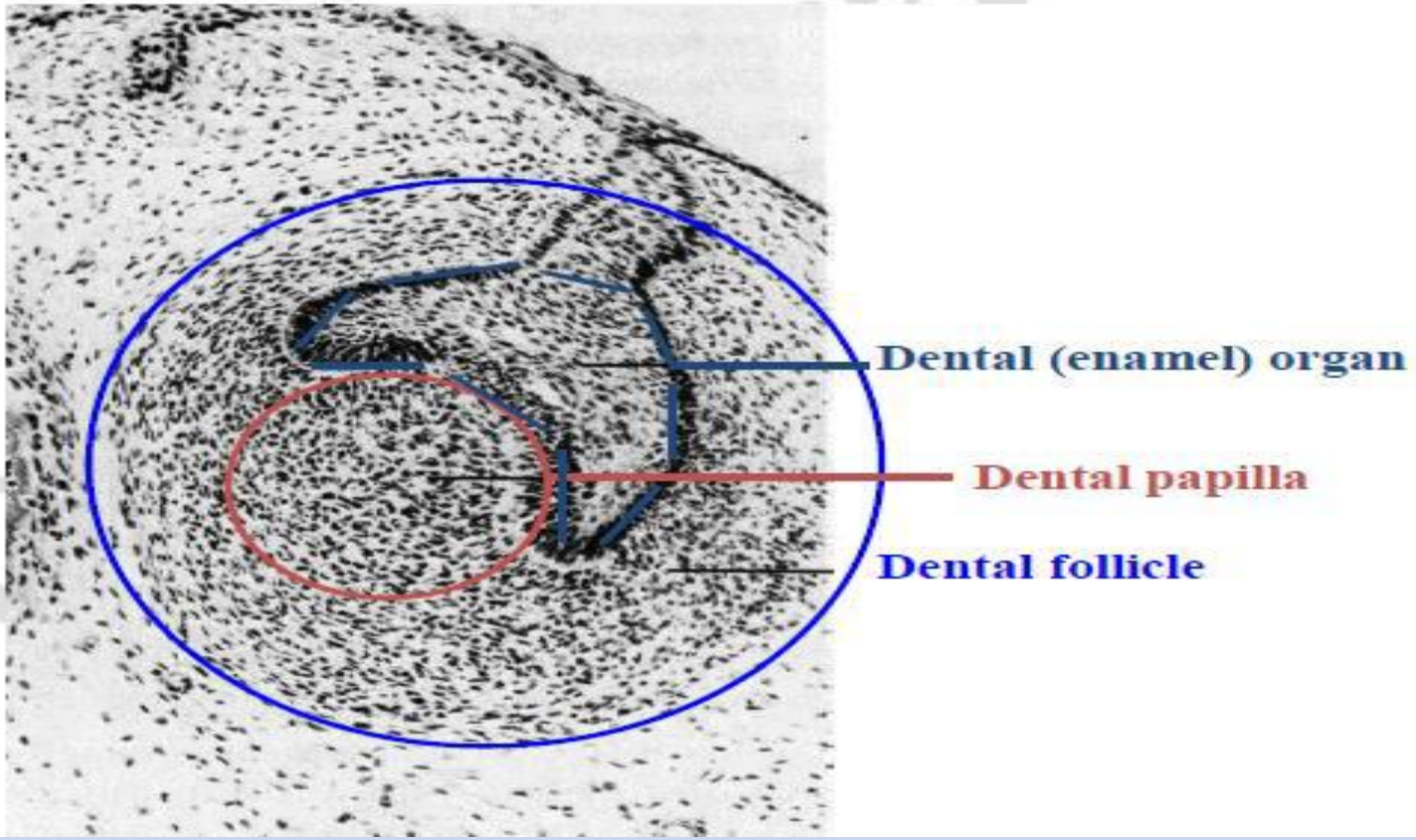
2- The second permanent molar is initiated at 1st year after birth,

3-and the third permanent molar is initiated at 4th or 5th years.

- ***A timetable to remember:*** Entire primary dentition initiated between 6 and 8 weeks of embryonic development.
- Successional permanent teeth initiated between 20th week in utero and 10th month after birth Permanent molars between 20th week in utero (first molar) and 5th year of life (third molar)

- **2- BUD STAGE:**
- It occurs at 8 weeks. It is named so, because there is an extensive proliferation or in growth of the dental lamina into buds or ovoid swelling (masses) penetrating into the ectomesenchymal. This penetration is occurring at 10 different locations involving the primary (deciduous) dentition of maxillary arch and 10 sites for mandibular arch.
- These buds are representing the primordial of the enamel organs of primary dentition.
- **3- CAP STAGE:**
- By the eleventh week, the tooth bud continues to proliferate leading to formation of cap shape structure attached to the dental lamina, which is characterized by a shallow invagination on the deep surface of the bud.

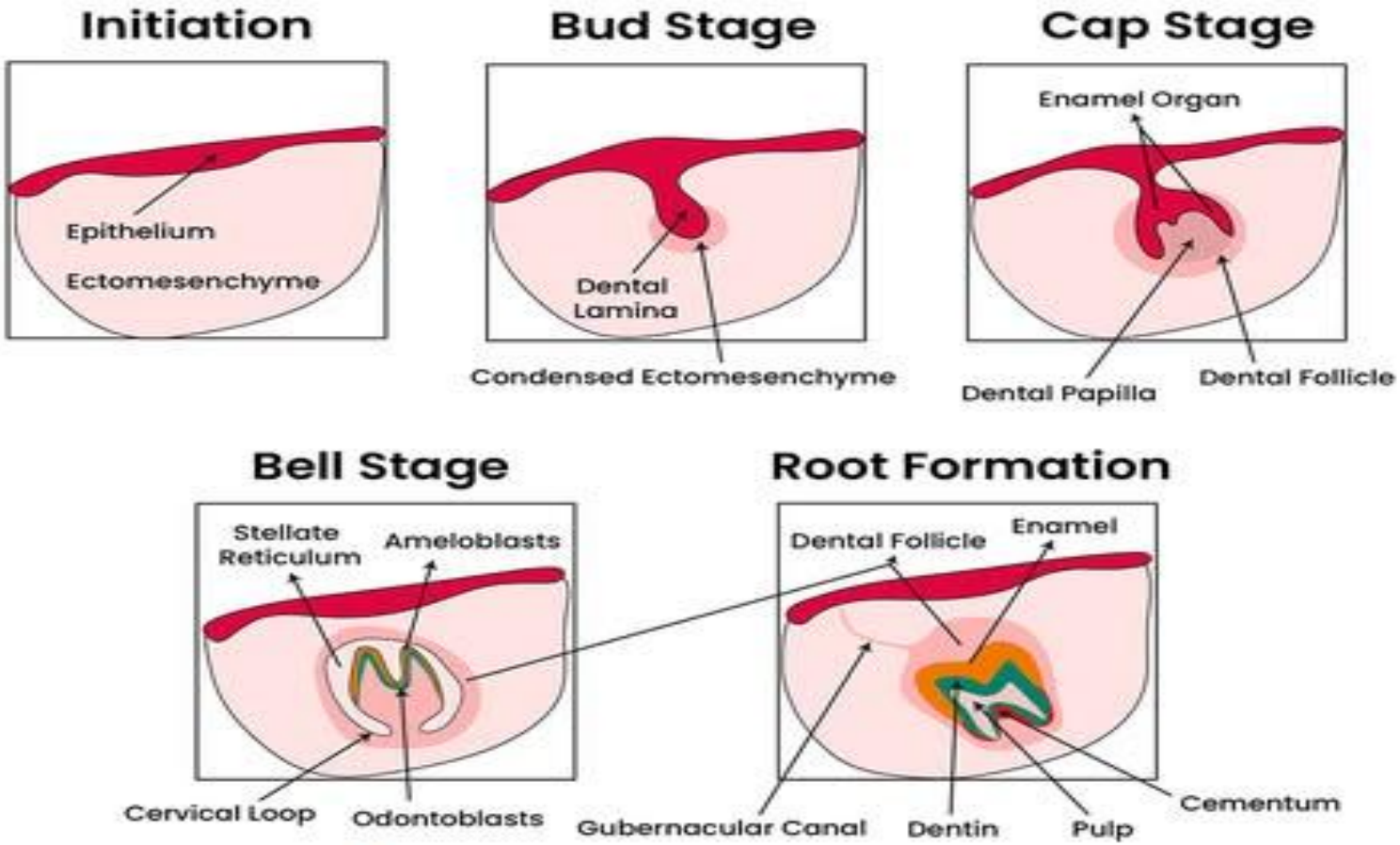
- ***At this stage three structures appear:***
- **a. The enamel organ** which appear in a shape of cap.
- **b. Dental papilla:** Which is a collection of ectomesenchymal cells occupying the depression of the cap. The cells of dental papilla will give rise to the dentin and the pulp of the tooth**.**
- **c. The dental sac (or follicle)** which is a collection of ectomesenchymal cells outside the enamel organ. The cells of the dental sac will give rise to the cementum of the tooth, the periodontal ligament and the alveolar bone.
- a, b and c are all together called the tooth germ of the tooth.



- *Figure 2: Is showing the cap stage of tooth development. The three parts of tooth germ is represented by enamel organ; dental papilla; and dental follicle.*

- **4- BELL STAGE:**
- It occurs between twelve to fourteenth week. During this stage there will be a determination of the **shape of the crown for the tooth**. Also during this stage, the **permanent teeth** develop from the lingual extension of dental lamina named as the **successional lamina.**
- Four types of epithelial layers could be seen in the enamel organ at this stage:
- **i. Inner enamel epithelium:** Consists of a single layer of cells that differentiate into **ameloblasts which form the enamel of the tooth.**
- **ii**. **Stratum intermedium**: This layer is essential for the enamel formation because its cells contain alkaline phosphatase.
- **iii**. **Stellate reticulum:** The cells are star-shaped with long processes
- Its function includes: Protection of stratum intermedium and inner enamel epithelium,
- **iv. Outer enamel epithelium**: This layer is a route through which the nutrients reaches to the other layer of the enamel organ.
- **Dental papilla**: Part of its ectomesenchyme differentiate into odontoblasts.
- **Dental sac (follicle)**: Its ectomesenchyme will form the cementum, periodontal ligament (PDL) and part of alveolar bone.

Tooth Development



- At bell stage is associated with the formation of first dental hard tissues of the crown which include the dentin and enamel. Usually the dentin is formed before the enamel.
- **Root of tooth development usually starts after the completion of the crown development.**
- **Agents affecting tooth and bone development:**
- 1- Vitamin A deficiency:
- 2- Vitamin C deficiency:
- 3- Vitamin D deficiency.