**Oral Histology**

**Lecture 3 Tooth development**

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**Stages of tooth development are also described according to physiologic changes & function during development & are called histophysiological stages.**

**These include:**

**1- Initiation 2- Proliferation3- Histodifferentiation 4-Morphodifferentiation5- Apposition**

**3-Bell stage which is dividedinto**

1. **Early bell stage**

As the invagination of the epithelium deepens and its margins continue to grow, the enamel organ assumes a bell shape. In the bell stage crown shape is determined. It was thought that the shape of the crown is ***due to*** *the pressure exerted by the growing dental papilla cells on the inner enamel epithelium. This pressure however was shown to be opposed equally by the pressure exerted by the fluid present in the stellate reticulum.*This is the stage of **histodifferentiation.**

The folding of enamel organ to cause different **crown shapes** is shown to be due to differential rates of mitosis and differences in cell differentiation time which is a stage of .Cells begin to differentiate only when cells cease to divide. The inner enamel epithelial cells which lie in the **future cusp tip or incisor region** stop dividing earlier and begin to differentiate first. The pressure exerted by the continuous cell division on these differentiating cells from other areas of the enamel organ cause these cells to be pushed out into the enamel organ in the form of a cusp tip. The cells in another future cusp area begin to differentiate, and by a similar process results in a cusp tip form. The area between two cusp tips, i.e. the cuspal slopes extent and therefore of cusp height are due to cell proliferation and differentiation occurring gradually from cusp tips to the depth of the sulcus. Cell differentiation also proceeds gradually cervically, those at the cervix are last to differentiate.This is a stage of **morphodoifferentiation.**

The junction between inner and outerenamel epithelium is called cervical loop and it is an area of intense mitotic activity.

***Four different types of epithelial cells*** can be distinguished on light microscopic examination of the bell stage of the enamel organ.

**1-Inner enamel epithelium**

The inner enamel epithelium consists of a single layer of cells that differentiate prior to **amelogenesis** into tall columnar cells called **ameloblasts**.The cells of the inner enamel epithelium exert an organizing influence on the underlying mesenchymal cells in the **dental papilla**, which later differentiate into **odontoblasts.**

**2-Stratum intermedium**

A few layers of squamous cells form the stratum intermedium between the inner enamel epithelium and the stellate reticulum.This layer seems **to be essential to enamel formation.** It is absent in the part of the tooth germ that outlines the root portions of the tooth which does not form enamel.

**3-Stellate reticulum**

The stellate reticulum expands further, mainly by an increase in the amount of intercellular fluid. The cells are star shaped, with long processes that anastomose with those of adjacent cells. Before enamel formation begins, the stellate reticulum collapses, reducing the distance between the centrally situated ameloblasts and the nutrient capillaries near the outerenamel epithelium. Its cells then are hardly distinguishable from those of the stratum intermedium. **This change begins at the height of the cusp or the incisal edge and progresses cervically.**

**4-Outer enamel epithelium**

The cells of the outer enamel epithelium flatten to a low cuboidal form. At the end of the bell stage, preparatory to and during the formation of enamel, the formerly smooth surface of the outer enamel epithelium is laid in folds. Between the folds the adjacent mesenchyme of the dental sac forms papillae that contain capillary loops and thus provide a **rich nutritional supply for**

**the intense metabolic activity of the avascular enamel organ.** This would adequately compensate the loss of nutritional supply from dental papilla owing to the formation of mineralized **dentin.**

**Dental lamina**

The dental lamina is seen to extend lingually and is termed successional

dental lamina as it gives rise to enamel organs of permanent successors of deciduous teeth. The enamel organs of deciduous teeth in **the bell stage** show successional lamina and their permanent successor teeth in **the bud** stage.

**Dental papilla**

The dental papilla is enclosed in the invaginated portion of the enamel organ. Before the inner enamel epithelium begins to produce enamel, the peripheral cells of the mesenchymal dental papilla differentiate into **odontoblasts** under the organizing influence of the epithelium. First, they assume a cuboidal form later they assume a columnar form and acquire the specific potential to produce dentin. The basement membrane that separates the enamel organ and the dental papilla just prior to dentin formation is called the membrana preformativa.

**Dental sac**

Before formation of dental tissues begins, the dental sac shows

a circular arrangement of its fibers and resembles a capsular

structure. With the development of the root, the fibers of the

dental sac differentiate into the **periodontal fibers** that become

embedded in the developing **cementum and alveolar bone.**

**2-Advanced bell stage**

Is the stage of **apposition.** This stage is characterized by the commencement of **mineralization and root formation**. During the advanced bell stage, the boundary between inner enamel epithelium and odontoblasts outlines the future **dentinoenamel junction.** The formation of dentin occurs first as a layer along the future dentinoenamel junction in the region of future cusps and proceeds pulpally and apically. After the first layer of **dentin** is formed, the **ameloblast** which has already differentiated from **inner enamel epithelial** cells lay down enamel over the dentin in the future incisal and cuspal areas. The enamel formation then proceeds coronally and cervically, in all regions from the

dentinoenamel junction (DEJ) towards the surface. In addition,

the cervical portion of the enamel organ gives rise to the epithelial

root sheath of **Hertwig**. The Hertwig’s epithelial root sheath

(HERS) outlines the future root and is thus responsible for the

**shape, length, size, and number of roots.**







