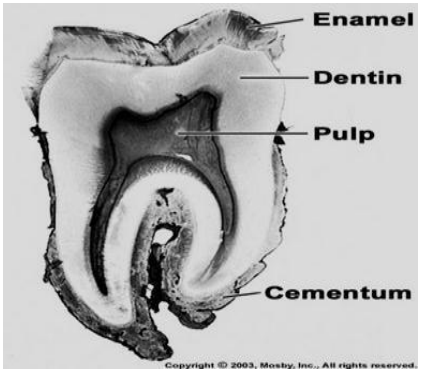
Lec 5

ENAMEL

Enamel is forming a hard protective covering of variable thickness over the entire surface of the crown of the tooth. It is the hardest biological substance. It is formed by a cell called **ameloblast.** Enamel is **not sensitive.** There is no blood and nerve supply.



Physical properties:

Thickness: The thickness of enamel is on the cusps of human molars and premolar is 2-2.5mm.

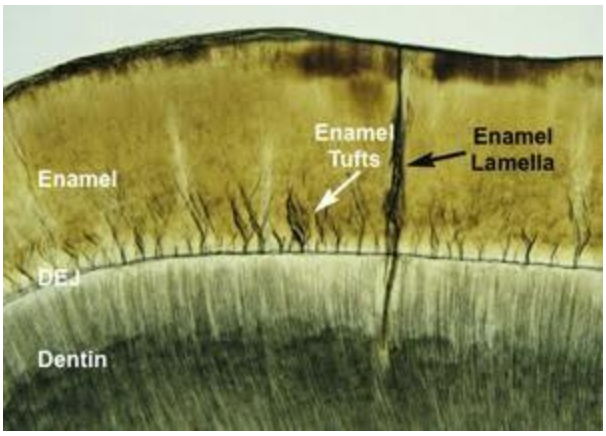
Color: The color is ranging from yellowish white to grayish .Thus the color of the enamel is reflections to the color of the dentin .

Chemical properties

The enamel consists mainly of inorganic materials (96%), and small amount of organic substance and water (3% water, and 1% organic substance).

Enamel microscopical Structure:

Enamel lamellae: Enamel lamellae are thin, leaf-like structures that extend from the enamel surface toward the DEJ They consist of organic material, with but little mineral content makes possible the distinction between cracks and enamel lamellae.



Enamel tufts: These are hypocalcified areas in enamel occurring in enamel due to defects in process of calcifications of enamel

Structure Rod:

The enamel is composed of enamel rods or prisms, rod sheaths, and in some regions a cementing interprismatic substance. The enamel rods normally have a clear crystalline appearance,permitting light to pass through them.

Amelogenesis

Amelogenesis , or enamel formation, is a two-step process. When enamel first forms ,it mineralizes only partially to

approximately 30%. Subsequently, as the organic matrix breaks down and is removed, crystals grow wider and thicker. This process whereby organic matrix and water are lost and mineral is added accentuates after the full thickness of the enamel layer has been formed to attain greater than 96% mineral content.

Life Cycle of the Ameloblasts

Enamel is the hardest calcified matrix of the body. The cells that are responsible for formation of enamel called ameloblast , the ameloblasts are lost as the tooth erupts into the oral cavity, and hence enamel cannot renew itself.

According to their function, the life span of the cells of the inner enamel epithelium can be divided into six stages:

1. Morphogenic stage.
2. Organizing or histodifferentiation stage.
3. Formative or secretory stage
4. Maturative stage.
5. Protective stage.
6. Desmolytic stage.

1.Morphogenic stage

Before the ameloblasts are fully differentiated and produce enamel, they interact with the adjacent mesenchymal cells, determining the shape of the dentinoenamel junction and the crown .

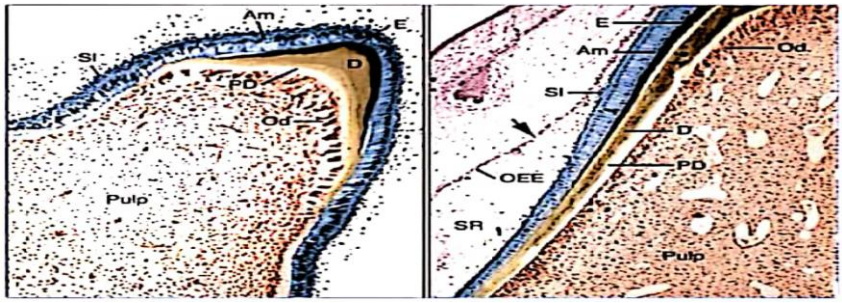
2.Organizing or histodifferentiation stage

In the organizing stage of development ,the inner enamel epithelium interacts with the adjacent connective tissue cells,

which differentiate into odontoblasts.

3.Formative or secretory stage

The ameloblasts enter their formative stage after the first layer of dentin has been formed.



4.Maturative stage

Enamel maturation (full mineralization) occurs after most of the thickness of the enamel matrix has been formed in the occlusal or incisal area. In the cervical parts of the crown, enamel matrix formation is still progressing at this time

5.Protective stage

When the enamel has completely developed and has fully calcified, the ameloblasts cease to be arranged in a well-defined layer and can no longer be differentiated from the cells of the stratum intermedium and outer enamel epithelium.

These cell layers then form a stratified epithelial covering of the enamel, the so-called **reduced enamel epithelium.**

The function of the reduced enamel epithelium is that of protecting the mature enamel by separating it from the connective tissue until the tooth erupts.

6.Desmolytic stage

The reduced enamel epithelium proliferates and seems to induce atrophy of the connective tissue separating it from the oral epithelium, so that fusion of the two epithelia can occur. It is probable that the epithelial cells elaborate enzymes that are able to destroy connective tissue fibers by desmolysis. Premature degeneration of the epithelium may prevent the eruption of a reduced enamel tooth.

Mineralization and maturation of the enamel matrix

Mineralization of the enamel matrix takes place in two stages. In the first stage a partial mineralization occurs in the matrix segments and the interprismatic substance are laid down.

The second stage, or maturation, is characterized by the gradual completion of mineralization. The process of maturation starts from the height of the crown and progresses cervically. Thus there is an integration of two processes: each rod matures from the depth to the surface, and the sequence of maturing rods is from cusps or incisal edge toward the cervical line. The rate of formation of enamel is 4 um/day, therefore to form a layer of enamel of 1mm thickness it would take about 240 days. The rate of enamel formation is more in permanent teeth than in deciduous teeth.