Lec. 3 Restorative dentistry

Biologic Consideration of Enamel and its clinical significance in restorative dentistry

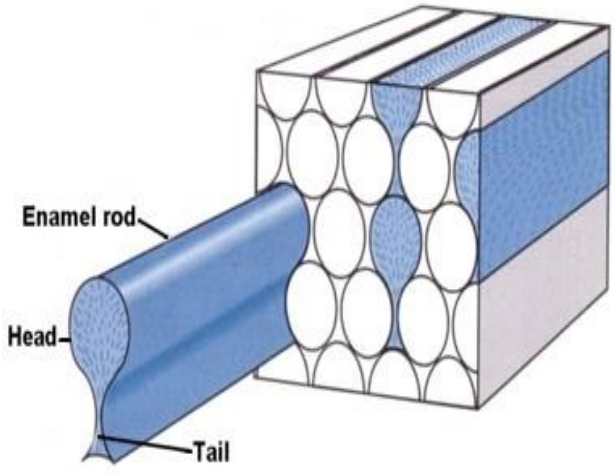
Enamel is the hardest and the highly mineralized substance of the human body; enamel covers the crown of the teeth. It provides protection, shape, color and texture to the crown.

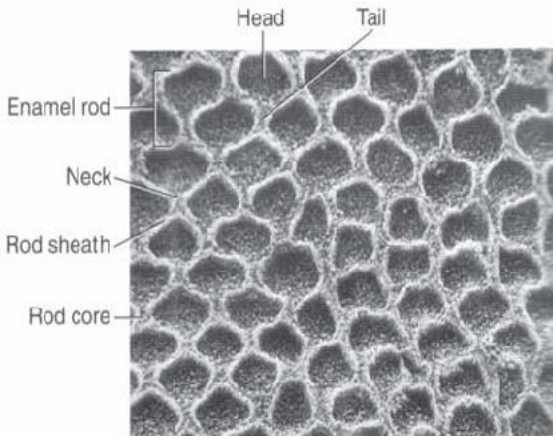
Enamel formation, *amelogenesis*, is accomplished by cells called *ameloblasts*. These cells originate from the embryonic germ layer known as *ectoderm*.

Structurally:

Enamel is composed of millions of enamel rods or prisms (which are the largest structural components), rod sheaths, and a cementing inter-rod substance. Each rod has a head and tail, head is directed occlusally and the tail is directed cervically. In transverse sections, enamel rods appear as hexagonal, round or oval, these may resemble fish scales.

Enamel is incapable of repairing itself once destroyed because the ameloblast cell degenerates after formation of enamel rod. Rods ran from dentinoenamel junction the surface of the tooth in wavy, tortuous course. They are oriented perpendicular to the DEJ. Towards the incisal edge, these become increasingly oblique and are almost vertical at the cusp tips. In the cervical region of permanent teeth enamel rods are oriented outward in a slightly apical direction.





❖ ***Clinical significance****:*

The course of enamel rods is of importance in cavity preparations. It is important that unsupported enamel rod is not left at the cavity, therefore preparation walls should be made parallel to direction of enamel rods. Loss of enamel rods that form cavosurface of dental restorations creates a gap defect, leakage of bacteria & their products that may lead to secondary caries. Therefore, a basic principle of cavity wall preparation is to bevel or parallel the direction of E. rods & avoid undercutting them.

Chemically:

Enamel is highly mineralized tissue. Main inorganic content in the enamel is hydroxyapatite crystals (HA) (96) %. In addition to inorganic content, it also contains a small portion of organic matrix (proteins and water) (4%) which is present in intercrystalline spaces.

Enamel is a very hard tissue due to its high content of minerals and their crystalline arrangement; thus, the enamel is forming a resistance covering of the tooth to withstand force of mastication. Hardness of enamel is different in different areas of the external surface of a tooth. It decreases from outer surface to its inner surface. Although, enamel is hard but brittle, so the underlying dentin (more elastic) acts as a cushion when masticatory forces are applied on it.

❖ ***Clinical significance:***

Enamel is hard but brittle. For this reason, during tooth preparation, for maximum strength of remaining tooth structure, all enamel rods should be supported by healthy dentin base.

Permeability:

Although enamel is a hard, dense structure, it is semipermeable to certain ions and molecules. The route of passage may be through structural units that are hypomineralized and rich in organic content, such as rod sheaths, enamel cracks, and other defects. Water plays an important role as a transporting medium through small intercrystalline spaces. Enamel permeability decreases with age.

Enamel is soluble when exposed to an acid medium, solubility of enamel increases from the enamel surface to the DEJ.

❖ ***Clinical significance:***

- When fluoride ions are present during enamel formation or are topically applied to the enamel surface, the solubility of surface enamel is decreased. Fluoride can affect the chemical and physical properties of the apatite mineral and influence the hardness and stability of enamel. Trace amounts of fluoride stabilize enamel by lowering acid solubility, decreasing the rate of demineralization, and enhancing that of remineralization. Remineralization is only because of enamels permeability to fluoride, calcium and phosphate (available from saliva or other sources).
- When composite resin used in operative dentistry, acid etching causes preferential dissolution of enamel surface and helps in increasing the bonding between resin and enamel.

Color:

Enamel is translucent in nature. Color is ranging from yellowish white to grayish mainly depends upon three factors:

1. Color of underlying dentin
2. Thickness of enamel
3. Amount of stains in enamel.

Anomalies occurring during developmental and mineralization stage, antibiotic usage and excess fluoride intake, affect the color of the tooth.

Thickness

Average thickness of enamel at the incisal edges of incisors is 2 mm; and at the cusp of premolar and molar, it ranges from 2.5 to 3.0 mm. Thickness decreases gradually from cusps or incisal edges to cervical region, it is a knife-edge at the neck of the tooth where the masticatory impact is the least.

❖ ***Clinical significance:***

Thickness of enamel at the base of pit and fissure is less. Pits and fissures are the areas of food and bacteria impaction, which make them highly susceptible to dental caries.

Age changes of enamel:

1. With age enamel worn out because of masticatory attrition which lead to loss of vertical dimension of the crown and flattening of occlusal surfaces.
2. Enamel cracks increased
3. Decrease of enamel permeability
4. Enamel discoloration
5. Translucency of enamel increased with age reflecting the color of dentin so the color of elderly patient appear more yellowish.
6. Chemical composition changes, the crystalline become denser thus resistance to dental caries increased.