Al Rasheed College of Dentistry
Oral Histology

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Lecture 9

Root formation and cementogenesis

The development of the roots begins after enamel and dentin formation has reached the future cementoenamel junction. The enamel organ plays an important part in root development by forming Hertwig' s epithelial root sheath **HERS** from cervical loop. Epithelial root sheath function is to determines the number, length, shape and size of tooth roots and also initiates radicular dentin formation.

Hertwig's root sheath consists of the outer and inner enamel epithelium only, and therefore it does not include the stratum intermedium and stellate reticulum. The cells of the inner enamel, epithelium remain short and normally do not produce enamel, but these cells have induced the differentiation of radicular dental papilla cells into **odontoblasts** and when the first layer of dentin has been laid down, the epithelial root sheath loses its structural continuity and its close relation to the surface of the root. Its remnants persist as an epithelial network of strands or clumps near the external surface of the root. These epithelial remnants are found in the periodontal ligament of erupted teeth near the cementum and are called **epithelial rests of Malassez.**

Development of single and multirooted teeth:

There is a pronounced difference in the development of HERS in teeth with one root and in those with two or more roots. The root sheath of a single -rooted tooth is a tubelike growth of epithelial cells enclosing a tube of D. and the developing pulp. Multirooted tooth develop similarly to a single rooted tooth until the furcation zone begins to form division of the root sheath.

Epithelial diaphragm: the proliferating end of the root sheath bends at a near 45 degree angle at the future cementoenamel junction, narrowing the wide cervical opening of the tooth germ. The epithelial diaphragm will encircle the apical opening of the dental pulp during root development.

Differential growth of the epithelial diaphragm in **multirooted teeth** causes the division of the root trunk into two or three roots. During the general growth of the enamel organ the expansion of its cervical opening occurs in such a way that long **tongue like extensions** of the horizontal diaphragm develop. **Two** such extensions are found in the germs of lower molars and **three** in the germs of upper molars.

Before division of the root trunk occurs, the free ends of these horizontal epithelial flaps grow toward each other and fuse.

The differentiation of odontoblasts and the formation of dentin follow the lengthening of the root sheath. At the same time the connective tissue of the dental sac surrounding the root sheath proliferates and invades the continuous epithelial root sheath dividing it into a network of epithelial strands **epithelial rests of Malassez)**.

This epithelium is moved away from the surface of the dentin so that connective tissue cells of dental sac come into contact with the outer surface of the dentin and differentiate into **cementoblasts** that deposit a layer of cementum onto the surface of the dentin.

The rapid sequence of proliferation and destruction of Hertwig' s root sheath explains the fact that it cannot be seen as a continuous layer on the surface of the developing root.

The wide apical foramen is reduced first to the width of the diaphragmatic opening itself and later is further narrowed by apposition of dentin and cementum to the apex of the root.

If cells of the epithelial root sheath remain adherent to the dentin surface, they may differentiate into fully functioning ameloblasts and produce enamel. Such droplets of enamel, called **enamel pearls** are sometimes found in the area of furcation of the roots of permanent molars.

Accessory root canals: This occur

1-If the continuity of HERS is broken or is not established prior to dentin formation, a defect in the dentinal wall of the pulp happen. Such defects are found in the pulpal floor corresponding to the furcation or on any point of the root itself.

2-if the fusion of the horizontal extensions of the diaphragm remains incomplete. This accounts for the development of accessory root canals opening on the periodontal surface of the root.

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Cementogenesis

Cementum formation in the developing root is preceded by the deposition of dentin along the inner aspect of Hertwig' s epithelial root sheath. Once dentin is formed, breaks occur in the epith. root sheath allowing the newly formed dentin to come in direct contact with connective tissue of the dental follicle and the undifferentiated mesenchymal cells derived from dental sac are differentiate into cementoblasts, which responsible for cementum formation (cementogenesis). cementogenesis is occur in two stages:

1- Cementum matrix formation (cementoid tissue).

2- Mineralization of this matrix.

Cementoblast secrete uncalcifed matrix composed of collagen and protein polysaccharides known as cementoid tissue. Since growth of the cementum is a rhythmic process under normal conditions, a thin layer of cementoid tissue is only seen on the surface of the cementum. This cementoid is lined by cemenoblasts. After some cementum matrix has been laid down, its mineralization begins by addition of hydroxyapatite crystals on the cementoid tissue to form mature cementum.

Unlike ameloblasts and odontoblasts, which leave no cellular bodies in their secreted products, many cementoblasts become entrapped by the cementum they produce and become mature **cementocytes**. As a result of the deposition of cementum over the dentin, the **cementodentinal** junction is formed.