CEMENTUM

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- Cementum in Health

INDEX (CEMENTUM IN HEALTH)

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INTRODUCTION

- Cementum is the mineralized dental tissue covering the anatomic roots of human teeth.
- It was first demonstrated microscopically in 1835 by two pupils of Purkinje.
- It begins at the cervical portion of the tooth at the cementoenamel junction and continues to the apex.
- Cementum furnishes a medium for the attachment of collagen fibers that bind tooth to surrounding structures.
- It is a specialized connective tissue that shares some physical, chemical, and structural characteristics with compact bone, however human cementum is avascular.

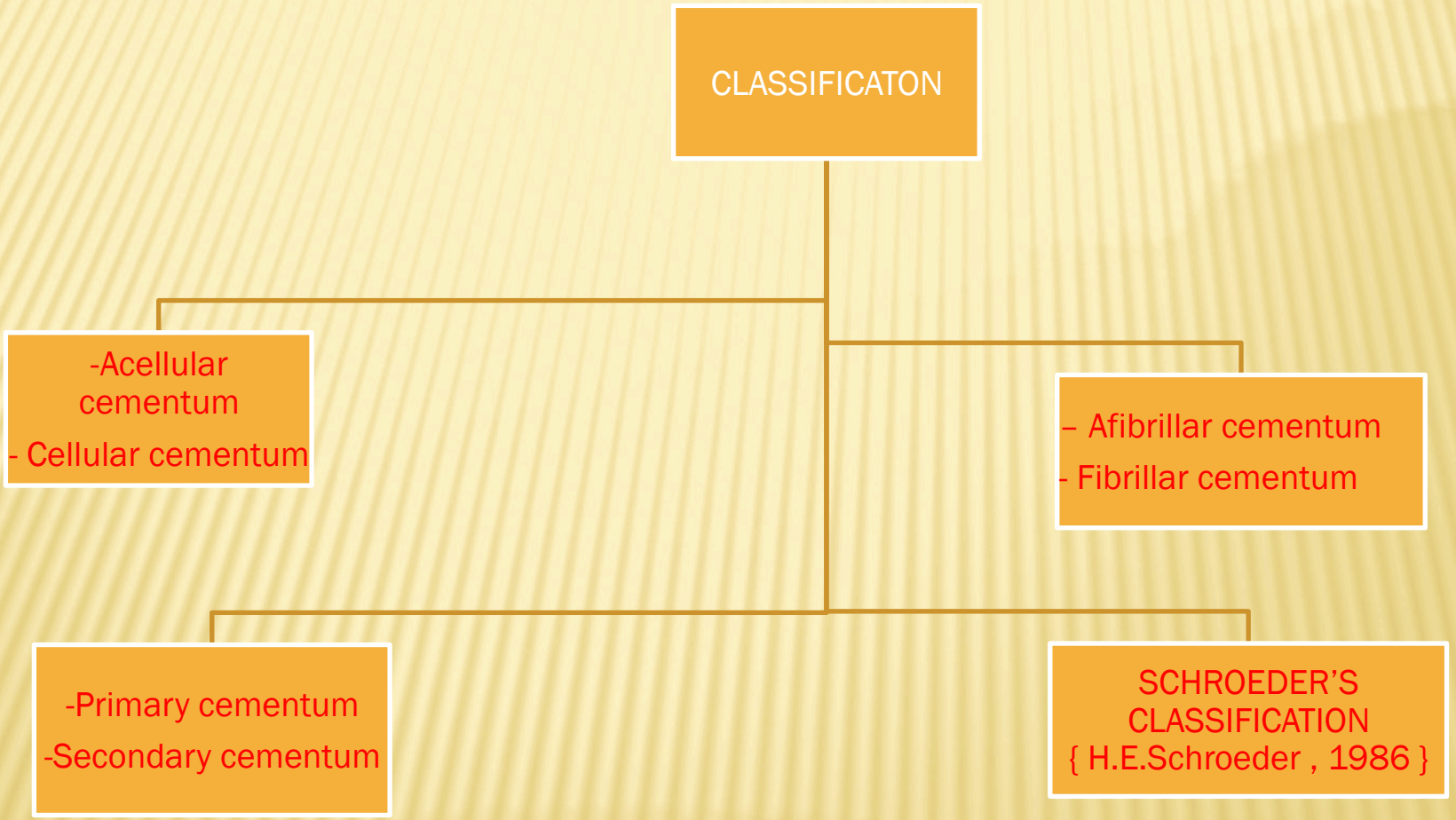
PHYSICAL CHARACTERISTICS

- The hardness of fully mineralized cementum is less than that of dentin.
- Cementum is light yellow in color and can be distinguished from enamel by its lack of luster and its darker hue.
- Cementum is somewhat lighter in color than dentin. The difference in color, however, is slight, and under clinical conditions it is not possible to distinguish cementum from dentin based on color alone.
- Under some experimental conditions cementum has been shown to be permeable to a variety of materials.

CHEMICAL COMPOSITION

- On a dry weight basis, cementum from fully formed permanent teeth contains about 45% to 50% inorganic substances and 50% to 55% organic material and water.
- ***The inorganic portion***
  - consists mainly of calcium and phosphate in the from hydroxypatite.
  - Numerous trace elements are found in cementum in varying amounts. It is of interest that cementum has the highest fluoride content of all the mineralized tissues.
- ***The organic portion of cementum***
  - consists primarily of type I collagen and protein polysaccharides (proteoglycans). Amino acid analyses of collagen obtain and alveolar bone. The chemical nature of the protein polysaccharides or ground substance of cementum is virtually unknown

CLASSIFICATION



SCHROEDER'S CLASSIFICATION { H.E.SCHROEDER , 1986 }

1. ACELLULAR AFIBRILLAR CEMENTUM (AAC)

- ***No cells / fibres, only mineralized ground substance***, product of cementoblasts, found in coronal cementum 1-15 microns thick
- The acellular afibrillar cementum. consists of a mineralized matrix, which appears similar to the interfibrillar matrix of acellular extrinsic fiber cementum, but contains neither collagen fibrils nor embedded cells.
- The lack of collagen fibrils indicates that this cementum variety has no function in tooth attachment.
- *The acellular afibrillarcementum can be identified by light and electronmicroscopy.*

2. ACELLULAR EXTRINSIC FIBRE CEMENTUM (AEFC)

- ***No cells, densely packed extrinsic sharpey's fibres***, product of cementoblasts & fibroblasts, found in cervical 3rd , 30-230 microns thick { H.E.Schroeder, 1986 }
- For this type of cementum all the collagen is derived as Sharpey's fibres from the periodontal ligament (the ground substance itself may be produced by the cementoblasts).
- This type of cementum corresponds with primary acellular cementum and therefore covers the cervical two-thirds of the root. It is therefore formed slowly and the root surface is smooth. The fibres are generally well mineralised.

3. CELLULAR MIXED STRATIFIED CEMENTUM (CMSC)

- ***Contains cells, densely packed extrinsic sharpey's fibres & intrinsic fibres,*** product of cementoblasts & fibroblasts, found in apical 3rd , 100-1000 microns thick

4. CELLULAR INTRINSIC FIBRE CEMENTUM (CIFC)

- ***Contains cells, no extrinsic fibres*** , product of cementoblasts ,in humans, this variety fills resorption lacunae

5. INTERMEDIATE CEMENTUM

- It is ill defined zone near cementoenamel junction and is assumed to be derivative of Hertwig epithelial root sheath.

CEMENTOGENESIS

- Cementum formation in the developing tooth is preceded by the deposition of dentin along the inner aspect of Hertwig's epithelial root sheath.
- Once dentin formation is under way, breaks occurs in the epithelial root sheath allowing the newly formed dentin to come indirect contact with connective tissue of the dental follicle.
- Cells derived from this connective tissue are responsible for cementum formation.

At the ultrastructural level

- Breakdown of Herwig's epithelial roots sheath involves degeneration or loss of its basal lamina on the cemental side. Loss of continuity of the basal lamina is soon followed by the appearance of collagen fibrils and cementoblasts between epithelial cells of the root sheath.
- Some sheath cells migrate away from the dentin toward the dental sac, whereas others remain near the developing tooth and ultimately are incorporated into the cementum.
- Sheath cells that migrate toward the dental sac become the epithelial rests of Malassez found in the periodonral ligament of fully developed teeth.

CEMENTOBLASTS

- Soon after Hertwing's sheath breaks up, undifferential mesenchymal cells from adjacent connective tissue differentiate into cementoblasts .
- These ultra structural features are not unique to cementoblasts and can be observed in order cells actively producing proteins and polysaccharides.
- After some cementum matrix has been laid down, its mineralization begins. The uncalcified matrix is called cementoid.
- Calcium and phosphate ions present in tissue fluids are deposited into the matrix and arranged as unit cells of hydroxyapatite. Mineralization of cementoid is a highly ordered event and not the random precipitation of ions into an organic matrix.

CEMENTOID TISSUE

- Under normal conditions growth of cementum is a rhythmic process, and as a new layer of cementoid is formed, the old one calcifies.
- A thin layer if cementoid can usually be observed on the cemental surface.This cementoid tissue is lined by cementoblats.
- Connective tissue fibers from the periodontial ligament pass between the cementoblasts into the cementum. These fibers are embedded in the cementum and serve to attach the tooth to surrounding bone.
- Their embedded portions are known as sharpey’s fibers . Each sharpey’s fiber is composed of numerous collagen fibrils that pass well into the cementum.

CEMENTODENTINAL JUNCTION

- The dentin surface upon which cementum is deposited is relatively smooth in permanent teeth. The cementodentinal junction in deciduous teeth, however, is sometimes scalloped. The attachment of cementum to dentin in either case is quite firm although the nature of this attachment is not fully understood.
- The interface between cementum and dentin is clearly visible in decalcified and stained histologic sections using the light microscope. In such preparations cementum usually stains more intensely than does dentin.

CEMENTOENAMEL JUNCTION

- The relation between cementum and enamel at the cervical region of teeth is variable.
- In approximately 30% of all teeth, cementum meets the cervical end of enamel in a relatively sharp line.
- In about 10% of the teeth, enamel and cementum do not meet. Presumably this occurs when enamel epithelium in the cervical portion of the root is delayed in its separation from dentin. In such cases there is no cementoenamel junction. In stead, a zone of the root is devoid of cementum and is, for a time, covered by reduced enamel epithelium.
- In approximately 60% of the teeth, cementum overlaps the cervical end of enamel for a short distance. This occurs when the enamel epithelium degenerates at its cervical termination, permitting connective tissue to come in direct contact with the enamel surface.

FUNCTION OF CEMENTUM

1. Attaches one end of periodontal ligament and help to keep the tooth in the socket.
2. Protects root surface from injury and resorption by continuous formation. It repairs any defect in the root.
3. Helps eruption by apposition at apical end.
4. Maintains length of root by apposition which compensates for occlusal wear.
5. Helps to maintain width of the periodontal ligament.

CEMENTUM RESORPTION & REPAIR

1. LOCAL FACTORS.

a. trauma from occlusion orthodontic movement
b. periodontal disease
c. pressure from malaligned erupting
d. teeth, cysts, tumor
e. teeth without functional antagonists
f. embedded, replanted. transplanted teeth.
g. periapical disease

2.SYSTEMIC FACTORS

a. calcium deficiency
b. hypothyroidism
c. hereditary fibrous osteodystrophy
d. paget's disease

3. IDIOPATHIC

CEMENTICLES

- They are globular masses of cementum arranged in concentric lamellae that lie facing PDL adhering to root surface arising from calcified epithelial rests around small spicules of cementum / bone, traumatically displaced into PDL from sharpey's fibres

CEMENTAL TEARS

- Means detachment of a fragment of cementum from root surface, owing to an acute occlusal blow or from intermittent episodes of sustained pressure If torn away completely, complete tears otherwise incomplete.
- The defect caused by tearing away of cementum is repaired by ingrowth of connective tissue small areas of cementum tear away probably because the attachment of cementum to PDL is stronger than the union at CDJ.
- The detached cementum may be reunited by new cementum to root / completely resorbed / partial resorption followed by addition of new cementum and embedding of new collagen fibres.

CLINICAL CONSIDERATIONS

- Cementum is more resistant o resorption than is bone, and it is for this reason that orthodontic tooth movement is made possible when a tooth is moved by means of an orthodontic appliance, bone is resorbed on the side of the pressure, and new bone is formed on the side of tension. On the side toward which the tooth is moved, pressure is equal on the surfaces of bone and cementum. Resorption of bone as well as of cementum may be anticipated.
- However, in careful orthodontic treatment, cementum resorption is minimal or absent but bone resorption leads to tooth migration.

- In most cases of repair there is a tendency to reestablish the former outline of the root surface. This is called *anatomic repair*

- However, if only a thin layer of cementum is deposited on the surface of a deep resoprtion, the root outline is not reconstructed, and a baylike recess remains. In such areas sometimes the periodontal space is restored to its normal width by formation of a bony projection. So that a proper functional relationship will result. The outline of the alveolar bone in these cases follows that of the root surface. In contrast to anatomic repair, this change is called *functional repair.*

- If teeth are subjected to a severe blow, fragments of cementum may be severed from the dentin. The tear occurs frequently at the cementodential junction, but it may also be in the cementum or dentin.
- Transverse fracture of the root may occur after trauma and these may heal by formation of new cementum.
- Frequently, hyperplasia of cementum is secondary to preiapical inflammation or extensive occlusal stress.

THANK YOU