Correlation Between The Clinical And Microscopic Features Of The Gingival Tissue

☒ Color

The color of the attached and marginal gingiva is generally described as **"coral pink**; it is produced **by** the vascular supply, the thickness and degree of keratinization of the epithelium, and the presence of pigment-containing cells.

The attached gingiva is demarcated from the adjacent alveolar mucosa on the facial aspect by a clearly defined mucogingival line. The alveolar mucosa is red, smooth, and shiny rather than pink and stippled. A comparison of the microscopic structure of the attached gingiva with that of the alveolar mucosa provides an **explanation for the difference in appearance**. The epithelium of the alveolar mucosa is thinner and non-keratinized, and it contains no rete pegs. The connective tissue of the alveolar mucosa is loosely arranged, and the blood vessels are more numerous. The color of **inflamed gingiva** may vary from red to bluish red **due to** vasodilatation which leads to bleeding tendency.

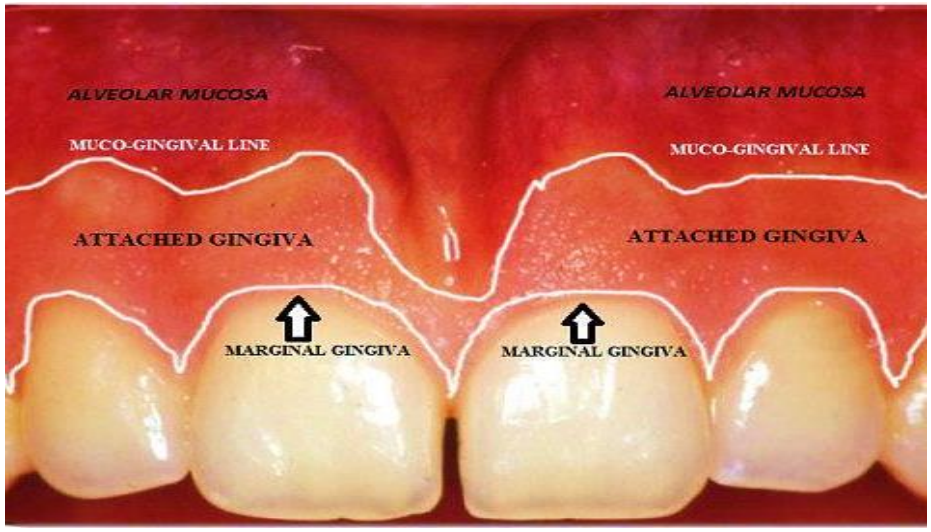

Fig. Features of the attached gingiva and alveolar mucosa.

Fig. The differences between the healthy and diseased gingiva.

Physiologic Pigmentation (Melanin):-

- Melanin is responsible for the normal pigmentation of the skin, the gingiva, and the remainder of the oral mucous membrane.
- Melanin is present in all normal individuals (often not in sufficient quantities to be detected clinically).
- Melanin pigmentation in the oral cavity is prominent in black individuals
- Ascorbic acid directly down-regulates melanin pigmentation in gingival tissues.

☒ Size

The size of the gingiva corresponds with the sum total of the bulk of cellular and intercellular elements and their vascular supply. **Alteration in size** is a common feature of gingival disease.

☒ Contour

The contour of the gingiva **depends on** the shape of the teeth and their alignment in the arch, the location and size of the area of proximal contact, and the dimensions of the facial and lingual gingival embrasures.

The gingiva usually ends coronally in knife edged margins and scalloped in contour. In inflamed gingiva, the contours are often rounded and enlarged **because** of vascular stagnation and increases formation of collagen fibers.

☒ Shape

The shape of the interdental gingiva is administrated by the contour of the proximal tooth surfaces and the location and shape of the gingival embrasures. When the proximal surfaces of the crowns are relatively flat faciolingually, the roots are close together, the interdental bone is thin mesiodistally, and the gingival embrasures and interdental gingiva are narrow mesiodistally. Conversely, with proximal surfaces that flare away from the area of contact, the mesiodistal diameter of the interdental gingiva is broad. The height of the interdental gingiva varies with the location of the proximal contact. Thus in the anterior region of the dentition, the interdental papilla is pyramidal in form, whereas the papilla is more flattened in the molar region.

☒ Consistency

The gingiva is firm and resilient and, with the exception of the movable free margin, tightly bound to the underlying bone. The collagenous nature of the lamina propria and its contiguity with the mucoperiosteum of the alveolar bone determine

the firmness of the attached gingiva. The gingival fibers contribute to the firmness of the gingival margin.

In inflamed gingiva, the consistency may be **soft and spongy** because of the vascular stagnation and decrease in the amount of gingival collagen fibers or **extremely firm** because of excessive formation of collagen fibers (fibrosis), this is in case of chronic inflammation.

☒ Surface Texture

The gingiva presents a textured surface similar to that of an orange peel and is referred to as stippled. The attached gingiva is stippled; the marginal gingiva is not. The central portion of the interdental papillae is usually stippled, but the marginal borders are smooth. Stippling is less prominent on lingual than facial surfaces and may be absent in some persons. Stippling varies with age. It is absent during infancy, it appears in some children at about 5 years of age, it increases until adulthood, and it frequently begins to disappear during old age. The degree of keratinization and the prominence of stippling appear to be related.

Fig. Clinical health gingival tissue.

Fig. Periodontitis & gingivitis features.

Table 1.1: Differences between alveolar mucosa and attached gingiva

	Alveolar mucosa	*Attached gingiva*
Color	Red	Pink
Surface texture	Smooth and shiny	Stippled
Epithelium	Thinner Nonkeratinized Rete pegs absent	Thicker Parakeratinized Rete pegs present
Connective tissue	More loosely arranged More blood vessels	Not so loosely arranged Moderate blood vessels

Periodontal ligament (PDL)

The periodontal ligament is the soft, richly vascular and cellular connective tissue which surrounds the roots of the teeth and joins the root cementum with the socket wall. The periodontal ligament space has the shape of an hourglass and is narrowest at the mid-root level. The width of the periodontal ligament is approximately **0.25 mm**.

Cellular composition: cells of PDL are categorized as:

1. Synthetic cells

A. Osteoblast

B. Fibroblast (most prominent cells 65%)

C. Cementoblasts

2. Resorpative cells

A. Osteoclasts

B. Cementoclasts

C. Fibroblasts

3. Progenitor cells

4. Epithelial rest of malassez

5. Connective tissue cells (mast cells and macrophages)

Synthetic cells:-

1-Osteoblasts: Covers the periodontal surface of the alveolar bone. It responsible for the formation of alveolar bone.

2-Fibroblasts: The most prominent connective tissue cells **(65%).** The main function of the fibroblasts is the production of several types of fibers (Collagen fibers, Reticulin fibers, Oxytalan fibers and Elastin fibers). Fibroblasts are also instrumental in the synthesis of connective tissue matrix.

3-Cementoblasts: Lining the cementum and are responsible for cementum deposition.

Resorpative cells:-

1-Osteoclasts: these are the cells that resorb the bone and tend to be large and multinucleated.

2-Fibroblasts: Synthesize collagen and also resorb and degrade the old collagen fibers.

3-Cementoclasts: Cementum undergoes continual deposition during life. However resorption of cementum occurs in certain circumstances by cementoclasts.

Progenitor cells: It differentiate into functional type of connective tissue cells.

Epithelial rest of Malassez: Found close to cementum, when certain pathologic conditions are present, cells of epithelial rest can undergo rapid proliferation and can produce a variety of cysts and tumors of the jaws.

Connective tissue cells

Mast cells: Play a role in inflammatory reaction.

Macrophages: Capable of phagocytosis.

Extracellular components:

1. Fibers ⟶ A. Collagen B. Oxytalan

2. Ground substances ⟶ A. Proteoglycans B. Glycoproteins

Periodontal fibers: the most important elements of the periodontal ligament are the principal fibers. They are collagenous in nature and are arranged in bundles following a wavy course. The terminal portion of the principal fibers insert into the cementum and bone are termed **Sharpey's fibers.**

The principal fibers of the PDL are arranged in five groups: (Fig.9)

1- **Alveolar crest fibers:** extend obliquely from the cementum just beneath the junctional epithelium to the alveolar crest.
   Function: retain tooth in socket and resist lateral movement.
2- **Horizontal group:** extends from cementum to the alveolar bone at right angle to the long axis of the tooth.
   Function: resist lateral tooth movements.
3- **Oblique group:** the largest group extending coronally in an oblique direction from the cementum to the bone.
   Function: tolerate with the effect of vertical masticatory stresses and transform such stresses into the alveolar bone.
4- **Apical group:** they radiate from the cementum of root apex to the bone.
   Function: it prevents tooth tipping, resists luxation, and protects blood, lymph and nerve supply of the tooth.
5- **Inter-radicular fibers:** Extends from cementum of bifurcation areas into furcal bone.
   Function: it resists luxation and also tipping and torqueing.

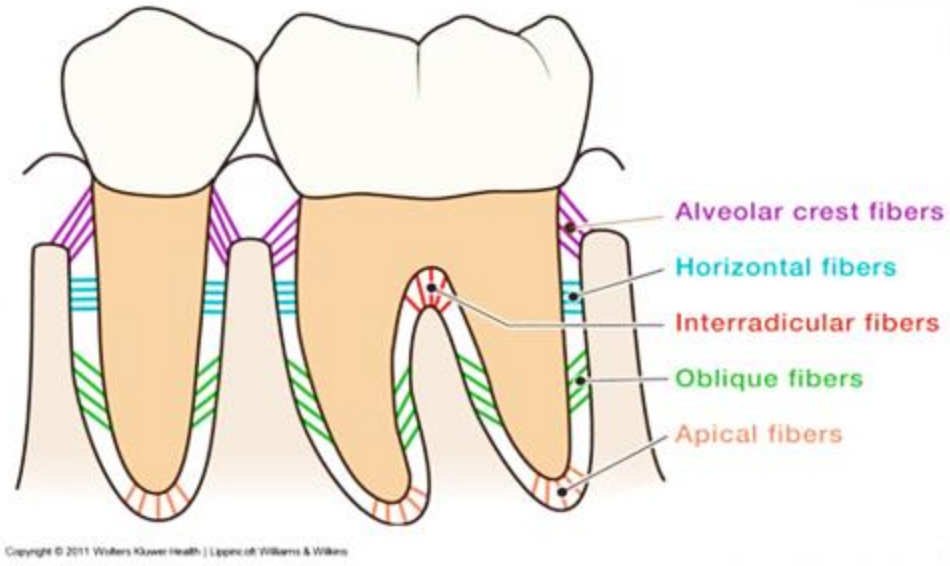

Fig.9:- The principal fibers of the PDL groups.

Ground substance: The ground substance is made up of two major groups of substances

1-Glycosaminoglycans: such as hyaluronic acid, proteoglycans.

2- Glycoproteins: such as fibronectin and laminin

It also has high water content (70%).

Development of principal fibers of PDL:-

It will be as follows:

1-Small, fine brush like fibrils are detected arising from the root cementum (RC) and projecting into the PDL space.

2-Small fibers are seen on the surface of the alveolar bone proper (ABP) but only in thin, small numbers.

3-The number and thickness of fibers originating from the bone increase and elongate. They radiate towards the mid portion of the periodontal ligament space.

4-The fibers originating from the cementum also increase in length and thickness and fuses with the fibers originating from the alveolar bone in the periodontal ligament space.

5-Following tooth eruption, the principal fibers become organized in bundles and run continuously from bone to cementum.

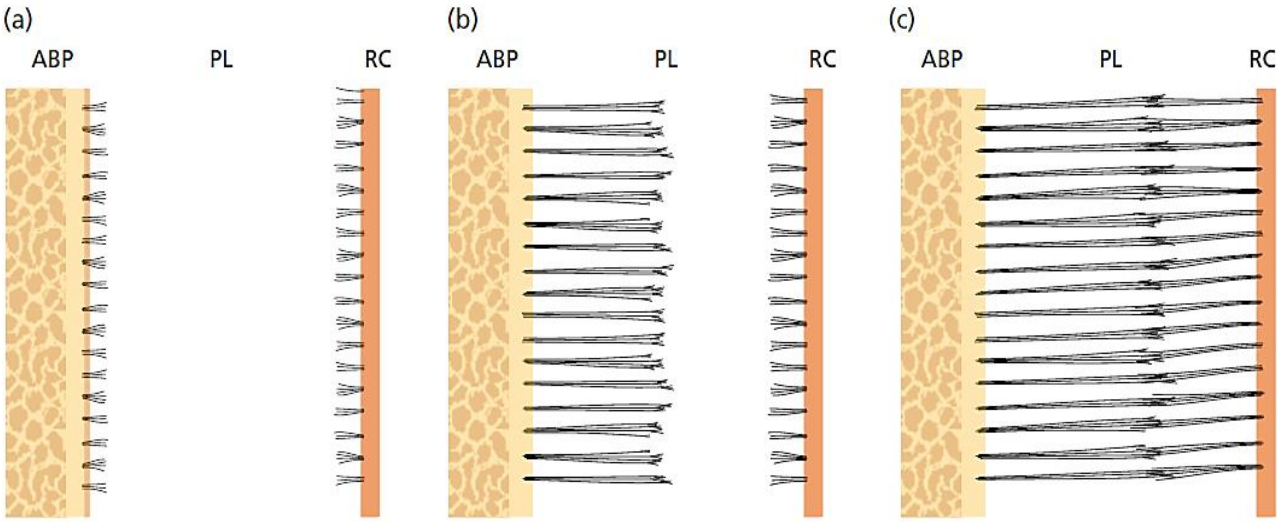

Fig:- The development of the principal fibers of the periodontal ligament. The alveolar bone proper (ABP), the periodontal ligament (PL), and the root cementum (RC).

Structures present in the periodontal ligament connective tissue:-

1-Blood vessels: periodontal ligament is supplied by branches derived from three sources dental, inter-radicular and Interdental arteries.

2-Lymphatics: lymphatic vessels follow the path of blood vessels in the periodontal ligament.

3-Nerve intervention: periodontal ligament is mainly supplied by dental branches of the alveolar nerve. The periodontal ligament has mechanoreceptors providing sense of touch, pressure, pain and proprioception during mastication.

4-Cementicles: calcified masses adherent to or detached from the root surface.

Functions of the PDL:

1. Physical function

2. Formative and remodeling

3. Nutritional and sensory function

Physical function

1. Provision of a soft-tissue "casing" to protect the vessels and nerves from injury by mechanical forces

2. Transmission of occlusal forces to the bone

3. Attachment of the teeth to the bone

4. Maintenance of the gingival tissues in their proper relationship to the teeth

5. Resistance to the impact of occlusal forces (shock absorption).

Formative and Remodeling function.

Cells of the periodontal ligament have the capacity to control the synthesis and resorption of the cementum, ligament and alveolar bone. Periodontal ligament undergoes constant remodeling; old cells and fibers are broken down and replaced by new ones.

Nutritive functions

Since PDL has a rich vascular supply, it provides nutrition to the cementum, bone, and gingiva.

Sensory functions

The PDL is supplied with sensory nerve fibers which transmit sensation of touch, pressure and pain to higher centers.

Clinical consideration:

The width of PDL space varies with age, location of tooth, degree of stress to which the tooth was subjected. In compliance with the physiologic mesial migration of the teeth the PDL is thinner on the mesial root surface than on the distal surface.

A tooth in hyperfunction may have a wider PDL space and a tooth in hypofunction may have a narrow PDL space.

The width of PDL space is about 0.25mm in normal functions. It is widest at the cervical and apical portions of the root and narrowest at the middle.