

Normal periodontium

The normal periodontium provides the support necessary to maintain teeth in function. It consists of **four principal components**: gingiva, periodontal ligament, cementum, and alveolar bone (**Fig.1**).

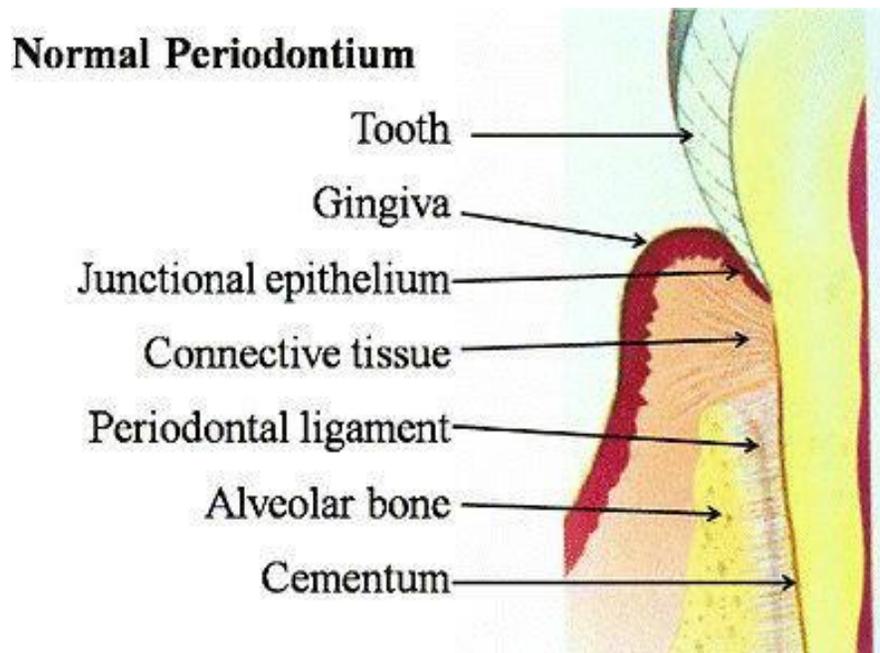


Fig.1 :- Anatomy of the normal periodontium.

Oral Mucosa

The oral mucosa consists of the following **three zones**:

1. Masticatory mucosa: it includes the gingiva and the hard palate. The boundaries are from the free gingival margin to the mucogingival junction on the facial and lingual surfaces.

The mucogingival junction is a distinct line between the apical end of the attached gingiva and the alveolar mucosa (**Fig.2**).

No mucogingival junction on the palatal side because both gingiva and alveolar mucosa are of the same type which is masticatory mucosa.

2. Specialized mucosa: it covers the dorsum of the tongue.

3. Lining mucosa: is the oral mucous membrane that lines the remainder of the oral cavity. Examples for this type are the tissue covering the lips, cheeks, floor of the mouth, inferior surface of the tongue, soft palate and the alveolar mucosa.

Alveolar mucosa: is located apical to the attached gingiva and extends into the vestibule of the mouth, it is darker red and movable because it has no elastic fibers.

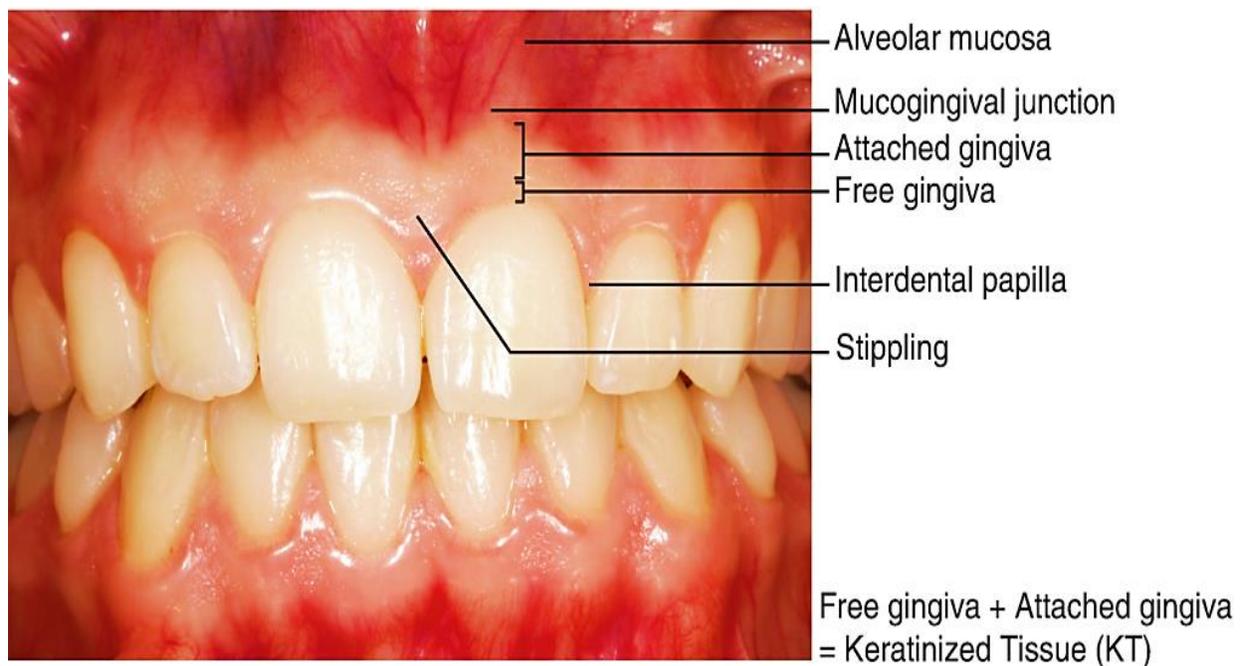


Fig.2:- Facial view define the normal oral & alveolar mucosa.

Gingiva

Clinical Features

In an adult, normal gingiva covers the alveolar bone and tooth root to a level just coronal to the cemento-enamel junction.

Anatomically the gingiva is divided **into**:

1. Marginal gingiva (free or un-attached gingiva)

2. Attached gingiva

3. Interdental gingiva

1-Marginal Gingiva

The marginal or unattached gingiva is the terminal edge or border of the gingiva that surrounds the teeth in collar-like fashion (**Fig.3**). In about 50% of cases, it is demarcated from the adjacent attached gingiva by a shallow linear depression called the **free gingival groove**. The marginal gingiva is usually about 1 mm wide, and it forms the soft-tissue wall of the **gingival sulcus**.

Gingival Sulcus

The gingival sulcus is the shallow crevice or space around the tooth bounded by the surface of the tooth on one side and the epithelium lining the free margin of the gingiva on the other side. It is V shaped and barely permits the entrance of a periodontal probe. Under absolutely normal or ideal conditions, the depth of the gingival sulcus is 0 mm or close to 0 mm. The probing depth of normal gingival sulcus is 2-3mm. in histological section the depth is about 1.8mm.

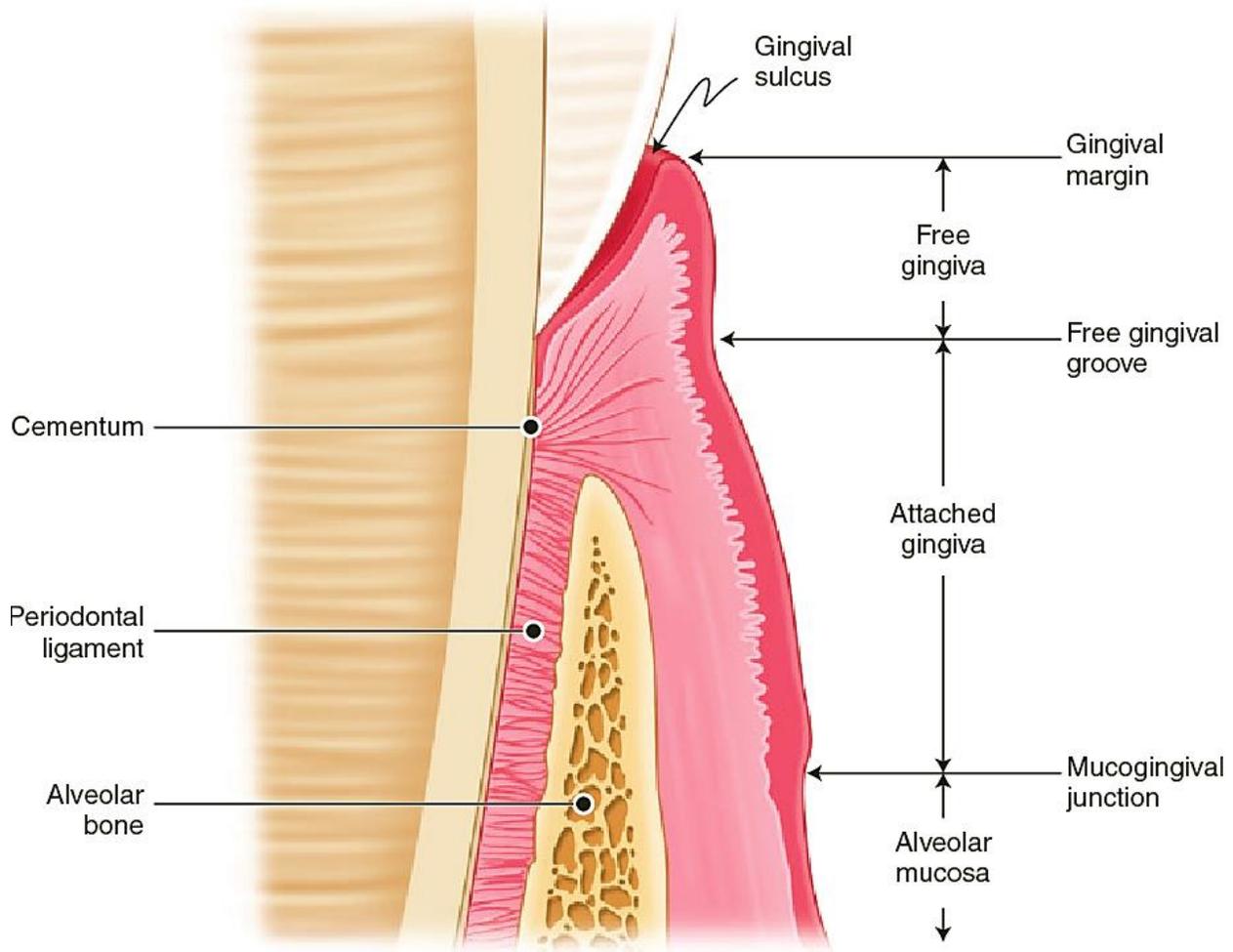


Fig.3 Anatomy of gingival tissue.

Gingival Fluid (Sulcular Fluid)

The value of the gingival fluid is that it can be represented as either a **transudate** or an **exudate**. The gingival fluid contains a vast collection of biochemical factors, which that use as a diagnostic or prognostic biomarker of the biologic state of the periodontium in health and disease. It also contains components of connective tissue, epithelium, inflammatory cells, serum, and microbial flora. In the healthy sulcus, the amount of gingival fluid is very small.

During inflammation, however, the gingival fluid flow increases, and its composition starts to resemble that of an inflammatory exudate. The main route of the gingival fluid diffusion is through the basement membrane, and then into the sulcus. **The gingival fluid is believed to do the following:** (1) rinse the gingival sulcus ; (2) contain plasma proteins that may improve adhesion of the epithelium to the tooth; (3) possess antimicrobial properties; and (4) exert antibody activity to defend the gingiva.

Attached Gingiva

The attached gingiva is continuous with the marginal gingiva. It is firm, resilient, and tightly bound to the underlying periosteum of alveolar bone. The facial aspect of the attached gingiva extends to the relatively loose and movable alveolar mucosa; it is demarcated by the mucogingival junction. **The width of the attached gingiva** is the distance between the mucogingival junction and the projection on the external surface of the bottom of the gingival sulcus or the periodontal pocket. It should not be confused with the **width of the keratinized gingiva**, although this also includes the marginal gingiva. The width of the attached gingiva on the facial aspect differs in different areas of the mouth. It is generally greatest in the incisor region (**3.5 - 4.5 mm in the maxilla, 3.3 - 3.9 mm in the mandible**) and narrower in the posterior segments (**1.9 mm in the maxillary first premolars and 1.8 mm in the mandibular first premolars**). The width of attached gingiva increases with age and super-erupted teeth.

Interdental Gingiva

The interdental gingiva occupies the gingival embrasure, which is the interproximal space beneath the area of tooth contact. The interdental gingiva can be pyramidal in which the tip of one papilla is located immediately beneath the

contact point; or it can have a “col” shape present as valley-like depression that connects a facial and lingual papilla (**Fig.4**).

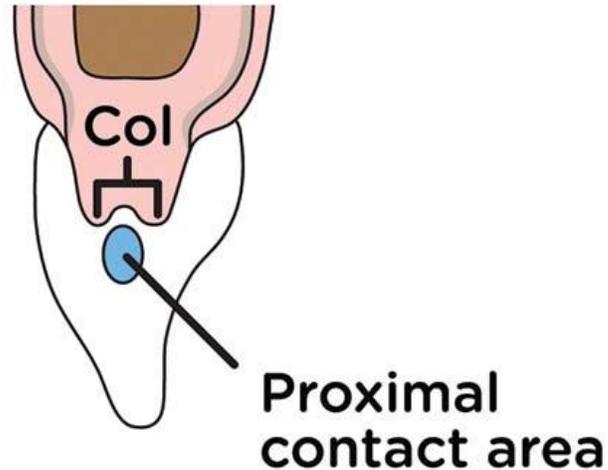


Fig.4:- Anatomy of the interdental area.

Microscopic features of gingival tissue

The gingiva consists of a central core of connective tissue covered by stratified squamous epithelium.

Three types of epithelium exist in the gingiva:

- 1. The oral or outer epithelium (Keratinized epithelium)**
- 2. The sulcular epithelium**
- 3. The junctional epithelium (Non-keratinized epithelium).**

Oral (Outer) Epithelium (OE)

It covers the crest and the outer surface of the marginal and attached gingiva. On average, the oral epithelium is 0.2- 0.3 mm in thickness. It is keratinized or parakeratinized or combination of both

Keratinization varies in different areas as in the following:

- ☒ Palate (**Most** keratinized)
- ☒ Gingiva
- ☒ Ventral aspect of the tongue
- ☒ Cheek (**least** keratinized)

The boundary between the oral epithelium and the underlying connective tissue has a wavy course. The projections of epithelial cells into the connective tissue are known as “**Rete Pegs**” while the intervening connective tissue portions which project into the epithelium are called **connective tissue papillae**. This alternating pattern of depression and protuberances of the connective tissue papillae and epithelial rete pegs is thought to give the attached gingiva the **stippled appearance** (Fig.5).

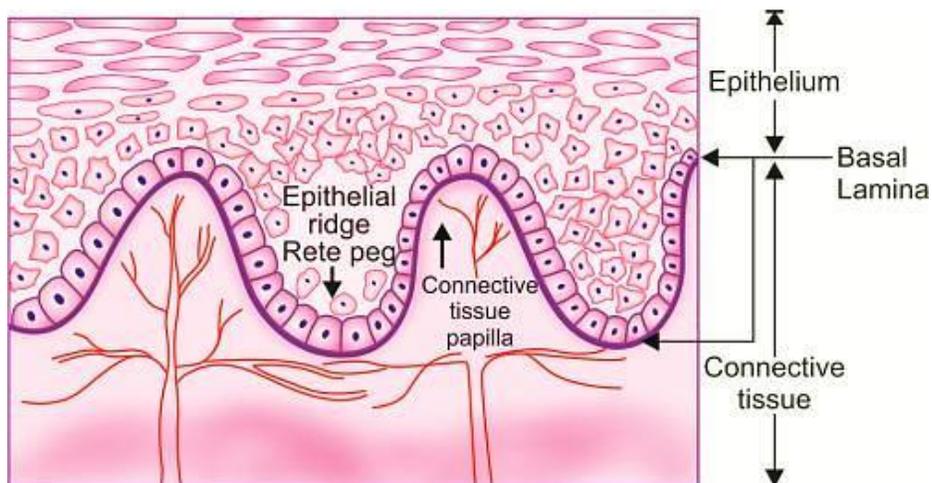


Fig.5: Rete pegs and C.T papilla

The oral epithelium has the following cell layers (Fig.6):

1. **Basal layer (stratum basale):** The basal cells are either cuboidal or cylindrical and have the ability to divide. The basal cells are separated from the connective tissue by a basement membrane.
2. **Spinous layer (Stratum spinosum):** Consists of large cells with short cytoplasmic processes
3. **Granular layer (stratum granulosum):** Granules are believed to be related to synthesis of keratin.
4. **Keratinized cell layer (stratum Corneum):** The most superficial layer.

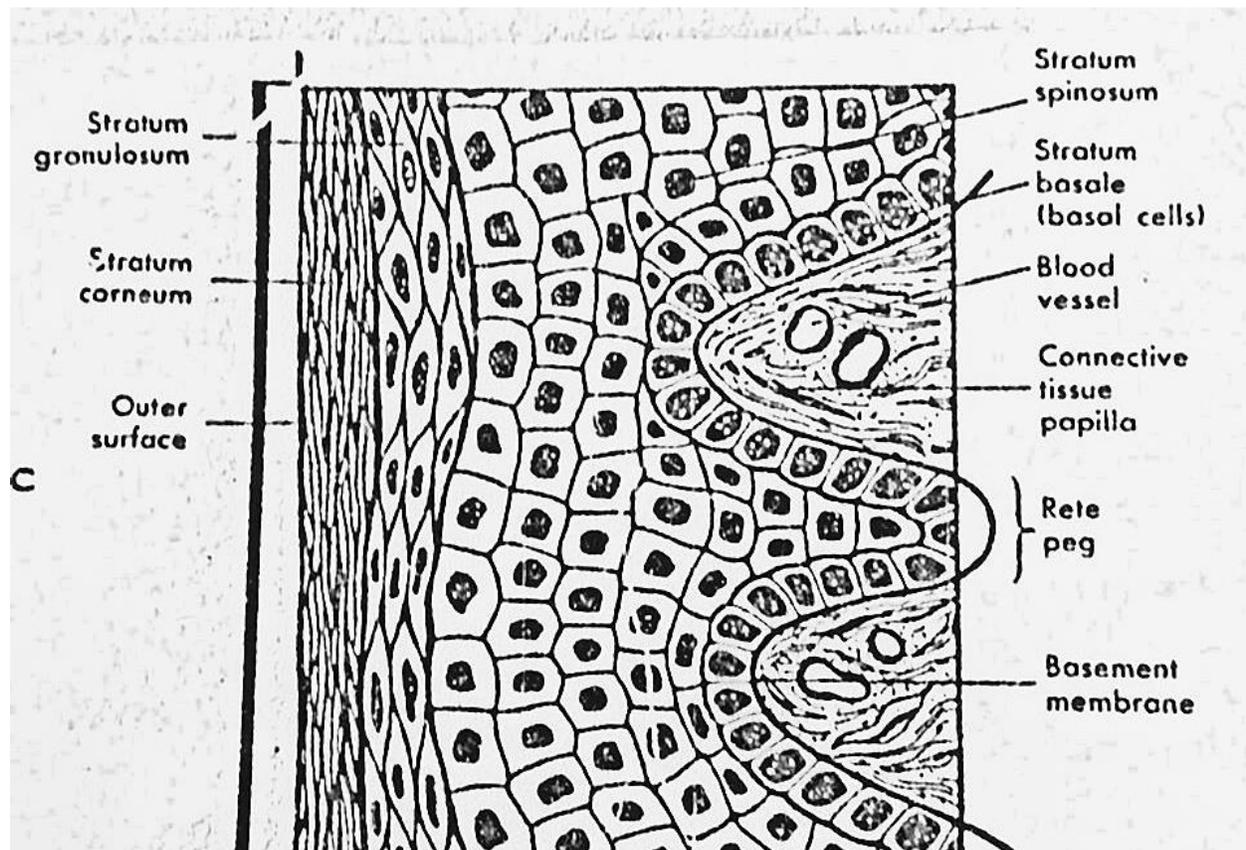


Fig.6:- The oral epithelium cell layers.

Types of cells in the oral epithelium:-

1. **Keratinocytes cell:** it is the principal cell type of oral epithelium comprises about 90% of the total cell population, responsible for the production of keratin which contributes to the protective function of the epithelium. These cells undergo continuous proliferation and differentiation from basal cell to the surface of epithelium. It takes about 3-4 weeks for the keratinocyte to reach the outer surface.
2. **Melanocyte cells:** responsible for the production of melanin pigment and can be found in the basal cell layer.
3. **Langerhans cell:** they play a role in defense mechanism of the oral epithelium. They have an immunological function by recognizing and processing antigens.
4. **Merkel cells:** they are located in the deeper layers of epithelium, they have nerve ending and have been identified as tactile receptors.

The epithelial cells are joined together by structure known as **desmosome**, which is composed of two **hemidesmosomes** separated from each other by **granulated material(GM)**.

Sulcular Epithelium (SE)

It lines the gingival sulcus and is thin; nonkeratinized stratified squamous epithelium without rete pegs. It extends from the coronal limit of the junctional epithelium to the crest of the gingival margin. The sulcular epithelium is act as a semi permeable membrane.

Junctional Epithelium (JE)

The epithelium that attaches the gingiva to the tooth surface. It forms the base of the sulcus. The junctional epithelium is attached to the tooth surface by **internal**

basal lamina and hemidesmosome and to the gingival connective tissue by **external basal lamina and hemidesmosome**. The attachment of the JE to the tooth is reinforced by the gingival fibers; hence, the JE and the gingival fibers are considered a functional unit, referred to as the **dentogingival unit**. It is quite permeable and thus serves as a pathway for diffusion of the bacterial plaque products to the connective tissue. There is also a diffusion of host defense substances in the opposite direction moving towards the sulcus (**Fig.7**).

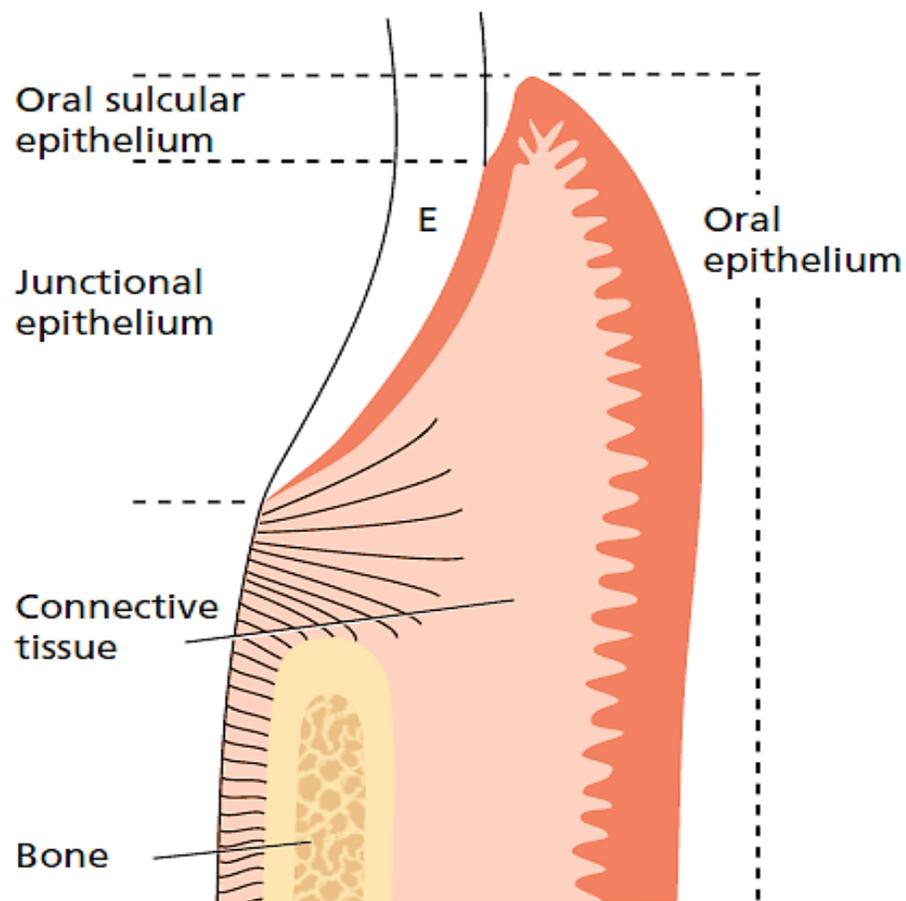


Fig.7:- Gingival epithelium.

Gingival Connective Tissue (CT) (Lamina propria)

The major components of the connective tissue are collagen fibers (around 60% of connective tissue volume), fibroblasts (around 5%), vessels and nerves (around 35%), which are embedded in an amorphous ground substance (matrix).

The different **types of cell** present in the connective tissue are:

(1) fibroblasts, (2) mast cells, (3) macrophages, and (4) inflammatory cells.

The connective tissue fibers are produced by the fibroblasts and can be divided into:

(1) collagen fibers (the most predominant fibers)

(2) reticulin fibers

(3) oxytalan fibers

(4) elastic fibers.

Gingival Fibers

The connective tissue of the marginal gingiva is contains a prominent system of collagen fiber bundles called the **gingival fibers**. These fibers consist of type I collagen.

The gingival fibers have the following functions:

1. To brace the marginal gingiva firmly against the tooth.
2. To provide the rigidity to withstand the forces of mastication without being deflected away from the tooth surface.
3. To unite the free marginal gingiva with the cementum of the root and the adjacent attached gingiva.

Gingival fibers groups (Fig.8):-

- 1. Circular fibers (CF)** are fiber bundles which run their course in the free gingiva and encircle the tooth in a cuff- or ring-like fashion.
- 2. Dentogingival fibers (DGF)** are embedded in the cementum of the supra-alveolar portion of the root and project out from the cementum in a fan-like configuration into the free gingival tissue of the facial, lingual, and interproximal surfaces.
- 3. Dentoperiosteal fibers (DPF)** are embedded in the same portion of the cementum as the dentogingival fibers, but run their course apically over the vestibular and lingual bone crest and terminate in the tissue of the attached gingiva.
- 4. Trans-septal fibers (TF)** extend between the supra-alveolar cementum of approximating teeth. The trans-septal fibers run straight across the interdental septum and are embedded in the cementum of adjacent teeth.

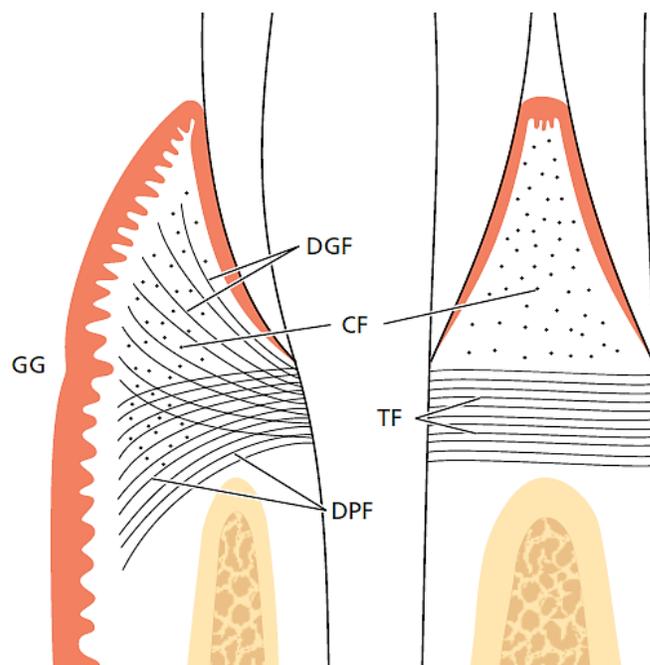


Fig.8:- Gingival fibers groups.

Blood supply and nerves:

Gingival tissue has rich vascular supply from internal maxillary artery :-

- **Supraperiosteal arteriols.**
- **Vessels of periodontal ligaments.**
- **Arterioles emerging from the crest of the Interdental septa.**

Nerve supply is derived from the **terminal branches of the maxillary and mandibular branches of the trigeminal nerve.**

For more info. Please check

- 1- **Chapter 3:** Anatomy, Structure, and Function of the Periodontium in Newman and Carranza's Clinical Periodontology book.
- 2- **Chapter 1 :** Anatomy of Periodontal Tissues in Clinical Periodontology and Implant Dentistry Niklaus P. Lang and Jan Lindhe.