

# ANATOMY AND PHYSIOLOGY OF PERIODONTIUM

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# Periodontal Tissues

Tissues that surround  
the teeth

✓ **GINGIVA**

Tissues that support  
the teeth

✓ **PERIODONTAL LIGAMENT**  
✓ **CEMENTUM**  
✓ **ALVEOLAR BONE**

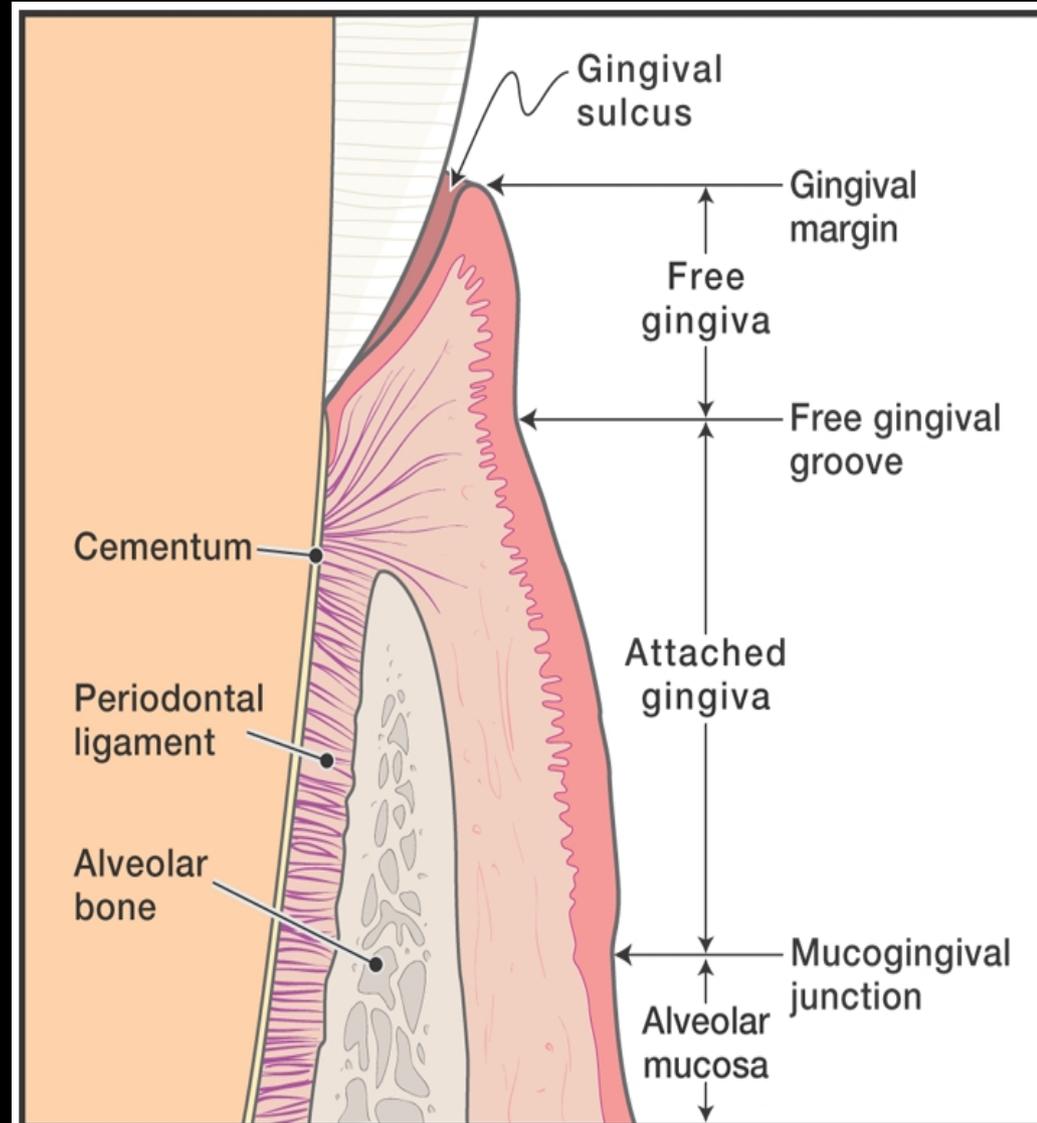
# GINGIVA

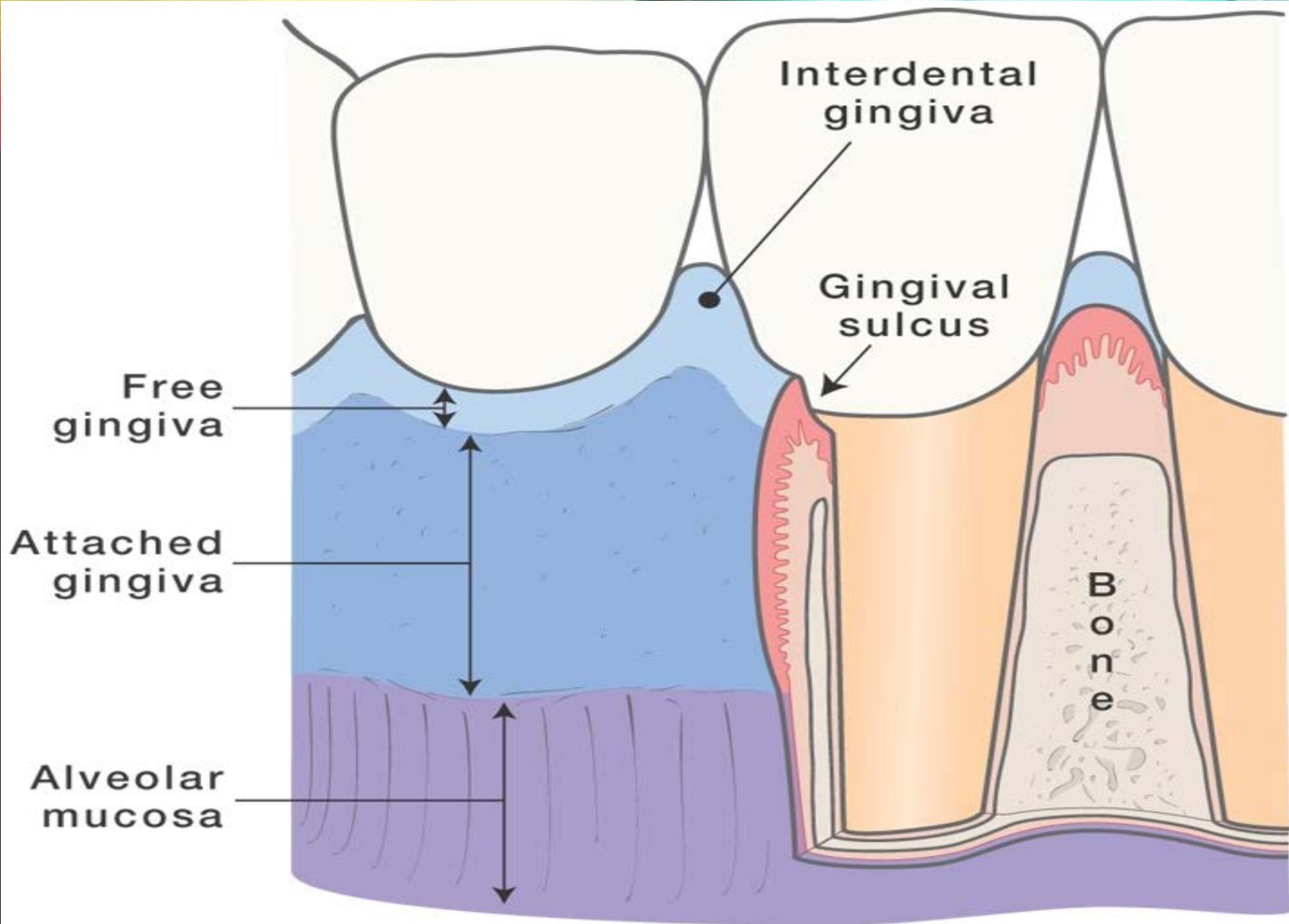
Is the part of the oral mucosa that covers the alveolar processes of the jaws and surrounds the necks of the teeth

Gingiva begins at the muco-gingival line and ends at the cervix of each tooth

# Clinically, gingiva is divided into 3 parts:

- 1- Marginal gingiva
- 2- Attached gingiva
- 3- Interdental papilla





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V  
A**

**Marginal**



Alveolar  
mucosa

Muco-gingi  
junction

**Interdental**

**Attached**

# 1- MARGINAL GINGIVA: ( UNATTACHED OR FREE GINGIVA )



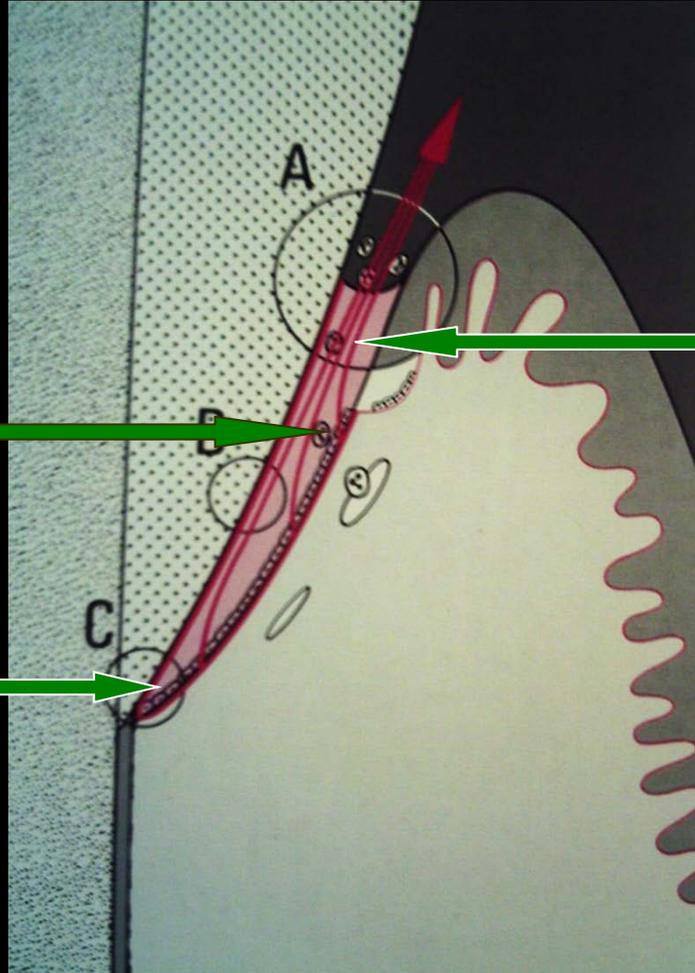
It is the terminal edge or border of gingiva surrounding the teeth in a collar like fashion & it is demarcated apically from the attached gingiva by the free gingival groove

# Gingival Sulcus

Space bounded by free gingival margin, the tooth, & the most coronal attachment of junctional epithelium

Gingival Fluid

Junctional Epithelium



Gingival Sulcus Normal depth (1-3 mm)

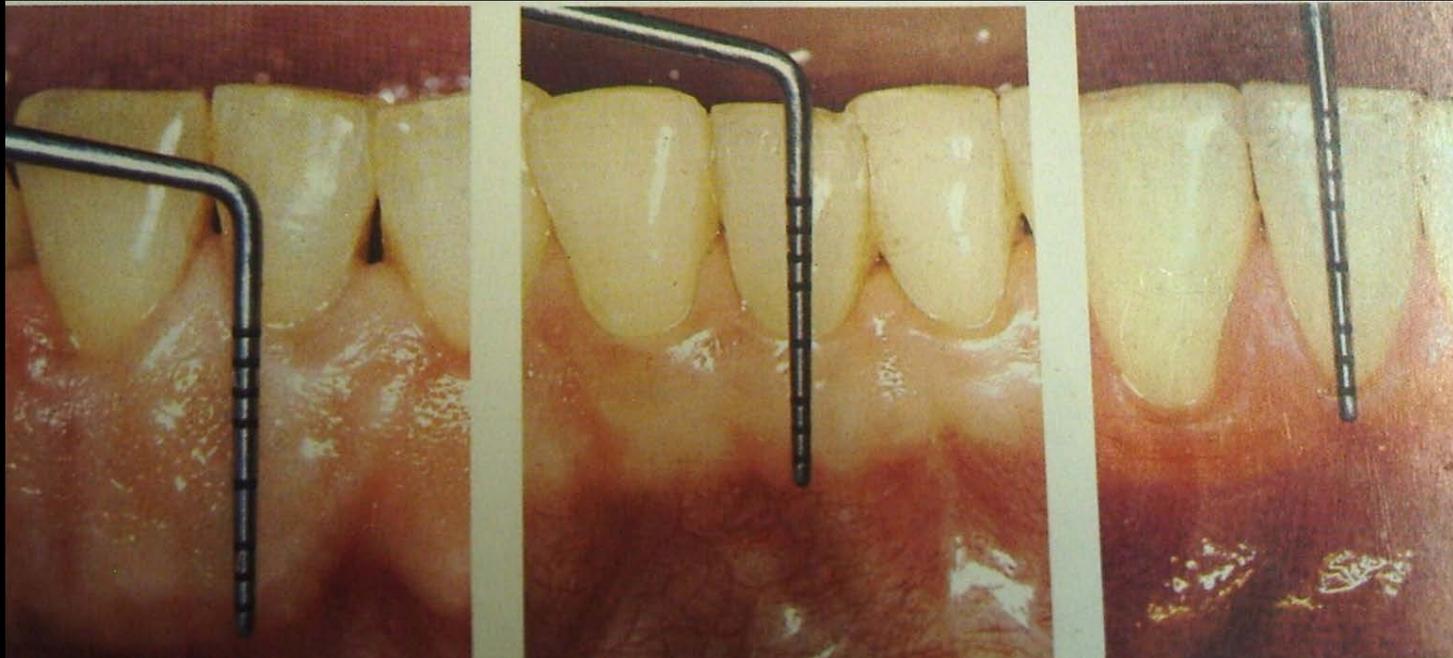
## **Junctional Epithelium**

- **Surrounds the necks of each tooth.**
- **Have a key role to maintain the periodontal health.**
- **Prevent bacterial colonization to subgingival area by:**
  - **Acting as a barrier against bacteria by its firm attachment**
  - **Allowing flow of GCF, inflamm cells, antibodies**

## **Gingival Fluid**

- **Comes from the gingival connective tissue.**
- **Helps to the mechanical cleaning of the sulcus.**
- **Has antimicrobial properties.**

## 2- Attached Gingiva



**It is a continuity to the marginal gingiva.  
It is firm, resilient and tightly bound to the  
Underlying teeth & periosteum of alveolar bone**

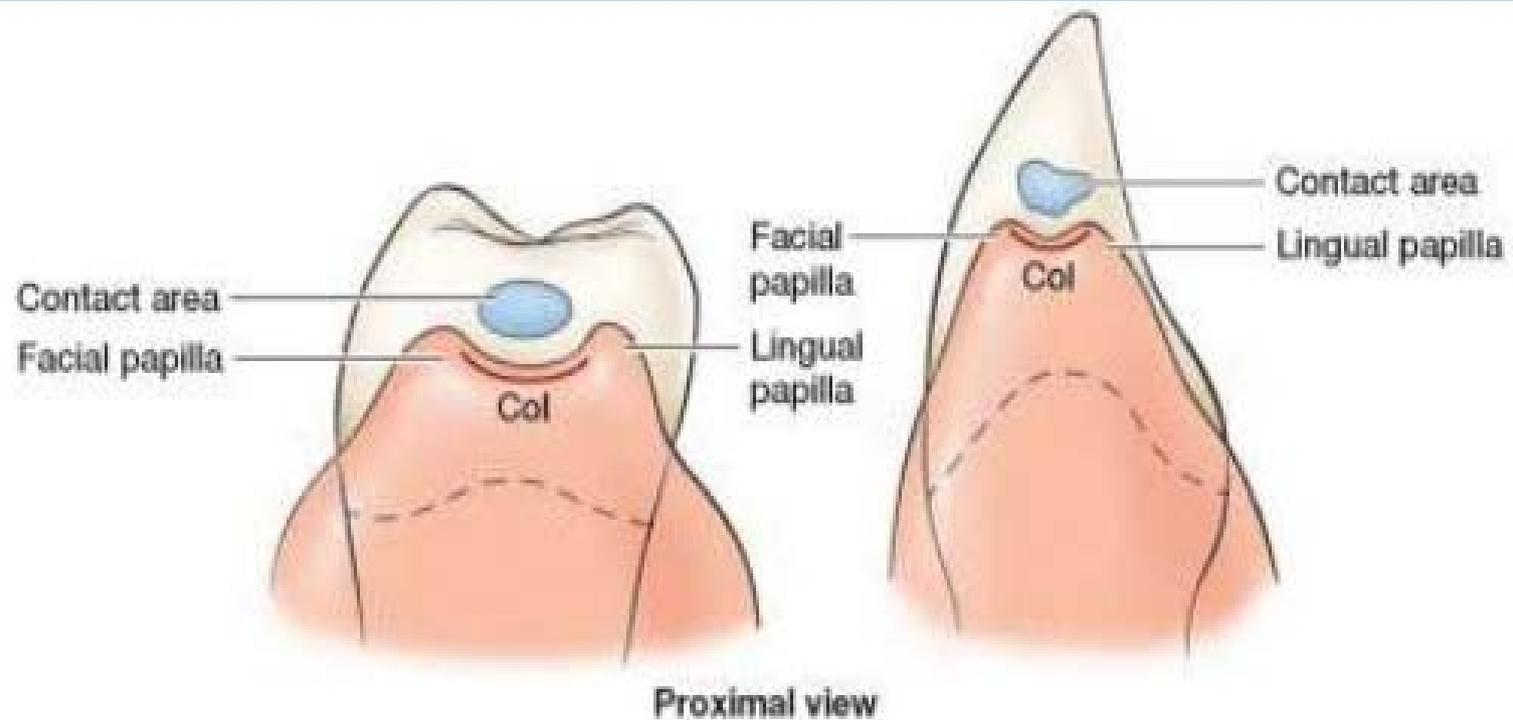
### 3- Interdental Gingiva (Papilla)



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- It occupies the gingival embrasure, which is the interproximal space beneath area of tooth contact.
- Can be pyramidal or has a “col” shape

- "col" is a valley like depression that connects a facial and lingual papilla .



# MICROSCOPIC FEATURES

The gingiva consists of

Central core of  
Connective Tissue

- Fibers
- Ground Substance
- Cells

Stratified Squamous  
Epithelium

- Keratinized
- Non-keratinized

# CORRELATION OF CLINICAL AND MICROSCOPIC FEATURES

## 1- Gingival colour

- Normal gingival colour is coral pink
- Variation in normal color is possible depending on:
  - The amount of melanin pigmentation in tissue ( Dark skinned people exhibit dark blue color of gingiva , especially at the base of the interdental papillae )
  - The thickness of epithelium
  - The degree of keratinization of epithelium
  - The degree of vascularity of connective tissue



The color of inflammed gingiva ( gingivitis ) may vary from red to bluish- red , due to vasodilataion blood vessels

# CORRELATION OF CLINICAL AND MICROSCOPIC FEATURES

## 2- Gingival consistency

- Healthy gingiva is usually resilient, firm & bound to the underlying bone because of the dense collagenous nature of the gingival connective tissue.
- In inflamed gingiva, the consistency may be soft, swollen & spongy, due to the vascular stagnation & decrease in amount of gingival collagen fiber



### 3- Gingival surface texture

- Gingiva may have either stippled or smooth & shiny surface
- Attached gingiva is stippled, while free gingiva is smooth
- Reduction or loss of stippling is a sign of gingival disease



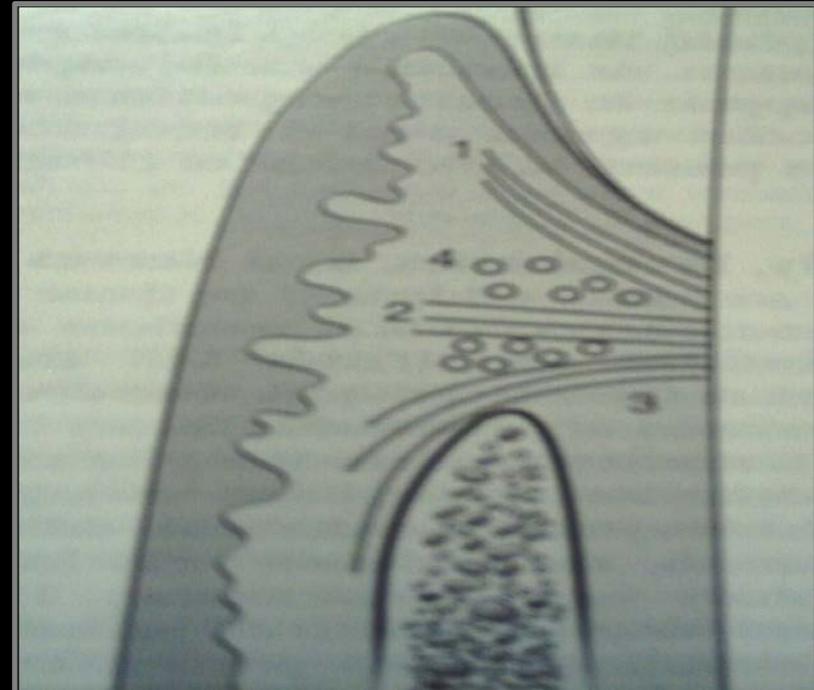
## 4- Gingival contour

- The gingiva usually ends coronally in knife edged margins & scalloped or arcuate in it's contour around each tooth
- In inflammed gingiva, the contours are often round & enlarged due to vascular stagnation & increase formation of collagen fibers



# Gingival Fibres

- They consist predominately of collagen fiber ( type I )
- Other fibers include: reticular, oxytalan, & elastic fiber
- These fibers arranged in groups of bundles according to their insertion & orientation in the tissue

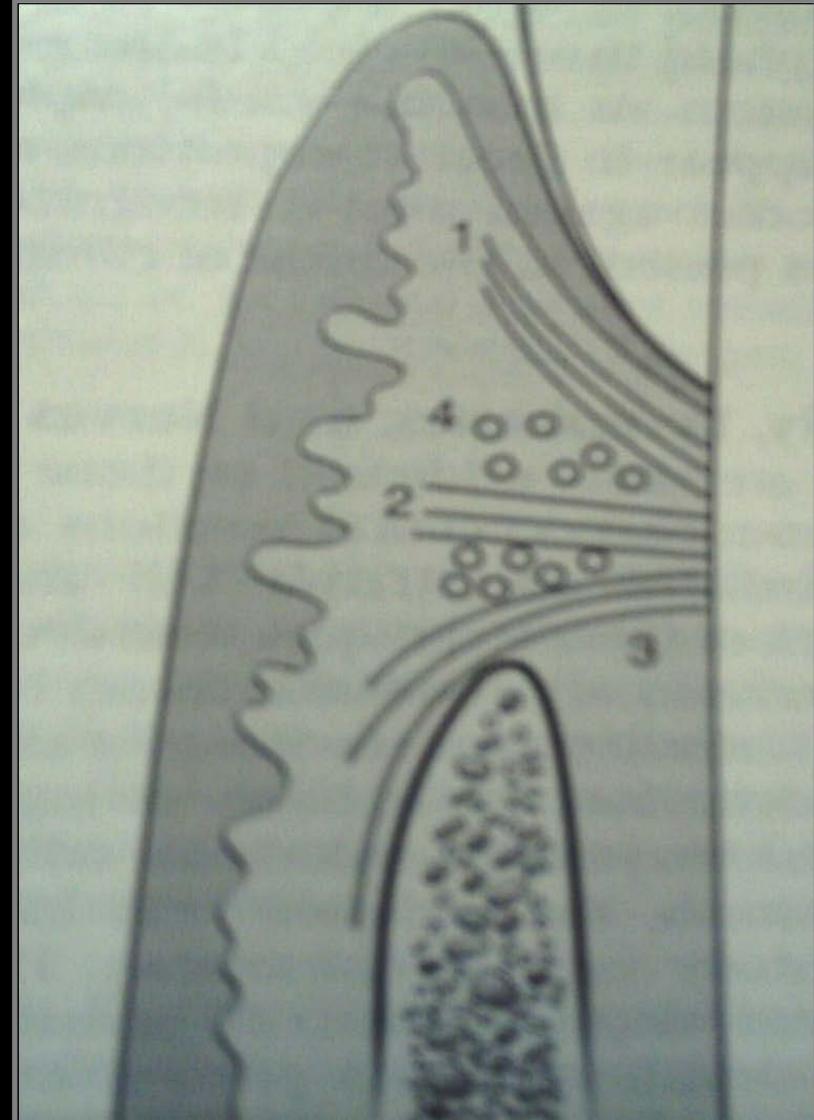


## 1. CIRCULAR GROUP:

These fibers run through the connective tissue of the marginal & interdental gingiva , & encircle the neck of tooth in a ring like fashion.

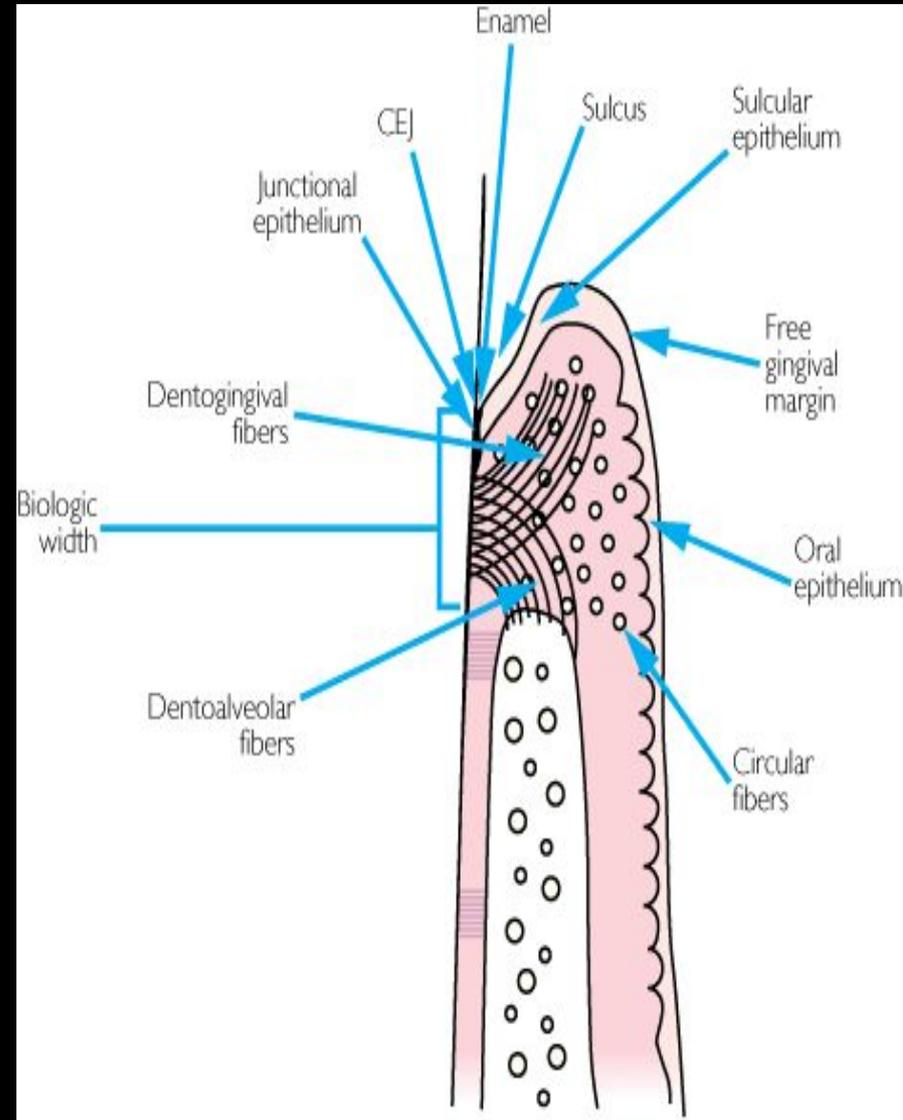
It helps to bind the free gingiva to the tooth

They are seen in cross sections



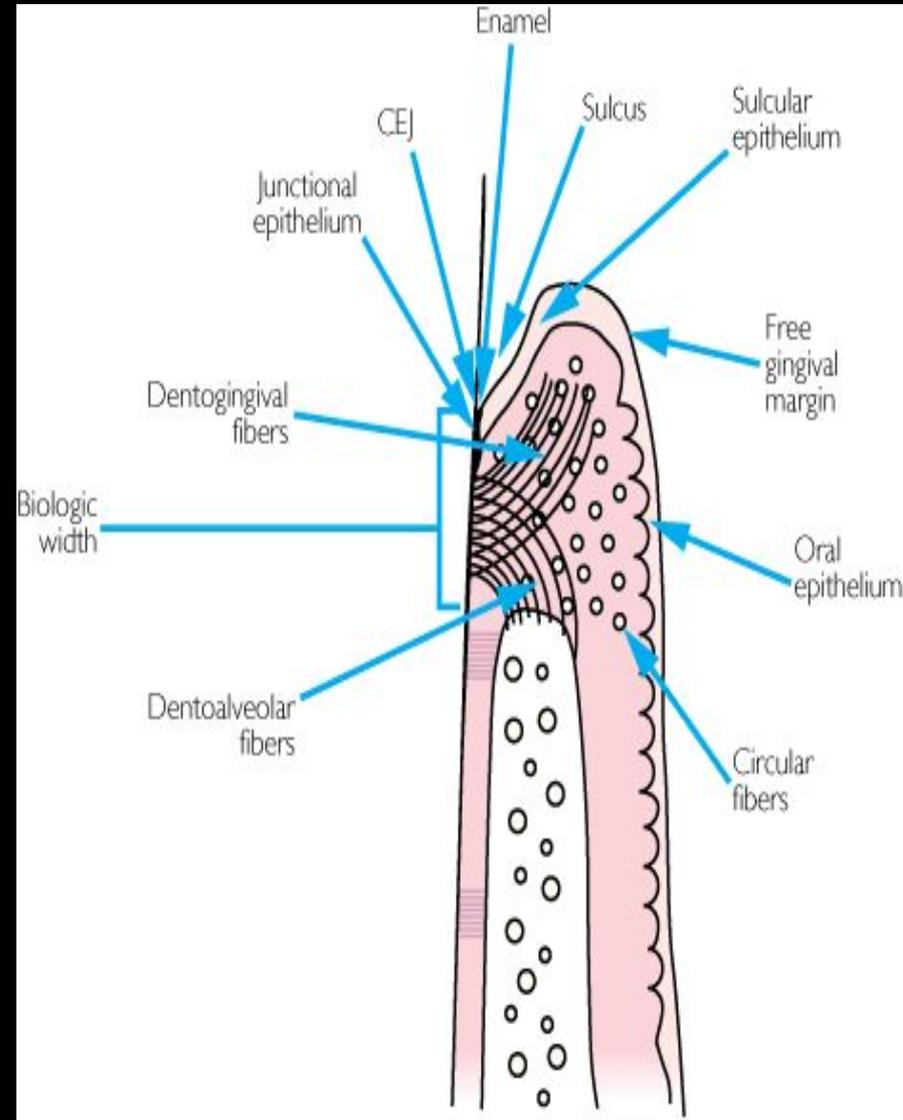
## 2- DENTOGINGIVAL GROUP:

These are the most numerous fibers projecting from the cervical cementum in a fan like fashion toward the free and attached gingiva



### 3. DENTOPERIOSTEAL GROUP:

They extend from cementum in apical direction to the periosteum of the alveolar bone crest



## 4. TRANSEPTAL GROUP

- These fibers run interdentially from the cementum just apical to the base of the junctional epithelium of one tooth over the alveolar crest and insert into the cementum of the adjacent tooth
- Thus they form an *interdental ligament* connecting all the teeth in the arch

# Functions of gingival fibers

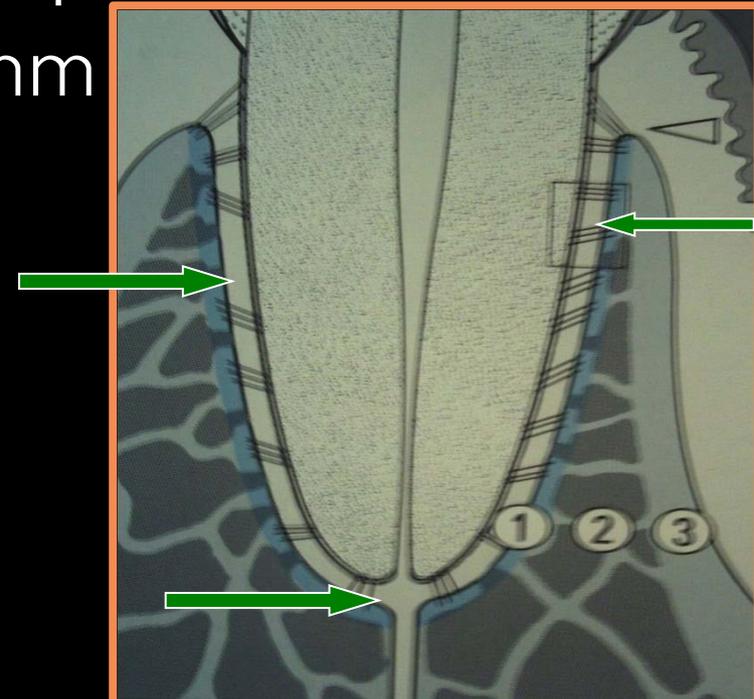
- ✓ To brace the marginal gingiva firmly against the tooth.
- ✓ To provide the rigidity necessary to withstand the forces of mastication without being deflected away from the tooth surface.
- ✓ To unite the free marginal gingiva with the cementum of the root and the adjacent attached gingiva.

# THE TOOTH-SUPPORTING STRUCTURES

- ❖ Periodontal Ligament.
- ❖ Cementum.
- ❖ Alveolar Bone

# Periodontal Ligament

- It is the connective tissue that surrounds the root and connects it to the bone
- It is continuous with the connective tissue of gingiva above the alveolar crest. It is also continuous with pulps at their apical foramina
- It has a thickness of 0.15-0.38mm
- , it is thinnest at mid root zone



# Functions of the Periodontal Ligament

## ❖ **Physical:**

- Attachment of the teeth to the bone
- Transmission of the occlusal forces
- Resistance to the forces impact  
( shock absorption )
- Maintenance of the gingival tissue in their proper relationship to the teeth during function

# Functions of the Periodontal Ligament

## ❖ **Formative and Remodelling:**

Cells of the P. Ligament participate in the formation and resorption of cementum and bone

## ❖ **Nutritional and Sensory:**

By the blood vessels and sensory nerve fibers that transmit tactile, pressure and pain sensation

# PRINCIPAL FIBERS OF PDL

- These are collagenous bundles, which follow a wavy pattern and consist primarily of **type 1** collagen
- They emerge from cementum of teeth to the alveolar bone
- The embedded portion of fibers into cementum on one side & alveolar bone on other side are termed **Sharpey's fibers**

**Sharpey's fibers pass uninterrupted through the bone of alveolar process to continue as principal fibers of PDL**

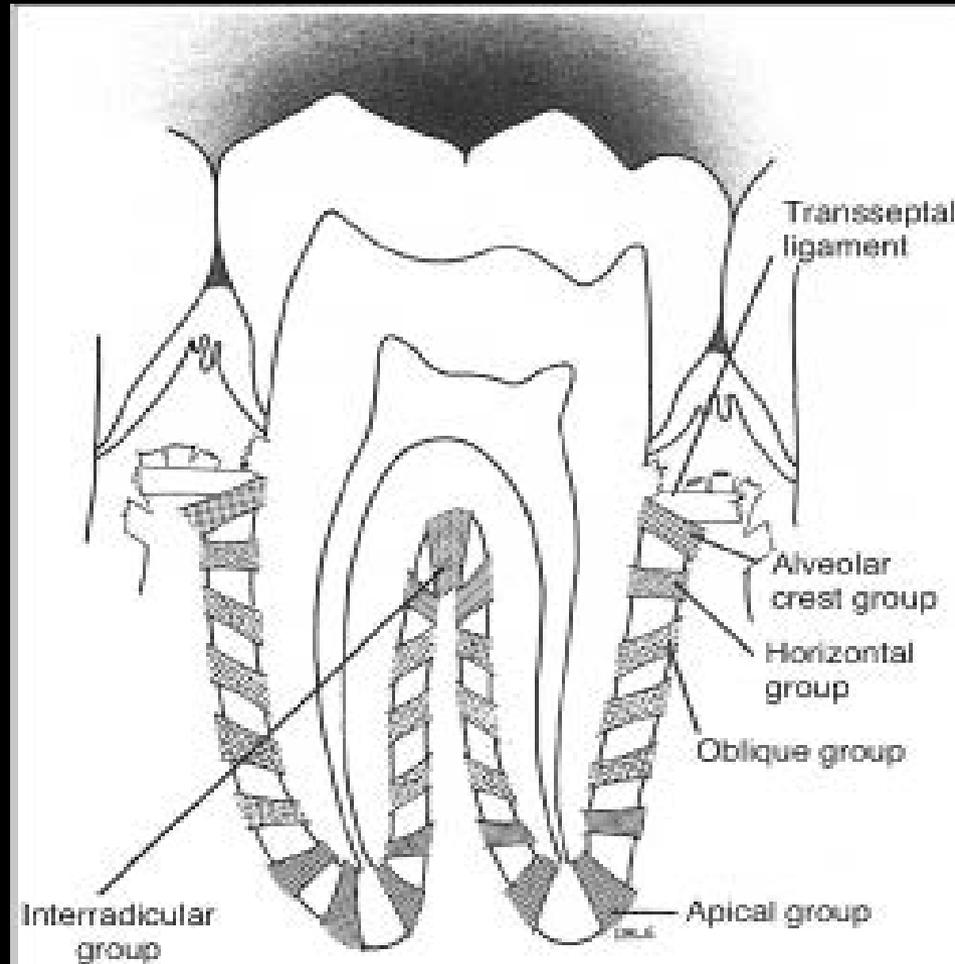
# PRINCIPAL FIBER BUNDLES OF PDL

## 1. THE ALVEOLAR CREST GROUP

These are attached to the cementum just below the cemento-enamel junction & running downward and outward to insert into the crest of the alveolar bone

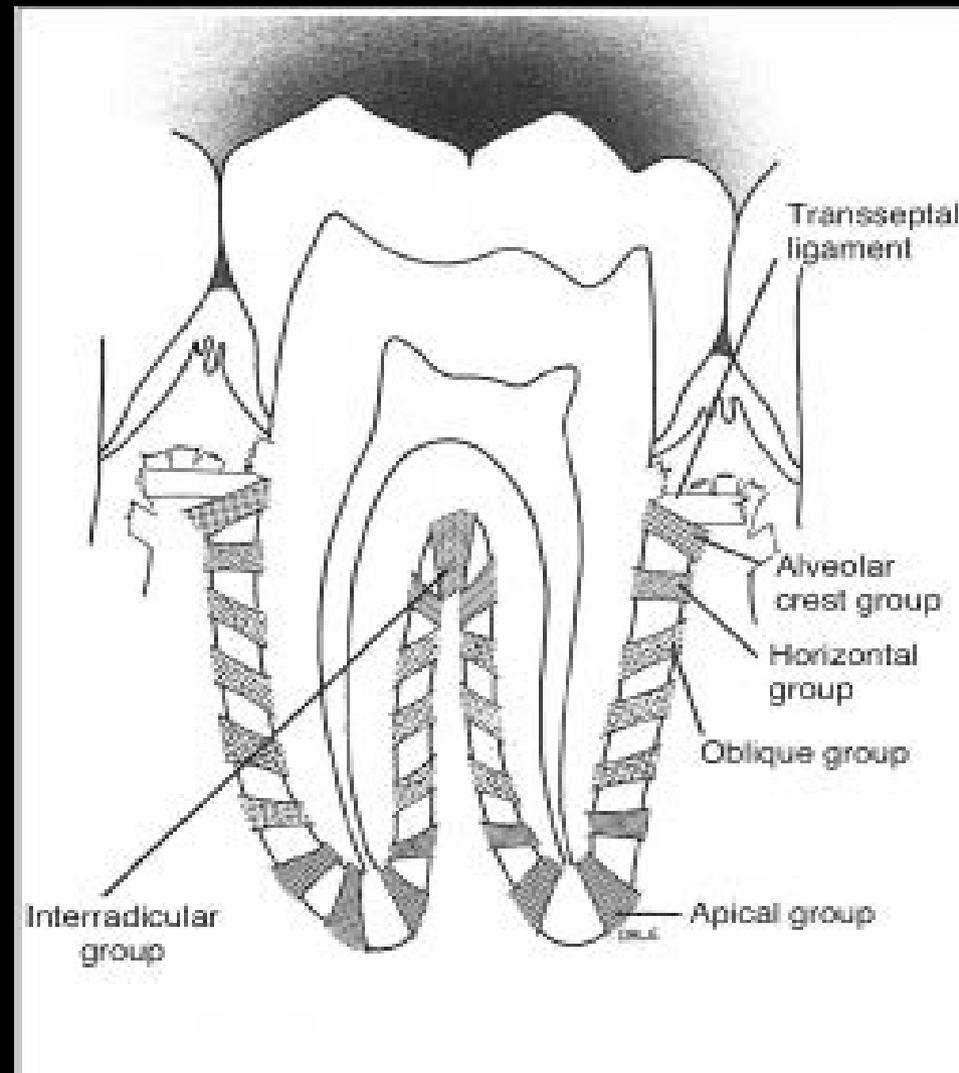
They are important to retain the tooth in its socket

( prevent extrusion ) & resisting lateral forces



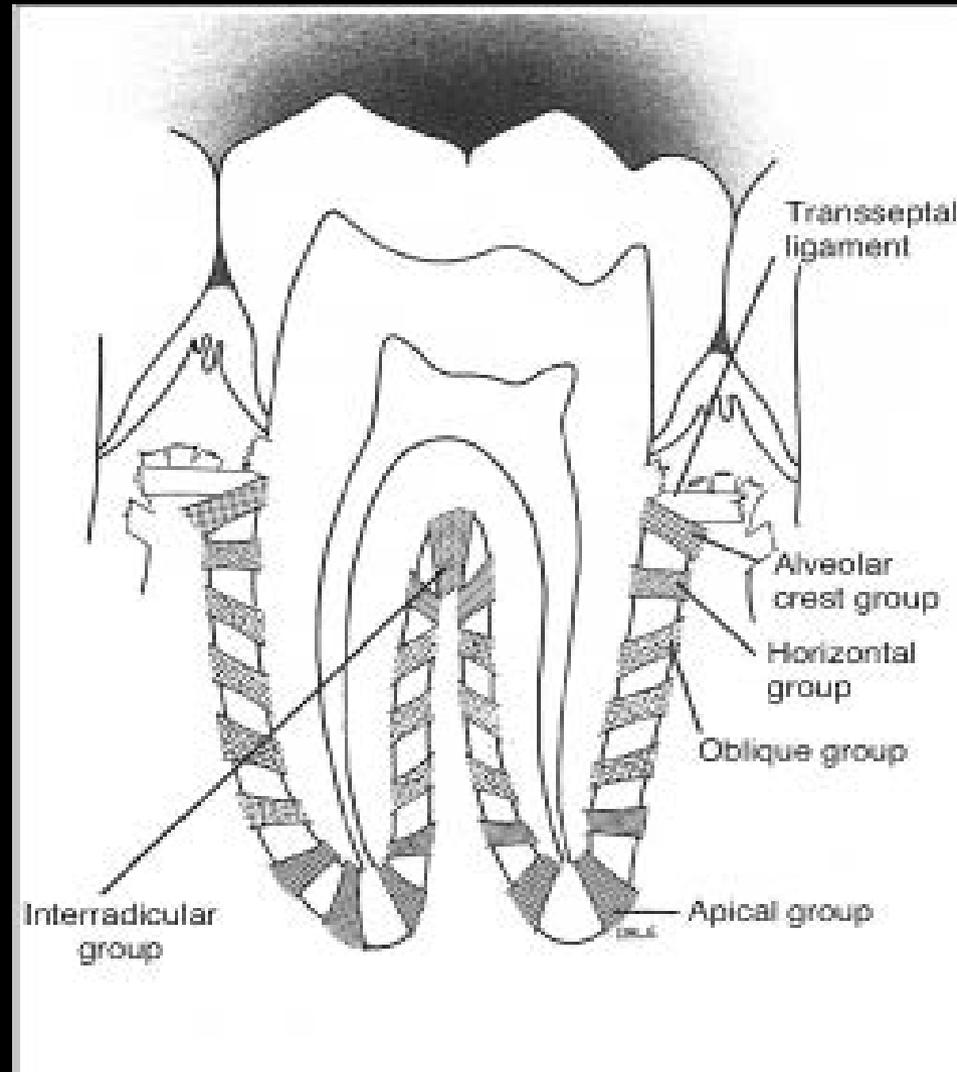
## 2. THE HORIZONTAL GROUP

- These are just apical to the alveolar crest fibers and running at right angles to the long axis of the tooth from the cementum to the bone below the alveolar crest
- Their functions are similar to those of the alveolar crest group .



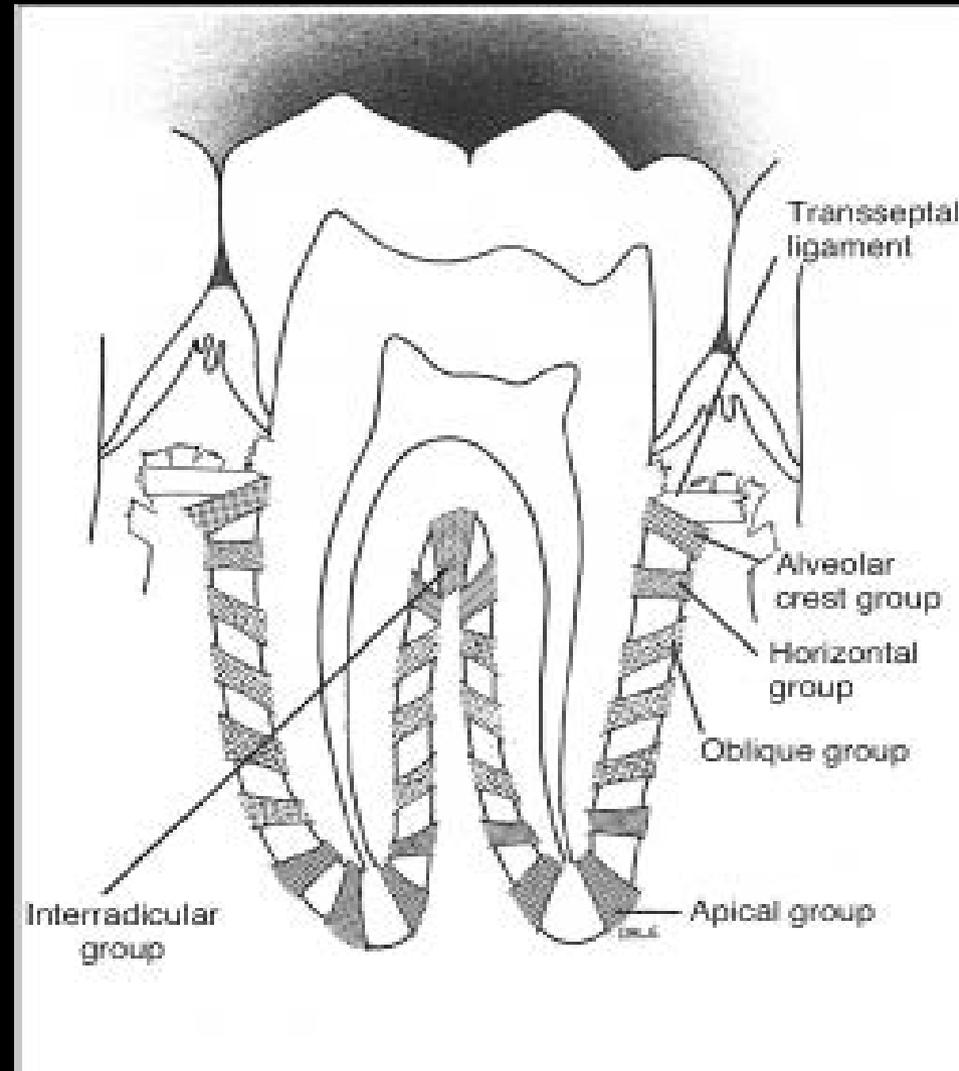
### 3. THE OBLIQUE GROUP

- They are the most numerous in the PDL and running from the cementum in an oblique direction to insert into the bone coronally
- They are important in bearing the load of masticatory forces



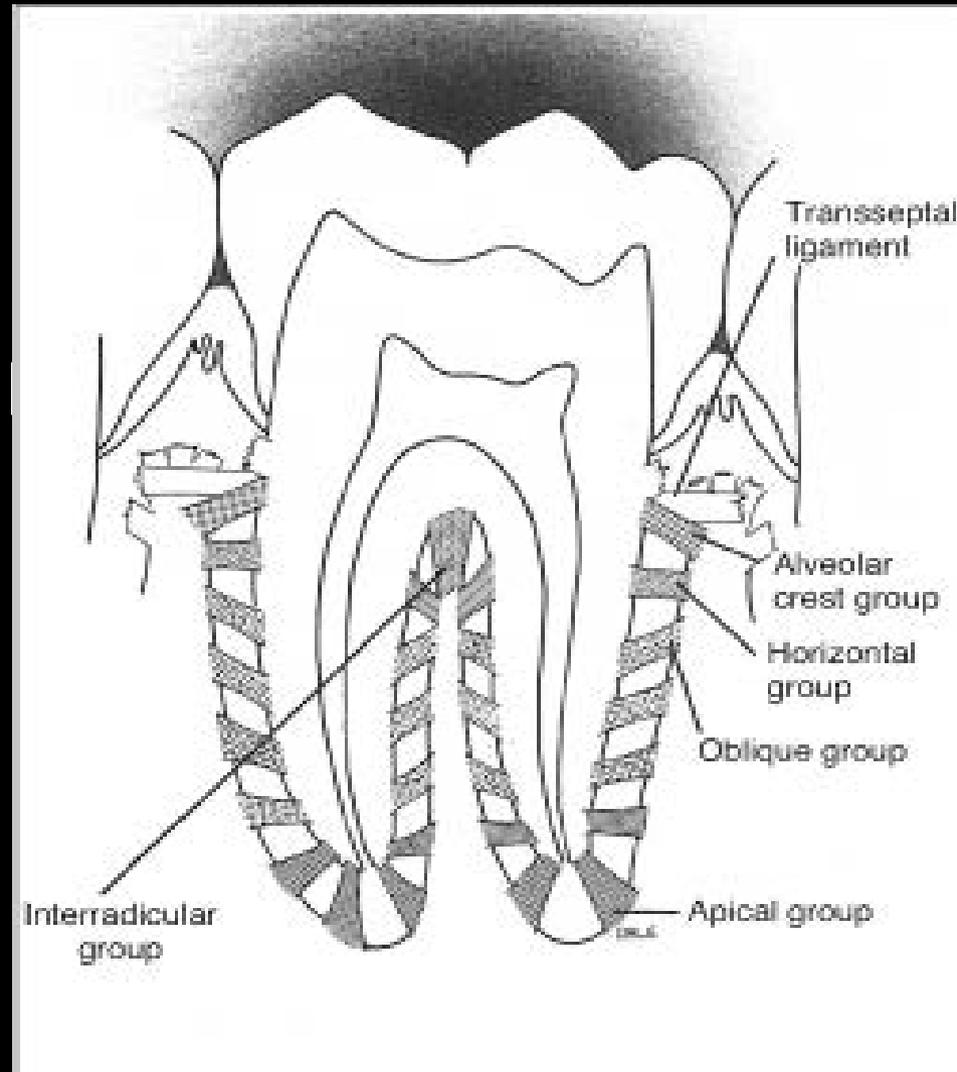
## 4. THE APICAL GROUP:

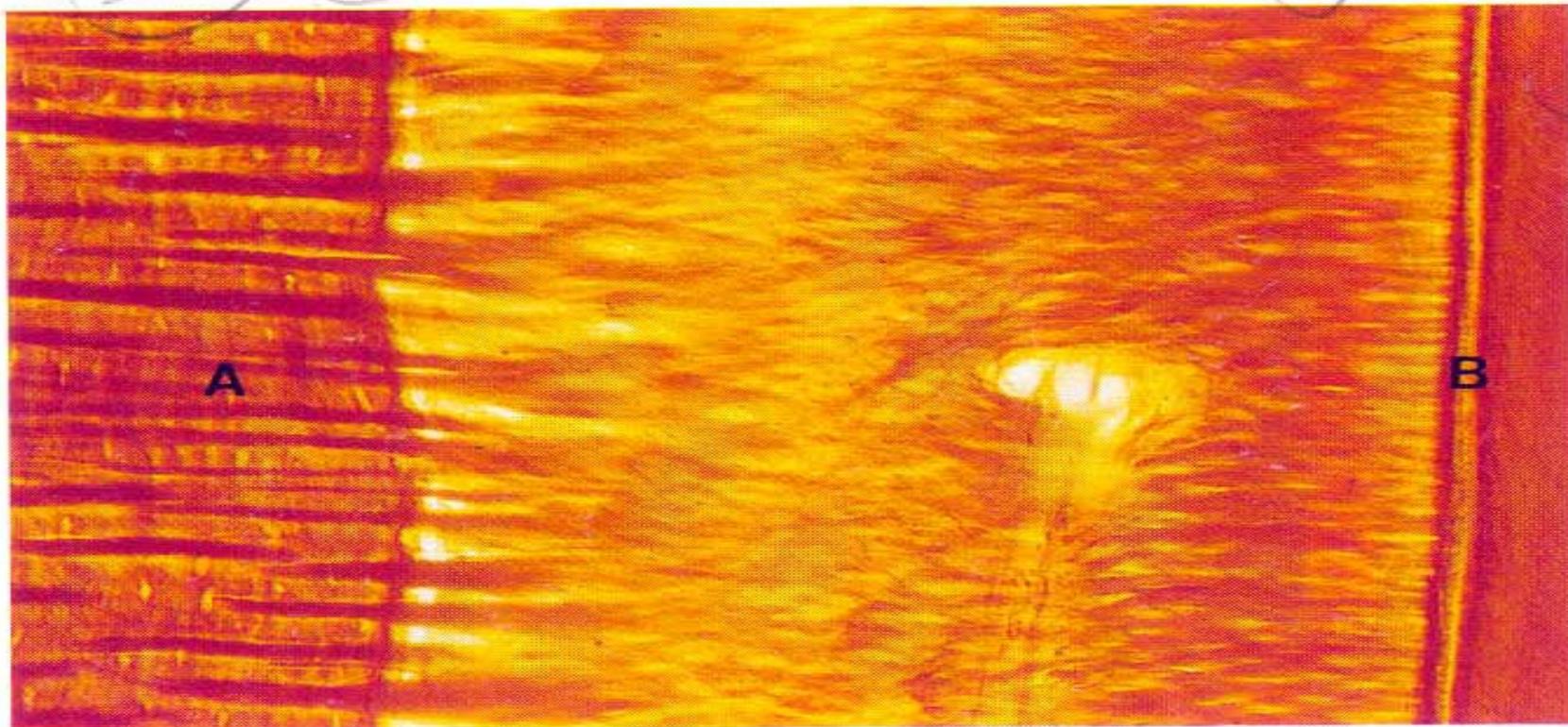
- These are radiating from the cementum around the apex of the root to the bone forming the base of the socket
- They resist vertical forces



## 5. THE INTERADICULAR GROUP

- Found only in the multi-rooted teeth and running from the cementum at furcation area to the interradicular bone
- They resist vertical and extrusive forces





**379 The insertion of periodontal fibres into alveolar bone (A) and cementum (B).** The horizontal lines in the bone and cementum represent the Sharpey's fibres. Note that the principal fibres are more numerous but smaller at their attachments to cementum than at the alveolar bone. (Decalcified section; van Gieson;  $\times 250$ )

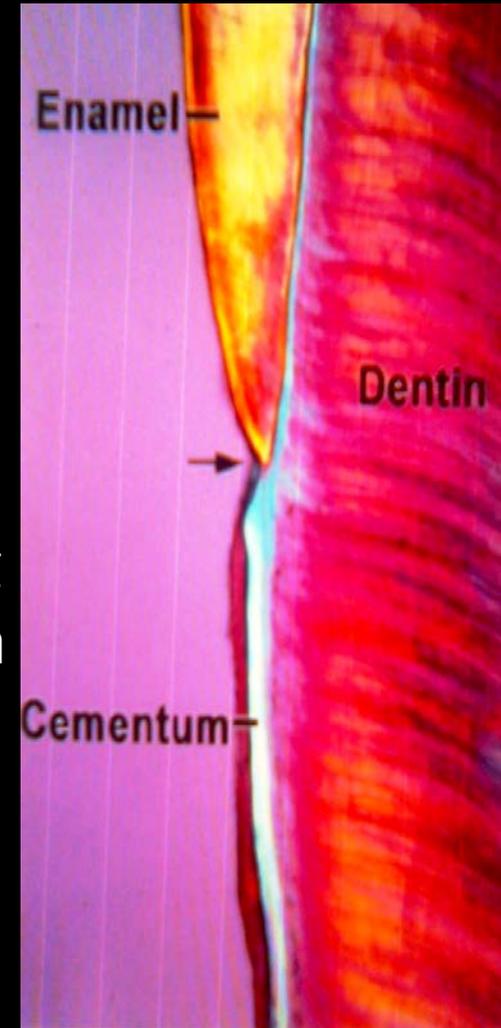
# Cementum

Is a thin layer of calcified connective tissue that covers the anatomical root of tooth

It is like a bone except that cementum is **a vascular**

Cementum deposition is continue throughout the life of tooth, so it's thickness increase with age

Cementum usully acts to provide a medium for attachment of collagen fibers that bind the tooth to the alveolar bone

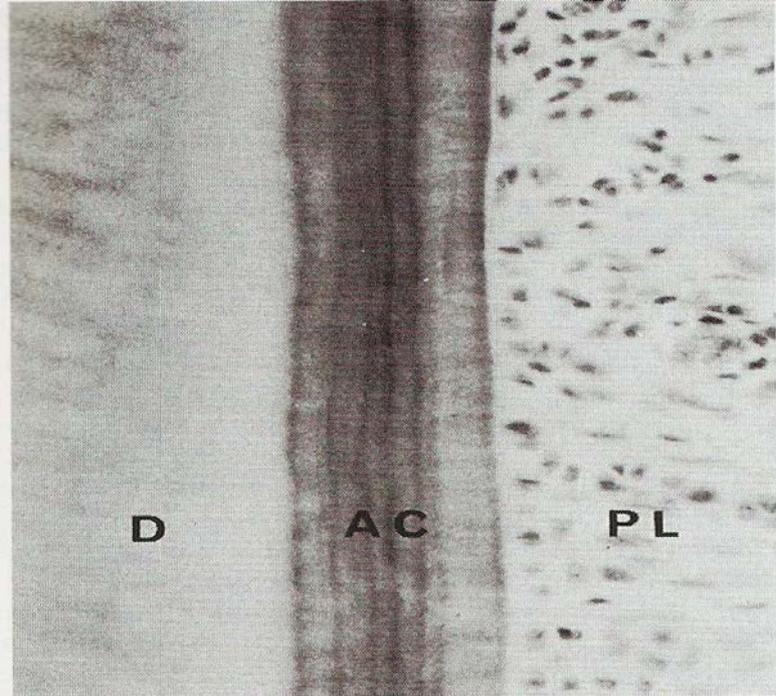


# Types of cementum:

- **A cellular** cementum ,known as a primary cementum & posses no cells

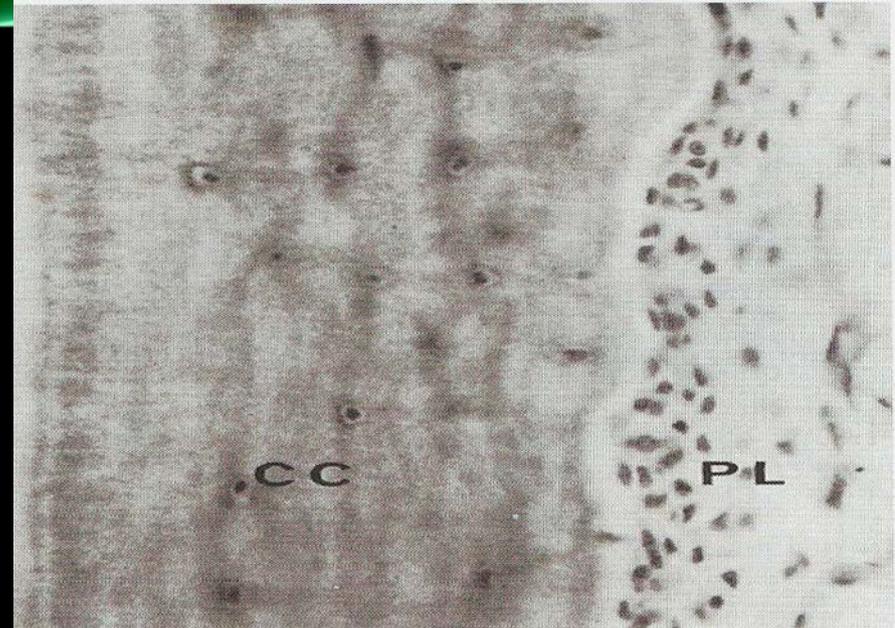
- **Cellular** cementum which is formed later and contains cells

- Both types are made mainly of collagen fibers, which can be either extrinsic or intrinsic, embedded in calcified matrix
- Extrinsic collagen fibers are mainly Sharpy's fibers, while the intrinsic fibers are synthesized by cementoblasts



## Acellular

- It is the first to be formed, before the tooth reaches the occlusal plane.
- Covers the cervical third or half of the root.
- It doesn't contain cells.

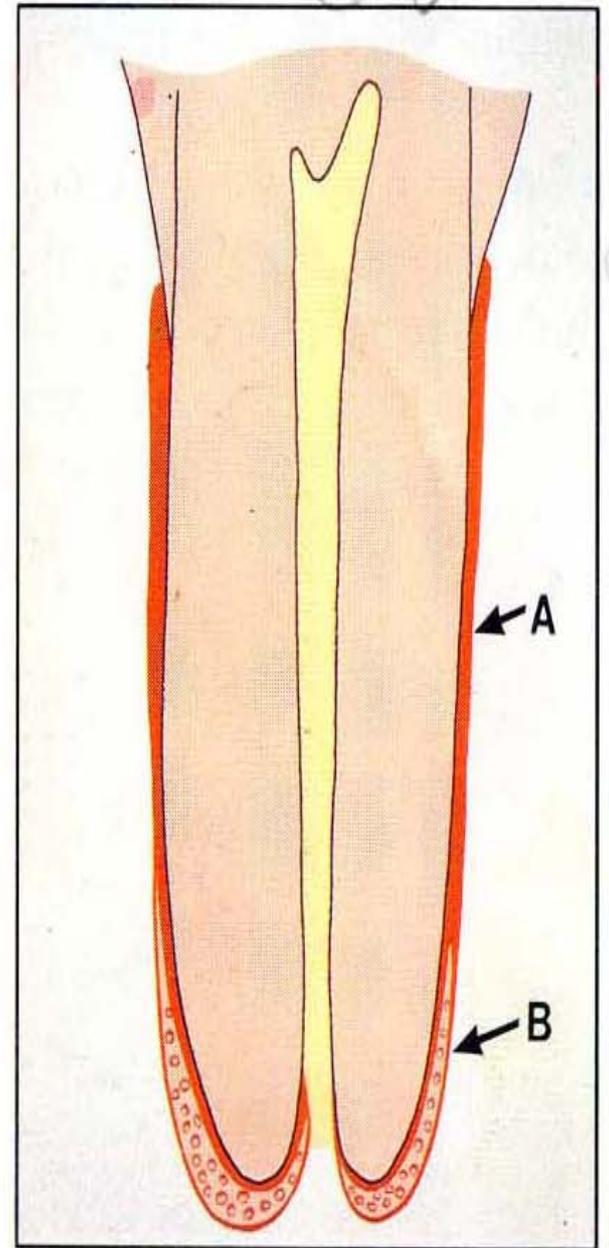


Cellular cementum (CC) showing cementocytes lying within lacunae

## Cellular

- Formed after the tooth reaches the occlusal plane.
- More irregular and contains cells (cementocytes).
- Less calcified than the acellular type.

**340 Cellular and acellular cementum.** Cellular cementum, as its name indicates, contains cells (cementocytes); acellular cementum does not. In the most common arrangement, acellular cementum (A) covers the root adjacent to the dentine, whereas cellular cementum (B) is found mainly in the apical area and overlying the acellular cementum. I

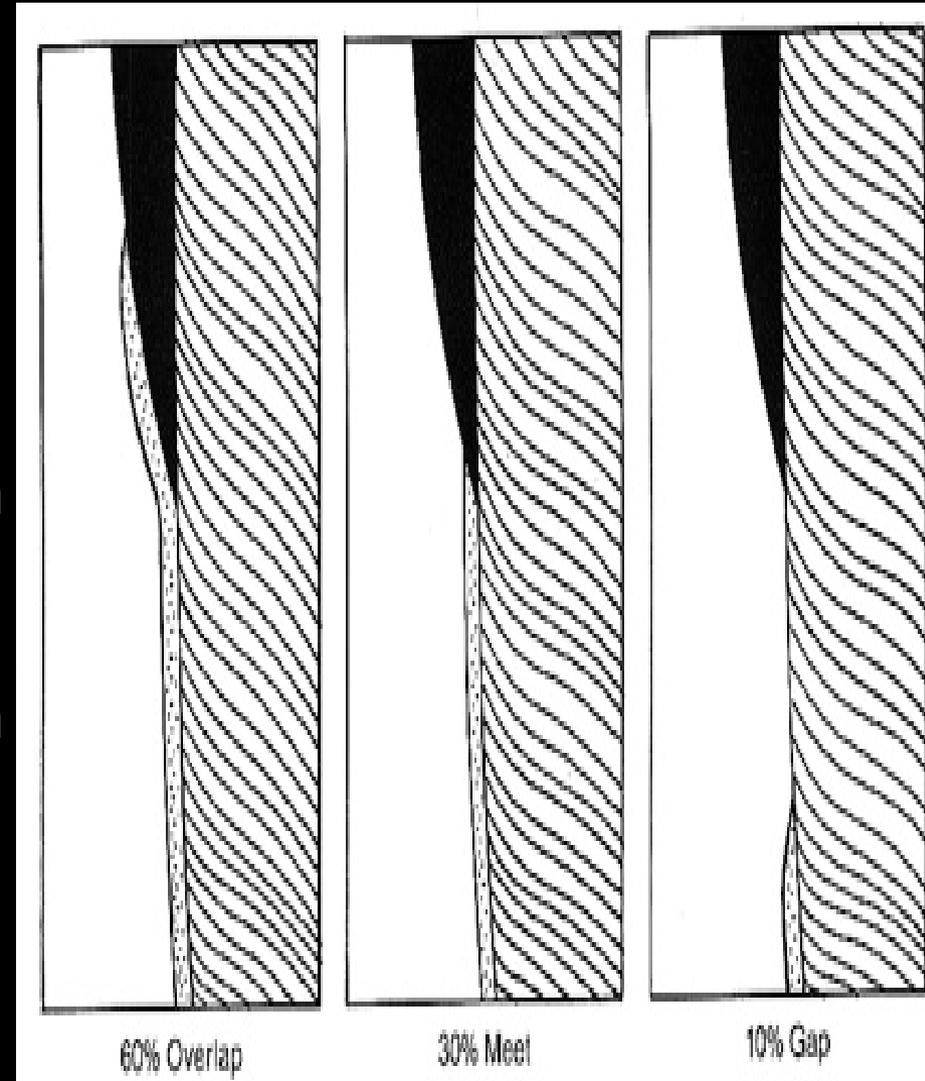


# PHYSICAL CHARACTERISTICS & COMPOSITION

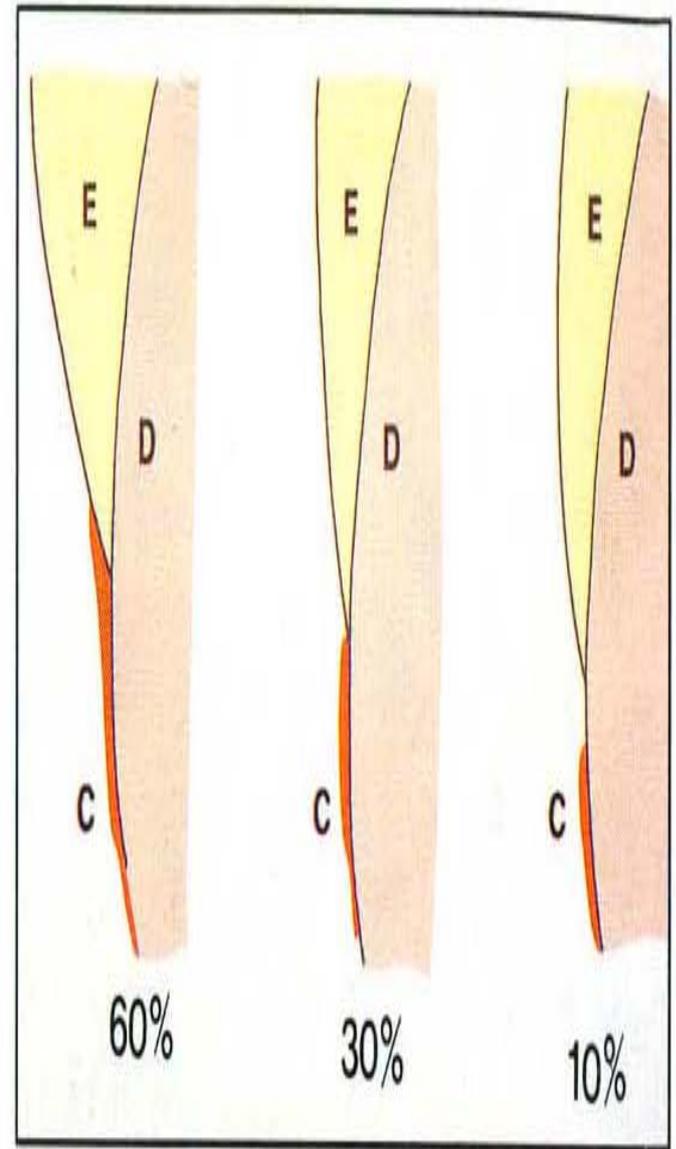
- COLOR: **YELLOW**
- HARDNESS: **LESS THAN DENTIN**
- COMPOSITION: **ORGANIC MATRIX (50%)**  
**INORGANIC ELEMENT (45-50%)**
- ORGANIC MATRIX: **COLLAGENOUS & NON-COLLAGENOUS PROTEINS**

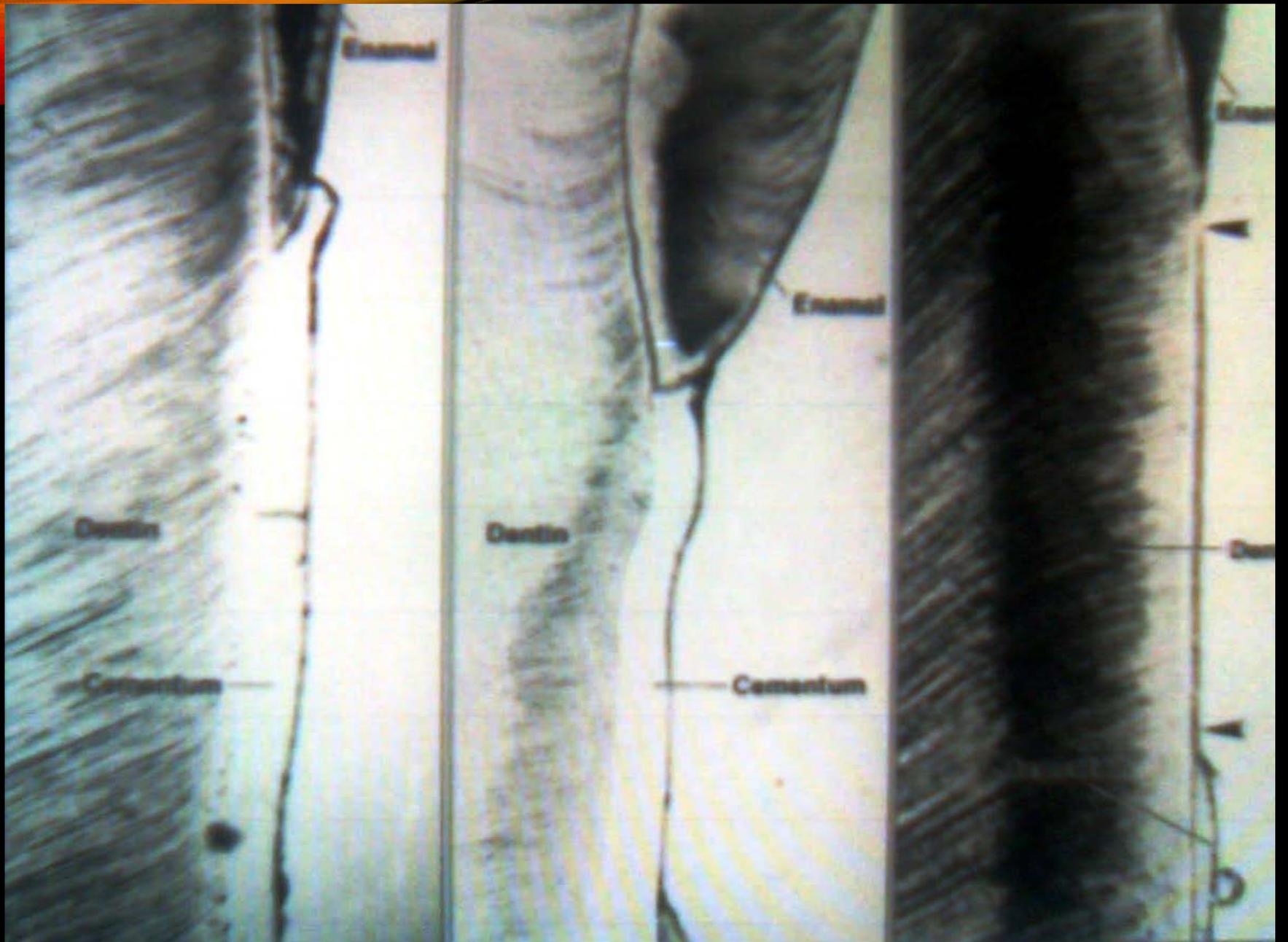
# CEMENTOENAMEL JUNCTION

- The relation of Cementum to Enamel at Cemento-enamel Junction (CEJ) is important in root planning procedure
- **"OMG rule"**
- In 60% of the teeth cementum **OVERLAPS** enamel for a short distance
- In 30% of the teeth cementum just **MEETS** enamel edge to edge forming a butt joint
- In 10% of the teeth there is a small **GAP** between cementum and enamel.



**338 The cement–enamel junction.** In any single section of a tooth, three arrangements of the junction between cementum and enamel may be seen. Pattern 1, where the cementum overlaps the enamel for a short distance, is the predominant arrangement in 60% of sections. Pattern 2, where the cementum and enamel meet at a butt joint, occurs in 30% of sections. Pattern 3, where the cementum and enamel fail to meet and the dentine between them is exposed, occurs in 10% of sections. Although one of these patterns may predominate in an individual tooth, all three patterns may be present.





# The Alveolar process ( Bone )

Anatomically, the jaw (maxilla and mandible) composed from 2 parts :

- 1-The alveolar process
- 2-The basal or body bone

The alveolar process is a part of jaw bone that forms and supports the socket of the teeth

**Note:** There is no distinct boundary exists between these two parts

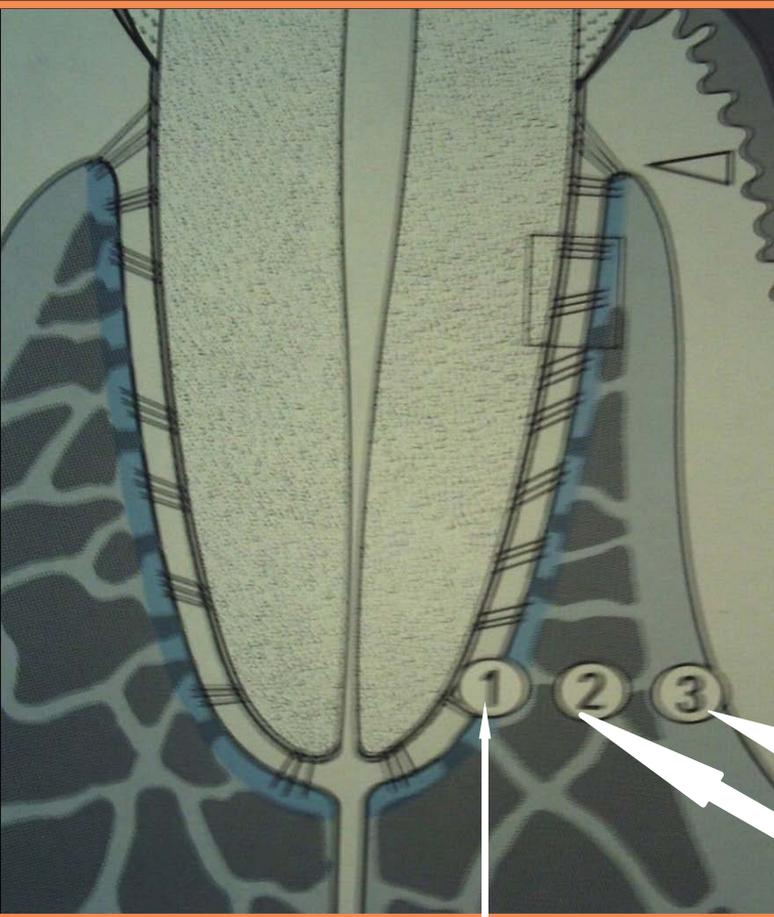
# Alveolar Process

## Alveolar process consists of:

1-Alveolar bone proper: Thin bone forming the inner wall of socket & give attachment to PDL

2-The supporting alveolar bone: Bone that surround alveolar bone proper & give support to the socket.  
It is composed of:

- a- Cortical plate ( Buccal & Lingual )
- b- Spongy bone

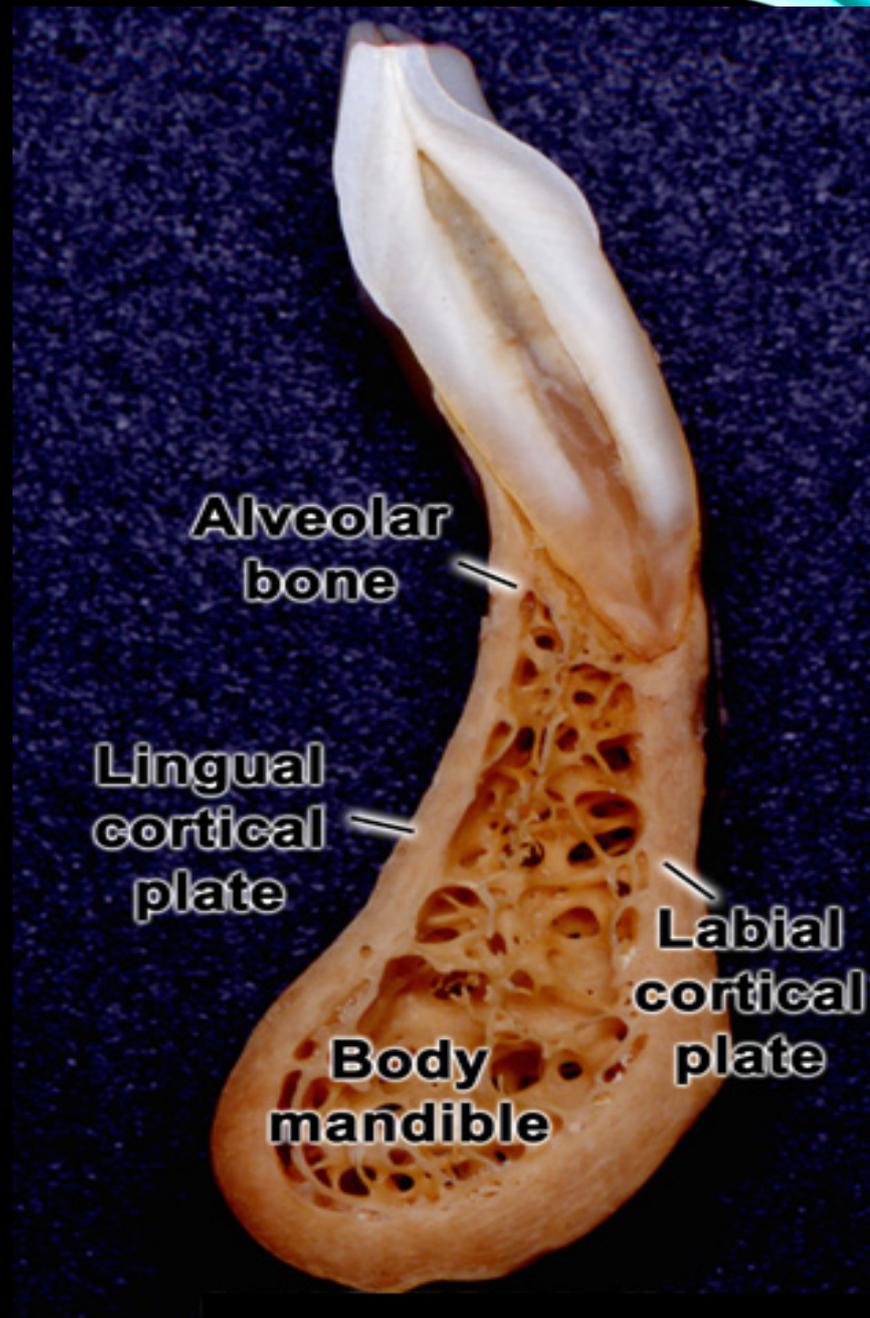


External plate of cortical bone

Central cancellous ,Trabeculae  
( spongy bone )

Alveolar bone proper

- Cortical plates and alveolar bone proper meets at the alveolar crest (1.5 -2 mm ) below the level of CEJ. This increase in periodontal disease
- Alveolar bone proper is perforated by foramina because it is vascular
- Nerves and vessels pass through it
- That's why it is called a **cribriform plate**

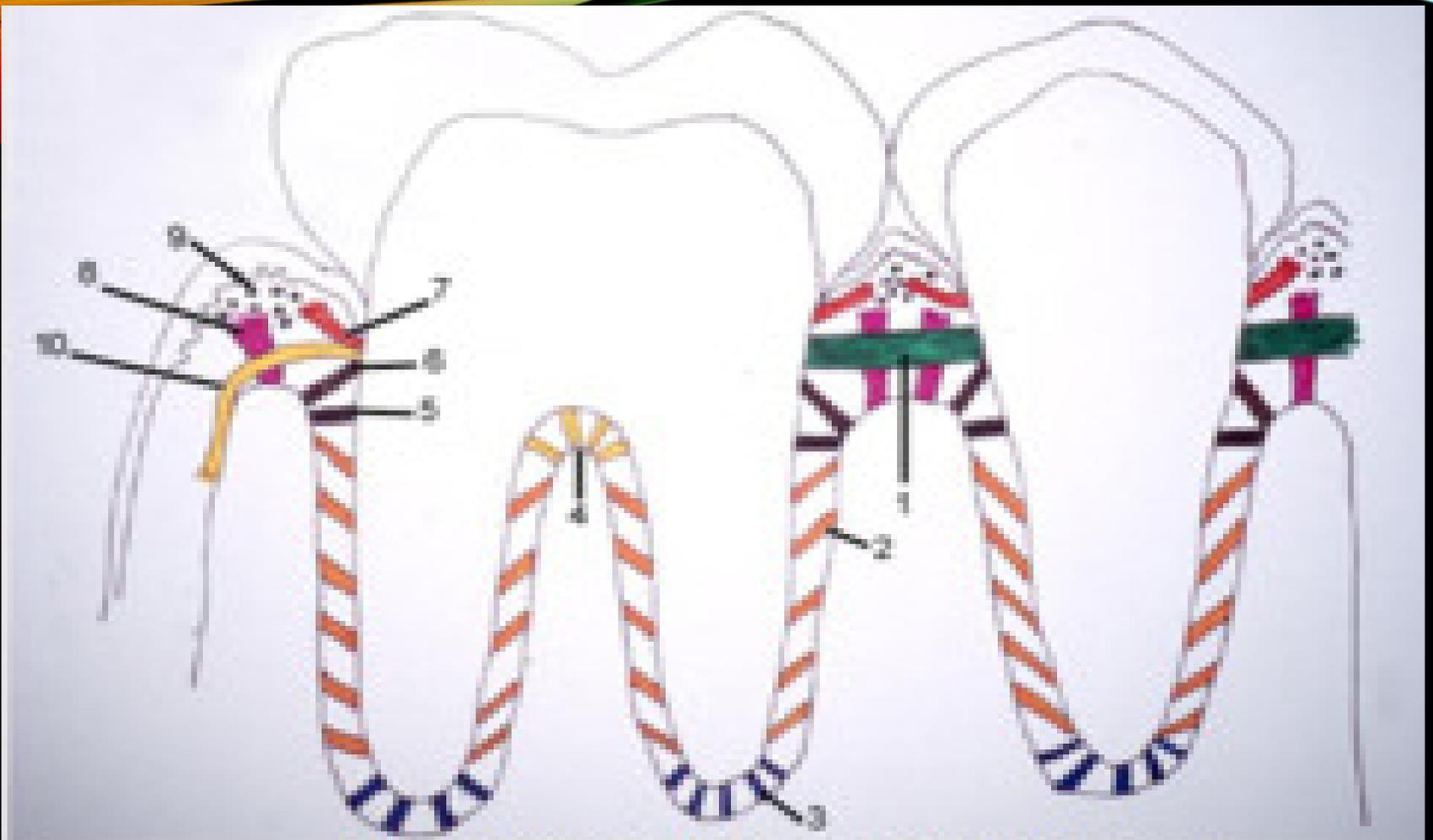


- Radiographically, alveolar bone proper is referred as

## **Lamina dura**

because of the increase in its radiopacity





### Principal fibers of the periodontal ligament

- |                       |                                   |
|-----------------------|-----------------------------------|
| 1. transseptal fibers | 6. alveolar crest                 |
| 2. oblique            | 7. dento-gingival (free gingival) |
| 3. apical             | 8. alveolar-gingival              |
| 4. interradicular     | 9. circular                       |
| 5. horizontal         | 10. dento-periosteal              |

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