# **Practice** 3

Tonsils – Waldeyer's ring
(Cut of decalcified tooth)

Periodontium
Gingiva

# Tonsils – Waldeyer's ring

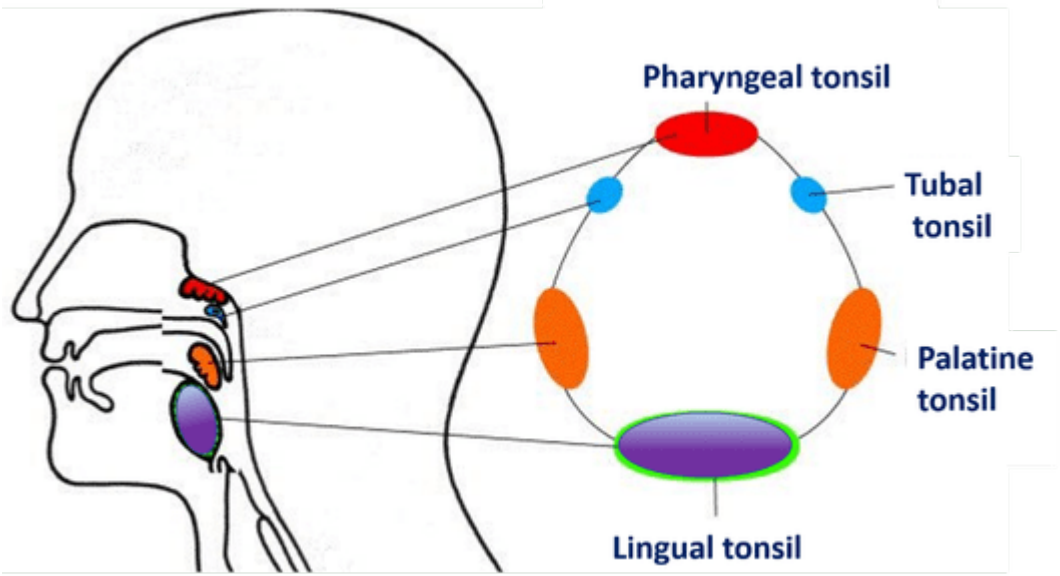
Group of peripheral lymphoid organs positioned at the entrance into naso- and oropharynx

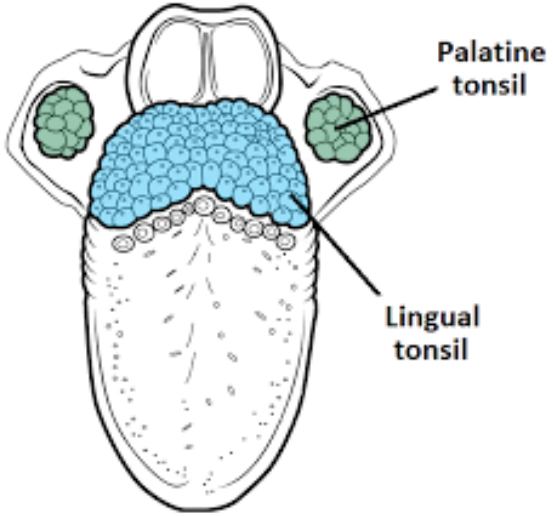
Total 6 (*tonsillae palatinae, tonsillae tubariae, tonsilla lingualis, tonsilla pharyngea*)

**Mucosal organs –** accumulation of lymphoid tissue in lamina propria

**B - dependent areas - secondary lymph follicles**

**T-dependent regions - interfollicular zones**



# Palatine tonsils

Positioned on the right and left side between glosopalatal and pharyngopalatal arches, ovoid shape, deep and branched tonsillar crypts, there are usually up to 35 (contain detritus), tonsil separated by fibrous capsula – can have septs.

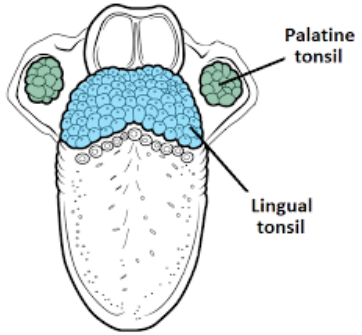
The surface of the tonsil is covered by a stratified squamous epithelium

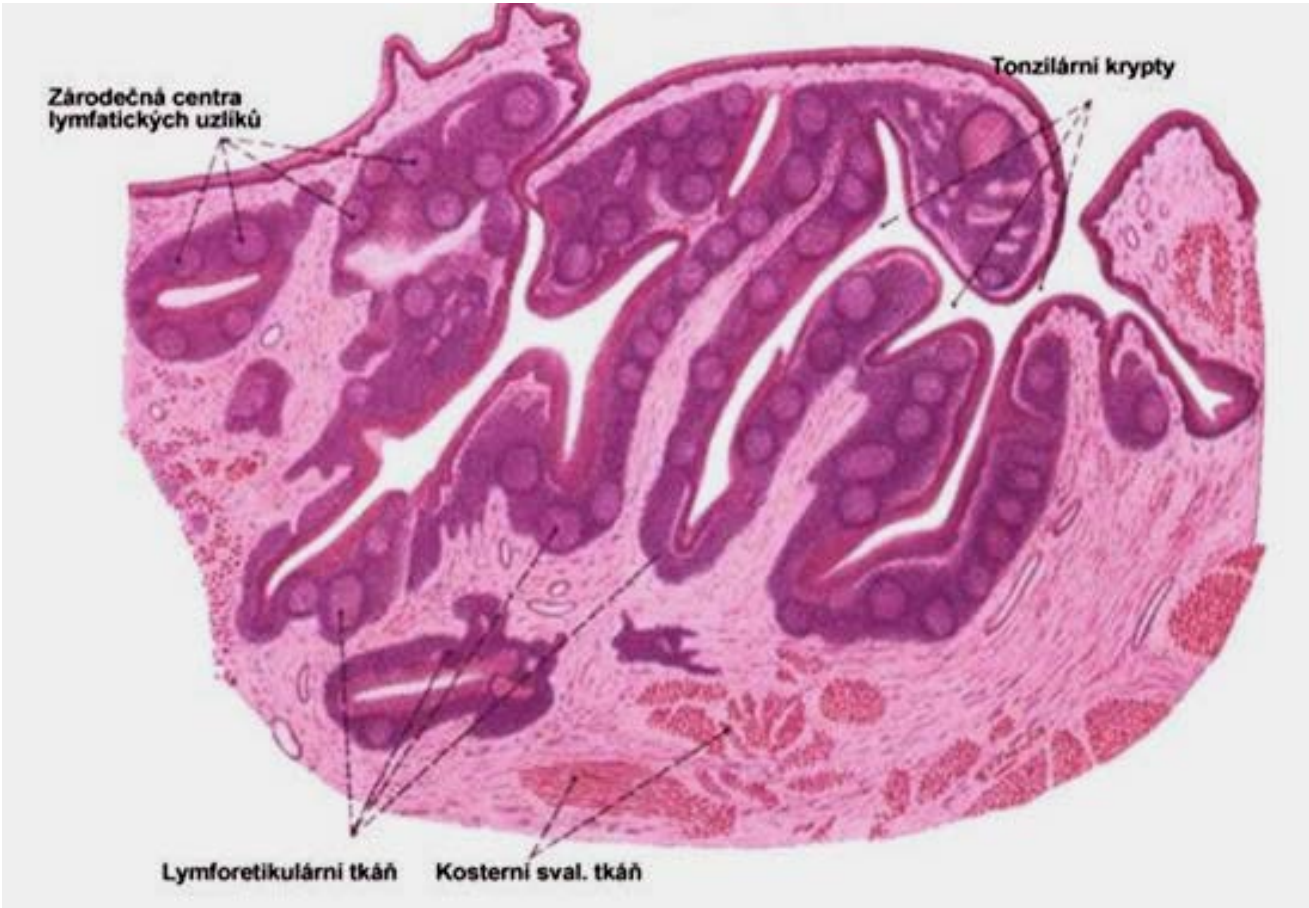
**In lamina propria** are large lymphatic follicles with light germinal centers

Brighter center - contains centroblasts

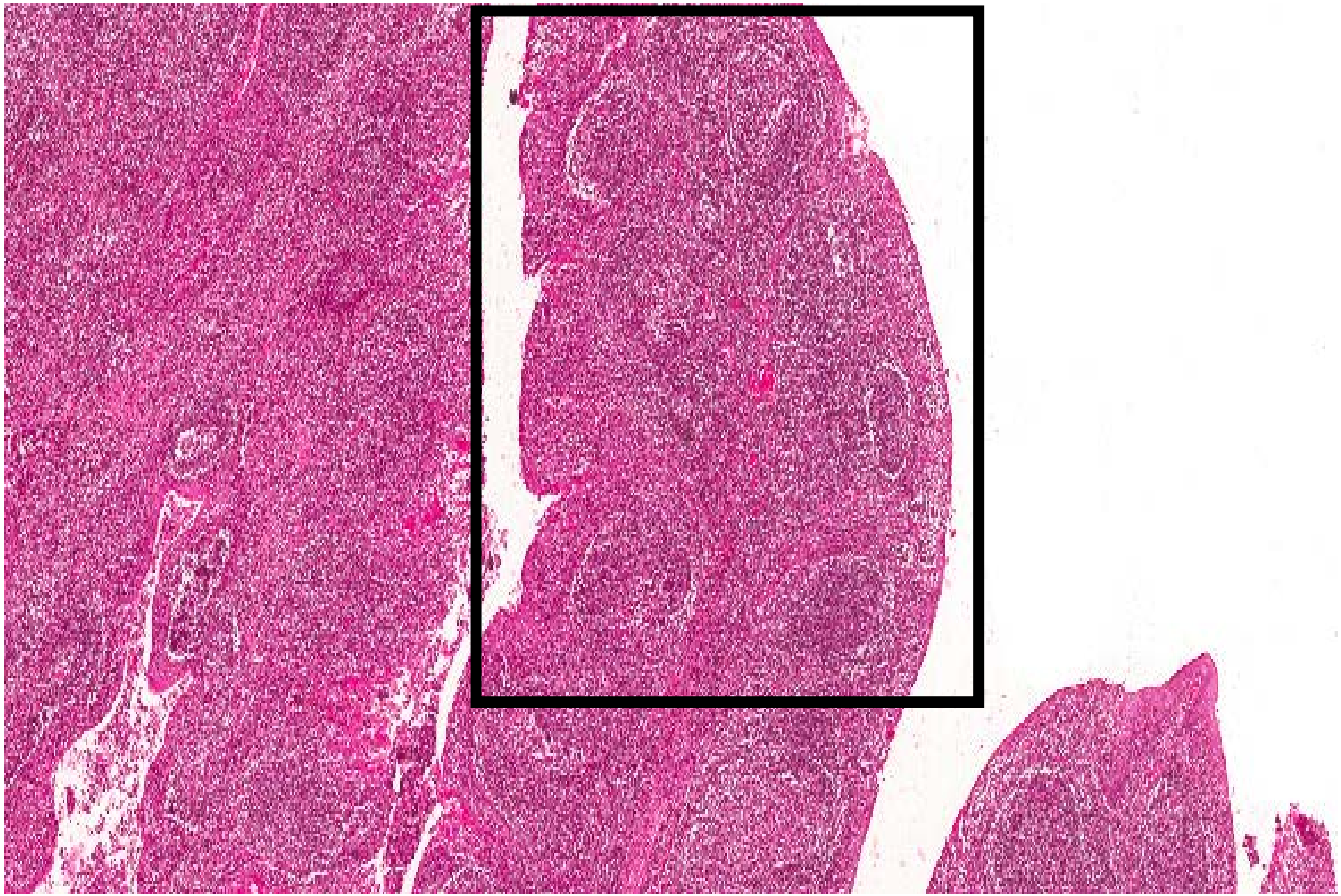
Epithelium above nodules (differences): The structure of the epithelium and the contacts between the cells are very loose, caused by infiltration by lymphocytes, macrophages, dendritic cells, discontinuous basement membrane

**FAE** – (follicle associated epithelium)



# Palatine tonsils



# Palatine tonsils

Lymphocytes which penetrate into the oral cavity are referred to as **salivary bodies**

A

**Tonsilla palatina (H.E.)**

1 – stratified squamous epithelium

2 – lymphocytes infiltrated epithelium (FAE)

3 – secondary lymph nodules or follicles

4 – detritus in tonsilar crypt

B

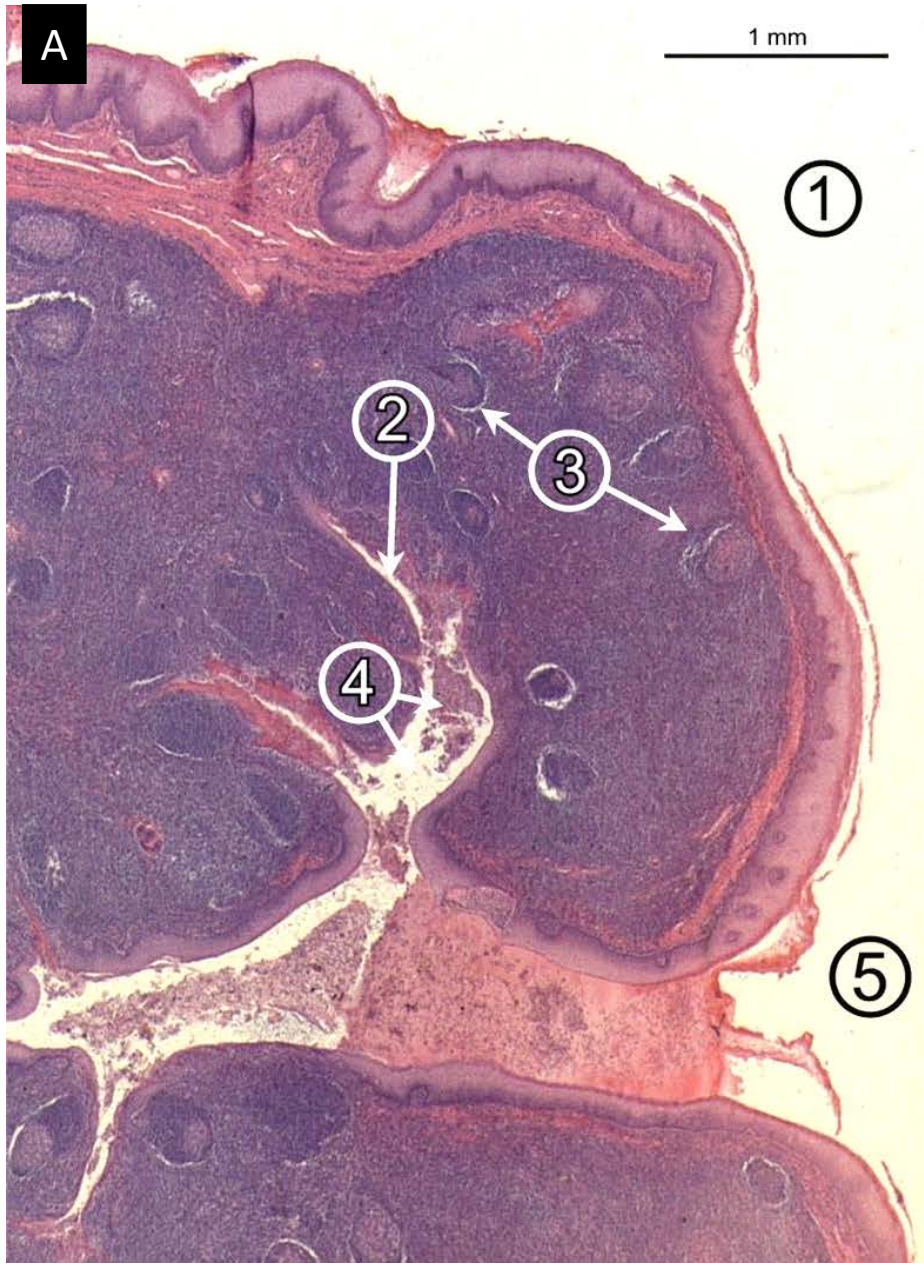
**Tonsilar crypt in detail (H.E.)**

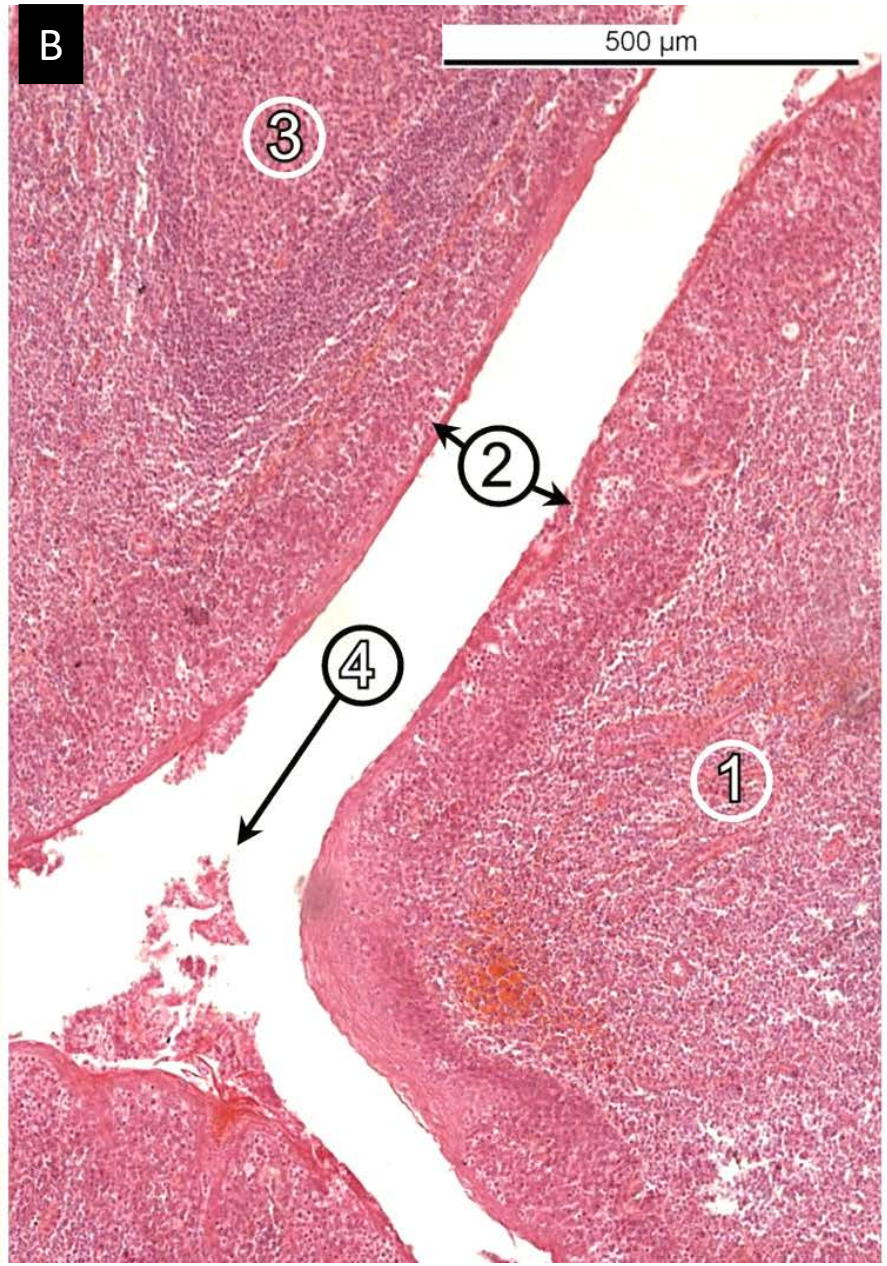
1 – stratified squamous epithelium

2 – with lymphocytes infiltrated epithelium

3 – germinal centre of a secondary nodule

4 – detritus



# Lingual tonsil

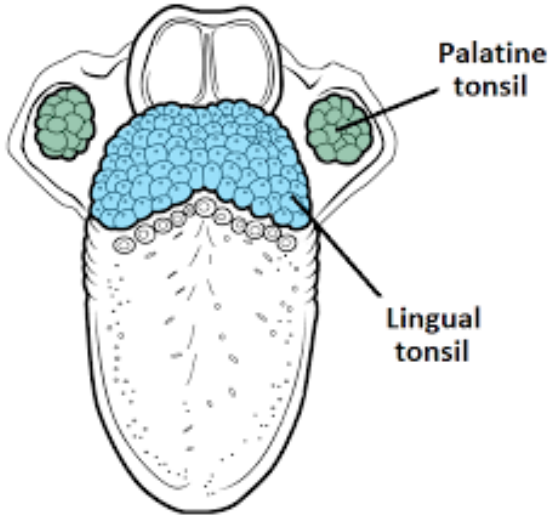
Group of lymph nodules (*folliculi linguales*) in the mucosa of **lamina propria** on the dorsal side of radix linguae behind the circumvallate papillae

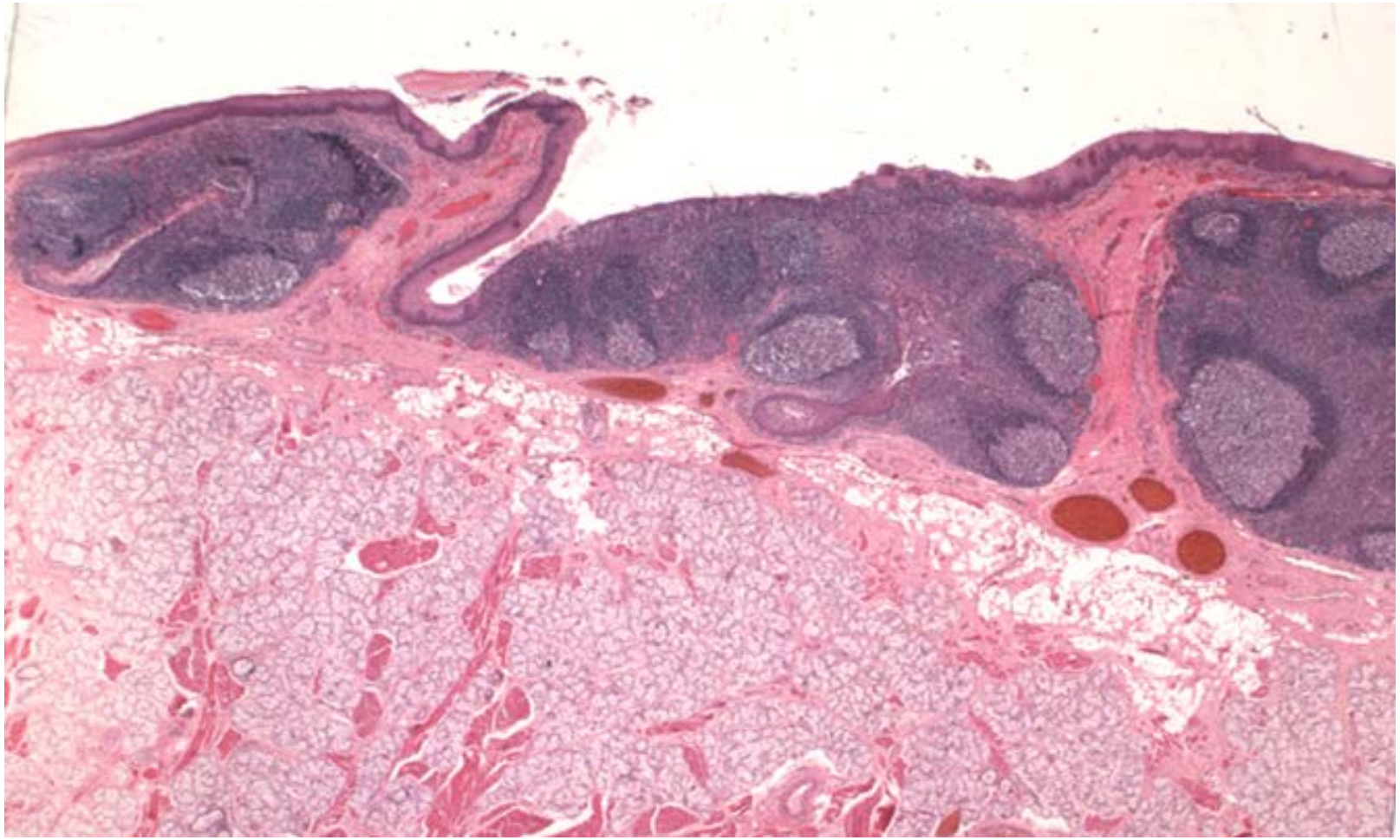
Surface covered by **stratified squamous epithelium**

At the bottom of shallow crypts are openings of purely mucinous Webers glands (*gll. Linguales posteriores*)

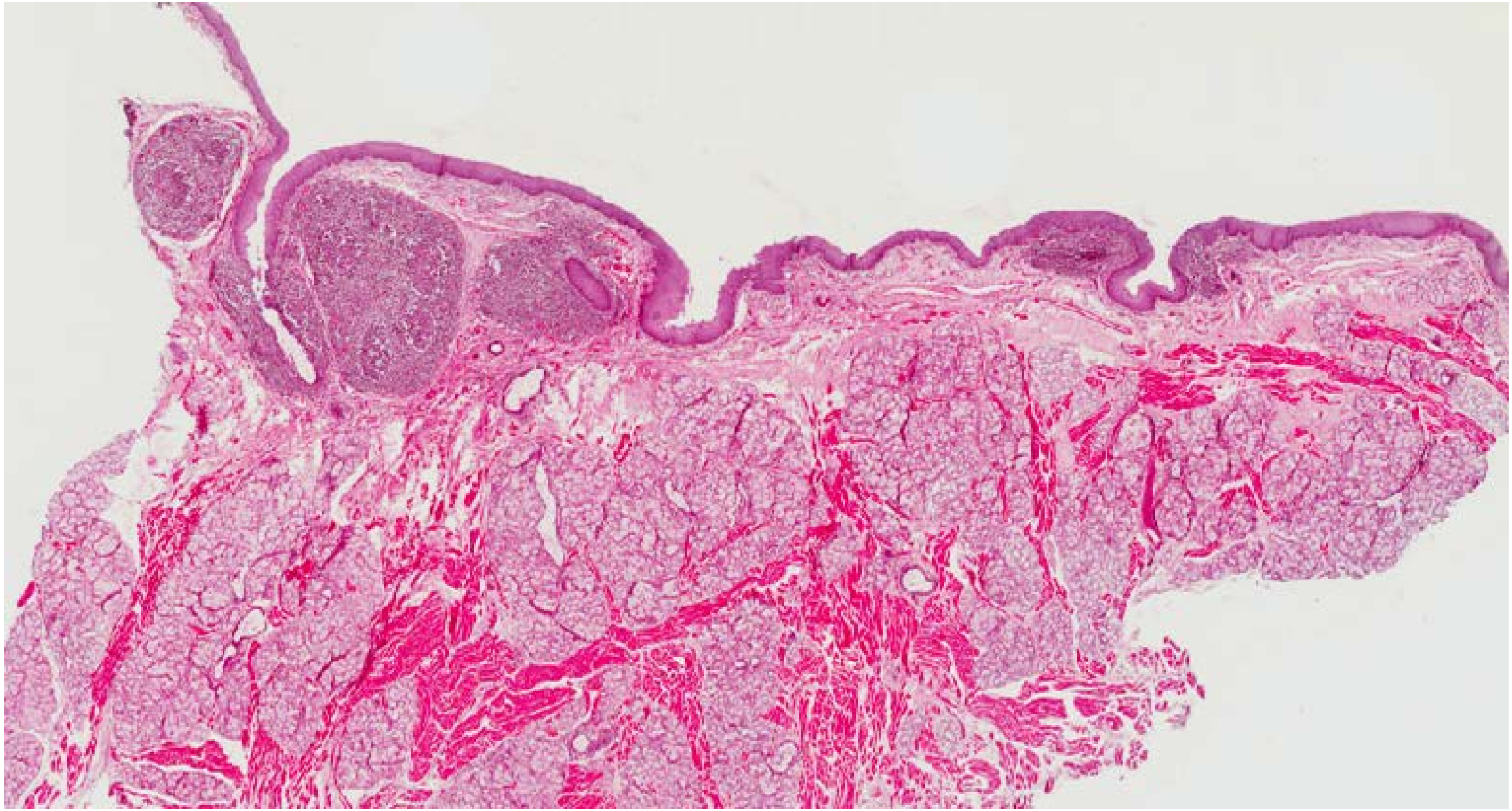
Crypts are perpetually washed outs – no detritus.

No obvious capsula.



# Lingual tonsil



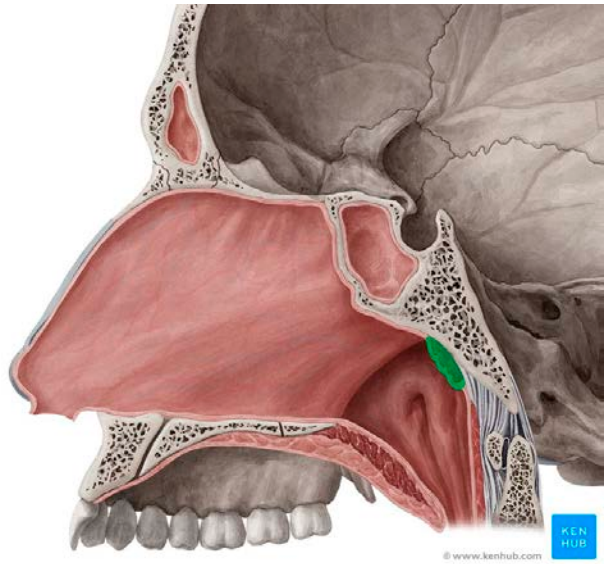
# Pharyngeal tonsil (Adenoid)

Located on the top of pharynx (*fornix pharyngis*)

From the other it differs by the surface covered by pseudostratified columnar epithelium which might contain goblet cells

Shallow crypts

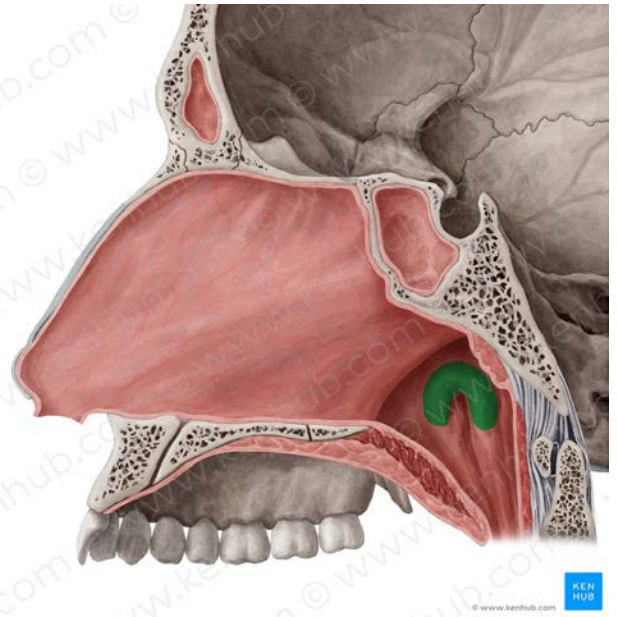
In childhood tonsilla pharyngea can often be hypertrophic which cause problems with nose breathing



# Tubal tonsils (Gerlach tonsils)

Paired tonsil

Group of small lymphoid tissue in lamina propria of mucosa in the pharyngeal opening of the eustachian tube (*ostium pharyngeum tubae auditivae*)

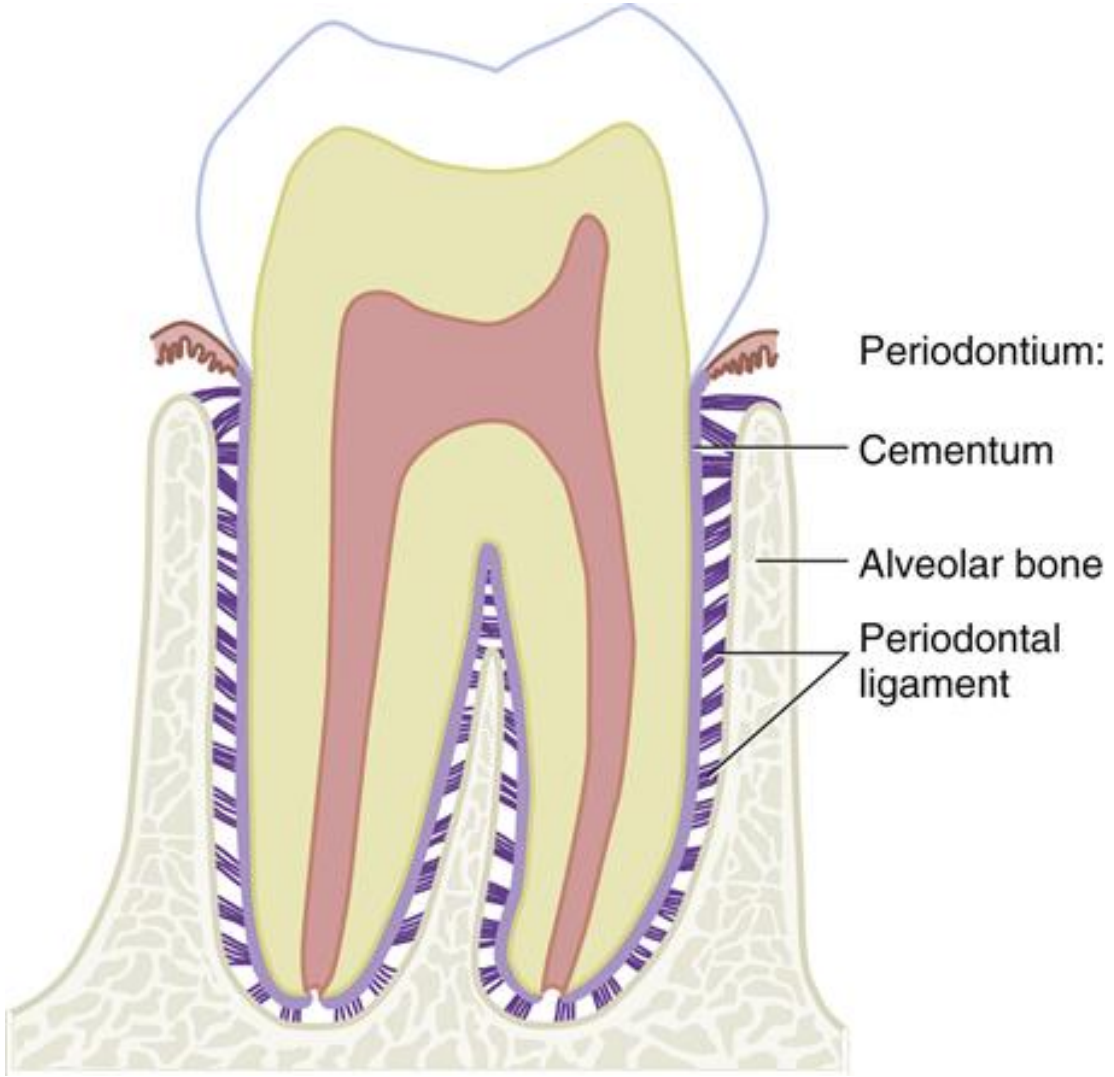


# Microscopic structure of periodontium, function and clinical relevance

# Periodontium (in general meaning)

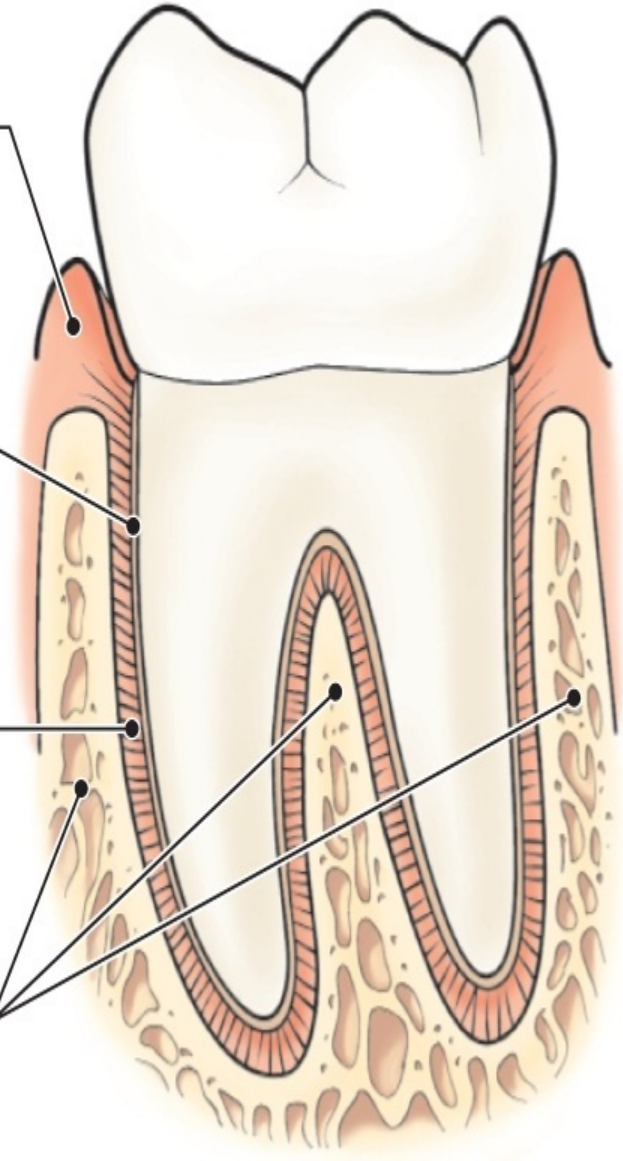
**Consists of:**

- **Alveolus**
- **Periodontal ligament –** dense collagenous tissue which ensure tooth stability and its attachment inside the alveolus
- **Cementum** – covering roots
- **Gingiva**



**Tissues of the Periodontium**

1. gingiva
2. cementum
3. Periodontal ligament
4. alveolus



# Periodontal ligaments

**Hold teeth inside the alveolus –** Balance and compensate the forces acting during mastication **(thecodontn dentition)**

**Transforms compressive forces during chewing** into tensile, which the dental bed better resists and is also better adapted to

Fills the space between the cribriform plate of dental socket and root (cementum)

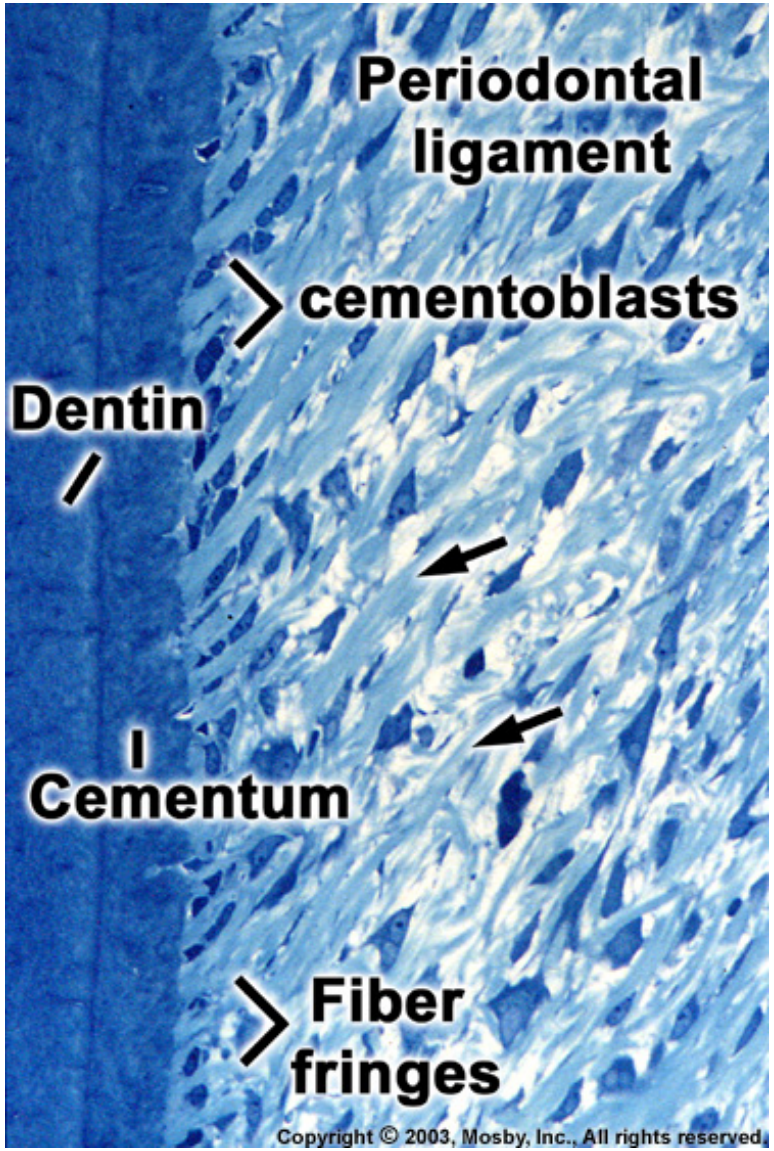
Dense collagenous tissue with higher amount of ECM (extracellular matrix)

**Periodontium thickness** - 0.18 - 1.0 mm, the thinnest in the middle part of the root

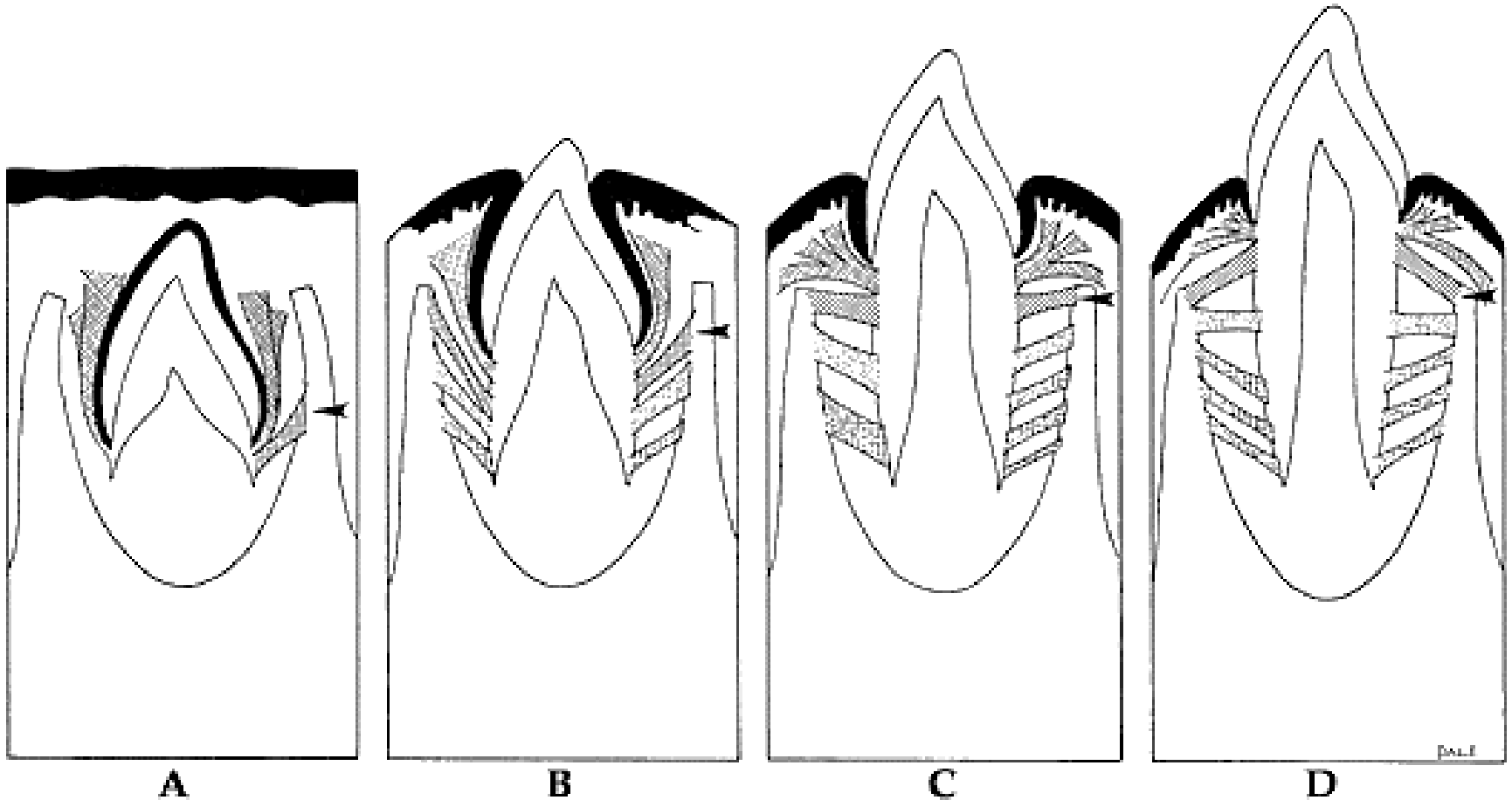
Collagenous fibers - fiber bundles - periodontal ligaments (ligaments)

Ends anchored in dental cementum and lamellar bone of cribriform plate (as Sharpey fibers)

They are of different thicknesses and have a wavy course



# Development



# Microscopic structure

Cellular: **Fibroblasts a Fibrocytes**

**ECM:**

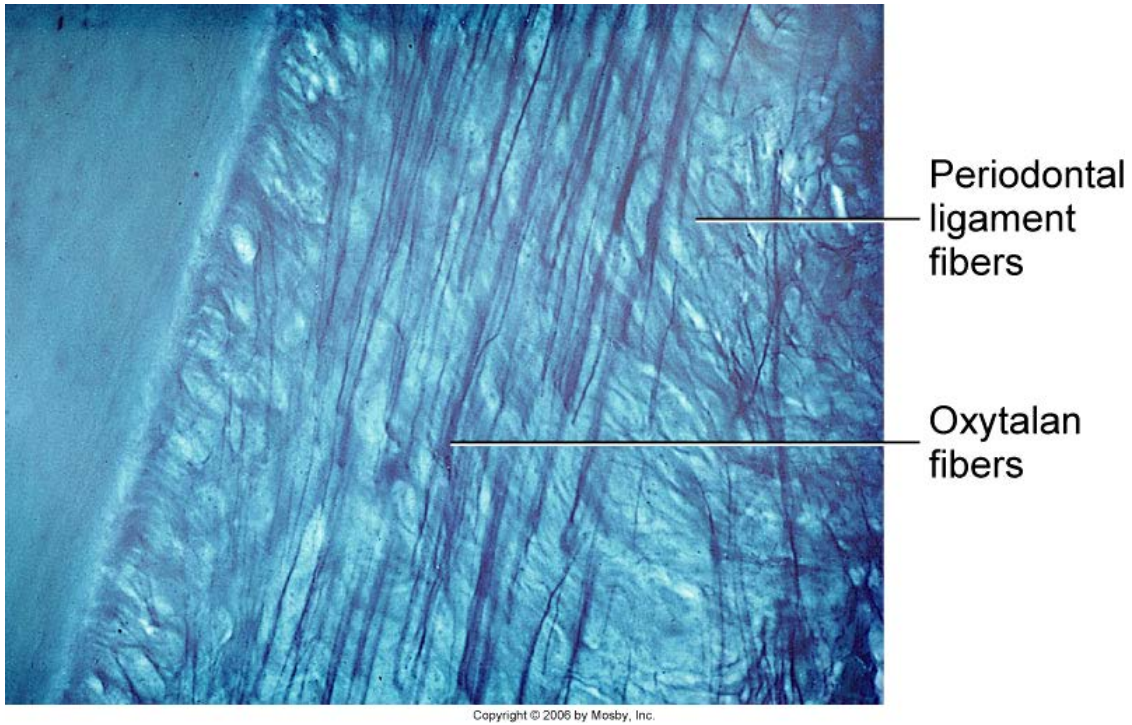
**Collagen fibres (I, III a XII)**

Fast turnover

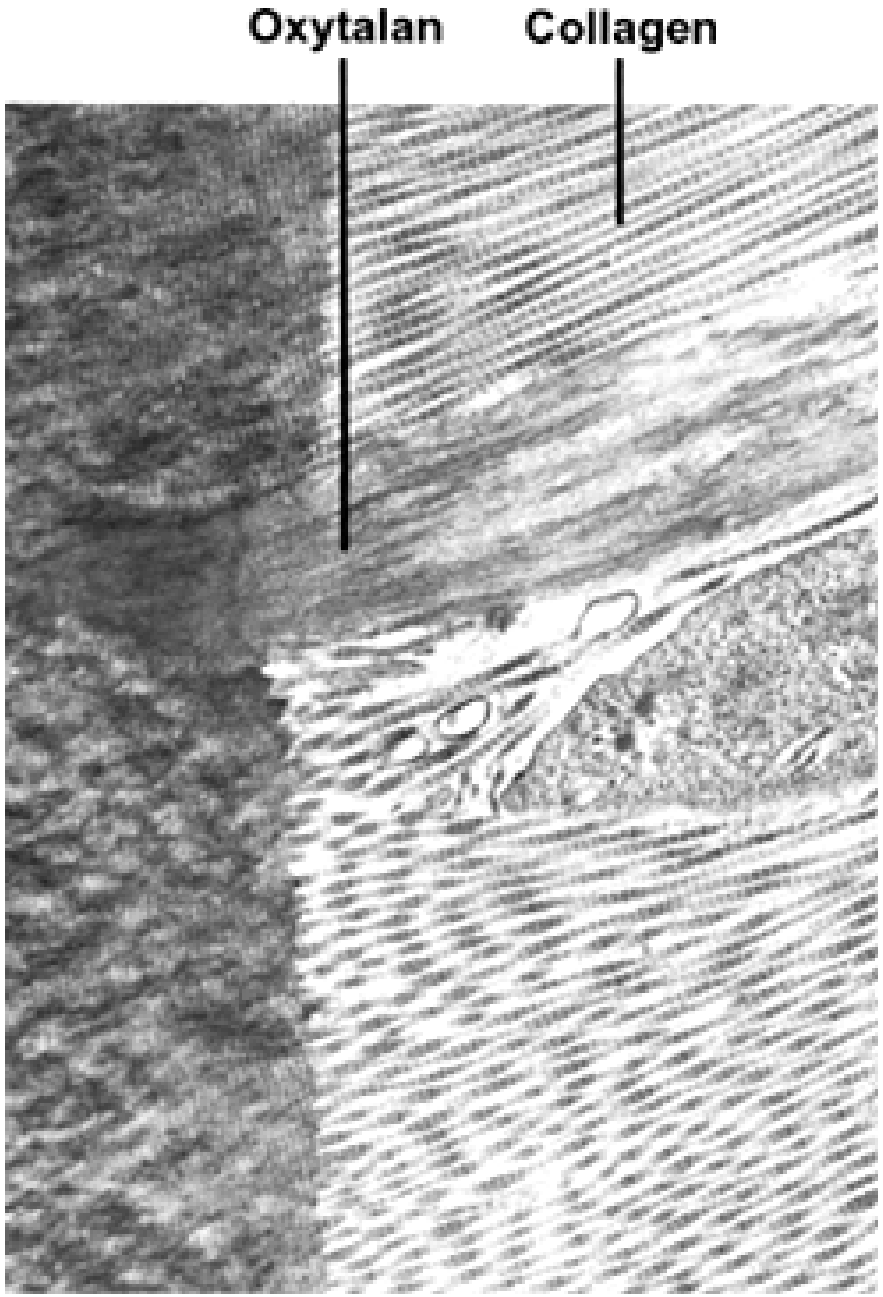
Organized into bundles

**Elastic fibres**

**Oxytalan fibres** (immature elastic fibres)







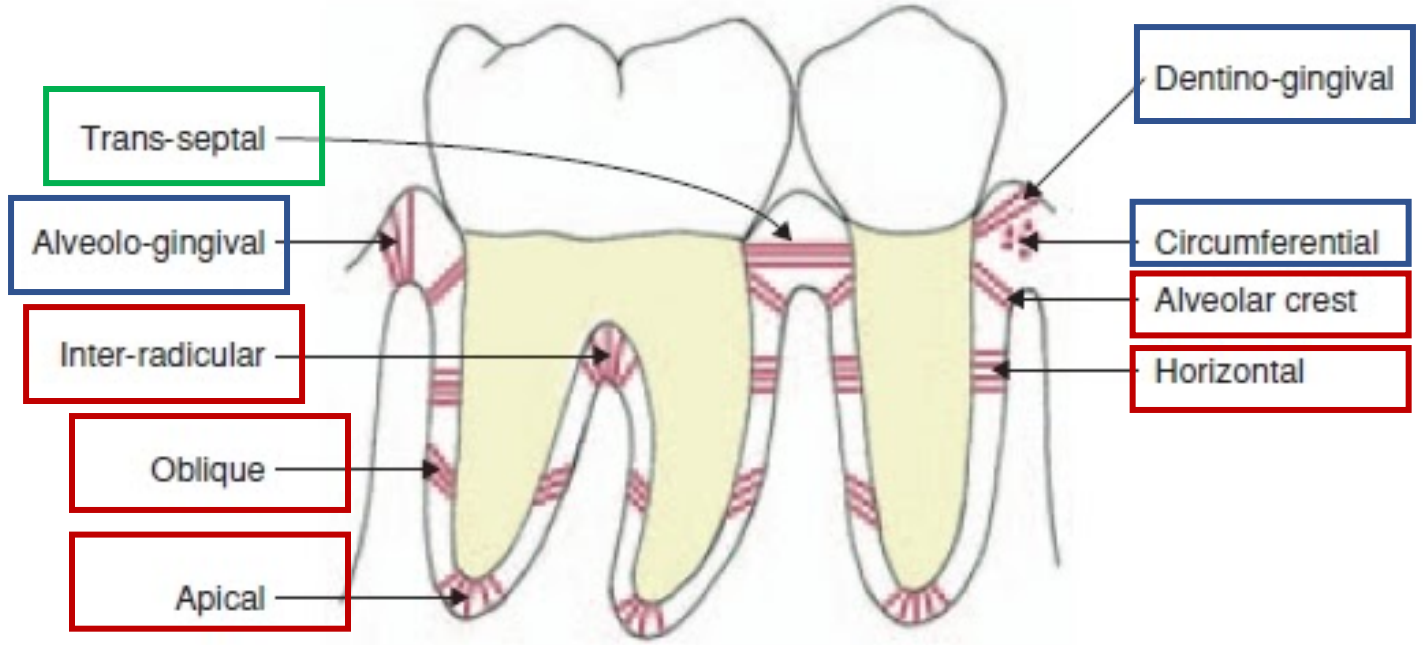
# Arrangement of periodontal ligaments

3 main groups:

**Gingival fibres**

**Transseptal** (interdental) **fibres**

**Alveolar fibres** (fibrae principales)



# Gingival fibres – attach the gingiva to the neck of the tooth

they are not actually part of the periodontium (they lie in the lamina propria of the gingiva)

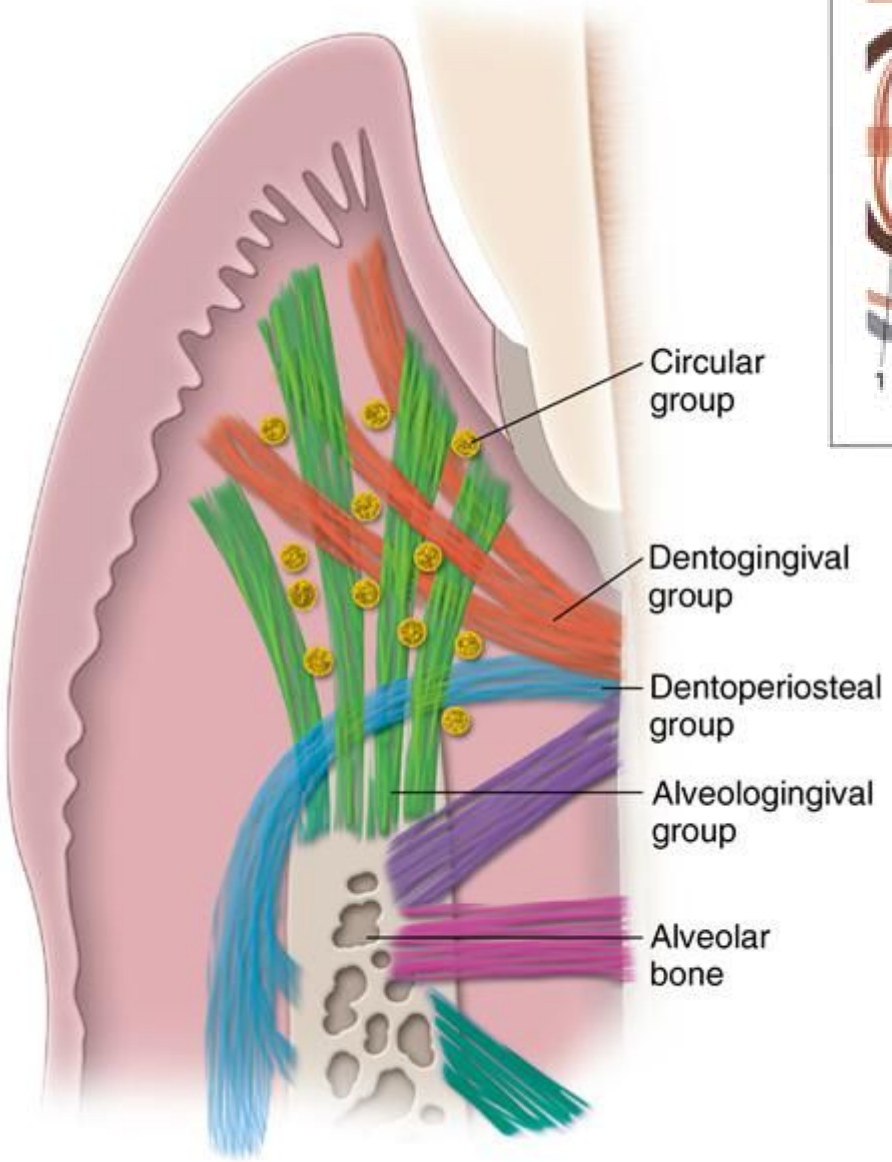
4 directions (groups):

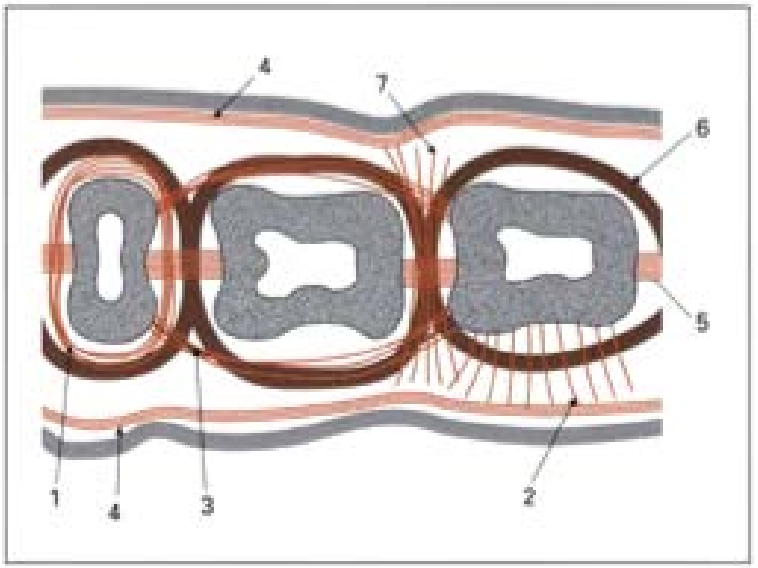
**Dentogingival** – from cementum at the tooth neck to gingiva afixa and libera. Most abundant

**Alveologingival** - from the edge of the alveolus gingiva afixa and libera

**Circular** - placed in free gingiva and they surround the neck of the tooth

**Dentoperiostal** - from the neck through the edge of the alveolus on the vestibular surface or lingual plate



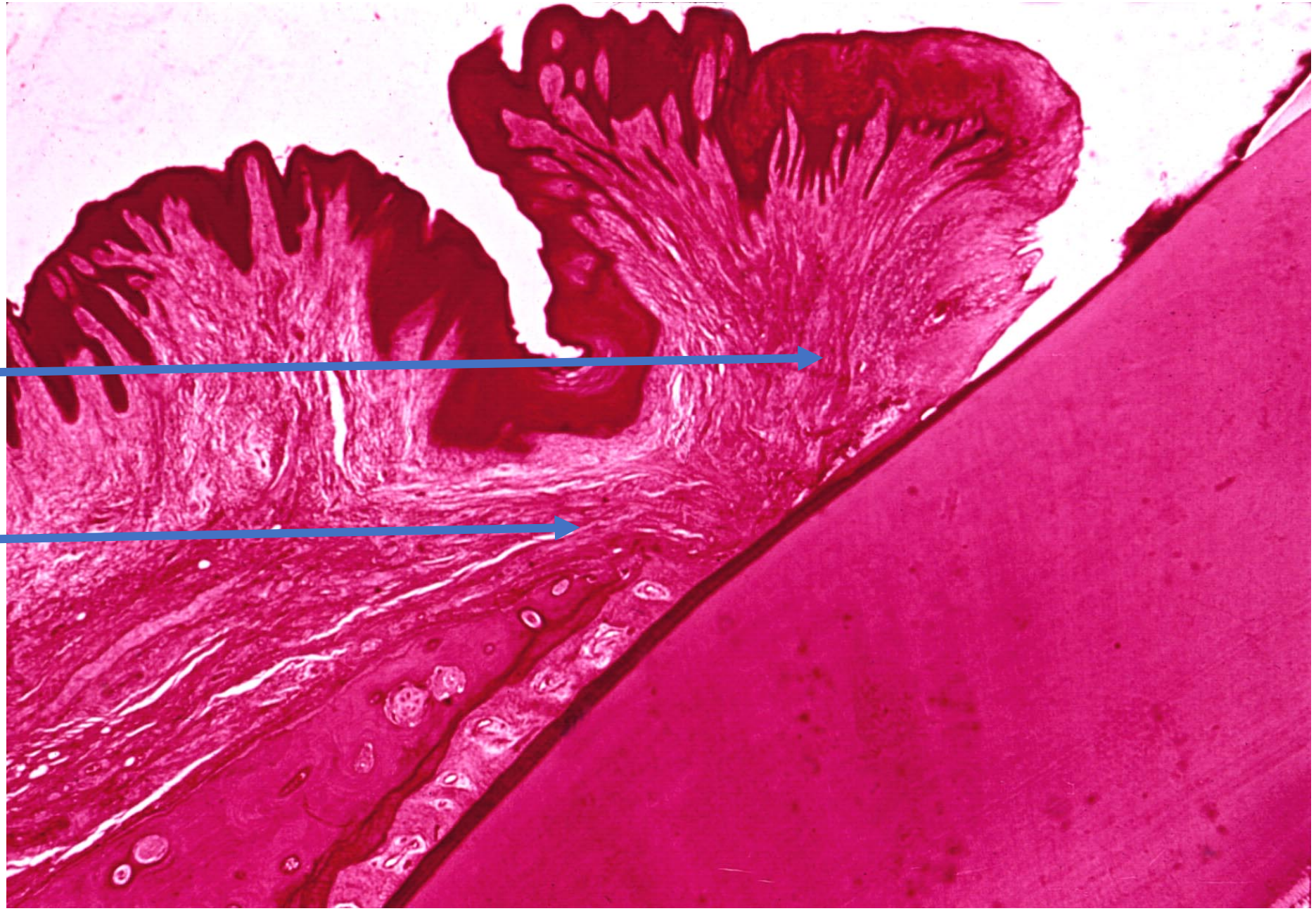




**Gingival CT fiber groups in horizontal section:**

- (1) circular fibers
- (2) dentogingival fibers
- (3) intercircular fibers
- (4) intergingival fibers
- (5) transseptal fibers
- (6) transgingival fibers
- (7) interpapillary fibers

Dentogingival

Dentoperiostal



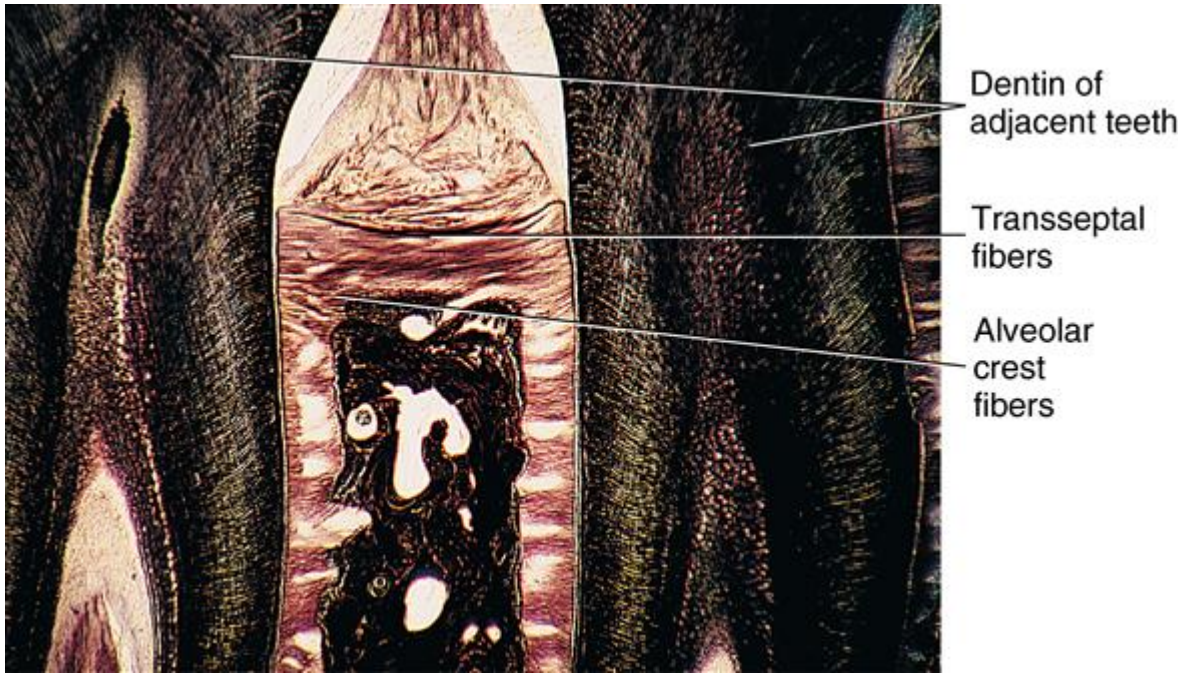
# Transseptal fibres – connect necks of neighboring teeth

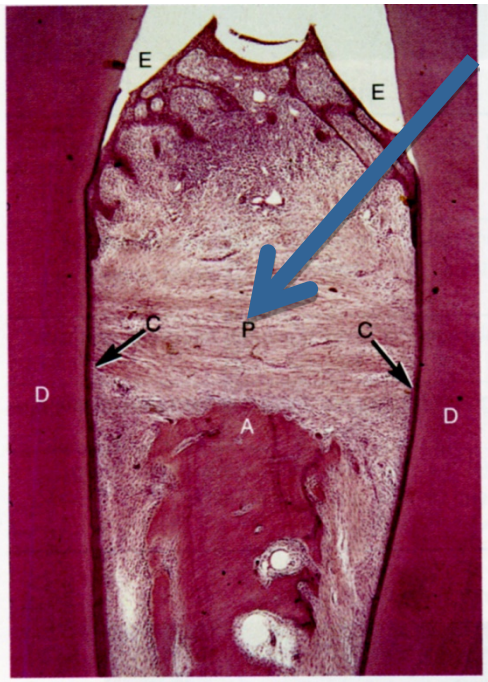
**Mesiodistally above the interalveolar septa**

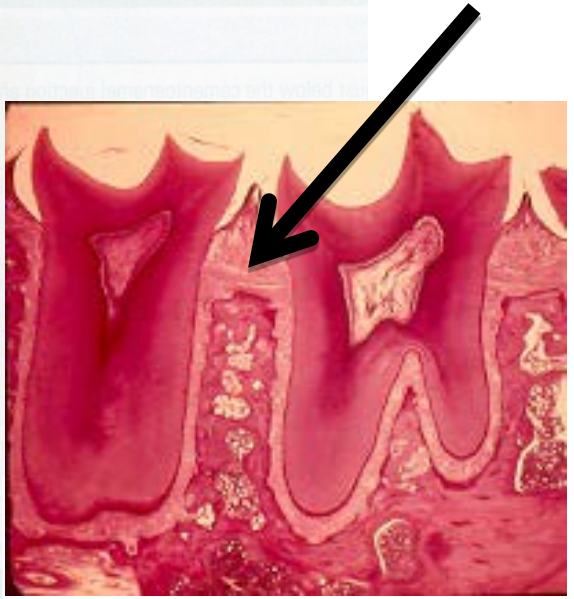
They strengthen the linear alignment of the teeth in the arch and form the basis for interdental papillae

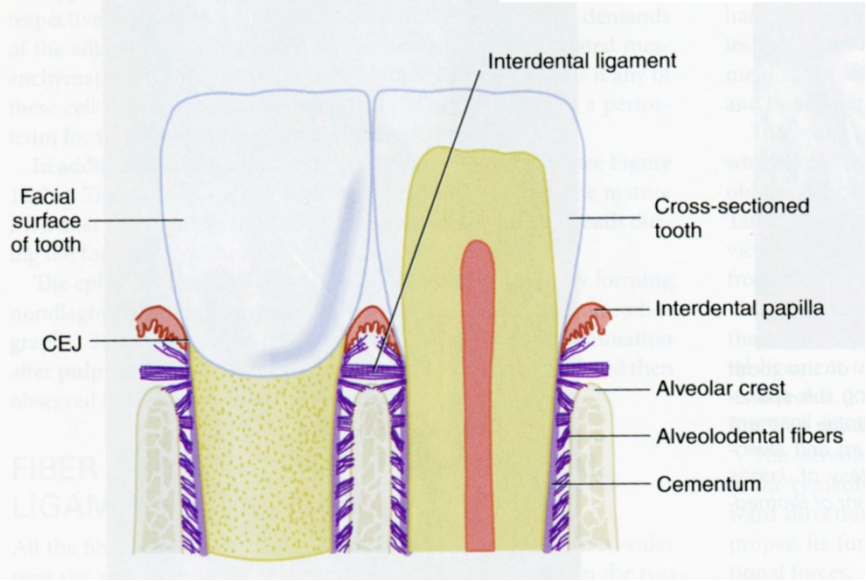
**They form the shape of the ridges of theinteralveolar septum**

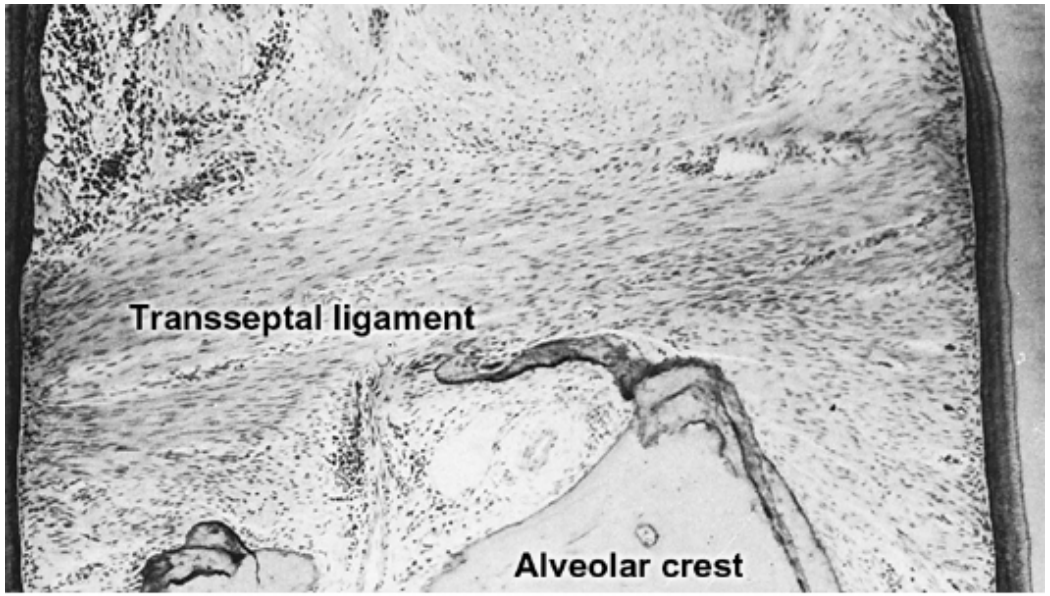
X-ray configuration (with inclination of septal tilt and depression)



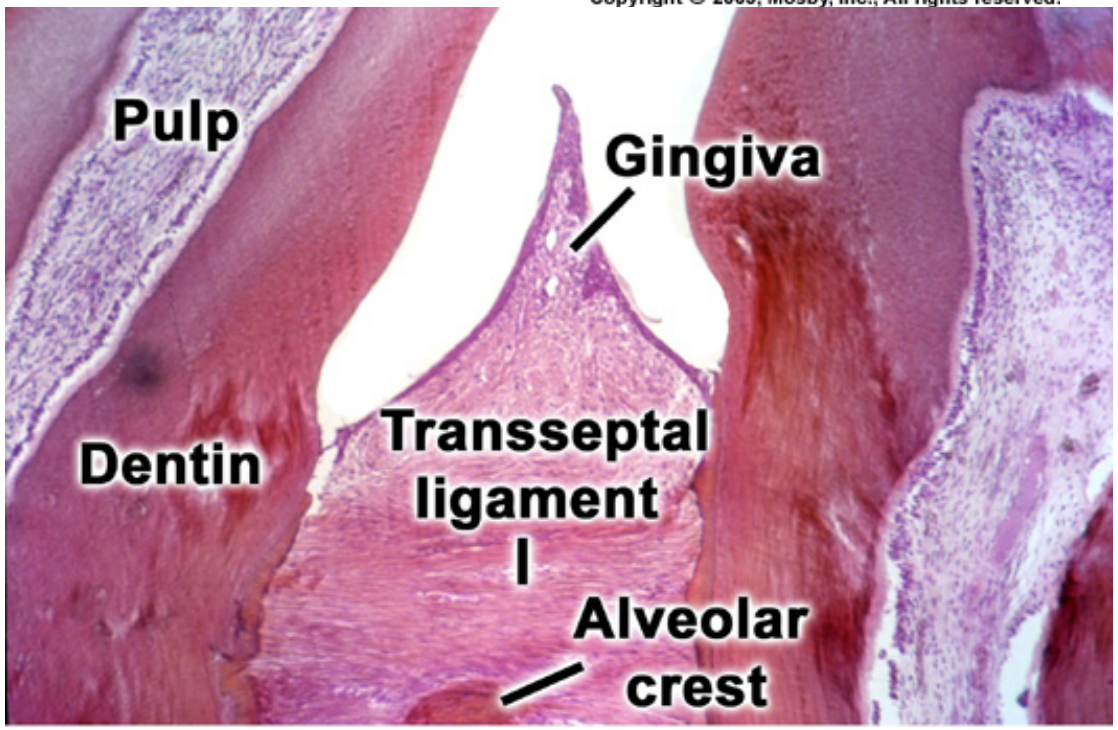



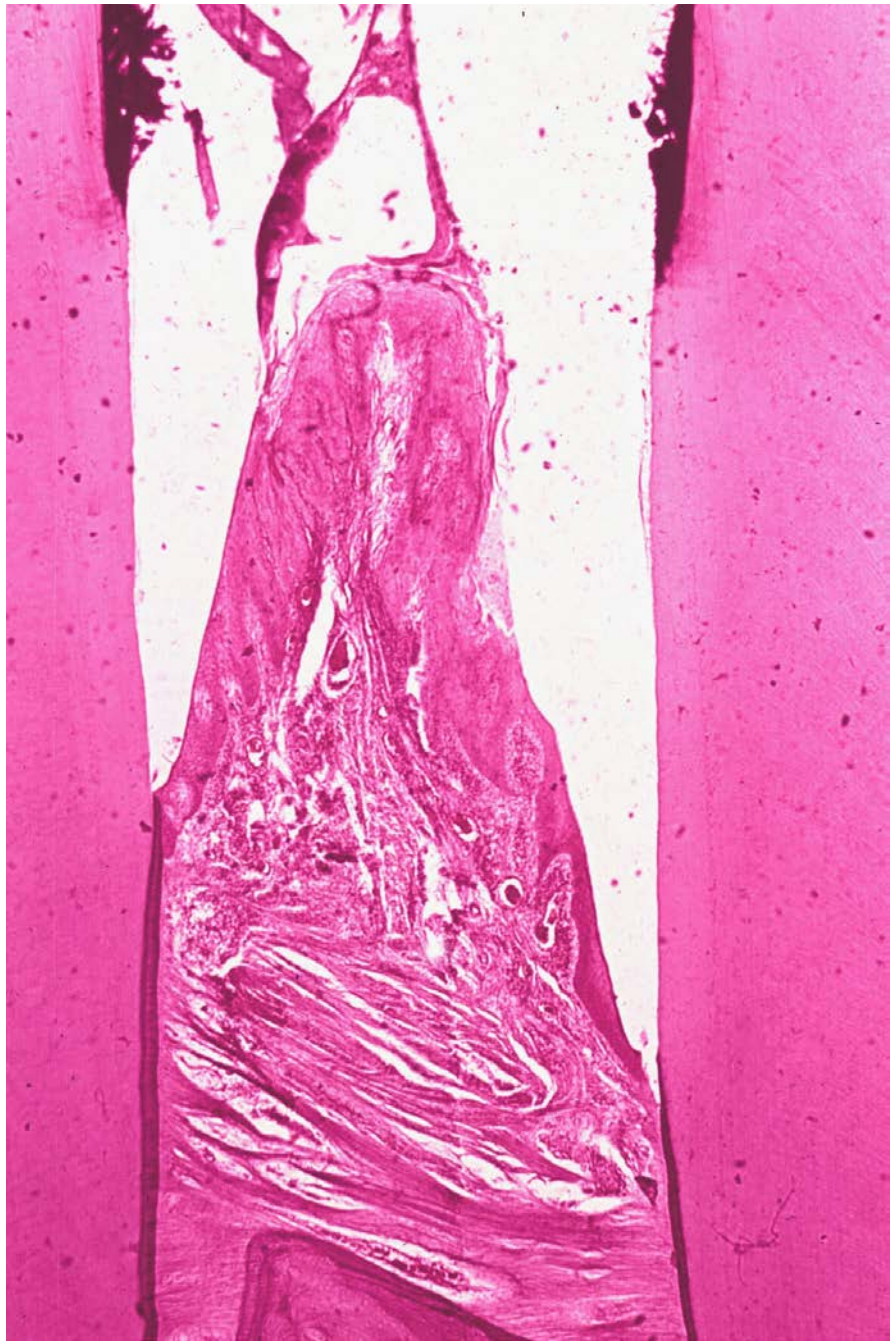






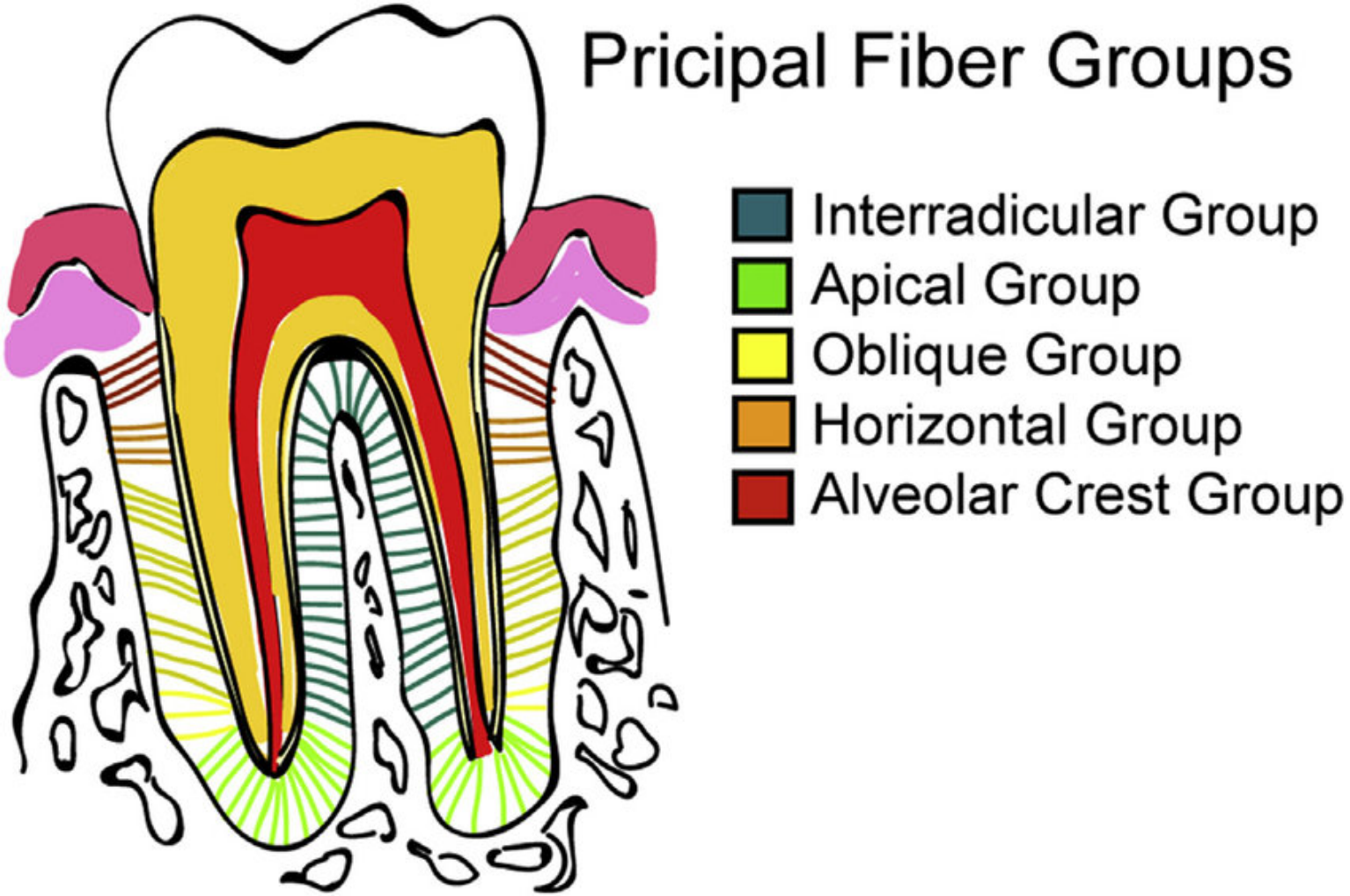


# Alveolar fibres

Between root and cribriform plate of alveolus (*os alveolare*)

Most abundant



# Alveolar fibres

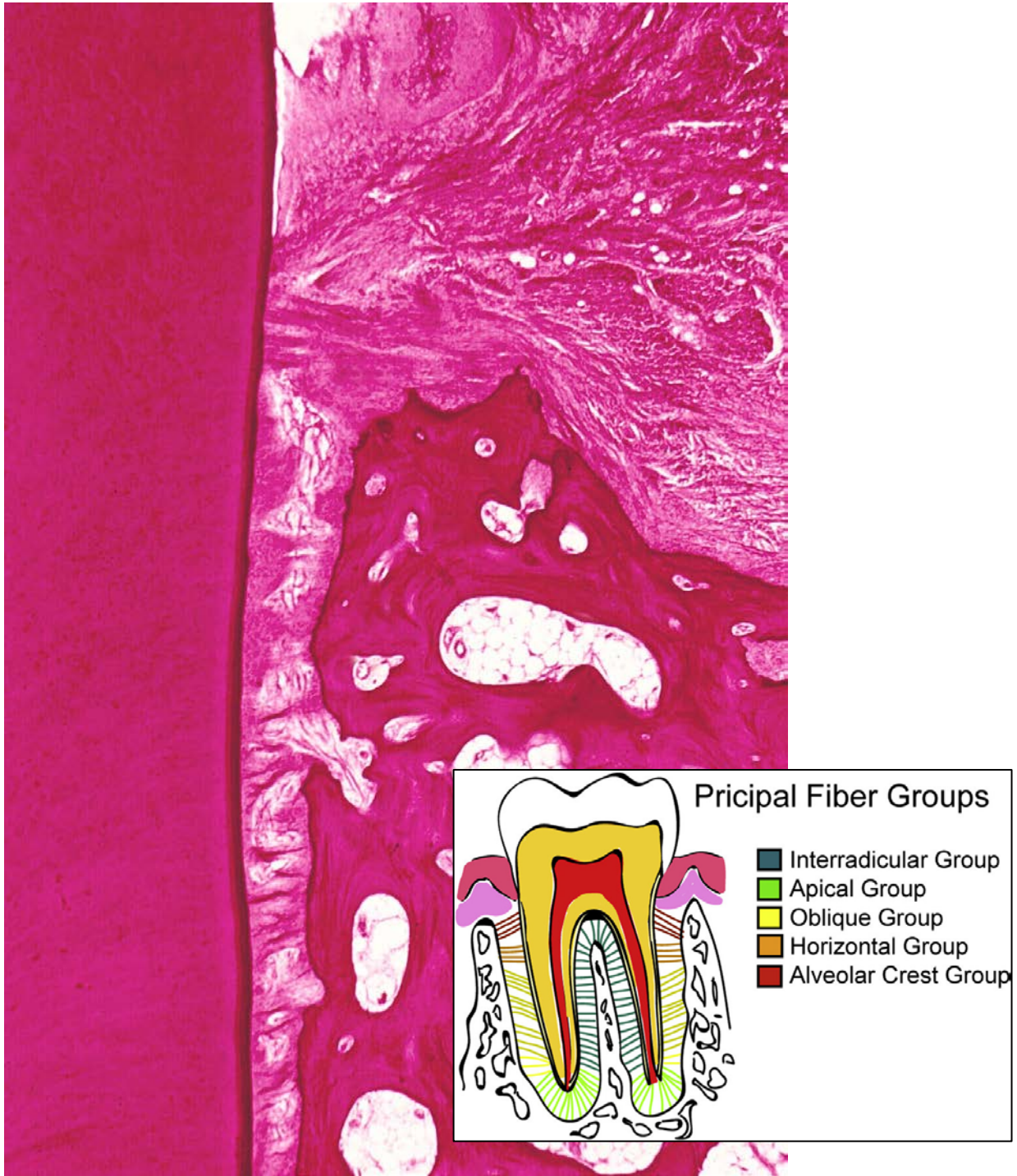
**Alveolar crest group** – from the neck to periosteum of interalveolar septum or periosteum of coronal edge of alveolus.

Function: **They prevent the tooth from moving out of the alveolus (sometimes missing)**

**Horizontal group** – in coronal third of tooth root and alveolus

Perpendicular to the longitudinal axis of the tooth

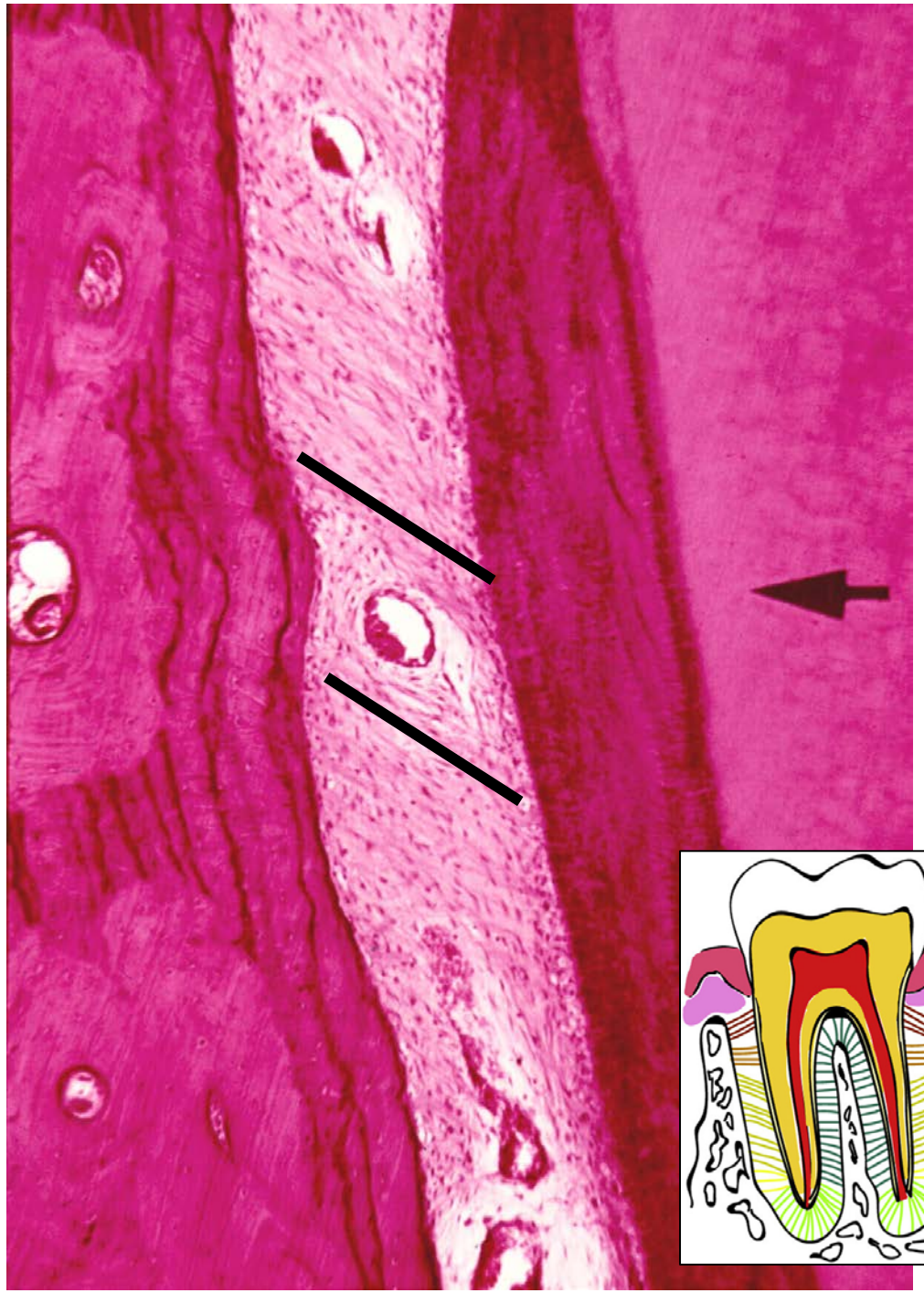
Function - **Prevents lateral (horizontal) movements of the teeth**

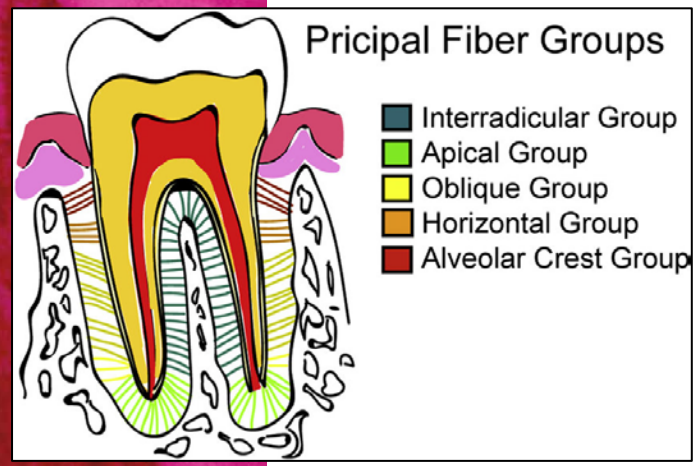


**<u>Oblique group</u>** – in the middle and apical third of root/alveolus

Diagonal course - the attachments on the cement positioned more apically than the insertion in the cribriform plate

Function - **Prevents the root from being pushed into the bed**

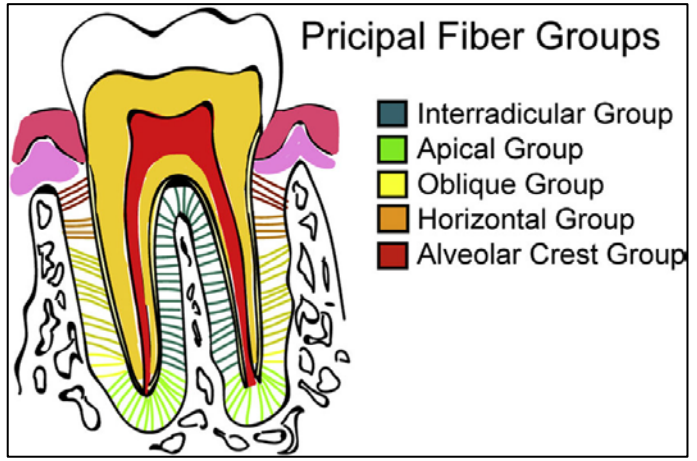




**Apical** – from the tooth apex to the bottom part of alveolus

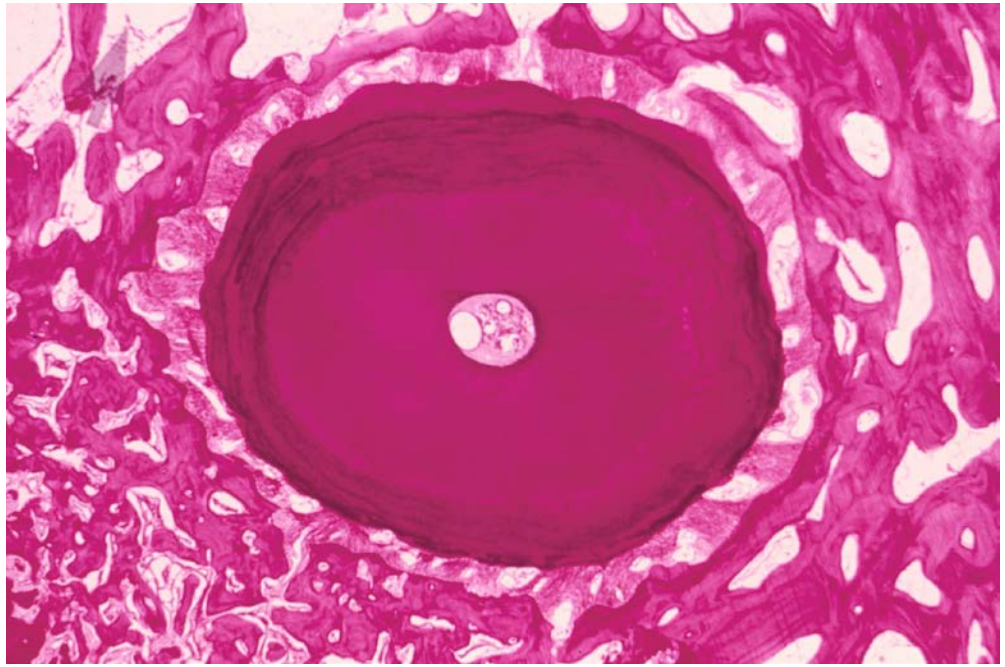
Radial course

Function – **Prevent the tooth from moving out of the alveolus (sometimes missing)**







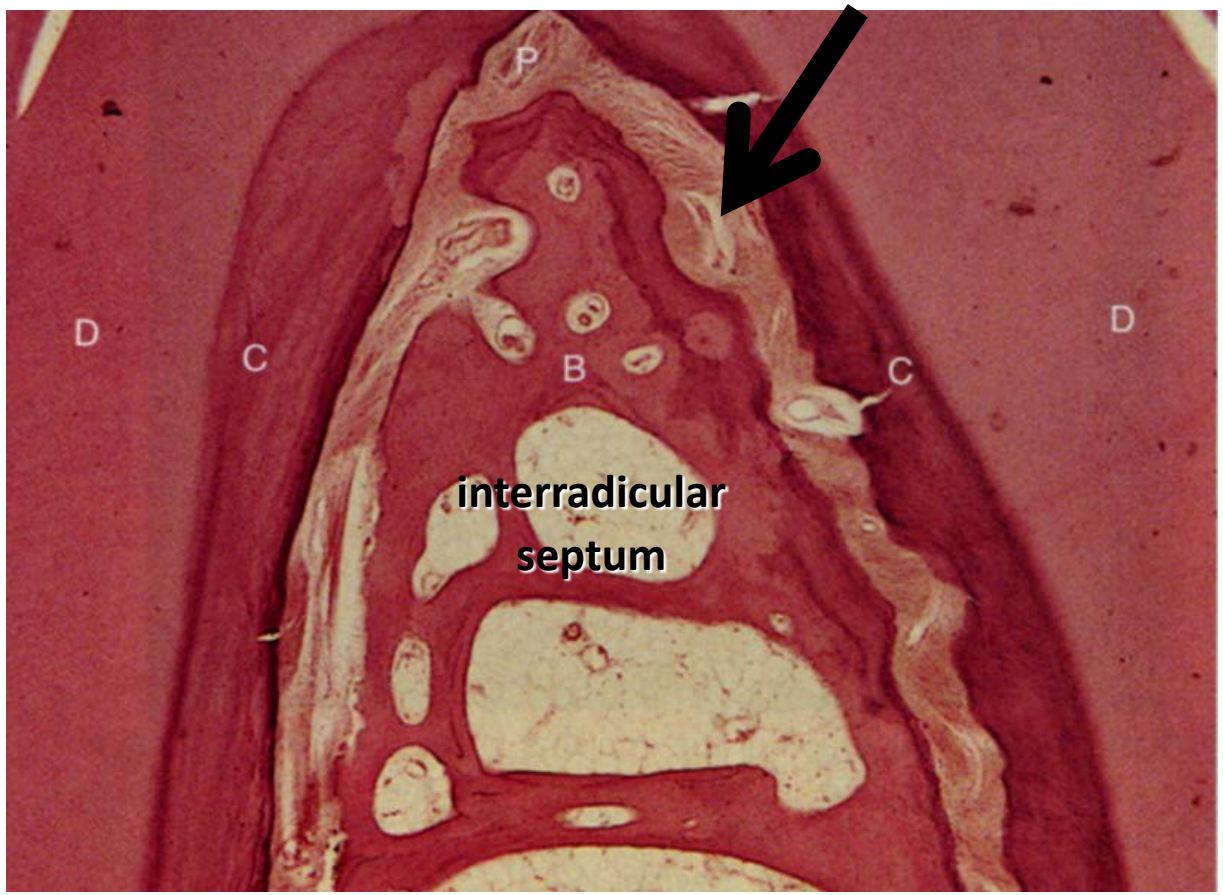


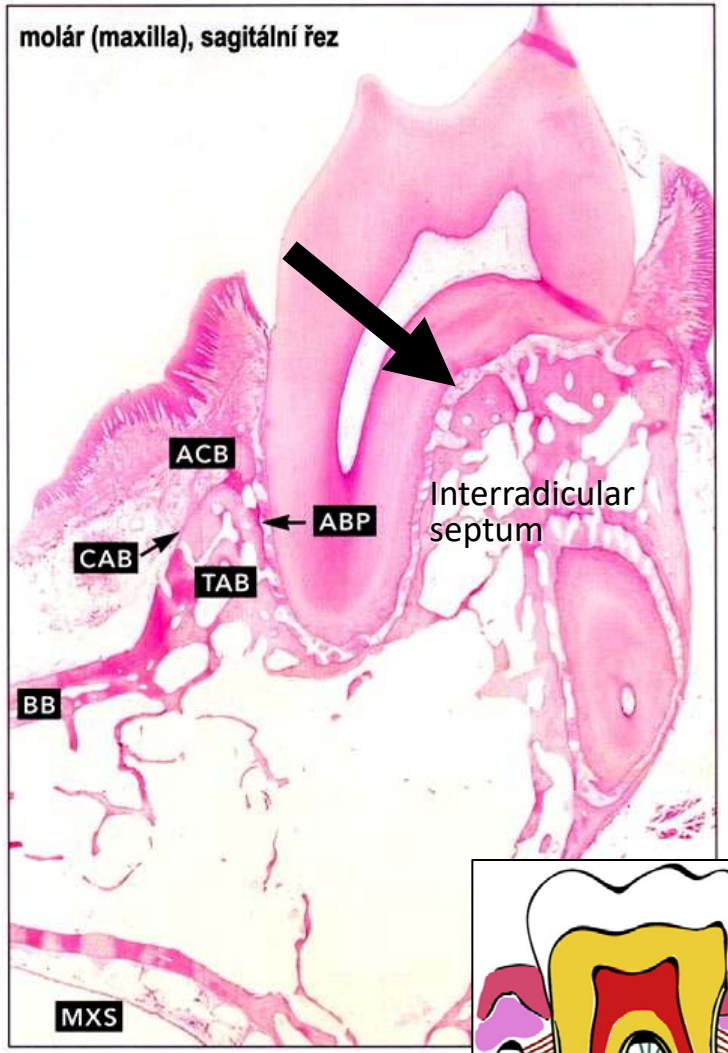
**<u>Interradicular</u> – only in teeth with more roots**

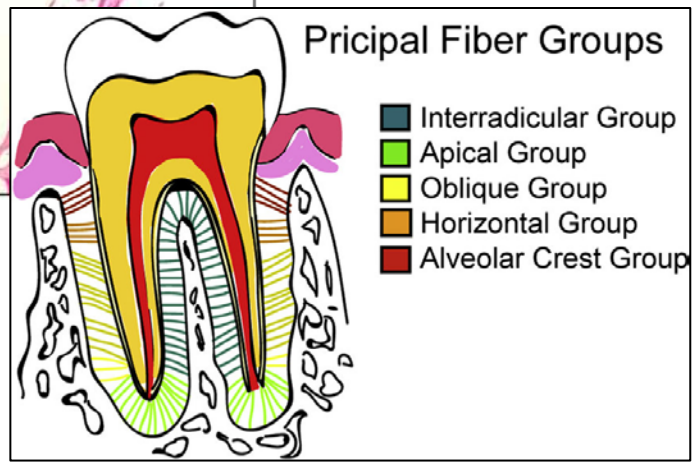
At the place of root branching

Attached to the alveolar septum between roots

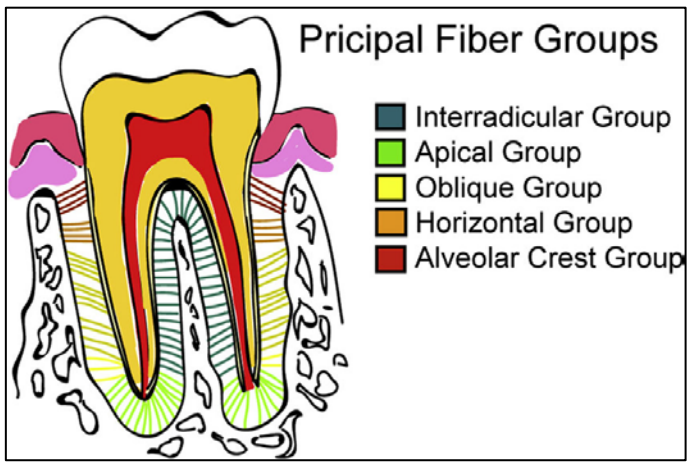
**Function – prevent the tooth from moving out of the alveolus and the rotation**

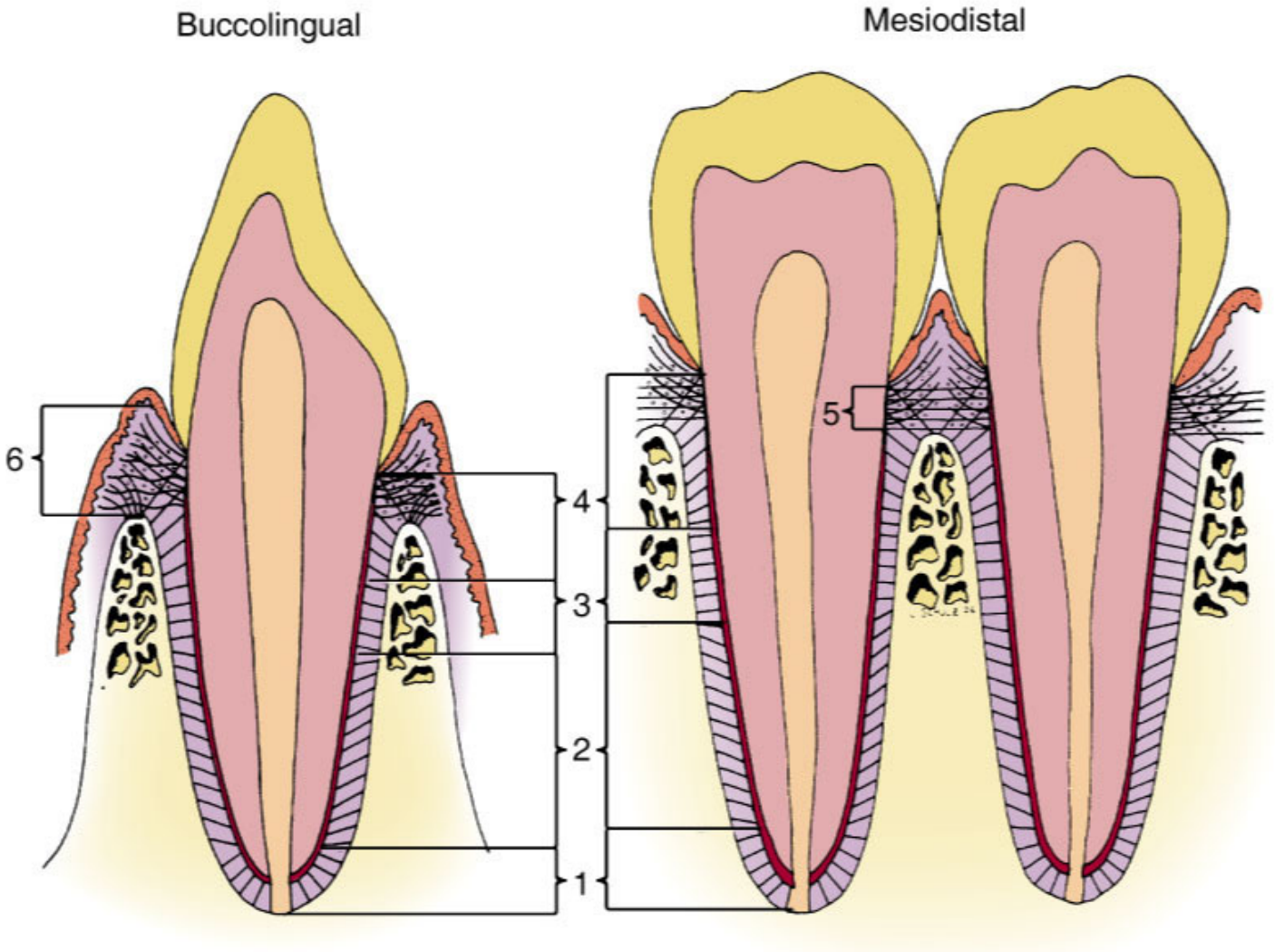


# Summarization




1. Aplical
2. Oblique
3. Horizontal
4. Alveolar crest
5. Transseptal
6. Gingival group

## Intermediate plexus

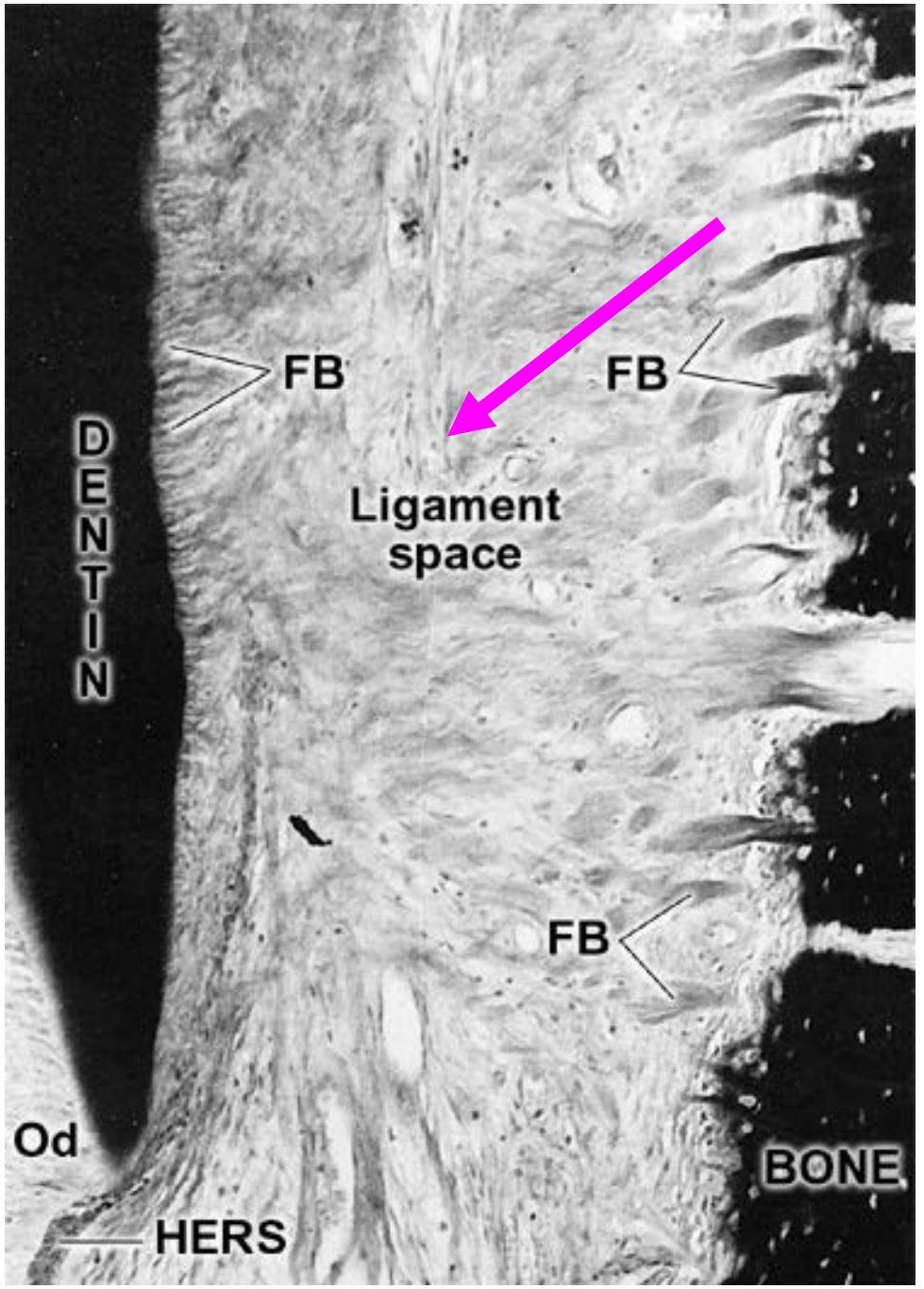
Some fibres has only one attachment – either in cementum or in cribriform plate of alveolar bone and the other is free

From this fibres is constituted

## Intermediate plexus

Function:

- Morphological and functional supply for potential reorganization of periodontal ligament
- Support for interstitial areas



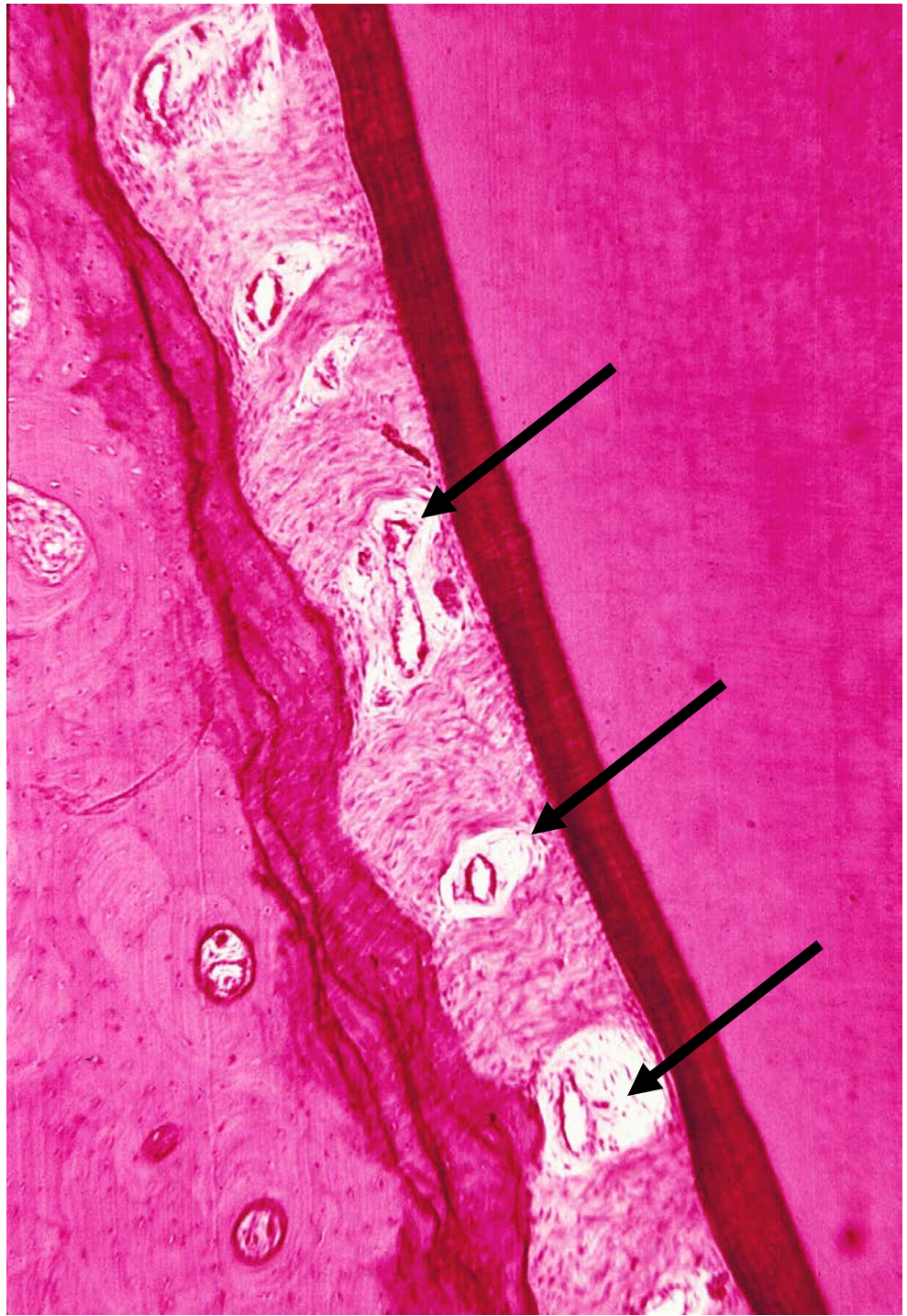
## Interstitial areas

Regions of **loose collagenous tissue**

Separate bundles of ligaments

Space for blood vessels and nerves which are responsible for periodontal space vitality

On samples they are paler tissue with obvious blood vessels and surrounded by amorphous tissue



# Blood and nervous supply of periodontal space

Highly innervated and numerous blood vessels in this region

Arterioles  derived from gingival, „pulpal“ and interalveolar branches

In interstitial areas they form a dense capillary network which branches can be found also between the ligaments

Lymphatic vessels

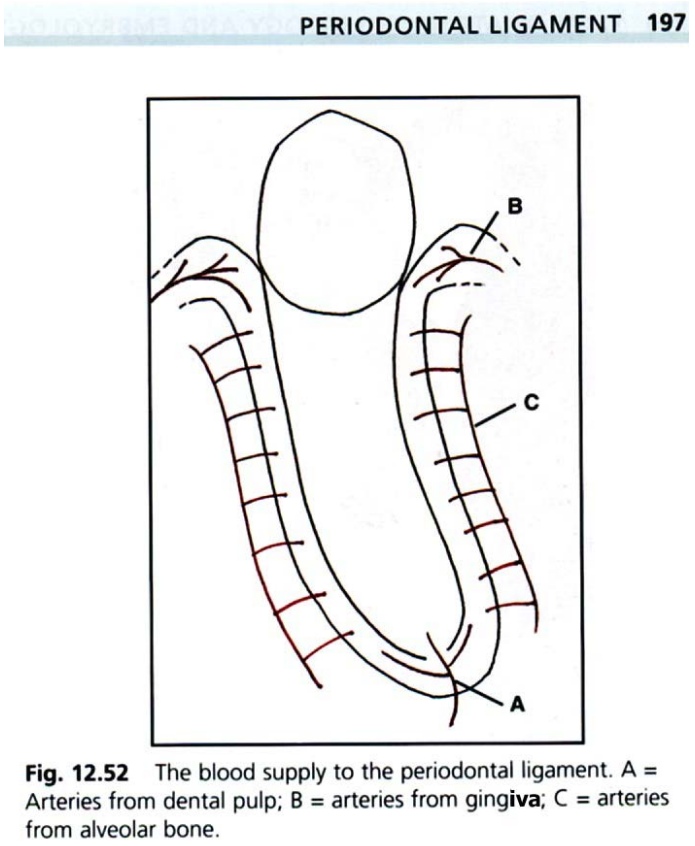
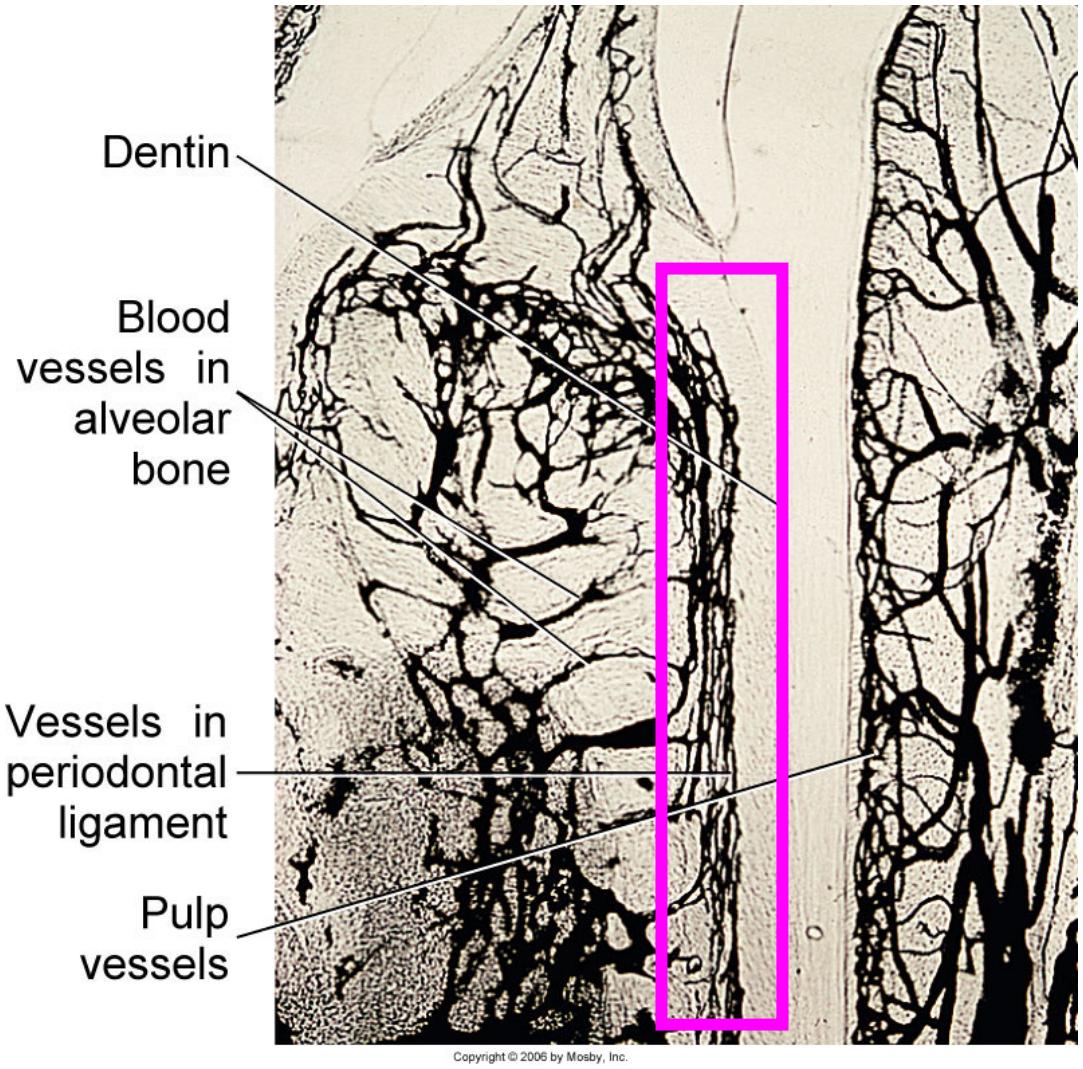


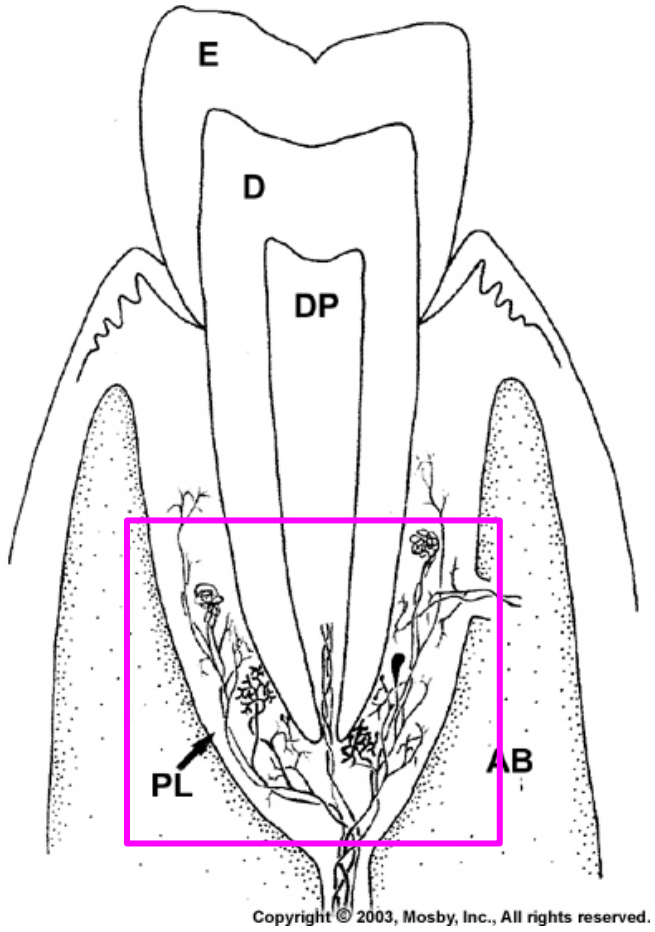

**Fig. 12.52** The blood supply to the periodontal ligament. A = Arteries from dental pulp; B = arteries from gingiva; C = arteries from alveolar bone.



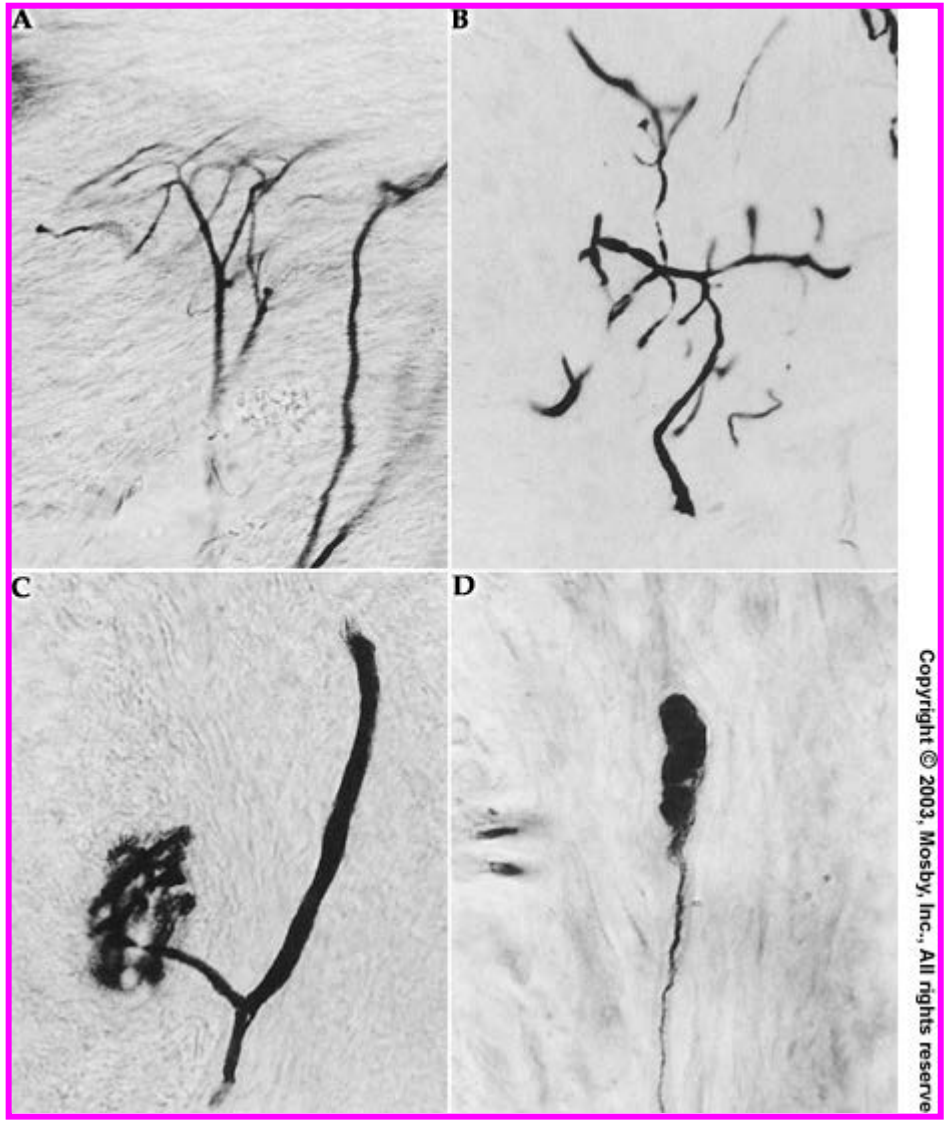
# Innervation

Three types of nerve endings

- **Free nerve endings** (pain) – from unmyelinated or from myelinated nerve fibers)
- **Ruffini-like endings** – In apical part of PDL
- **Lamellated corpuscles**







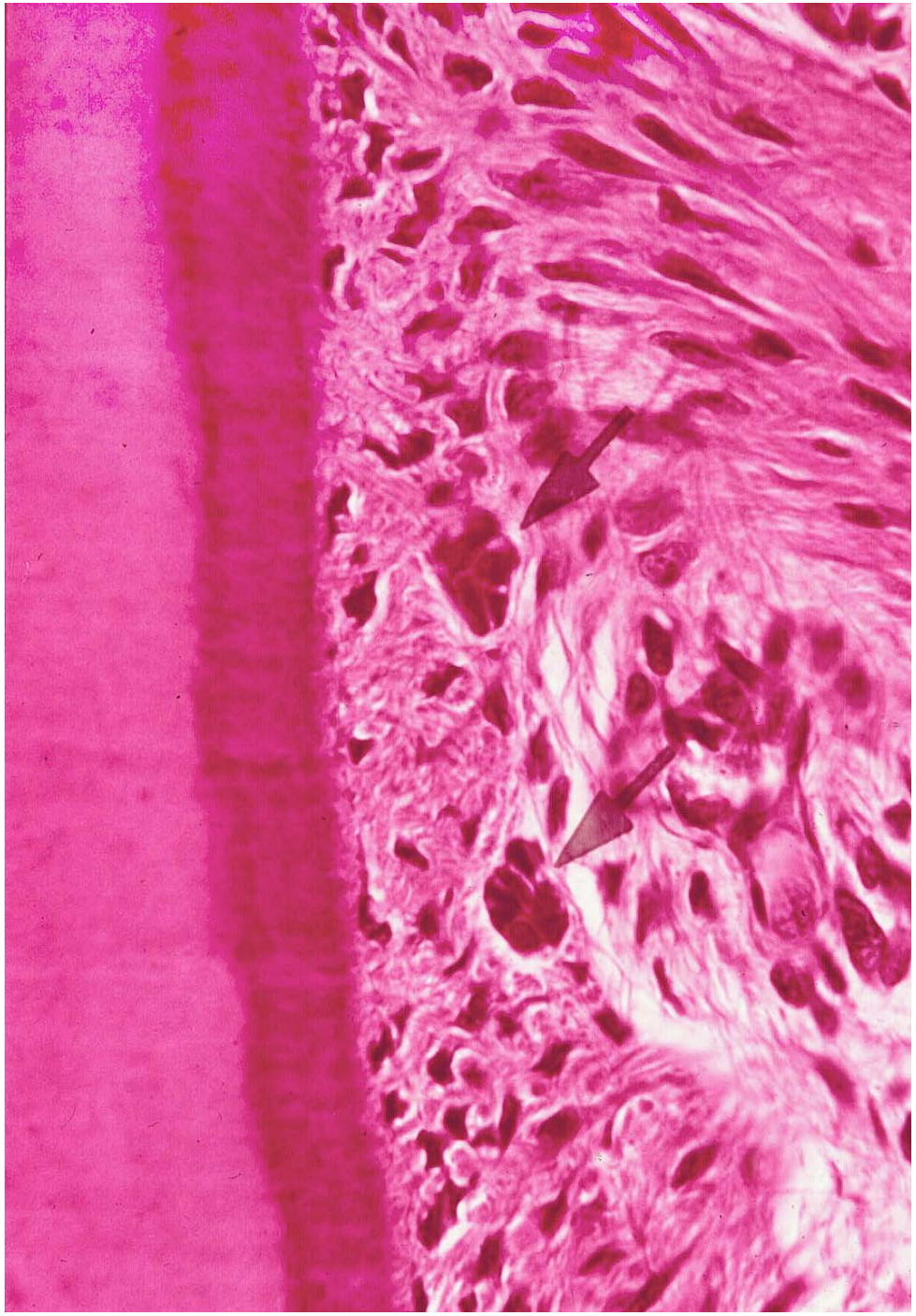
# Other structures in periodontal space

**ERM** (Epithelial rests of Malassez)

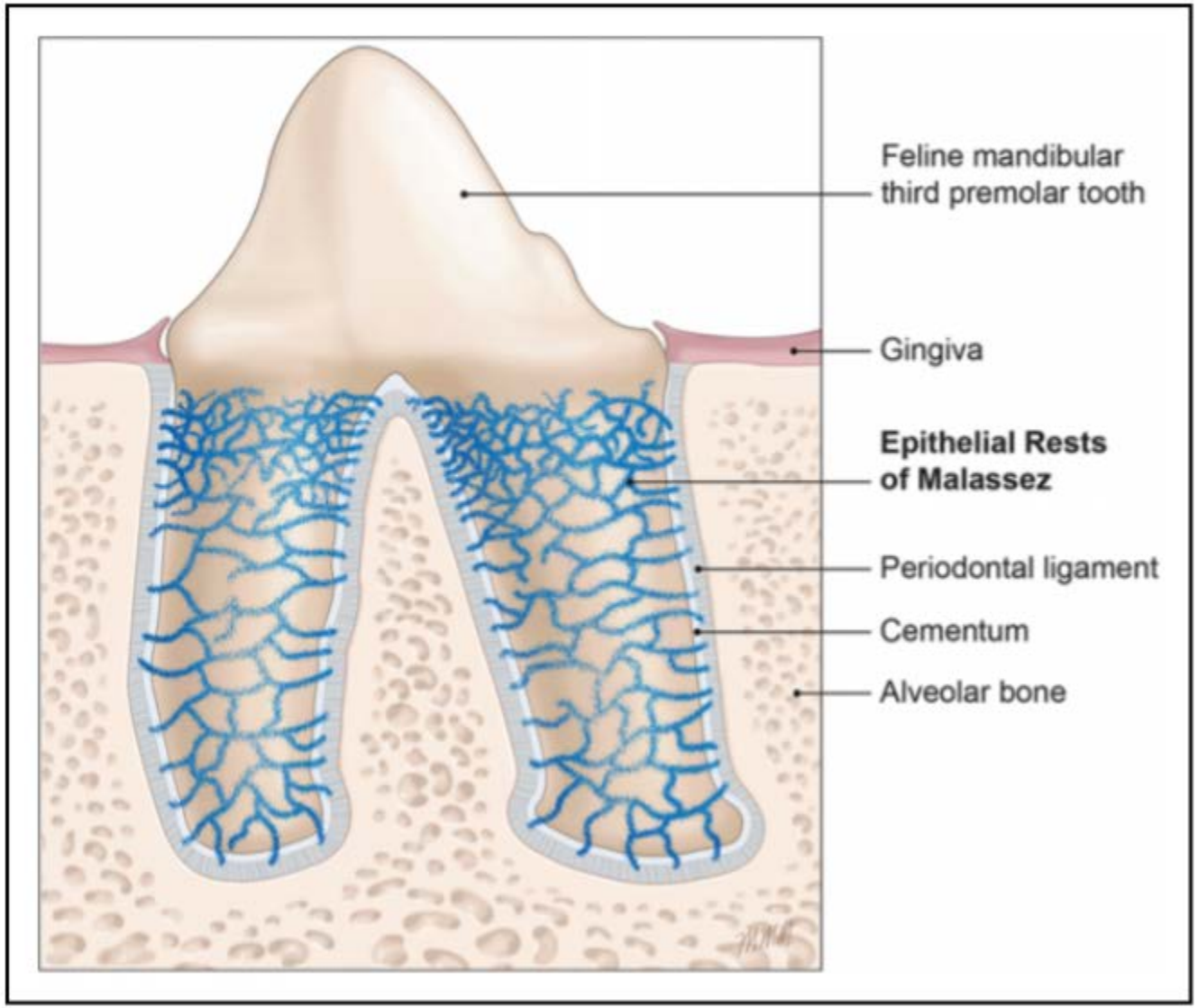
- Epithelial remnants from disintegrated **HERS** (Hertwig Epithelial Root Sheat)
- Pool of stem cells, interactive support for adjacent cells
- Can undergo **EMT** (Epithelial to Mesenchymal Transition)

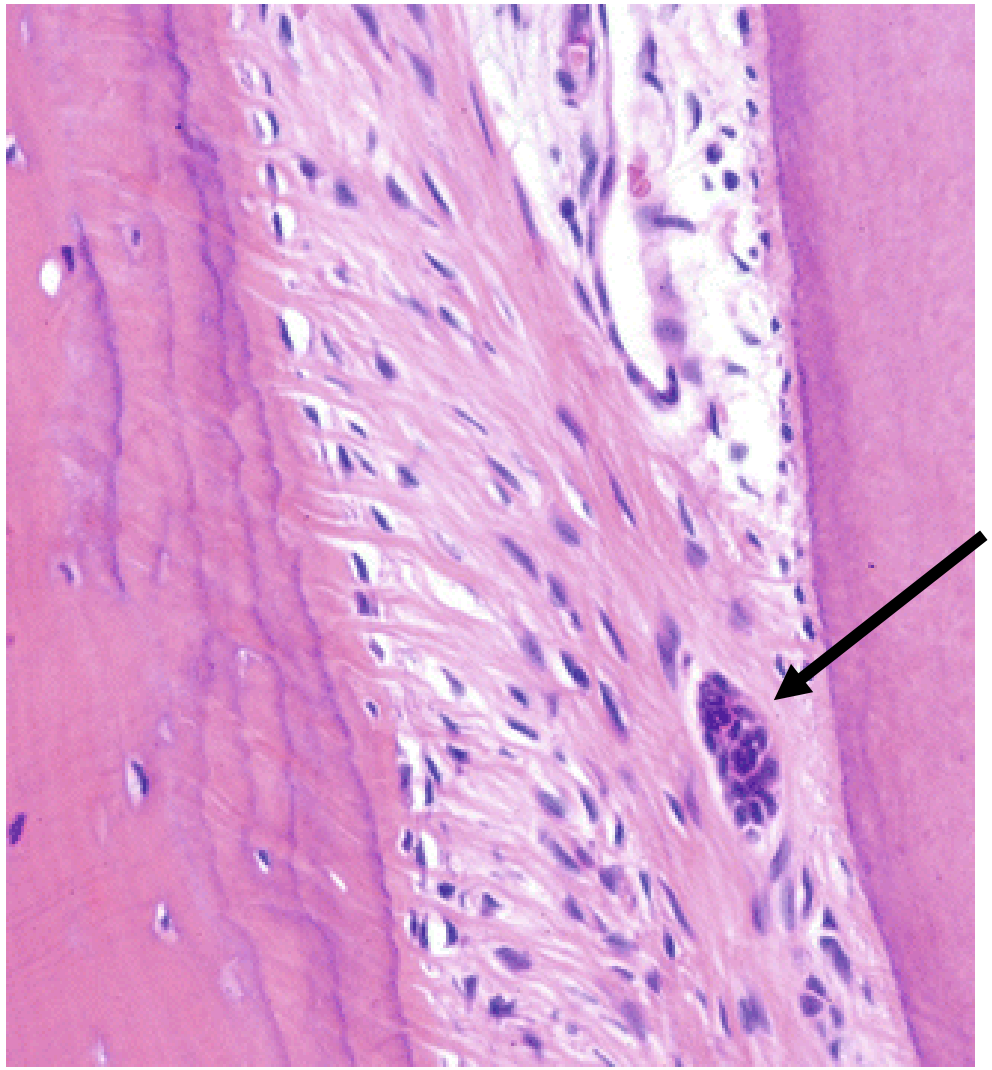
**Granulomas and cysts**

**Cementicles**



# ERM = Epithelial rests of Malassez



# Periodontal changes during ageing

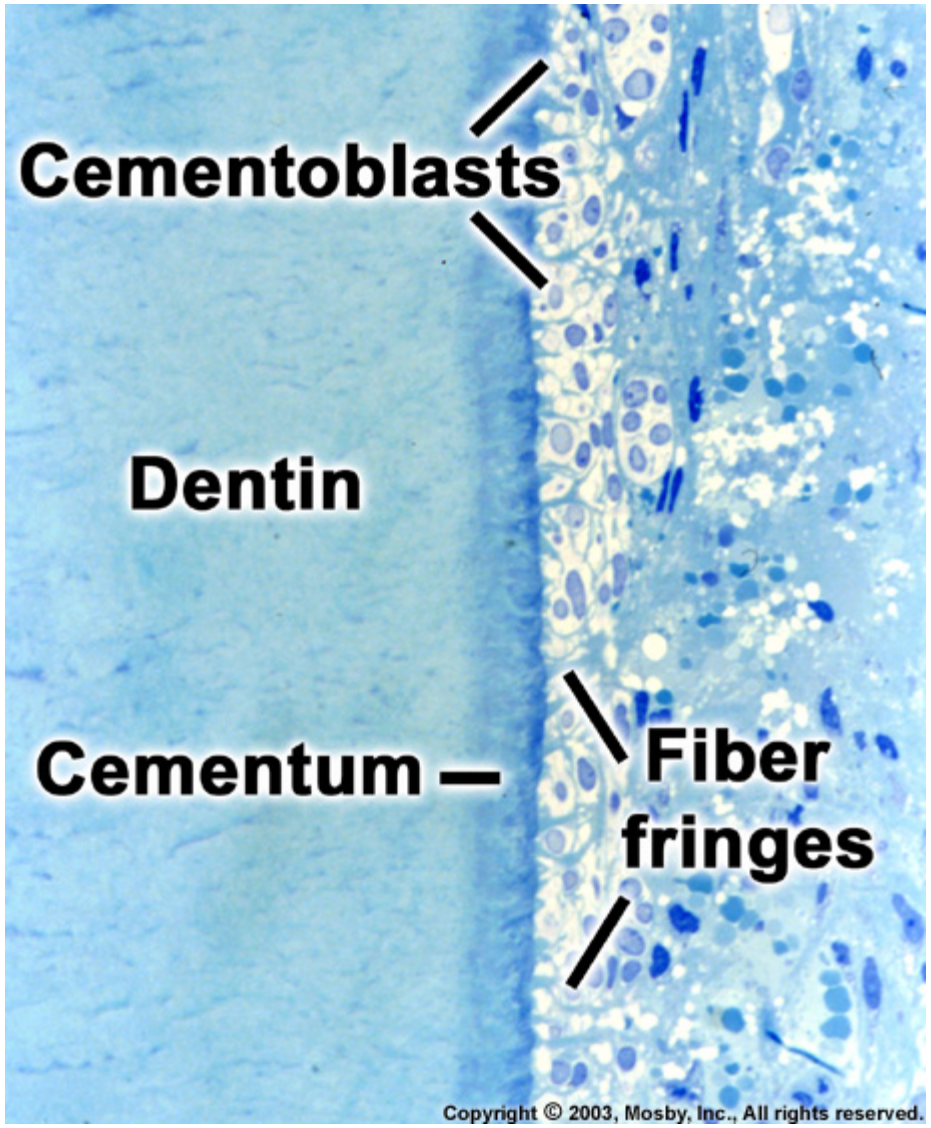
**Changes while losing an antagonist – nonfunction**

- Periodontal space narrowing
- Weakening and loosening of fibers
- Cementum thickening
- Weakening of the cribriform disc

**Changes due to overload**

**Acute (trauma)** – blood effusions, fiber rupture, necrosis and resorption, ankylosis

**Chronical – hypercementosis**



# Periodontal fibres (ligaments) - terminology

**Gingival fibres** - fibrae gingivales (fibrae gingivodentales, fibrae gingivales circulares)

**Transseptal fibres** - fibrae interdentales

**Alveolar fibres** - fibrae alveolodentales (fibrae principales)

| | | |
|---|---|---|
| Alveolar cres | - | lig. dentale superius |
| Horizontal | - | fibrae alveolodentales transversae |
| Oblique | - | lig. dentale inferius |
| Apical | - | fibrae apicales |
| Interradicular | - | fibrae interradiculares |

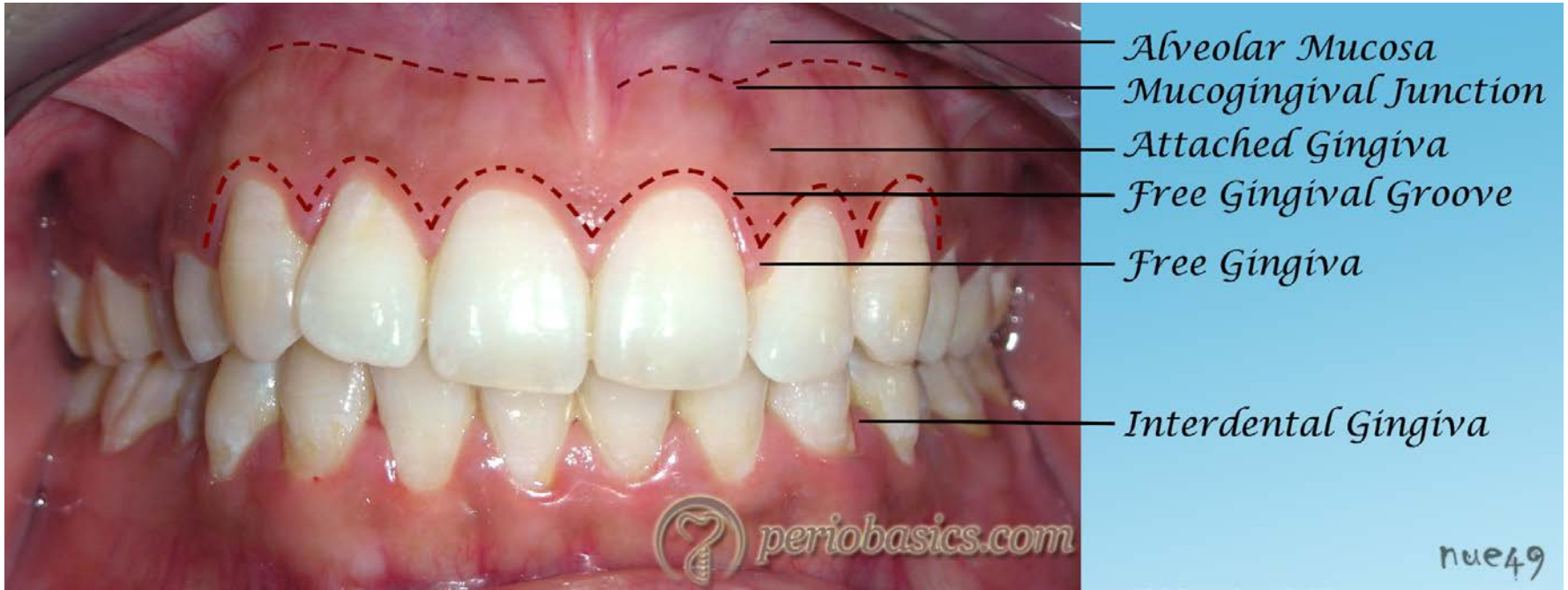
# Gingiva

# Gingiva

- Masticatory oral mucosa
- Around tooth necks and covering alveolar bone. Firmly attached to adjacent hard tissues
- Very stiff, pale pink color, resistant to pressure and friction
- It is not movable – forming mucoperiosteum

**Mucogingival junction (line)**

- The border between gingiva and lining mucosa which covers the rest of alveolar process
- Apparent on the vestibular aspect of both mandible and maxilla and on lingual aspect of mandible



# Gingiva

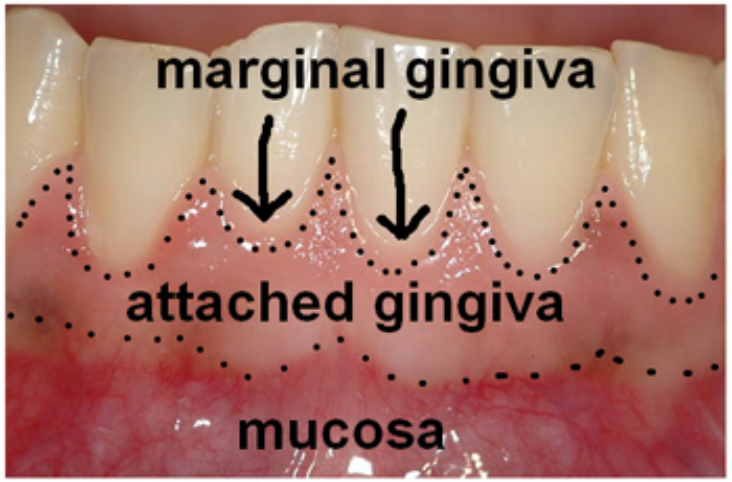
Topography: **2 compartments**

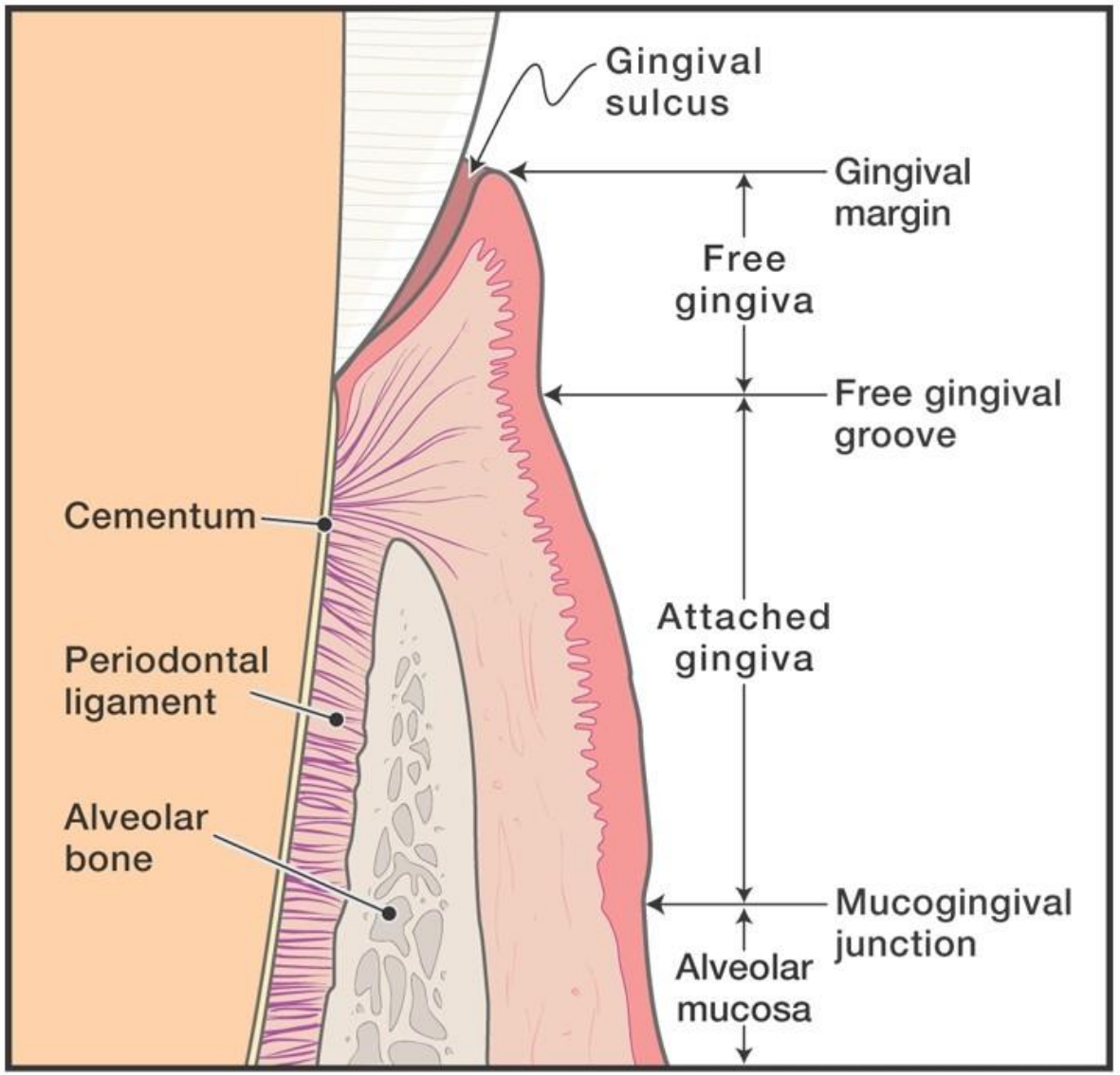
**Gingiva libera (Free gingiva)**

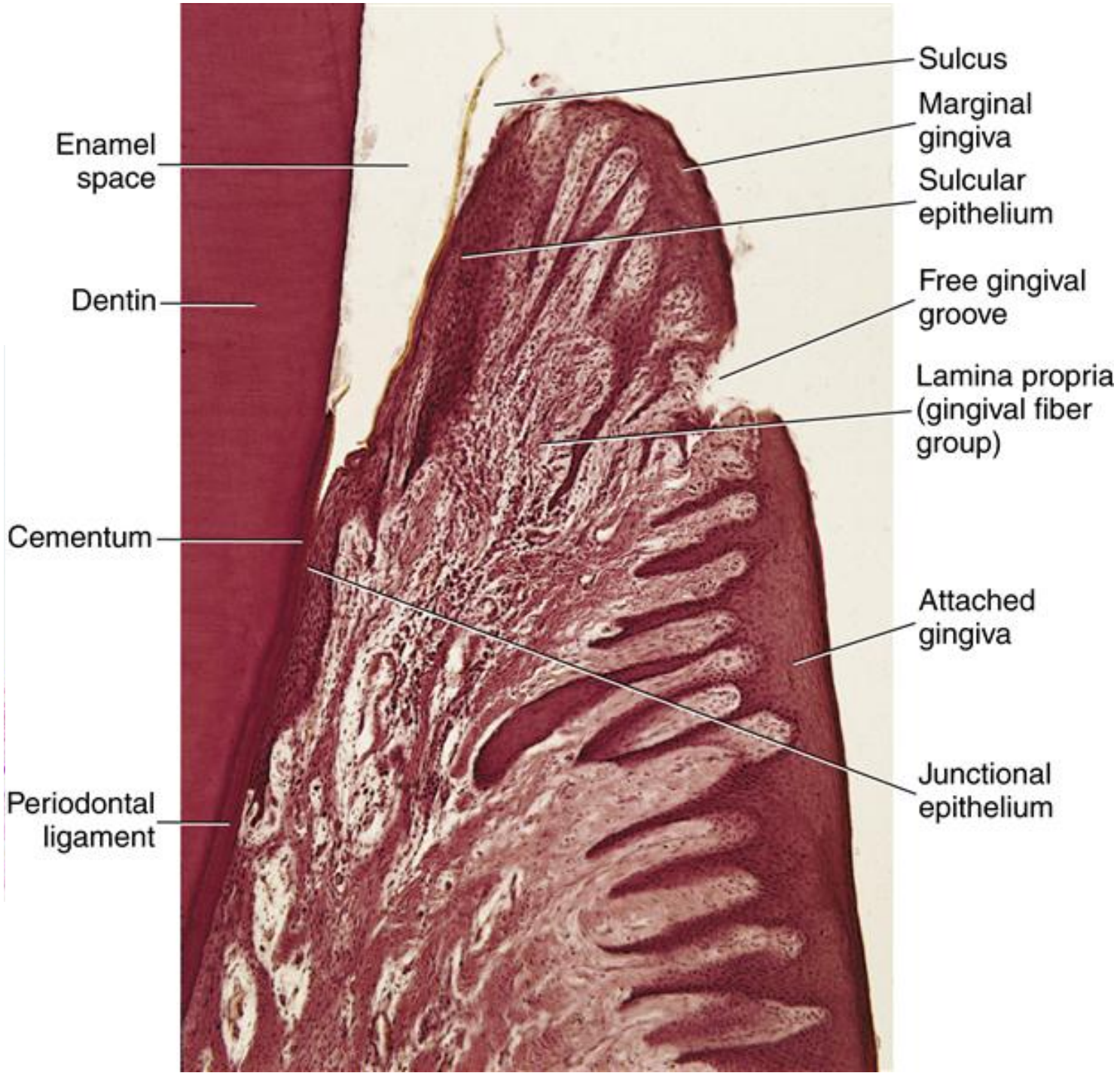
(gingiva supraalveolaris)

**Gingiva affixa (Attached gingiva)**

(gingiva alveolaris)

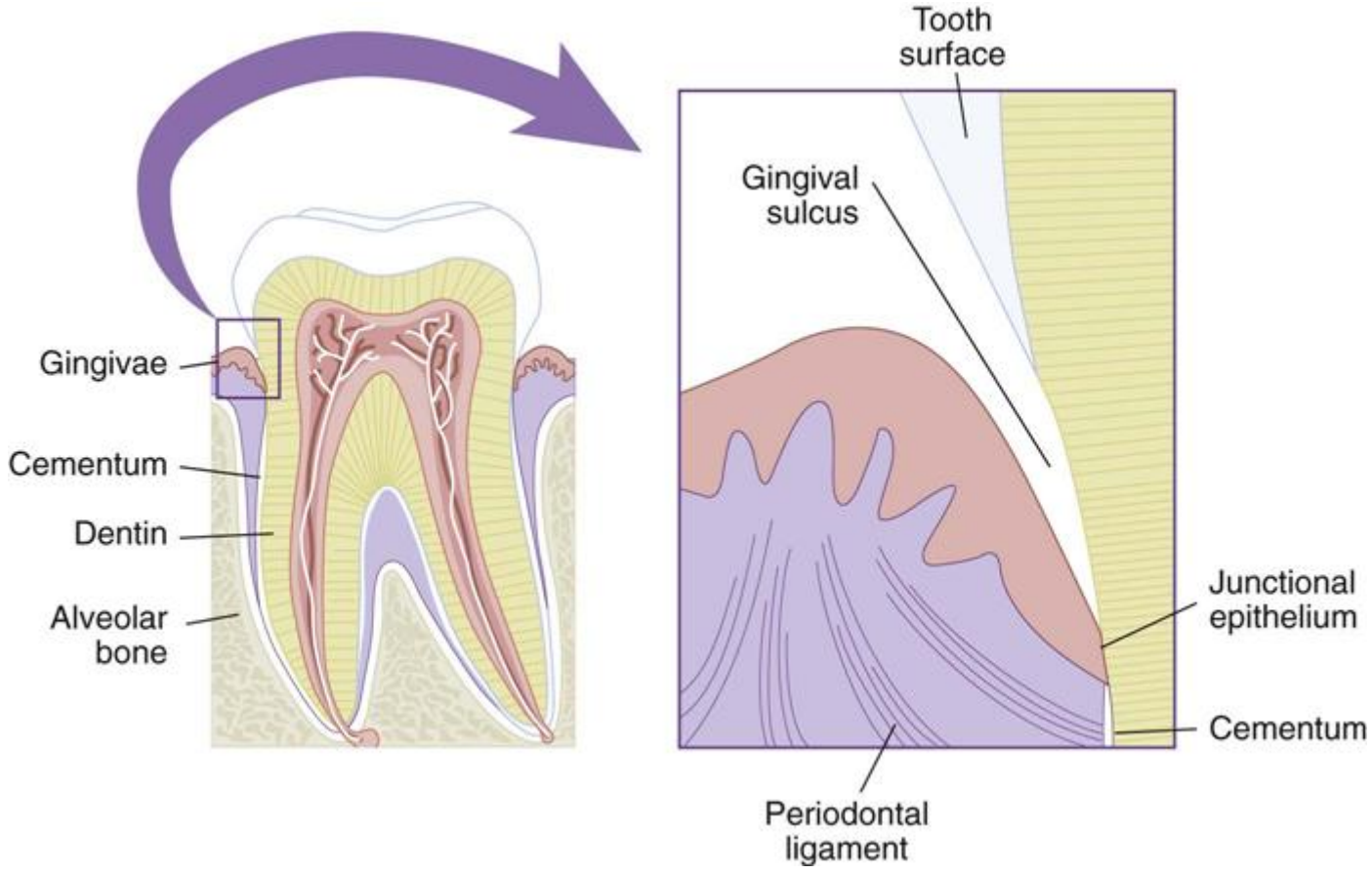



Sulcus
Marginal gingiva
Enamel space
Sulcular epithelium
Dentin
Free gingival groove
Lamina propria (gingival fiber group)
Cementum
Attached gingiva
Junctional epithelium
Periodontal ligament

# Sulcus gingivalis (Gingival sulcus)

- Circular groove, physiological depth: 1-2 mm
- **Liquor gingivalis:** plasma-like fluid which leaks from adjacent capillaries. The fluid has antimicrobial and anti-inflammatory properties, contains proteins and carbohydrates



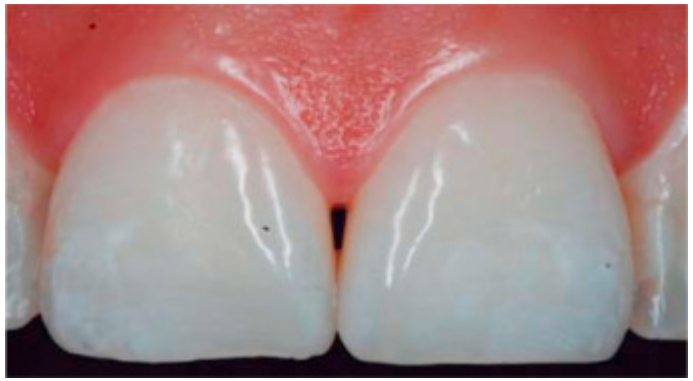
# Trigonum interdentale

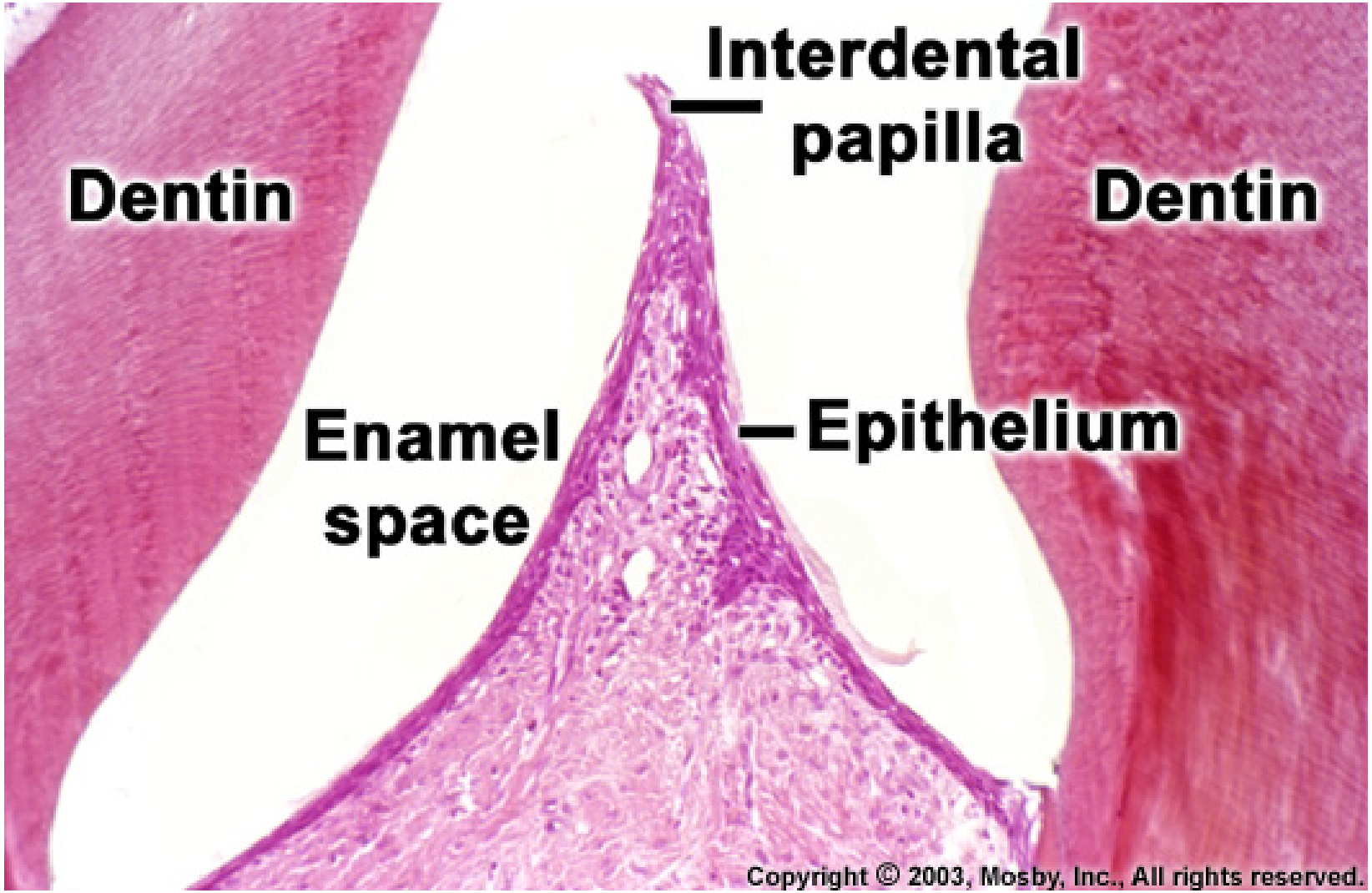
**Interdental papillae, interdental gingiva**

Between neighbouring teeth, free gingiva forms a protrusion: **trigonum interdentale**

**Vestibular and lingual aspect**

Každá má vestibulární a linguální část, connected by intedental saddle





# Microscopic structure of gingiva

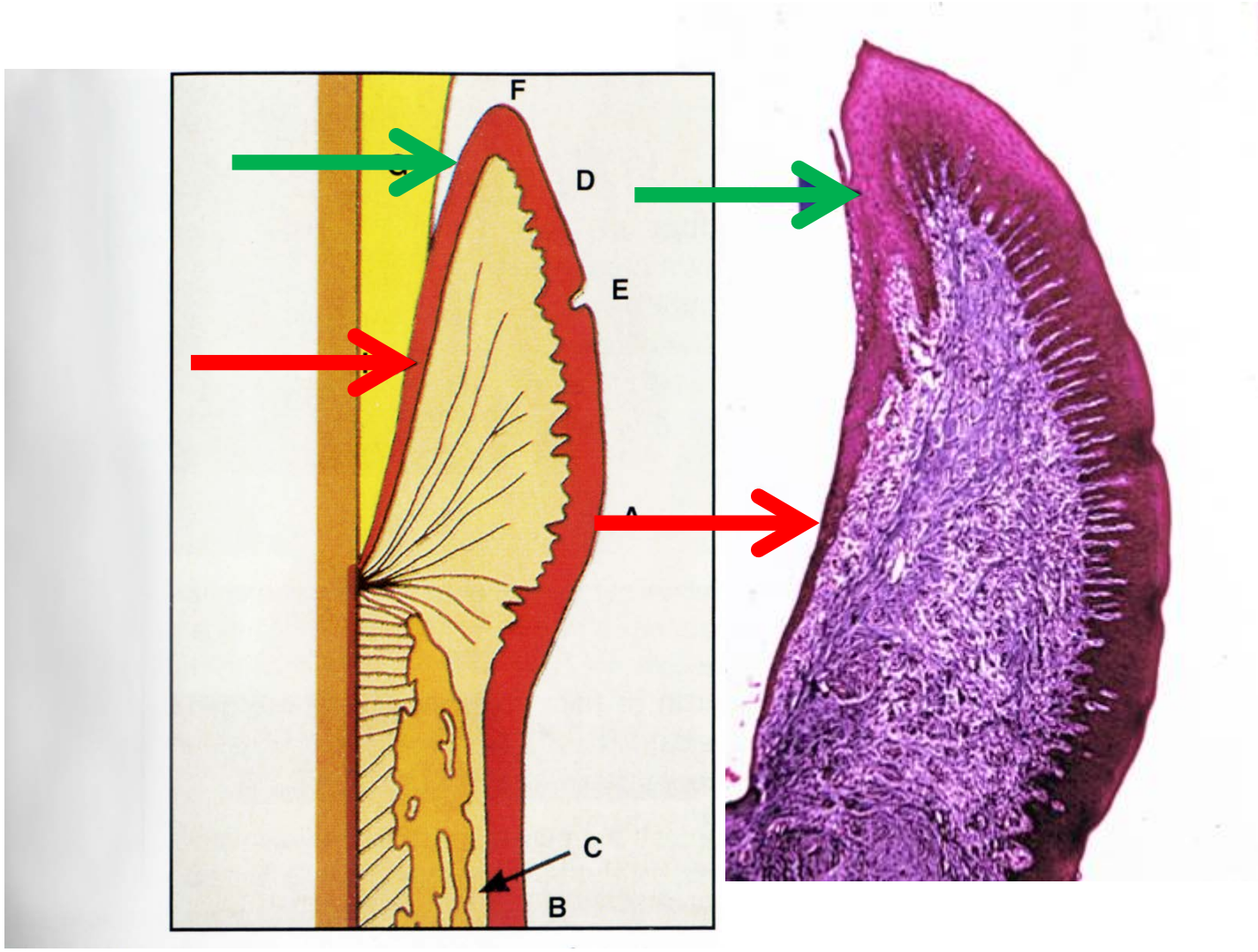
**Stratified squamous epithelium**

Keratinized at vestibular and palatinal side

No keratinization on the side facing teeth: **Sulcular epithelium**

On the side facing teeth it keeps non-differentiated epithelium characteristics.

**Junctional epithelium** (epithelial attachment of Gottlieb) is firmly attached to teeth and seal the periodontal space from the environment of oral cavity.



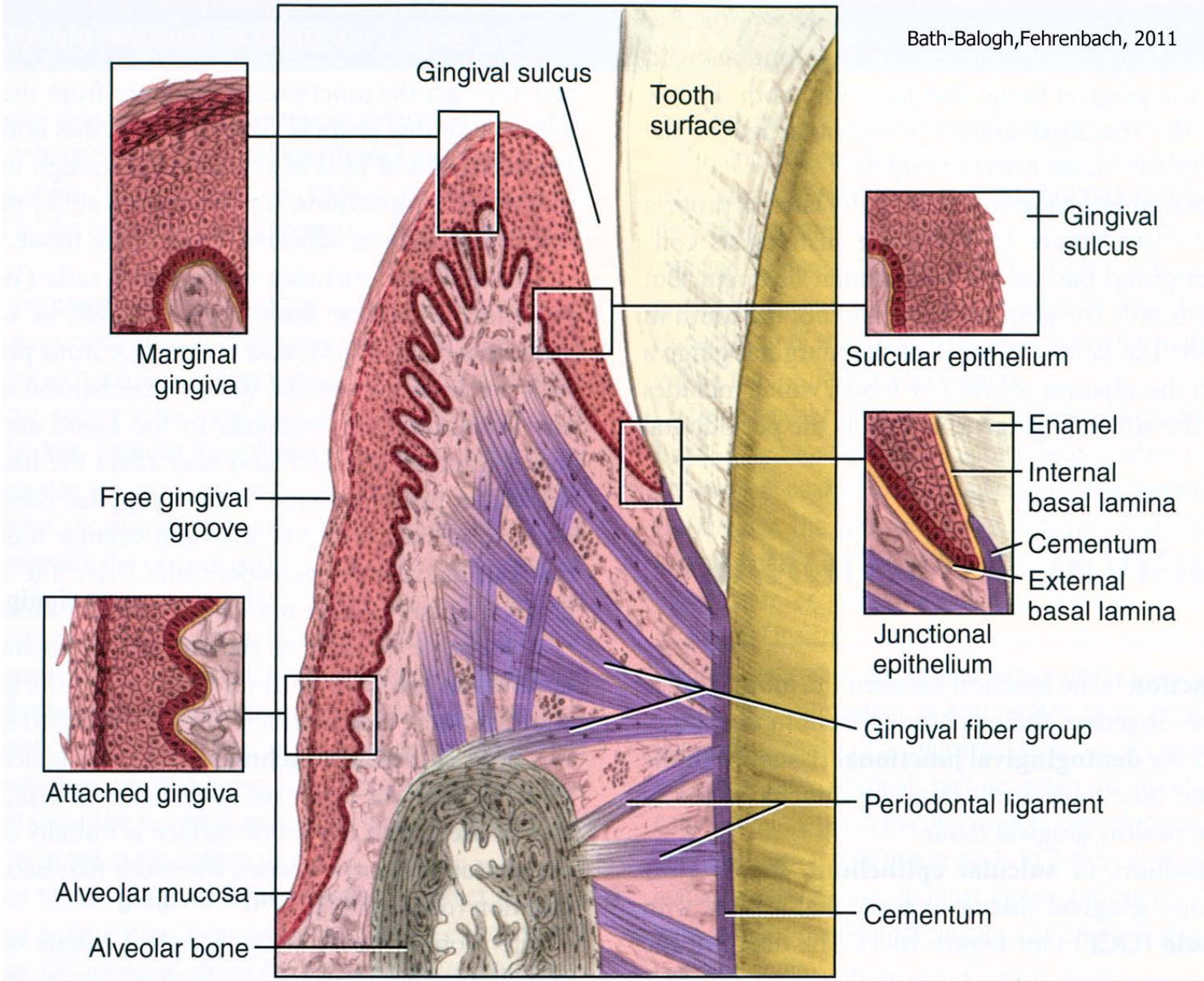



**FIGURE 10-1** Gingival and dentogingival junctional tissue: marginal gingiva, attached gingiva, sulcular epithelium, and junctional epithelium.

# Lamina propria

**Gingiva affixa**

Dense collagenous connective tissue with papillas which are numerous and thin. Their presence causes a rough surface

**Gingiva libera**

Under the epithelium of free gingiva is lower amount of papillas and always missing under epithelium which is facing teeth

**Collagenous fibres** are ordered into 4 groups:

dentogingival, circular, dentoperiostal and alveologingival

*(chapter periodontium)*

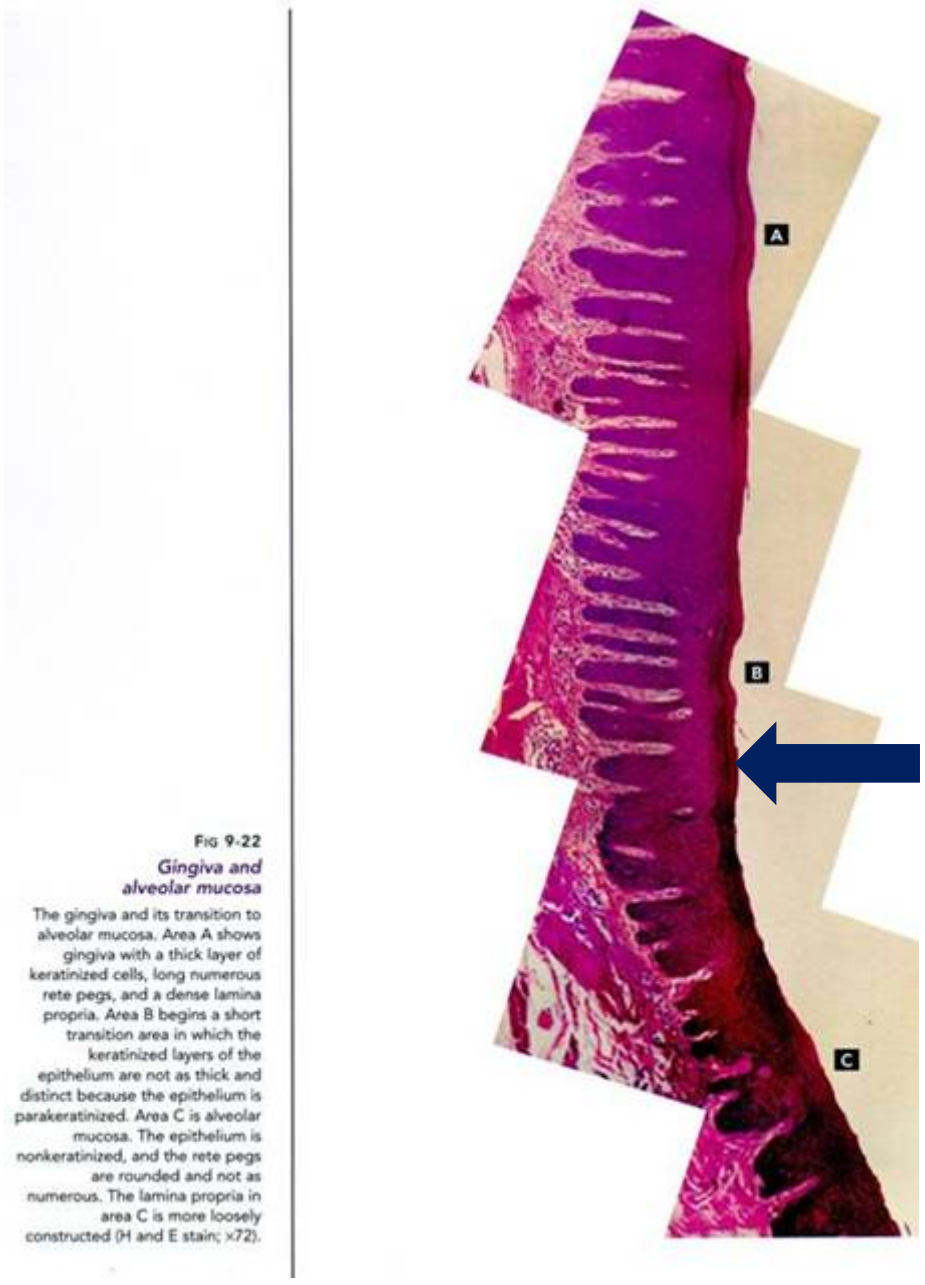



FIG 9-22
*Gingiva and alveolar mucosa*
The gingiva and its transition to alveolar mucosa. Area A shows gingiva with a thick layer of keratinized cells, long numerous rete pegs, and a dense lamina propria. Area B begins a short transition area in which the keratinized layers of the epithelium are not as thick and distinct because the epithelium is parakeratinized. Area C is alveolar mucosa. The epithelium is nonkeratinized, and the rete pegs are rounded and not as numerous. The lamina propria in area C is more loosely constructed (H and E stain; ×72).

# Junctional epithelium

**Epithelial attachment, epithelial attachment of Gottlieb,**

Protects the periodontal space from aggresive outer environment of oral cavity resp. sulcus gingivalis (against bacteria, toxins, pieces of food)

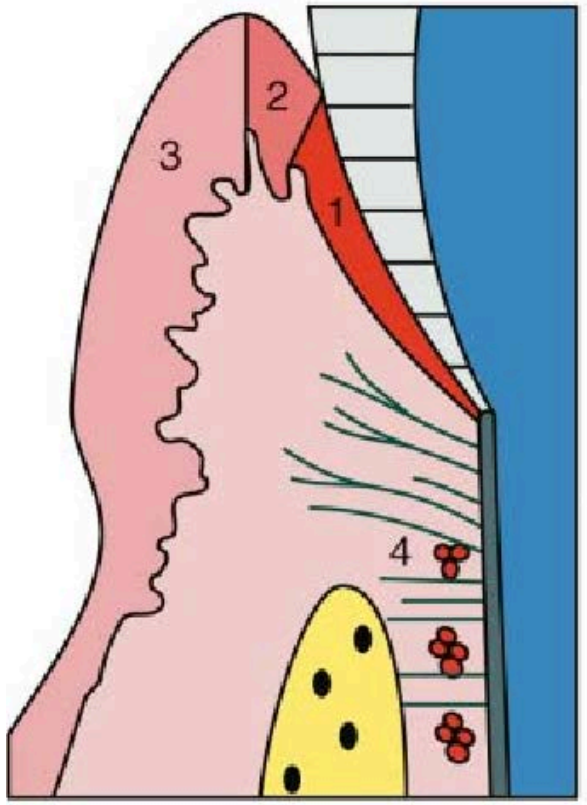
It is characteristic by the **fusion of sulcular epithelium with hard tissues of teeth in the are of the neck**

**Zone of fusion is under the sulcus gingivalis**

Width: 0,25 - 1 mm

**This epithelium is permanently actively regenerated** – stem cell activity

Cells are in several layers, flattened




**Dento-gingival junction**

1. Junctional epithelium (JE)
2. Sulcular epithelium
3. Oral epithelium
4. Epithelial rests of Malassez

**JE functions**

– attachment to tooth
– barrier
– rapid turnover
– antimicrobial defence
– GCF flow

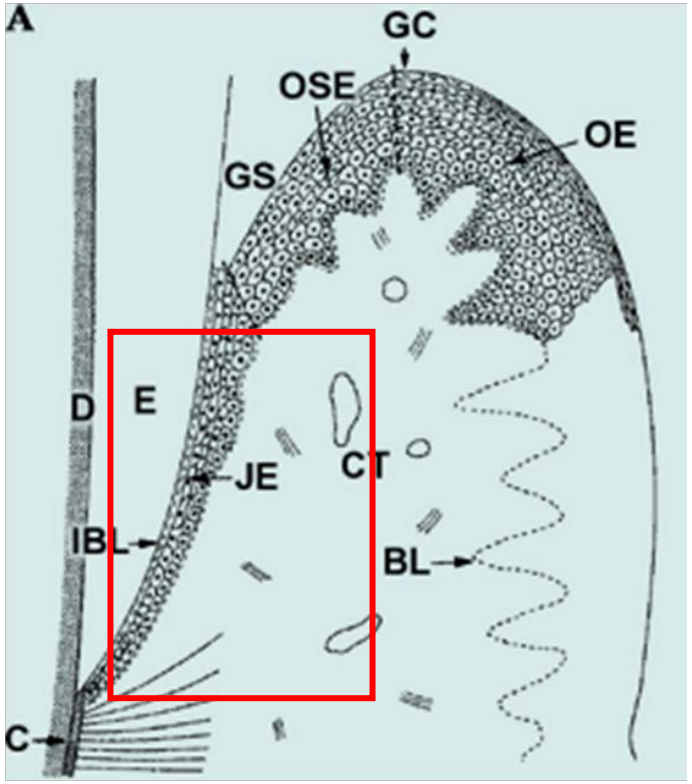
# Junctional epithelium

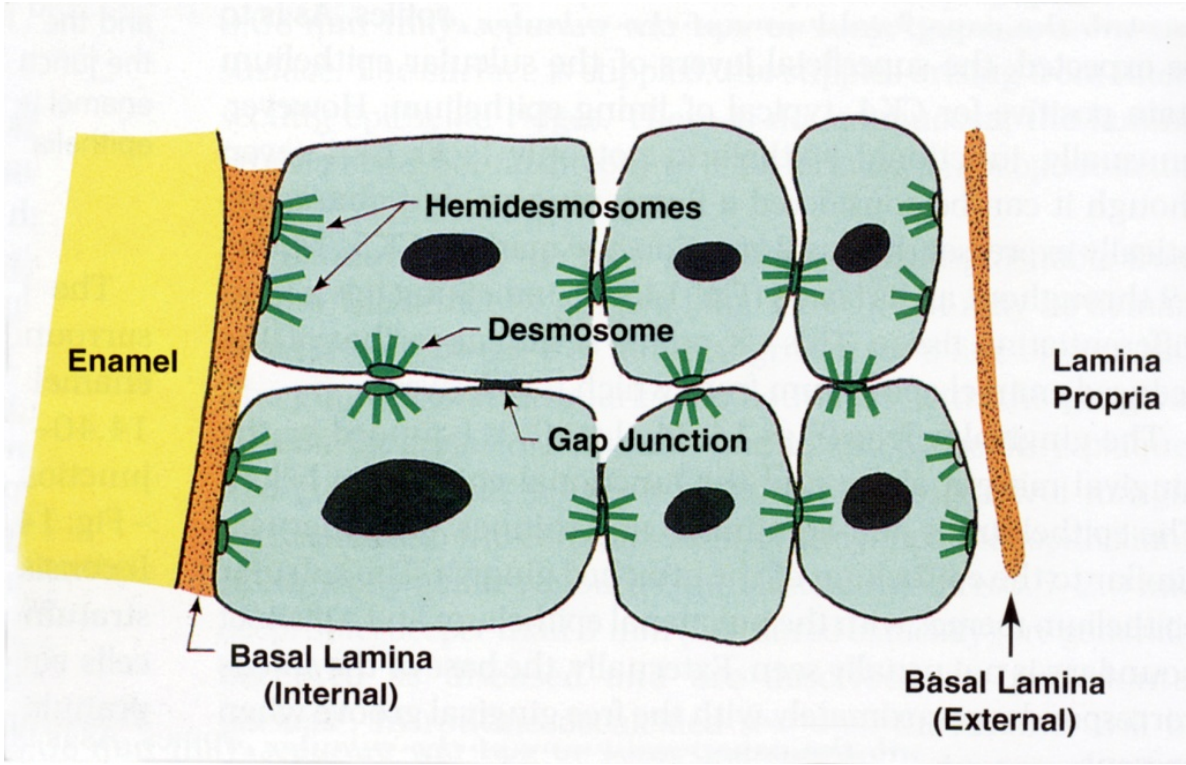
Between the innermost layer of cells and hard tissue are hemidesmosomes, between cells are desmosomes

The line between epithelium and connective tissue is **smooth** (no papillae), connective tissue contains numerous leukocytes and B-lymphocytes, acts as an immunological barrier

Narrowing ath the apical end

Fast turnover: **4-6 days.** Regenerates well after mechanical damage



# Gingival recession

Consequence: tooth loosening and ultimately tooth loss

**Gingival recession in periodontitis**

Normal state: in primary dentition and healthy permanent dentition up to 20‘-30‘ – the apical end of the junctional epithelium at CEJ

**Later junctional epithelium moves more apically**, until it finally moves to the cementum of the tooth neck

In old age, cementum, can be exposed and a condition in which the clinical crown becomes larger than the anatomical crown

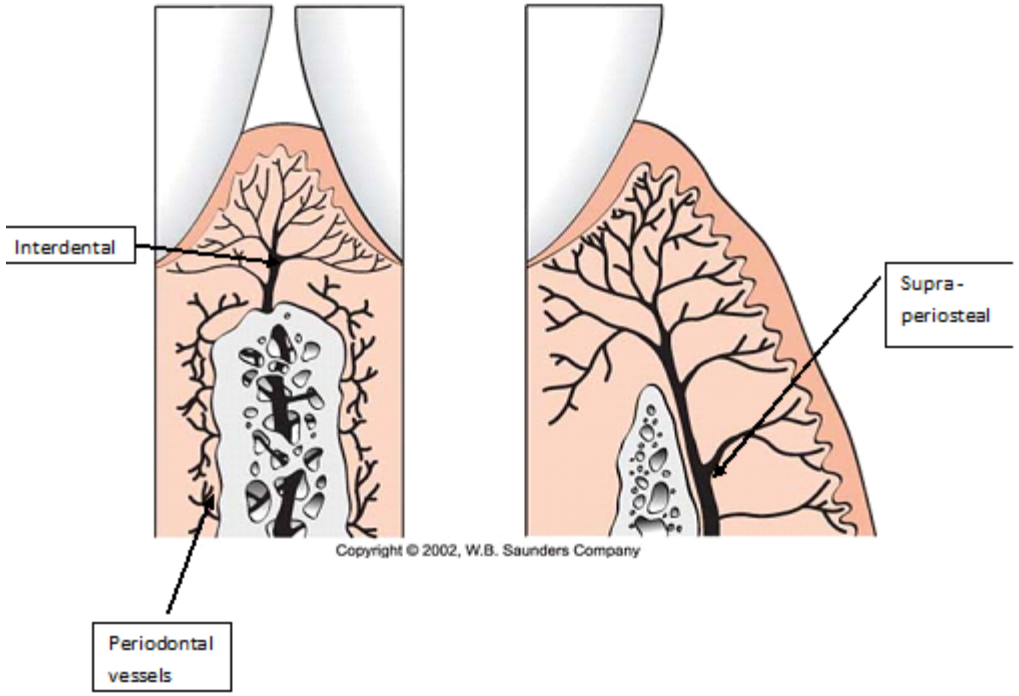
# Blood supply and innervation of gingiva

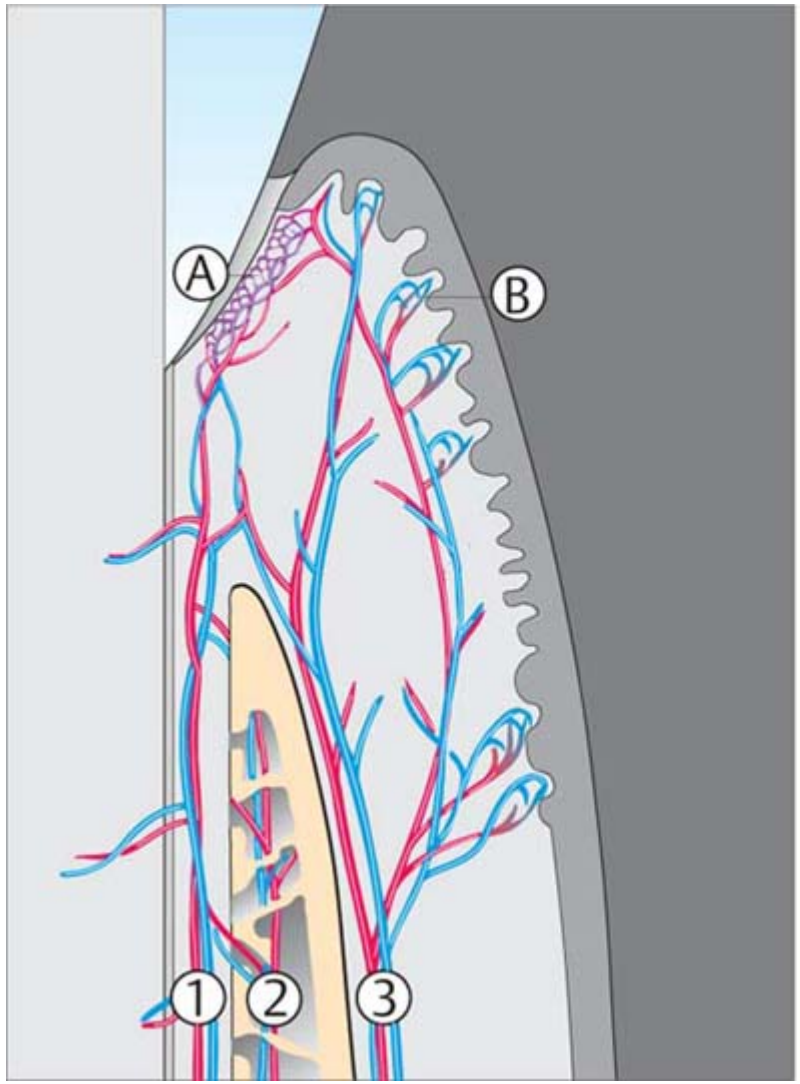
Arterioles from aa. alveolares, a. mentalis, aa. palatinae, a. buccinatoria

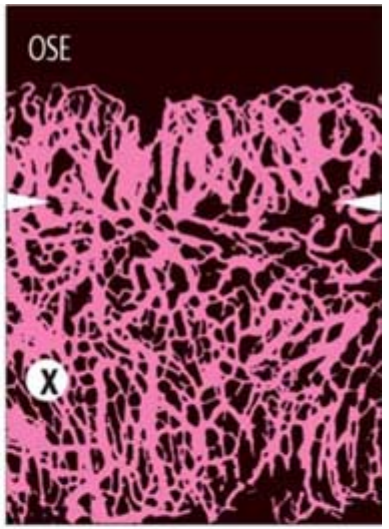
Branch into capillary networks with anastomosis with the periodontal network

Lymphatic vessels and along the blood vessels

Nerve fibres as a free nerve endings and form corpuscles




**Blood Supply Pathways**

1 Periodontal
2 Alveolar
3 Supraperiostal/mucogingival

**A Post-capillary Venous Plexus**

**B Sub-epithelial Capillary Loops**