Oral Mucosa

Part 2

Gingiva and Epithelial Attachment

Free or marginal gingiva

Attached gingiva attaches with the neck of the tooth by means of junctional epithelium

Histology of Gingiva

Thick (250 µm), either orthokeratinized or parakeratinized stratified squamous epithelium with a stippled surface

A: Rete pegs
B: Connective tissue papilla
C: Parakeratin
D: Spinous layer

In healthy attached gingiva “stippling” is seen which appears as small pits in the epithelium and are due to deep rete pegs. The lamina propria is composed of long narrow papillae which are not highly vascular. No distinct submucosa is noted as the overlying mucosa is directly attached to the underlying periosteum and cementum by collagen fibers

Free Gingiva: Keratinized; NOT STIPPLED; bound on inner margin by the gingival sulcus, which separates it from the tooth; bound on its outer margin by the oral cavity; and apically by the free gingival groove.

Attached Gingiva: Keratinized; STIPPLED; separated from the alveolar mucosa by the mucogingival junction (groove); Attached to the tooth by junctional epithelium.

http://dentistry.ouhsc.edu/intranet/WEB/Courses/CELL8002/Home.html
In A note the difference in keratinization, thickness of epithelium and ridge pattern.

In B stained with an elastic stain, note the presence of elastic fibers in lamina propria in alveolar mucosa. Not much difference in the epithelium is seen between the two types of mucosa.

Dentogingival junction is the region where the oral mucosa meets the surface of the tooth. Very important because it is a weak area in the oral mucosa which is otherwise continuous. Bacteria on the surface of the tooth produce toxins that can incite inflammation and damage if it enters into the mucosal tissues.

Gingival sulcus in healthy individuals is ~ 0.5 to 3 mm (mild inflammation is present - 1.8 mm average)

Depth greater than 3 mm is considered pathologic; and the sulcus represents periodontal pocket.

Floor of the sulcus and the epithelium cervical to it is called junctional epithelium which is in contact with the tooth surface (enamel and sometimes cementum).

Wall of the gingival sulcus is lined by nonkeratinizing stratified squamous epithelium that is derived from and continuous with the rest of the oral mucosa - oral sulcular epithelium.

Junctional epithelium
The epithelium that is attached to the tooth (enamel or sometimes cementum) surface continuous with sulcular epithelium.

Derived from reduced enamel epithelium of the tooth germ

Junctional epithelium consists of flat cells aligned parallel to the tooth surface increasing in thickness from the apex to the crown

Attached to enamel by internal basal lamina and to the connective tissue by external basal lamina. Hemidesmosomes are present in both basal lamina.

Epithelial cell turnover in gingiva
Similar to all other epithelia, the deeper cells adjacent to the connective tissue undergo cell division to replenish those lost at the surface.

High rate of cell division

Migrate about 2 to 3 cell layers from the tooth surface and then join a main migratory route in a coronal direction, parallel to tooth surface, to be desquamated into the gingival sulcus.

Key point: Junctional epithelium readily regenerates from the sulcular epithelium or oral epithelium if it is damaged or surgically excised.

Connective tissue normally contains plenty of neutrophils which is different than the normal oral mucosa.
Col (or depression): This is how the gingiva looks in the interdental area. Similar to an outline of a depression or col with buccal and lingual peaks. Col epithelium is identical to junctional epithelium and has the same origin (from dental epithelium) and is also replaced continually by cell division.

Not sure if there is any significance that the col is more vulnerable to inflammation, but the incidence of gingivitis is greater interdentally.

How does Gingiva develop?

Blood supply to the gingiva: Derived from periosteal vessels in the periosteum of the alveolar process

Blood supply to the dentogingival junction: Continuation of interalveolar arteries

Nerve supply to the gingiva: Terminal branches of periodontal nerve fibers and by branches of the infraorbital and palatine, or lingual, mental, and buccal nerves

Histology of Hard Palate

Thick orthokeratinized (or parakeratinized in areas) epithelium showing ridges (rugae)

Lamina propria shows long papillae with thick dense connective tissue

Submucosa is mucoperiosteum with dense collagenous connective tissue attaching directly to periosteum. Contains fat and salivary glands
1. **Filiform papilla**: Makes up majority of the papillae and covers the anterior part of the tongue. They appear as slender, threadlike keratinized projections (~2 to 3 mm) of the surface epithelial cells. These papillae facilitate mastication (by compressing and breaking food when tongue is apposed to the hard palate) and movement of the food on the surface of the tongue. The papillae is directed towards the throat and assist in movement of food towards that direction. NO TASTE BUDS.

2. **Fungiform papilla**: (Fungus-like) These are interspersed between the filiform papillae. More numerous near the tip of the tongue. Smooth, round structures that appear red because of their highly vascular connective tissue core, seen through a thin, nonkeratinized stratified squamous epithelium. Taste buds are usually seen within the epithelium.
3. **Foliate Papilla**: (Leaf-like). Present on the lateral margins of the posterior tongue. Consist of 4 to 11 parallel ridges that alternate with deep grooves in the mucosa, and a few taste buds are present in the epithelium. They contain serous glands underlying the taste buds which cleanse the grooves.

4. **Circumvallate papilla**: (Walled papilla). 10 to 14 in number these are seen along the V-shaped sulcus between the base and the body of the tongue. Large, ~ 3 mm in diameter with a deep surrounding groove. Ducts of von Ebner glands (serous salivary glands) open into the grooves. Taste buds are seen lining the walls of the papillae.

**Taste Buds**: Unique sense organs that contain the chemical sense for taste. Microscopically visible barrel-shaped bodies found in the oral epithelium. Usually associated with papillae of the tongue (circumvallate, foliate and fungiform). Also seen in soft palate, epiglottis, larynx, and pharynx. Referred to as NEUROEPITHELIAL STRUCTURES. But most correctly referred as epithelial cells closely associated with club-shaped sensory nerve endings. These nerves arise from the *chorda tympani* in anterior tongue and *glossopharyngeal* in posterior tongue and come to lie among the taste cells. Each taste bud has ~ 10 to 14 cells. Majority are taste cells with elongated microvilli that project into the taste pore. (Epiglottis and larynx – Vagus nerve)

- **Type 1 dark cell** (60% of cells)
- **Type 2, light cells** (30%)
- **Type 3 (7%)** and **Type 4 (basal cells ~ 3%)**

![Image of papillae and taste buds]
### Taste Buds in the Human Adult

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<tr>
<th>Location</th>
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<tbody>
<tr>
<td>Tongue</td>
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<tr>
<td>Soft palate</td>
<td>2,500</td>
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<tr>
<td>Epiglottis</td>
<td>900</td>
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<tr>
<td>Larynx/pharynx</td>
<td>600</td>
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<td>Oropharynx</td>
<td>250</td>
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4 taste sensations: Sweet, salty, sour and bitter
- Sweet and salt: anterior tongue
- Sour: lateral tongue
- Bitter: region of circumvallate papilla

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Basal cells interface with a membrane separating the epithelium and lamina propria. The membrane is called basal lamina. Basal cells attached to basal lamina by hemidesmosomes.

Epithelial cell-cell contact is made through desmosomes (in oral cavity appears discoid and called macula adherens). These are anchored intracellularly by tonofilaments.
Nonkeratinocytes in oral epithelium:
Constitute about 10% of epithelial cell population. Three major cells which are all clear cells with a halo around their nuclei.

1. **Langerhan’s cells**: found on stratum spinosum (suprabasal) and function in antigen trapping and processing. Dendritic cells. No desmosomes or tonofilaments.

2. **Merkel cell**: Located in basal cell layer (mostly in gingiva). Function as touch receptors. Nondendritic. Sparse desmosomes and tonofilaments.


4. **Lymphocytes and leukocytes**: Inflammatory cells that are not clear cells. Associated with inflammatory response in oral mucosa.
Lamina Propria

Superficial papillary layer (associated with rete ridges) and deeper reticular layer (between papillary layer and deeper structures)

Reticular refers to the netlike arrangement of collagen fibers (nothing to do with reticulin fibers)

Papillary layer has thin and loose collagen fibers with many capillary loops

Reticular layer has collagen fibers arranged in thick bundles that are parallel to surface

Lamina propria also contains various cells, blood vessels, nerves and fibers (collagen and elastic) embedded in an amorphous ground substance

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