

# Anatomy of the periodontium

The periodontium, or the tissue surrounding the tooth, is made up of four basic components: **gingiva**, **periodontium**, **alveolar bone** and **cement** on root surface. Each of these components has its irreplaceable meaning, unique structure and function. Pathological processes affecting even just one of the components can significantly affect the periodontium as a whole.

## Gingiva

Between the *gingiva*, which is light pink in color, and the alveolar mucosa, which is deep red, there is a sharp line called **the mucogingival border**. On the palatal side, there is no alveolar mucosa, but a rigid palatal mucosa, which is not sharply demarcated from the gingiva and flows smoothly into it.

The marginal edge of the gingiva extends into the **interdental papilla**. Each interdental papilla has 3 parts - vestibular, oral and a *papilla saddle* that duplicates the point of contact and is of different widths on different teeth (wide for molars, narrow for incisors).

Gingiva is divided into two types: *free* and *connected*.

### Free (marginal gingiva)

The free gingiva adheres tightly to the neck of the tooth about 2 mm above the level of the **cementoenamel border**, thus forming a border 0.5–2 mm wide, with a shiny surface and pale pink color under physiological circumstances.

### Attached gingiva

The attached gingiva is connected to the bone and reaches up to the **mucogingival border**, on its surface we can find so-called *stippling* (dimpling), which is created by the binding of collagen fibers. The function of the attached gingiva is to prevent the movement of the marginal gingiva during movement of the alveolar mucosa. In the frontal section, larger movements occur due to the movement of the lips, the attached gingiva should be at least 3 mm here, in the distal section due to the movement of the cheeks, smaller movements of the alveolar mucosa occur, so 2 mm of attached gingiva is sufficient here.

## Gingival epithelium

From a histological point of view, the gingiva is covered by three types of epithelium – **oral gingival**, **sulcular** and **connective**.

- **Oral gingival epithelium** is located between the mucogingival border and gingival margin, thus occupying the largest surface of the gingiva. It is formed by a multi-layered squamous keratinized epithelium as part of the so-called *masticatory mucosa*. In some people, it may contain pigment cells (*melanocytes*) that give the gingiva a shade different from the standard pink color.
- The **sulcular epithelium** lines the surface of the *gingival sulcus*, which is a groove around the tooth, which under physiological circumstances should be up to 2 mm deep. Sulcular epithelium is stratified squamous non-keratinizing.
- **Connecting or junctional epithelium** extends from the bottom of the gingival sulcus to the cementoenamel border and is firmly connected to the tooth surface, and is histologically identical to the sulcular epithelium.

## Connective fibers of the gingiva

The gingiva contains 4 basic types of connective fibers, most of which are attached to the surface of the root.

1. Dentogingival fibers extend from the surface of the root to the edge of the gingiva.
2. From the surface of the root to the surface of the alveolar bone go **dentoperiosteal fibers**.
3. Transdental fibers pass between the cervical parts of adjacent teeth in a horizontal direction above the alveolar bone line.
4. **Circular fibers** go around the tooth and form a cuff that holds the gingiva tightly to the tooth.

## Alveolar bone

The quality of another part of the periodontium - the **alveolar bone** - is assessed by *X-rays*, most often by the intraoral X-ray status. X-ray status is slowly being pushed out these days OPG, on which the area of the frontal teeth is less legible, so sometimes it is advisable to supplement the OPG with specific intraoral images.

We distinguish between individual teeth an **interdental septum** and in multi-rooted teeth an **interradicular septum** between the individual roots.

On the radiograph, we evaluate 2 basic parameters - the relationship of the edge of the alveolar bone to the tooth and the quality of the bone.

## The relationship of the alveolar bone to the tooth

Under physiological circumstances, the edge of the alveolar bone extends a maximum of 1 mm below the level of the **cemento-enamel border**. If the edge of the bone extends below, this is a pathological condition. We attribute the reduction of the edge of the bone without breaking its structure to the so-called *atrophy of the periodontium*.

## Alveolar bone quality

On the radiograph, we distinguish 2 types of bone tissue - **spongiosis** and **compact**.

- **Spongiosis** has a typical spongy structure and forms the main volume of the alveolar bone.
- **Compact** is distinct as a white line on the entire surface of the septum. Disruption of the surface compact is a typical manifestation of *periodontitis*.

Between the compact and the surface of the tooth on the roentgenogram, we see a dark line of a certain width, which corresponds to the **periodontal fissure**. Under physiological circumstances, the periodontal gap is 0.3 mm wide in the central part, 0.33 mm wide at the apex, and 0.35 mm wide at the neck.

## Periodontium (denticles, suspensory periodontal ligaments)

The dentition is a vascularized tissue forming the syndesmotomic connection between the tooth and the jaw. It is very cellular and contains a large number of fibers, filling the space between the surface of the tooth root and the alveolar bone - the periodontal gap. 1-2 mm apically from the cemento-mineral boundary it passes into the attached gingiva.

### Periodontal ligaments (Sharpey's fibers)

they are very *strong collagen fibers* in the shape of the letter S, thanks to which they do not tear when bitten, but stretch smoothly and thus resist excessive forces during chewing. Among these fibers are a large number of **unspecified mesenchymal cells** from which the fibers can regenerate.

The basic 4 groups of periodontal ligaments are:

1. **Alveolar fibers** which start at the cervical part of the root and go obliquely apically to the edge of the alveolar bone.
2. **Horizontal fibers** which are more numerous than alveolar fibers.
3. **Oblique fibers** go from the bone obliquely apically to the root surface, they are the most numerous.
4. **Apical fibers** have a radial course on all sides around the apex of the tooth.

Between the periodontal ligaments there are lymphatic and blood vessels *and also* nerve fibers with free nerve endings, which protect the tooth from overload by a reflex mechanism.

## Cement

Cement is the structure on the surface of the root to which the periodontal ligaments are anchored.

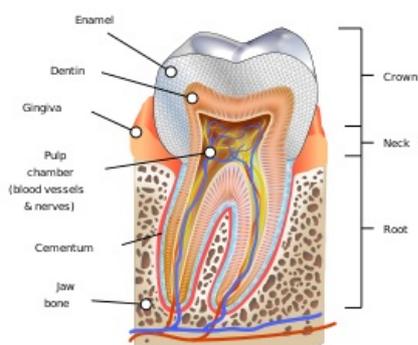
We have 2 basic types of cement - **primary** (acellular) and **secondary** (cellular).

### Primary cement

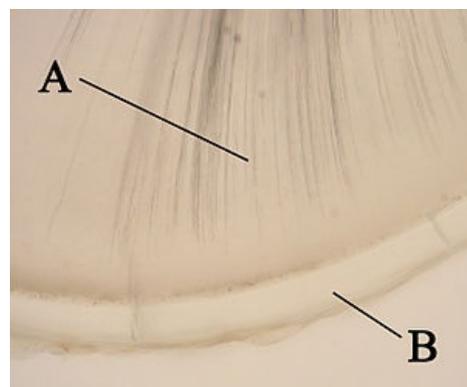
Primary cementum is formed during embryonic development and does not contain any cells, so it does not have the ability to transform in any way.

### Secondary cement

Secondary cementum contains **cementoblasts** (cementocytes), which give it the ability to transform over the course of life according to the load on the tooth and thus anchor the periodontal ligaments according to the current need. The more the tooth is stressed, the more cement is formed. This can lead to **hypercementoses**, which cause problems in case of tooth extraction.



Structure of fibrous fibers anchoring teeth.



A - dentin; B - cement

## Links

## Related Articles

- Periodontal pathology
- Periodontology – basics

## Source

- POLENÍK, Pavel. *Anatomy of the periodontium* [lecture for subject Preventive dentistry, specialization Department of Dentistry, LFP UK]. Pilsen. 12.12.2008.

## References

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- LINDHE, Jan – KARRING, Thorkild – LANG, Niklaus Peter. *Clinical Periodontology and Implant Dentistry*. 4. edition. Blackwell Munksgaard, 2003. ISBN 1-4051-0236-5.