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THE MAIN FUNCTION AND HISTOLOGICAL STRUCTURE OF THE ORAL MUCOSA

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Abstract. Knowledge of the normal state of the oral mucosa is a prerequisite for accurate diagnosis of its diseases. Normally, the mucous membrane of the oral cavity has a smooth shiny surface, and the intensity of the gloss is directly influenced by the degree of its moistening with the oral fluid. The color of the mucous membrane ranges from pale pink to red, depending on the degree of vascularization of the underlying connective tissue. The mobility of the mucous membrane depends on its topography and is determined by the presence of a well-developed submucous layer. The most mobile mucous frill of the lips, cheeks, floor of the mouth, soft palate in contrast to the mucous membrane of the gums and hard palate.
Keywords: epithelium, immunoglobulin, mucous membrane, oral microflora, inflammation, prevention, treatment.

Relevance: The mucous membrane lining the oral cavity consists of stratified squamous epithelium (the number of layers of which is not the same in different parts of the oral cavity), the basement membrane, the lamina propria of the mucous membrane and the submucosa [2, 8]. In the area of the hard palate, gums, tongue, the epithelial layer is more pronounced, in the area of the lips and cheeks, the mucous membrane itself is well expressed, in the area of the bottom of the oral cavity, transitional folds, the submucosal layer is developed, which is absent in other parts of the oral cavity.

The epithelium lines 80% of the COP surface, the area of which in an adult is about 172 cm2; the remaining 20% is accounted for by the teeth. According to morphological and functional characteristics, 3 types of COP are distinguished - chewing, lining (integumentary), and specialized. The thickness of the COP epithelium layer is 200-600 microns [15].

The chewing mucosa lines the hard palate and gums, is covered with stratified squamous keratinizing epithelium, is tightly attached to the bone, is inactive, has high strength and low permeability [5, 13].

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The lining mucosa covers the cheeks, lips, floor of the mouth, the oral surface of the soft palate, and the ventral surface of the tongue. It is covered with stratified squamous non-keratinizing epithelium, mobile, elastic.

A specialized mucous membrane lines the dorsal surface of the tongue, covered with a multilayer flat non-keratinizing epithelium, and in some areas with keratinizing epithelium [7]. It is characterized by the presence of papillae and taste buds, attached to the underlying muscle tissue, moderately mobile and mechanically strong.

The epithelial layer faces the oral cavity and is constantly undergoing renewal due to desquamation of the upper layers of cells, as a rule, three layers are distinguished: basal, thorny and superficial (keratinizing). The granular layer is found only with orthokeratosis [1]. Signs of parakeratosis are found in areas that are not subject to significant constant mechanical stress, for example, in the cheeks, with the exception of the zone of closing teeth, while in areas with increased stress (hard palate, gums), orthokeratosis is detected, as in the epidermis

The epithelial layer is directly facing the oral cavity and, due to the desquamation of the upper layers of cells, undergoes constant renewal. On the hard palate, tongue and gums, epithelial cells form the stratum corneum [9]. In these areas, it is represented by several rows of completely keratinized cells devoid of nuclei. Adjacent to it is a granular layer, which consists of elongated cells containing keratohyalin grains in their cytoplasm. In the area of the floor of the oral cavity, the lower surface of the tongue, periodontal attachment in the norm, keratinization is not observed [17].

In these areas, the surface layer of the epithelium is represented by flattened cells of the spiny layer - a layer of flat cells. Directly adjacent to it are thorny cells, which are located in several layers (in areas where there is keratinization, thorny cells adjoin the granular layer).

The deepest layer of the epithelium is the germ layer, which is formed by cells of a cylindrical or cubic shape. They are located in one row and are directly adjacent to the basement membrane. Due to the growth layer, due to cell division, the renewal of the epithelium is mainly carried out.

The basement membrane consists of a dense plexus of thin argyrophilic fibers with a specific orientation. Some of them are directed to the basal layer and come into contact with cylindrical cells.

The proper layer of the mucous membrane consists of connective tissue, represented by the main substance, fibrous structures and cells. Cells are represented by fibroblasts, histiocytes, plasma cells, mast cells. On the border with the epithelium, the mucous membrane itself forms protrusions - papillae, which are introduced into the epithelium to different depths. In the mucous membrane itself, vascular, nerve plexuses, and lymphatic vessels pass.

The submucosal layer is represented by loose connective tissue. The structure of the buccal mucosa. The basement membrane separating the epithelium from the

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connective tissue layer of the oral mucosa is a zone of moderate and, in some cases, non-uniform electron density up to 100 nm thick. The plasma membrane of basal cells, located along the lower border of the epithelium, has semi-desmosomes, between which pinocytic vesicles are located [17].

Semi-desmosomes have a layered structure due to the alternation of zones of different electron density. They differ from desmosomes, which have a seven-layer structure, in a smaller set of layers. In the cytoplasm of the basal cells, respectively, the projections of the semi-desmosomes show a large number of tonofilaments [10].

Basal cells are cylindrical in shape and are located in one row on the basement membrane. The nuclei of these cells, as a rule, are rounded, with small protrusions of the karyoplasm, only occasionally the nuclei of the basal cells are serrated. The perinuclear space is expressed along the entire perimeter of the nucleus, nuclear pores are revealed. Chromatin is often slightly thickened around the periphery of the nucleus; one or two nucleoli are well defined [12].

The plasma membrane of the basement cells at the junction with the basement membrane is poorly distinguishable. The cytoplasm of basal cells contains mitochondria, lamellar apparatus, cytoplasmic reticulum, ribosomes, tonofilaments and various inclusions. Mitochondria are numerous, of various sizes, round or oval in shape. Their matrix often has a low electron density and contains a few cristae, less often it is electron-dense.

The lamellar complex consists of flattened sacs - dictyosomes, located in parallel, small vesicles and large vacuoles at the poles of the dictyosomes. In the cytoplasm of the cells of the basal layer, tonofilaments, free ribosomes and polysomes are found. A large number of ribosomes are fixed on the surface of the cytoplasmic cisterns.. The content of the cisterns is a fine-grained substance.

The structure of the mucous membrane of the lips. The mucous membrane of the lips consists of two zones. The red border is the transition zone from the skin of the outer surface of the lip to the vestibular surface, which has the usual structure of the mucous membrane [14]. The stratified squamous epithelium of the red border of the lips shows a tendency to keratinization, it has a well-defined granular layer. The proper layer of the mucous membrane of the lips forms numerous protrusions that are deeply embedded in the epithelium.

The excretory ducts of the sebaceous glands open directly on the surface of the epithelium. On the inner surface of the lip, the epithelial layer is thinner, the connective tissue papillae of the mucous membrane itself are less pronounced. Reduced sebaceous glands are found in the submucosal layer. Bundles of muscle fibers adjoin the submucosal layer.

The structure of the mucous membrane of the floor of the mouth, transitional folds. The epithelial layer in these areas of the mucous membrane is of moderate thickness and does not keratinize. The mucous membrane folds well, since the submucous layer is pronounced. In the transitional fold of the mucous membrane of the cheeks and the bottom of the oral cavity are the excretory ducts of the parotid (at

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the level of the molars of the upper jaw - the mouth of the Stenon), sublingual (Bartholin - in the area of the incisors of the lower jaw) and submandibular (Warton - on both sides of the frenum of the tongue) of the salivary glands.

The structure of the mucous membrane of the soft palate. The soft palate is lined with multi-layered flat non-keratinized epithelium, a large number of elastic fibers is determined in the mucous membrane itself, numerous glands are located in the submucosal layer, the muscle layer is made up of striated fibers.

The structure of the mucous membrane of the hard palate. The epithelium is stratified squamous keratinizing. The area adjacent to the teeth, the area of the palatine suture - is devoid of the submucosal layer [18]. In the anterior section, adipose tissue is located in the submucosal layer. In the posterior parts of the hard palate, there is a significant accumulation of mucous glands. The mucous membrane of the hard palate with its fibrous structures is tightly connected to the bone tissue [6].

The structure of the mucous membrane of the tongue. It consists of stratified squamous epithelium and the mucous membrane itself, the submucosal layer is not expressed, therefore, the mucous membrane is motionless. The epithelium along with its own layer forms papillae on the back of the tongue. Distinguish between filiform, mushroom, leaf-shaped and grooved papillae.

Filiform - the most numerous, have a conical shape, are found over the entire surface of the dorsum of the tongue, especially in the anterior sections. The epithelium becomes keratinized, giving the tongue a whitish tint. The mushroom papillae have a shape corresponding to the name. The epithelium is not keratinized,the loops of the blood capillaries shine through, giving the formations the appearance of red dots [4].

The largest number of these papillae are located at the tip of the tongue. The papillae have the appearance of folds of the mucous membrane, located on the lateral surface of the tongue, where the epithelium is not keratinized. Contains a large number of flavoring bulbs. The grooved papillae are immersed in the thickness of the tongue, located in the region of its root in the form of a Roman numeral V, the apex of which coincides with the blind opening of the tongue.

A rounded, or flattened, papilla is surrounded by a shaft - a fold of the mucous membrane, where Ebner's mucous-protein glands (glands of the grooved papillae) open, therefore they are called papillae surrounded by a shaft. There are many taste buds in the epithelium. The tissue of the tongue contains mucous, proteinaceous, mucous-proteinaceous glands. The lower surface of the tongue is lined with stratified squamous non-keratinizing epithelium, reminiscent of the epithelium of the floor of the oral cavity [16].

Age features and changes in the oral mucosa. In persons of different ages, the oral mucosa has its own structural features. Up to 16 years of age, the epithelial layer is rather thick, the epithelial papillae are well formed. The structure of both the epithelial cover and the connective tissue base is clearly expressed. The abundance of cellular elements and blood vessels in the connective tissue stroma, which is

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characterized by a rather loose structure, the absence of dystrophic changes in epithelial cell structures, a clear differentiation of tissue relationships indicate a high level of reactivity and viability of the tissue complex [2, 3].

In persons of the second age group (from 18 years), certain quantitative and qualitative changes occur: smoothness of the epithelial papillae, the appearance of cells with vacuolated cytoplasm in the spiny layer of the epithelium, loosening of the connective tissue stroma, expansion of the excretory ducts of the small salivary glands and the development of lymphoid infiltrates. These changes are most pronounced in the second period of this age [11].

In persons aged 60 years and older, structural changes of a regressive nature concern both the epithelium and the oral mucosa itself. The thickness of the epithelium of the mucous membrane decreases on the lip from 500 to 300 microns, on - from 700 to 400 microns, on the tongue - from 800 to 600 microns. The cells of the new layer of the epithelium become low-prismatic, small, pyknotic, the amount of DNA, RNA and dehydrogenases in them decreases. Due to keratinization of the squamous squamous epithelium, the oral mucosa becomes grayish-white.

In the subepithelial connective tissue, the number of cells and fibers decreases, elastic fibers are sclerosed and thickened, hyalinization occurs in collagen fibers, which leads to immobility of the mucous membrane. The mucous membrane of the hard palate thickens, becomes loose. The epithelium of the mucous membrane of the cheeks becomes thinner due to the spiny and basal layers. Parakeratosis is found in the epithelium of the retromolar region, lips.

Atrophy of the papillae of the tongue is observed, the leaf-shaped papillae are smoothed, and the folds of the tongue are also referred to gerontological signs. With age, sclerotic changes in the blood vessels of the oral mucosa increase. The density of the capillary loops of the gums decreases, some of the anastomoses become empty. In the absence of teeth, age-related changes in the mucous membrane are more pronounced. The rate of secretion of the salivary glands decreases, the amount of saliva decreases, which causes dryness of the mucous membrane [20].

The external carotid artery and its branches provide blood supply to the oral mucosa, branches supplying blood to the jaw, teeth, and mucous membrane depart from the internal jaw artery. In the lower jaw, the lower alveolar artery forms branches that deliver blood to the periodontium and gums. The artery of the buccal muscle supplies blood to the muscles, the mucous membrane of the vestibule of the mouth and the gums of the upper jaw. The gums in the upper molars receive blood from the superior alveolar artery.

Through the inferior orbital artery, blood flows to the areas of the gums located in the area of the premolars and anterior teeth. The branches of the descending palatine artery supply blood to the mucous membrane of the palate. The veins accompanying the arteries flow into the internal jugular vein. Lymph flows into regional lymph nodes (chin and submandibular). Innervation of the oral mucosa

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occurs due to the second and third branches of the trigeminal, nasopalatine, buccal, lingual, glossopharyngeal and vagus nerves.

Functions of the oral mucosa. The mucous membrane of the oral cavity is resistant to the influence of irritating factors: physical (temperature, mechanical), chemical, biological (infection). This resistance is largely determined by the integrity of the epithelium, which is associated with the provision of a barrier function. The mucous membrane has a complex of factors of specific and nonspecific immunity, which in most cases provides a barrier to the penetration of the organism [15].

Barrier function. The functions of the barrier are to delay the transition of a foreign substance from the outside to the tissue or from the blood to the tissue and to create optimal conditions for the vital activity of tissue elements. In the oral cavity, the function of an external barrier is performed by the epithelium of the mucous membrane, preventing the penetration of various antigens: microorganisms, viruses, carcinogens. Moreover, the quality of the barrier largely depends on the number of layers and the shape of the epithelial cells.

The most durable barrier is in the tongue, covered with keratinized stratified epithelium. The submucosal layer of the tongue contains a relatively small number of cells capable of phagocytosis. The gingival barrier has a number of features: the epithelium of the marginal gum is capable of keratinization, which makes it resistant to mechanical stress, chemical and temperature factors. A significant number of cells with phagocytic activity accumulate in the submucosal layer of the gums in comparison with a similar layer of the mucous membrane of the tongue.

In the case when the components of saliva and tissue barriers do not cope with the pathogenic action of microflora, factors of nonspecific and specific immunity, which are realized with the participation of lymphoid tissue, are included in the protection process [19]. The most pronounced accumulation of lymphoid tissue in the oral cavity is the palatine and lingual tonsils, which also serve as an external barrier. In the tonsils, infectious and toxic substances (viruses, toxins) are rendered harmless, and white blood cells are transformed.

The barrier function of the mucous membrane is also associated with the peculiarities of its structure and function. In particular, the performance of the barrier function is ensured by the presence of keratinization areas in the zones where the greatest mechanical load is noted. The cells of the basal and styloid layers of the epithelium of the oral mucosa have a higher mitotic capacity compared to the cells of the epidermis. Regeneration in the oral mucosa proceeds quite actively both from the side of the epithelium and from the side of the connective tissue base [2, 20].

It should be noted the rapid differentiation of epithelial cells of the oral mucosa. The epithelium is constantly renewed, while cells of the surface layer that enter the oral fluid are exfoliated, both in the epithelium and in the stroma of the oral mucosa, active metabolic processes take place. Thus, maintaining the integrity of the epithelial layer is achieved by a combination of three mutually balanced and simultaneous processes.

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This is regeneration - continuous formation of cells in the basal layer due to the division of poorly differentiated precursors; differentiation - a change in the morphofunctional characteristics of cells simultaneously with their displacement to the overlying layers; desquamation - removal from the surface of the epithelium of cells (horny scales), damaged and containing microorganisms on their surface.

Epithelial cells, in particular interstitial cells (IEC), provide the maximum number of contacts with antigens on the surface of the COP. The main function of interstitial cells is their barrier role, which is determined by the intercellular interaction of epithelial cells with each other and with the microenvironment. The ability of antigens to cross this barrier is regulated by soluble mediators, including permeability-enhancing cytokines (IL-4, IL-13, TNF) and barrier-enhancing cytokines (IL-6).

Cytokines have pleiotropic biological effects on various types of cells, mainly participating in the formation and regulation of the body's defense reactions. Being synthesized in the focus of inflammation, cytokines act on almost all cells involved in the development of inflammation, including granulocytes, macrophages, fibroblasts, endothelial and epithelial cells, and then on T and B lymphocytes.

Specific receptor molecules (polymeric immunoglobulin receptor for IgA and IgG) are involved in the intercellular transport of antigens and their fragments directly to the surface of epithelial cells. The barrier properties of the COP epithelium are enhanced by the production of cationic proteins by its cells, defenzymes - peptides with a wide spectrum of antimicrobial activity.

The oral cavity also has its own local immunity, which plays an important role in protecting against infections. Its consistency depends on many factors:

1. The integrity of the mucous membrane.
2. The content of immunoglobulins A, G, M.
3. Quantitative and qualitative characteristics of saliva. The oral fluid contains:

• lysozyme (breaks down peptidoglycans of bacteria, causes osmotic lysis and death of microorganisms);

• lactoferrin (captures iron ions of the microbial cell, inhibits the respiratory function of bacteria);

• fibronectin (has adhesive properties, opsonizes pathogenic microorganisms, activates complement in the classical way);

• defenzymes (bind to the cytoplasmic membrane of bacteria, form pores in the membrane - cause cell death);

• neutrophils;

• secretory IgA. 4. The state of the lymphoid tissue.

The mucous membrane takes part in providing local immunity, which, along with the protective antimicrobial properties of the oral fluid, the presence of phagocytes between the cells and epithelial rows and in the connective tissue, ensures rapid restoration of structures in case of damage. In the epithelium of the COP, a large number of neutrophils are found, which migrate from the vessels of the lamina

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propria of the mucous membrane and retain high functional activity on the surface of the epithelium. Among intraepithelial lymphocytes, T-helpers 1 and T-helpers 2, cytotoxic T-helpers, B-lymphocytes are found.

An important component of protection areimmunoglobulins - IgG, IgA, IgM. They are determined in saliva, in the fluid of the gingival sulcus in free form; in bound form, they form immune complexes and are eliminated by phagocytes. The greatest amount of immunoglobulins is contained in the connective tissue of the gums, richly supplied with microvessels. Immunoglobulins enter saliva by passive diffusion, mainly in the area of the tooth-gingival sulcus, as well as between the epithelial cells of the gums.

In the oral cavity, the main secretory immunoglobulin is sIgA, which has the ability to bind exotoxins. SIgA is the most resistant to enzymes, therefore it is found in the highest amounts in saliva. A small amount of IgG is produced by the plasma cells of the gingival mucosa. Immunoglobulins can be in the oral cavity both in a free state and in a bound state, being adsorbed on the surface of lymphocytes, neutrophils, and epithelial cells. In addition toimmunoglobulins, saliva contains a small amount of complement components C3 and C4, which get there from the bloodstream through the periodontal sulcus. In the etiology and pathogenesis of a number of pathological processes in the oral cavity, a significant role is assigned to the microbial factor (representatives of saprophytic and opportunistic microflora).

Most of the dental diseases manifested on the oral mucosa do not have a specific pathogen and develop as a result of the colonization of autoflora and a decrease in the natural factors of the body's immunological resistance. Of all the factors that determine the nature and condition of the oral flora, saliva is decisive. In the oral cavity, bacteria are found in the following areas: saliva, dental plaque on the surface of the teeth, the periodontal sulcus, on the back of the tongue, on the surface of the mucous membrane

According to various authors, almost 30 microbial species are described as residents of the oral cavity. About 60% of the resident microflora are facultative and obligate-anaerobic streptococci, including Str. mutans and Str. sanguis are present on the teeth; Str. mitis, Str. mutans, Str. salivarius - on the mucous membrane of the cheeks; Str. salivarius - on the tongue. Of the anaerobic representatives, the resident microflora is represented by peptococci, veillonella, diphtheroids, neisseria, bacteroids. Actinomycetes, staphylococci, lactobacilli, spirochetes, leptospira, fusobacteria, spirilla, yeast-like fungi are found in the oral cavity in much smaller quantities.

Lactobacilli (L.acidophilus, L.brevis, L.fermentum) are important representatives of the normal microflora of the oral cavity. The role of microflora in the life of the body is great. Its positive effect is manifested in the stimulation of the immune system, participation in the synthesis of necessary substances, the absorption of iron and calcium salts. In cases of violations of the barrier function of the mucous membranes, a decrease in natural resistance, many representatives of the normal

microflora can lead to destructive processes of the mucous membrane, either complicating or independently causing various pathological conditions.

The microflora of the oral cavity plays an important role in the formation of nonspecific defense factors, and shifts in the species composition of microorganisms towards the pathogenic flora reflect the presence of immunobiological disorders. The number of microorganisms in the oral cavity changes during the day, with the leading role played by the production of saliva, which ensures the normal functioning of the organs of the oral cavity saliva.

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