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Hnidyk J.V.
Department of normal anatomy. Danylo Halytsky Lviv National Medical University, 79010 69 Pekarska Str., Lviv, Ukraine; julya.h@hotmail.com

CHANGES OF THE HEMOMICROCIRCULATORY FLOW AT THE MOUTH CORNER AND LIPS AT THE LATE STAGES OF EXPERIMENTAL STREPTOZOTOCIN-INDUCED DIABETES

Abstract. *This paper highlights the changes in the structure of the mucous membrane of the lips area and the mouth corner and the links of their hemomicrocirculatory bed at the ultrastructural level in the late stages of the experimental streptozotocin-induced diabetes. A significant deterioration of trophic causes the violation of the ultrastructure of epithlial plate and the structures of lamina propria. Submicroscopic changes in the blood vessels of the mucous membrane of the mouth corner in the experimental streptozotocin-induced diabetes were noticed within the terms of the experiment data. They indicate significant violations of the histohematogenous barrier and transcapillatory exchange. This makes it possible in the future to obtain new information about the pathogenesis and the dynamics of changes in tissues and organs at different stages of the course of the experimentally simulated pathological process. Such data may have practical application in the future studies to serve the development of diagnostic and preventive measures for this disease.*
Keywords: *lips, mucous corner, rats, diabetes mellitus, capillaries.*

Introduction. Diabetes mellitus is one of the most common diseases of the endocrine system, the subject of numerous scientific studies.

In modern diabetology the most topical and complex problem is affection of the capillary network, like causing factor. Diabetic microangiopathology is considered like generalized affection microcircullary flow, which is visible almost in all organs and tissues. In this case, experimental studies of the dynamics of structural transformations in the diseased organs and tissues in experimental models using morphological techniques is not enough. These studies make it possible to obtain new information about the processes of the pathogenesis of this disease [1, 2, 3]. Experimentally determinated results are important for practical applications, first of all, in order to develop new diagnostic and prophylactic measures in the treatment of diabetes [4, 5, 6, 7]. In this regard, we have carried out experimental and morphological study whose purpose was to study the ultrastructural morphological features of the structure of the mucous membrane of the lips, corner of the mouth and links of their hemomicrocirculatory bed in the early stages of experimental flow of streprozotocin-induced diabetes.

Objective: The aim of the study was researching processes of the morphological transformation at the ultrastructural level of the lips mucous membrane and mouth corner, and links of their hemomicrocirculatory flow in the course experimental streptozotocin-induced diabetes. Determining and providing analyses of the results to obtain new information about the processes of the pathogenesis and highlight the changes in the tissues on the different levels.

Materials and methods. When we selected an experimental model we used the recommendation of TG Teton and Soave [8], which is characterized by its adherence to sreptozotocin a new model of diabetes, the most common, adequate and up-to-date. Experiments were performed on 48 adult rats – males weighing 100-130g. All animals were kept in a vivarium in accordance with the "Rules of the use of experimental animals". Fence and training material for electronic microscopy was performed after euthanizing the animals with intraperitoneal injection of a solution of sodium thiopental 25 mg per 1 kg body weight. Before the fence material of mucous of lips and the corner of the mouth was examined with the use of light-refracting magnifying glass. Electron microscopic studies were performed in accordance with generally accepted by the Rules [9, 10]. Studying and photographing of the material was carried out using a microscope UEMV – 100K (Ukraine) at an accelerating voltage of 75 kV and the increase in the screen of 2000x Microscope – 124000h.

Results and discussion. At the end of the

eighth week course of streptozotocin indused diabetes during ultrastructural studies of the mucosal lip we have found out that there are significant changes in the cells of the epithelial layer (Fig. 1).

Among the basal epithelial cells, the nuclei of irregular shape due to deep invaginations of kariolema are visible. Karyoplasm osmio-core, because of heterochromatic regions, the nucleoli are compact, of small dimensions. These manifestations are the result of display of low functional activity of the nuclei. There are also manifestations of damage to the cytoplasmic organelles. In the basement membrane there are poorly circumscribed areas with little polydesmosom. Lamina propria of the mucosa of the lips is swollen, there is predominance of bright amorphous component. Part of the basal epithelial cells have a nucleus of a large area, which are dominated by karyoplasm of euchromatin and nucleoli are present. Some hypertrophied mitochondria are determined simultaneously by the presence of distinct organelles and Kristen.

The channel links of hemomirocirculatory mucosa of the lip at the end of the eighth week course of diabetes were significantly changed. (Fig. 2).

A separate group was sharply reduced of capillary lumen diameter, and some of these capillaries were not detected at all. The cytoplasm of endothelial cell was swelling, it was rendered separately from the damaged organelles of vacuoleshaped with a light – mitochondrial matrix theory, fragmented tubules of the granular endoplasmic reticulum and a small amount of pinocytosis vesicles. Separate cytoplasmic portions homogenized, they lack of organelles, no microvilli on the lumenal surface of endothelial cells. The basement membrane uneven in thickness, much thicker in some places. Pericytes and adventitial cells, largely changed. They contain pyknotic nuclei with a predominance of heterochromatin within karioplazma. In the cytoplasm, hypertrophic mitochondria were determined with areas of light matrix and disrupted cristae. The remaining few organelles are damaged. Perivascular spaces are swollen, they are with fibrous connective tissue, dominated by bright amorphous components, bundles of collagen fibers which are arranged loosely.

Ultra-microscopic study of the mucous

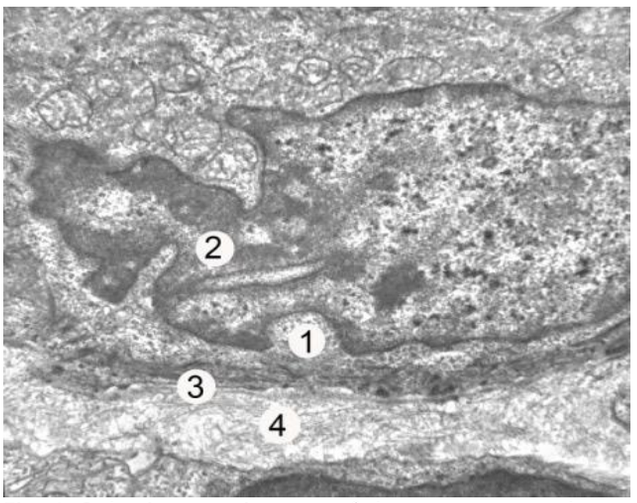

Fig. 1. Submicroscopic state of the mucous membrane of the lips at the end of the eighth week. SW. x 8000. 1. Basal epithelial cell; 2. Nucleus with deep invaginations; 3. Base of the membrane; 4. Lamina propria

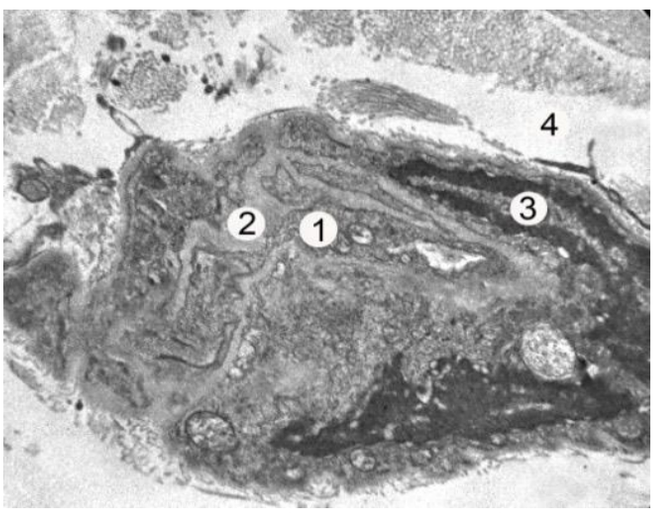

Fig. 2. Ultrastructure of blood capillary of lip mucosa at the eighth week. SW. x 7000. 1. Cytoplasm of endotheliocyte; 2. Thickened part of the basement membrane; 3. Osmiocore miofilament perisytes; 4. Perivascular space.

membrane of the mouth corner at the end of the eight – week course of my experimental streptozotocin induced diabetes is thinned, considerable damage to all layers of epithelial cells is visible(Fig. 3).

We could trace via basal epithelial cells with a small nucleus osmiophil of irregular forms. Their reflection of low functional activity of the nuclei. Significantly subjected to karyoplasm is osmiophilic due to heterochromatic regions. These manifestations are damaged organelles in the cytoplasm of these cells. Swollen mitochondria acquire electrontransperant matrix, cristen practically destroyed, as to make them vacuoleshaped. The basement membrane areas

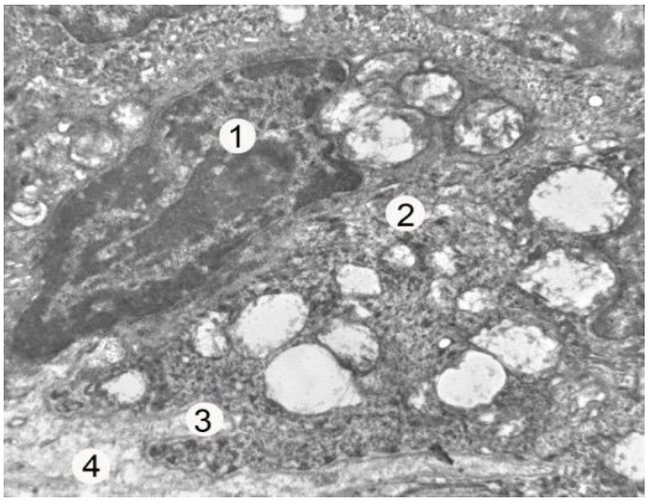

Fig. 3. Submicroscopic state of the mucous membrane of the mouth corner at the eighth week. SW. x 12,000. 1. Core; 2. Cytoplasm of epithelial cells of the basal; 3. Basal membrane; 4. Lamina propria.

are poorly contoured, semidesmosomes found, little do they clear. Lamina propria of the mucous membrane forms the nipples, electron light, edematous dominates the amorphous component.

Ultrastructural study of the mucous membrane of the mouth corner at the end of the eighth week of diabetes revealed significant changes in the levels of hemomicrovascularisation (Fig. 4).

Part of the capillaries, as in the previous period, have a reduced lumen diameter and wall thickening. The cytoplasmic region of the endothelial cells is thickened, cytolemma considerably uneven due to invangination and protrusions. Oblong nuclei have numerous invaginations of kariolema and heterochromatic regions of karyoplasm. Nuclear membranes are poorly circumscribed, nuclear pore is little. In endoteliocytes organelles are destructively changed. Tubules of the granular endoplasmic grid expanded unevenly and partially fragmented. Mitochondria are with the enlightened matrix and they contain damaged cristae. There are few ribosomes in the cytoplasm, policy and pinocytosis bubbles. The basement membrane is poorly contoured. In edematous, perivascular spaces of electron-light amorphous component are dominant, there are a few fibral structures. Damage of adventitial cells and fibroblasts is present.

At the end of the tenth week of the course of streptozotocin-induced insulin-dependent diabetes mellitus during ultrastructural studies of the mucosal lip we found that the basal membrane of such areas is clear, poludesmosomes are present, but the connective tissue of the lamina propria of the mucous membrane is swelling, it is dominated by bright amorphous components (Fig. 5).

Spinous layer of epithelial cells has signs of pathological transformation. The presence of cells that contain nuclei s deep invanginal of karyotheca , which gives them an irregular shape (Fig. 6).

Epithelial cells present at this stage have a round nucleus which is increased in size, in their karyoplasm there is a duplication of the nucleoli. In the cytoplasm there is high concentration of ribosomes and polyribosomes. Intercellular space is not as changed as in the epithelial layer in the pre- term experiment (Fig. 7).

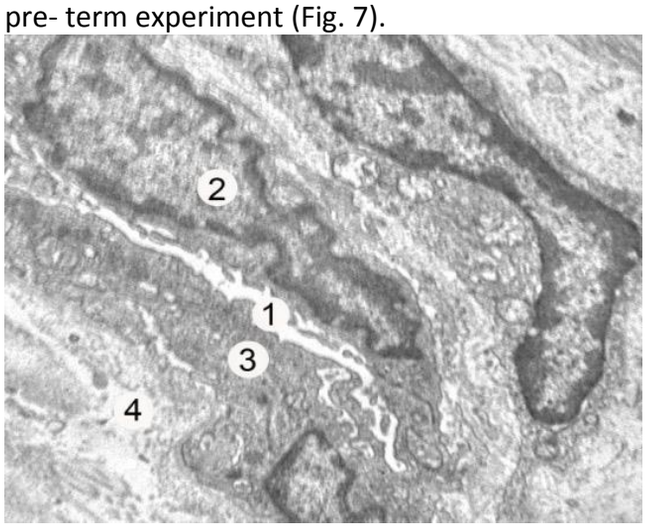

Fig. 4. Ultrastructure of the blood capillary of cavity mucosa of rat's corner at the end of the eighth week. SW. x 7000. 1. Reduced clearance; 2. Core of endotheliocyte; 3. Endotheliocyte of cytoplasm; 4. Pperivascular space.

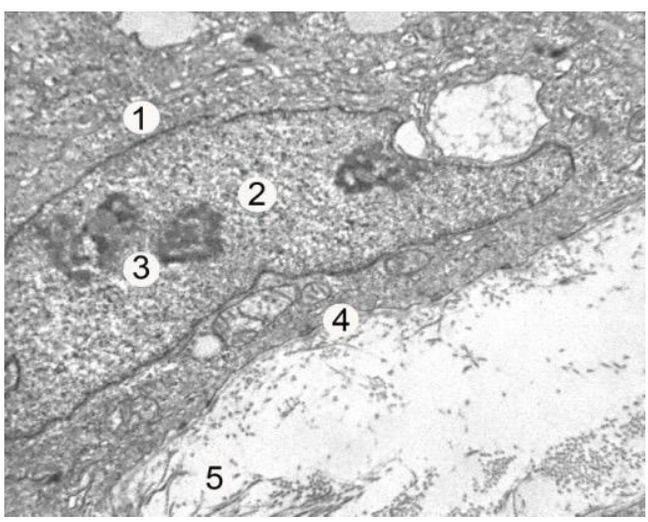

Fig. 5. Submicroscopic state of the mucous membrane of the lips at the end of the tenth week. SW. x 8000. 1. Cytoplasm of epithelial cells of the basal membrane; 2. Core; 3. Nucleolus; 4. Basal membrane; 5. Lamina propria.

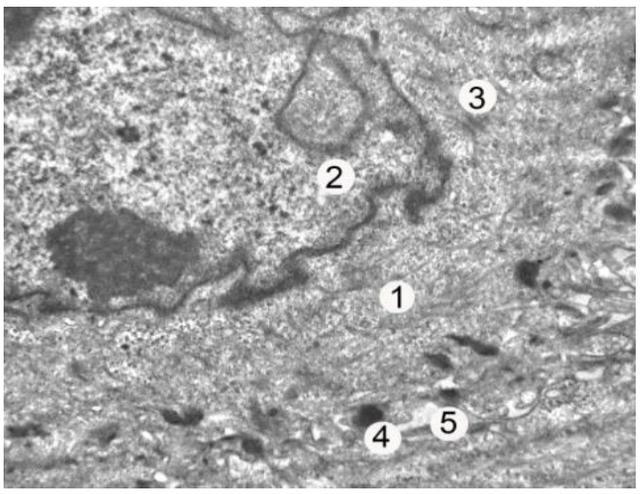

Fig. 6. Ultrastructural changes of lip mucosa of rats after the tenth week. SW. x 10 000. 1. Spinous of epithelial cell; 2. Nucleus with invaginations of kariolema; 3. Bundles of tonofilaments; 4. Desmosome; 5. Intercellular space.

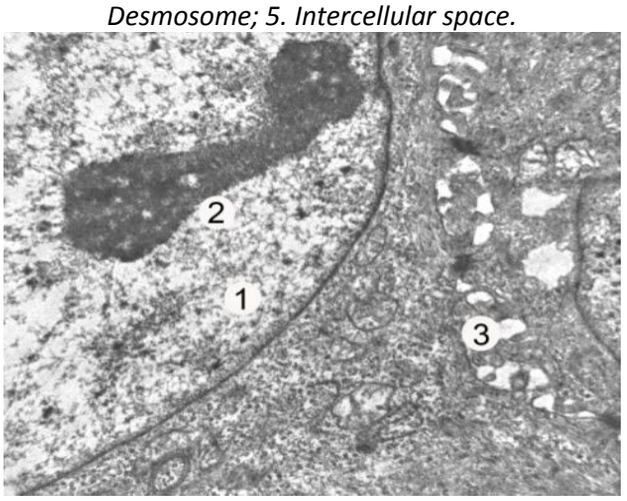

Fig. 7. Ultrastructural changes of lip mucosa after the tenth week. SW. x 12,000. 1. Neural epithelial cells of the nucleus; 2. Nucleolus; 3. Nntercellular space

Similar ultrastructural changes are determined in the endothelial surface layer. Thus, in terms of the terminal course of experimental streptozotocin-induced diabetes mellitus in the lining of the mouth we have visualized the Vanir as significantly altered epithelial cells and functionally active cells.

Ultrastructurally, we have identified capillaries that changed less in the pathological process in the structure of the wall (Fig. 8).

In endothelial cells there are elongated nucleus with signs of intussusception kariolemy core, with a rosary like contours of kariolemy and euchromatin in karyoplasm. Heterochromatin was localized at the periphery which had been synthesized near kariolema. The cytoplasmic regions of endothelial are of various thickness, contain many microvilli, some of which are of the oval form with the presence of pinocytosis vesicles. The number of small organelles, the mitochondria can be traced to the slightly exaggerated expression E signs of osmiophil matrix and a clear outline of cristae. The basal membrane of relatively uniform thickness and rather narrow. There are perivascular spaces around such small capillaries, they appear as thin microfibrils. Such a state is a separate part of the blood capillary that displays their increased functional activity. Thus, at the final stages in the course of the experimental streptozotocin-induced diabetes mellitus in the capillaries of the mucosa of the lip we found them significantly altered by the pathological process of capillary and functionally active part of them.

Spinous layer of epithelial cells with abnormal areas of the basal hyperglycemia (Fig. 9).

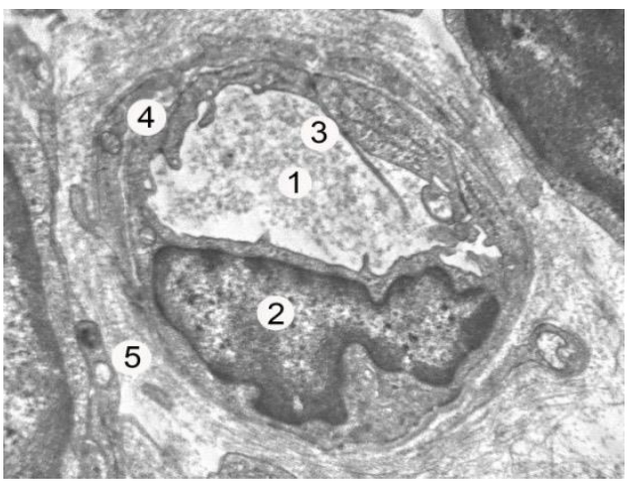

Fig. 8. Ultrastructure of blood capillary of lip mucosa after the tenth week. SW. x 9000. 1. Capillary lumen; 2. Core endotheliocyte; 3. Cytoplasmic domain with microvilli; 4. Basement membrane; 5. Perivascular space.

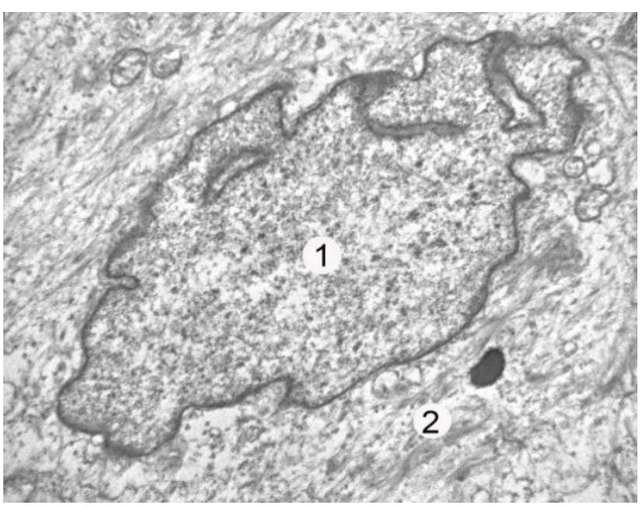

Fig. 9. Ultrastructural changes in the corner of the mouth mucosa after the tenth week. SW. x 10 000. 1. Neural epithelial cells of the nucleus; 2. Bundles of tonofilaments

There are cells with nuclei of irregular shape formed by the deep invaginations of karyotheca. In the cytoplasm, bundles of tonofilaments are quite visible. In some epithelial cells, the formation of conglomerates of osmiophil concentration of irregular shape is observed, which resembles eleidin in the cells of the stratum – present epithelium (Fig. 10).

Between epithelial cells and superficial spinous layers we have ascertained a significant enlargement of the intercellular spaces and damage to the desmosomal contacts (Fig. 11). In edematous perivascular spaces, electron-light amorphous component with a low content of fibrillar structures is dominant. Damaged adventitial cells and fibroblasts are seen.

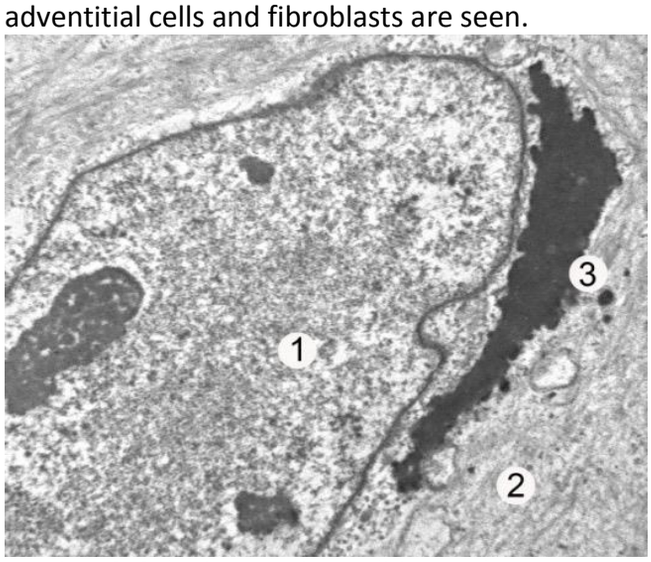

Fig. 10. Submicroscopic condition of the mucous membrane of the mouth corner at the end of the tenth week. Uv.h 12,000. 1. Core; 2. Cytoplasm of epithelial cells of the spinous layer; 3. Osmiophil structure.

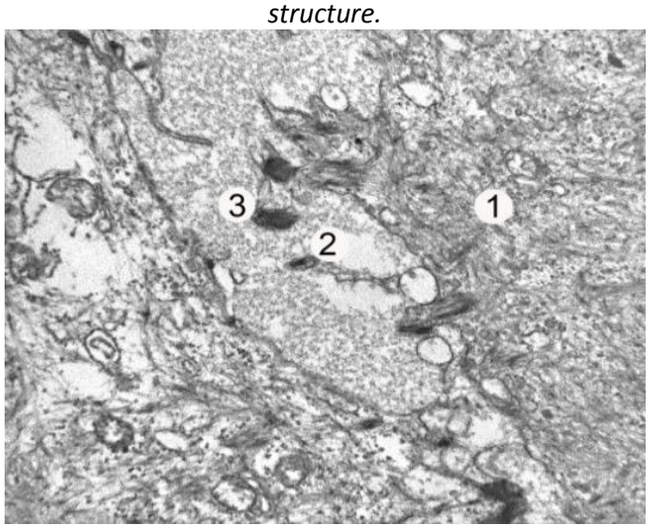

Fig. 11. Submicroscopic condition of the mucous membrane of the mouth corner at the end of the tenth week. SW. x15 000. 1. Cytoplasm of epithelial cells of the spinous layer; 2. Enhanced intracellular space; 3. Destructive changes of desmosome

Ultrastructural study found that the wall of the capillary slightly changed and the gaps are reduced in diameter. Endothelial cells of elongated shape with sharp contours and kariolemy euhromatin in karyoplasm. Some cytoplasmic region of endothelial cells have uneven thickness and contain pinocytic vesicles. Part of the organelles is damaged, mitochondria are hypertrophied with signs of enlightenment matrix with a non- significant number of cristae. The basement membrane is rather narrow and relatively thick. In the perivascular spaces, fibroblasts with large nuclei are defined, mitochondria, hypertrophic, dilated tubules of the granular endoplasmic reticulum, Golgi cisternae and ribosomes (Fig. 12).

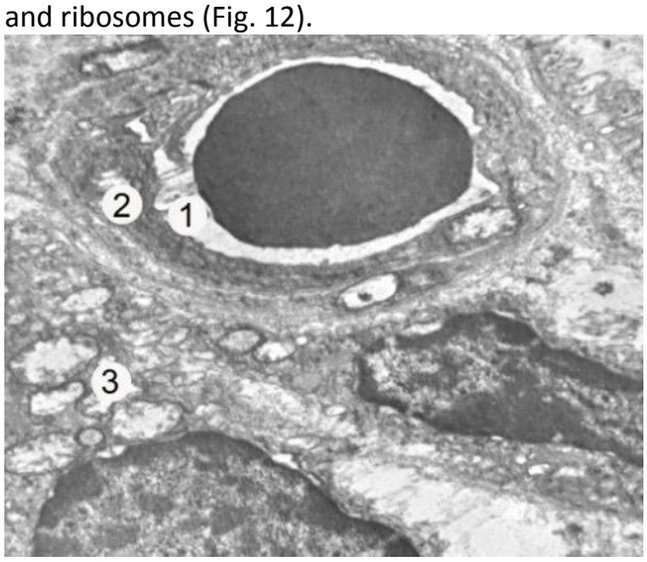

Fig. 12. Submicroscopic blood capillary state of the mucous membrane of the mouth corner at the end of the tenth week. SW. x 9000. 1. The lumen of the capillary with red blood cells; 2. Cytoplasm endotheliocyte; 3. Fibroblasts.

The model of streptozothocine induced diabetes create conditions close to real disease, helps in modeling an effects on organs and opened new datas occurred at the result of pathological process. Thus, at the later stages of the pilot course of streptozotocin-diabetes in the new record of epithelial mucosa of the mouth corner we established a significant change in all cell layers. By the end of 8th and 10th weeks of the experiment, lesions grow are characterized by disorganizational processes in the cells of the mucous membranes, the expansion of intercellular spaces as a consequence of damage to the desmosomal connections, change the lumen of the capillary endothelial cells of deconstruction. The wall of the capillary slightly changed and the gaps are reduced in diameter.

Endothelial cells of elongated shape with sharp contours and kariolema with euhromatin in karyoplasm. Some cytoplasmic region of endothelial cells have uneven thickness and contain pinocytic vesicles. Part of the organelles is damaged, mitochondrion are hypertrophied with signs. The basement membrane is rather narrow and relatively thick.

Installed reorganization of epithelial cells is significantly associated with impaired trophic and processes themselves with destabilization of metabolic processes. At the same time we have been ascertained slight signs of reparative regeneration, requiring corrective surgery.

Thus, the remote timing of occurrence of diabetes in the experimental blood capillaries of mucosa of the mouth and lip corner set various processes raising structural rearrangements, mainly capillary. These processes occur as a result of violations of trophic and metabolic destabilization that require medical correction.

Conclusions and the prospect of future research. It is common knowledge that the level of disease of the mouth tissues in the world ranges from 65% to 98%, and their destruction has a direct relationship with the state of physical health, including the state of the endocrine system. Since diabetes is one of the most common endocrine diseases, the process of the experimental study of the dynamics of morphological changes of various tissues on models by methods that are of limited use in the lifetime study of patients is extremely relevant today. This makes it possible in the future to obtain new information about the pathogenesis and the dynamics of changes in tissues and organs at different stages in the course of the experimentally simulated pathological process. Such data may have practical application in the future studies to serve the development of diagnostic and preventive measures for this disease.

Therefore, we believe that this study is important in terms of both experimental and morphological studies and from a practical point of view, because the data can be considered and used both in paradontology and endocrinology practices.

References:

1. Tattersall R. Diabetes: The Biography.Tattersall R. Oxford: Oxford University Press: Science and Technology. Medical Science. 2009: 240.

2. Balabolkin MI, Klebanov EM, Kremynskaya VM. Dyfferencial Diagnosis and Treatment endocrine diseases. MIA. 2008: 752.

3. Hohyn EE. Violation microcirculation in hypertonycheskoy disease, atherosclerosis, Saharna Diab. Hohyn EE. Ter. Archive. 2011; 83 (4): 5-13.

4. Kryvko YY, Mateschuk-Vatseba LR, Mass S.Ultrastructural links hemomikrocirculatory channels in normal and in experimental diabetes. Journal of Morphology. 2010; 16 (2): 397-401.

5. De la Rosa García E, Mondragón Padilla A, Aranda Romo S, Bustamante Ramírez MA. Oral mucosa symptoms, signs and lesions, in end stage renal disease and non-end stage renal disease diabetic patients. Med. Oral Patol. Oral Cir. Bucal. 2006; 1 (11): 467-473.

6. Christen U, Bender C, von Herrath MG. Infection as a cause of type 1 diabetes. Curr. Opin Rheumatol. 2012; 24 (4): 417–423.

7. Luscher TF, Rubanyi GM, Masaki T. et al. Endothelial control of vascular tone and growth. Supplement to Circulation. 1993; 87 (5): 1-3.

8. Tyton VG, Evseenko AA, Admazhyyan F. Models of diabetes mellitus, their selection and use. Biopolymers and cells.1999; 15 (12): 103-108.

9. Glauert AM. Fixation, dehydration and embedding of biological specimens. In Practical methods in electromicroscopi. North-Hollond (American Elsevier). 1975; 207.

10. Stempac JG, Ward RT. An improved staining method for electron microscopy. Cell Biology. 1964; 22: 697-701.