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EFFECT OF EXTERNAL AND INTERNAL BODY ENVIRONMENT ON THE GINGIVAL TISSUE (literary review)

Abstract. *The article presents the effect of different factors of the external and internal environment on the gingival tissue within the span of human life.*
Key words: *proteolytic activity, periodontal tissue, hypoxia, man.*

Within the span of human life the gingival tissue experiences continuous traumatic action of the external factors: physical (mechanical injuries while cleaning the teeth, chewing food), chemical (food components), temperature (food, drinks, expired air) and microbial oral environment. Therefore, physiological resistance of the gums experiencing continuous load results in weakening of the resistance of the oral cavity tissues and does not provide their stability against the action of pathogenic factors [1].

In all the cases the effect of various factors on the body finally results in decreased oxygen supply to the tissues inadequate to maintain metabolism functions and cellular structure. The resistance of the gingival epithelium to the action of continuous physiological damaging agents is found to be determined by the system of protective mechanisms [1]. In the process of regeneration of the gingival epithelium and elimination of the damaged cells in addition to the processes of lipid peroxide oxidation (LPO) and protein oxidation modification the processes of the tissue proteolysis play an important role in particular [2]. A number of works demonstrated that general proteolytic activity increases in pathologically changes gums [3].

Among the external factors causing systemic (organ) changes in the protective system and eventually alter physiological resistance of the periodontal tissues hypoxia deserves certain attention.

Hypoxia is one of the universal mechanisms to mediate the external environment action on the cells performing both adaptogenic and pathogenic effect on different levels of the body.

Hypoxic effect "wakes up" dynamic body reserves of the man and animals inhibited by the existing monotonous conditions [4]. Physiological hypoxia developing in the body in case of intensive physical work is a natural training factor for both functional systems and the whole body. Moderate hypoxia under conditions of highlands plays a role of biological stimulator of the structural and functional adaptation body response. Recently the approach to exogenous hypoxia as a training adaptogenous environmental factor has deserved more attention of both theoretical and practical medicine [5].

There is no need to mention here that decreased oxygen supply to the tissues (irrespective the type of hypoxia) lower than that of physiological levels results in oxidative stress. It refers to the periodontal tissue completely. At the same time, nowadays leading scientific stomatological journals of the world attract their attention to the fact that hypoxic stress is a cause of genetic changes on the molecular and cellular levels, and these changes available provide understanding of epigenetic re-programming caused by hypoxia.

In the process of adaptation to low partial pressure (hypoxia) transcriptional induction of formation of a number of factors (genes) occurs in cells and tissues participating in angiogenesis, metabolism of iron, glucose and proliferation of cells, that is their survival. Hypoxia induced factor (HIF) promotes survival of healthy endothelial cells and tumor cells, and therefore inhibition of

HIF activity can have a therapeutic effect [6].

Hypoxia induced factor (HIF) is sensitive to oxygen content transcriptional factor participating in modulation of gene activity. HIF-1 was discovered while searching factors responding to hypoxia at the end of 80-s (Goldberg, 1988) and called HIF-1 in the middle of 90-s (Wang, 1995) of the last century [7].

Nowadays HIF-1 is known to be a heterodimeric protein complex consisting of HIF-1 and HIF-1β subunits and regulate expression of a number of genes. It is a key link of the intracellular hypoxic signal and regulator of gene transcription involved in the molecular-cellular mechanisms of adaptation, growth, proliferation and differentiation of cells [8, 9].

The scientific literature dealing with this factor is indicative of an important role of HIF-1 factor in pulmonary hypertension, myocardial ischemia, oncologic and other processes. HIF-1 is considered to be a factor of peripheral adaptation influencing by means of stimulation of erythropoiesis, glucose utilization, tissue respiration, thermogenesis and other processes, and possess neuroprotective action in particular. At the same time, HIF-1 activity is caused by a subunit which is quickly ruined in case of normoxia, and under conditions of hypoxia when enzymes destructing it are inactivated, stabilizes followed by translocation into the nucleus. Analytical literary reviews deal with an important role of factors (induced by hypoxia 1-alpha factor – HIF-1, taphtalin), belonging to the genes sensitive to oxygen and appear in mesenchyme stem cells under conditions of hypoxia [10, 11]. The results are indicative of an important role of HIF-1 in the mechanisms of formation of hypoxic brain tolerance induced by pre-conditioning by means of triple hypobaric hypoxia.

HIF-1 is a factor regulating oxygen homeostasis, especially when interrupted interval hypoxia is applied. Long interrupted hypoxia (35 days) stimulates HIF-1 expression in the genioglossal muscle, decreases muscle resistance to the development of fatigue. Estrogens inhibit excessive HIF-1 expression, and it can explain improved muscular resistance of the upper respiratory tract in rats to long interrupted hypoxia under estrogen effect [12].

Experimental studies conducted on rats found considerable differences of hypoxia level and HIF-1 expression in the epithelium of the skin wounds and mucous membrane of the oral cavity.

Skin wounds appeared to be more hypoxic and contain a high level of HIF-1 in comparison with the mucous membrane of the oral cavity. Moreover, under conditions of stress, epithelial skin layer responded by further increase of HIF-1 (compared with the condition without stress). Other series of investigations found that hyperbaric conditions of keeping animals did not change HIF-1 expression considerably, either in skin wounds or epithelium of the oral mucosa. The authors suggest that specific differences in angiogenesis of the skin and oral mucosa cause different levels of sensitivity to hypoxia and HIF-1content: skin wounds have higher hypoxia level and HIF-1, than those of the mucous membrane of the oral cavity [13].

The studies conducted on people are of certain interest in this respect. Healing of wounds of the oral mucosa is known to be completed by minimally marked scarring in comparison with the similar process on the skin. Fibroblasts of the oral mucosa are considered to possess this increased property due to “young restoration” phenotype, that is, another expression profile of genes compared with the similar ones in the skin cells [14].

Insufficient attention is mentioned to be drawn to older age groups of patients suffering from periodontitis. The experiments conducted on monkeys (Macaca mulatta) found a low expression of anti-apoptotic genes in the gingival tissues of young animals as compared with the old ones [15].

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