EFFECT OF NONREMOVABLE ORTHODONTIC TECHNOLOGY ON ENDOTHELIAL DYSFUNCTION OF PERIODONTAL TISSUE

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Nonremovable orthodontic technology (NOT) is increasingly used in modern orthodontics in the treatment of dentofacial anomalies. Force effect directed to the abnormally spaced teeth can cause pathological changes in the periodontal tissues. In this prolonged pressure on the periodontal tissue leads to changes in the microovasculature (MCB) in these patients, which can not be displayed on the status of endothelial function. In this regard, particular importance is research concerning the choice of methods and means of prevention of dental diseases, aimed at improving the resistance of periodontal tissues in the treatment of patients with dentoalveolar anomalies. Given the long wearing NOT, methods of maintaining tissue homeostasis look promising non-pharmacological means, in particular the use of natural factors. It is to such biologically indispensable refers sunlight. Technology use its most effective component - polychromatic polarized light bioptron - called light therapy. The mechanism of therapeutic action are positive biophysical effects due to the properties of light generated bioptron machine, also referred as polarized, polychromatic, incoherent, low intensity light. The aim of our study was to investigate the impact of nonremovable orthodontic technology on endothelial function of periodontal tissues and to explore ways of its correction.

The study was performed on 80 experimental animals (rabbits breed Dutch males aged 9 months), which were puts the braces with opening spring. Animals of the comparison group (24 rabbit) did not receive any additional therapy. Animals of the first group studied (rabbit 24) received therapy session Bioptron lamp for 4 minutes. Second animal study group (24 rabbit) put applications Tivortin (donor nitric oxide). 8 animals in each group were deduced from experiment for the 2nd, 4th, 6th day in accordance with international standards bioethical research on animals. In addition to

the comparison group and the two study groups was allocated us intact group of animals (8 rabbits) that braces were not staged. These animals are in the control group.

After removal of the experiment rabbits, periodontal tissues were were stained with hematoxylin and eosin, according to van Gieson and Rego. Immunohistochemical study was performed by placing the indirect immunoperoxidase reactions with monoclonal antibodies to endothelial fractions and inducible NO-synthase (eNOs iNOs and accordingly) from Thermo scientific. The slides were studied under the microscope "Olympus BX -41" followed by the program "Olympus DP-soft version 3.2", which was carried out using morphometric study.

In the study derived from rabbits subgroups experiment on day 2 revealed that in the control group when compared with the intact group drugs, there are marked changes in the morphofunctional state MCB periodontal and as a consequence, in periodontal tissues. Bloodstream uneven blood supply, amid empty vessels present dramatically expanded, filled with blood. Noted the presence of small clots in the lumen of blood vessels. Besides microthrombuses localized in postcapillaries and venules.

After analyzing animal drugs comparison group derived from the experiment at different times can be stated that the use of HOT leads to significant changes in the MCB of periodontal tissues, which are exacerbated by increasing the term staging NOT. Study reveals microangioarchitectonics change in the course of vessels, increase their tortuosity strain contours, increased permeability of the walls, as well as a decrease in their per unit area with the formation reduced vessels zones and an imbalance between the ways of the ebb and flow of blood, as well as changes in the number and type of organization vessels. Last topic focuses mainly capillaries, characterized by a progressive decrease with time the number of network microvessels due to their "empty" and the formation of a large number of "loop-like" shape of the main types of capillaries. The latter may be an indication of the metabolic processes of transition to a lower level of security.

At the same time restructuring the MCB is unidirectional, both in compression and away from it, although the degree of vascular response is different. Spasm of

arterioles precapillaries, collapse of capillary dilatation and efferent microvessels tricks hemorrhages are most pronounced in the compression zone, the distance from the zone of compression severity described processes decreases, however, areas without such changes have been identified.

When setting the peroxidase reaction to endothelial NO-synthase in the comparison group decrease endothelial staining structures. Endothelium with stained more intensely than the surrounding tissue, but a clear linear staining was observed. Simultaneously observed diffuse staining not only perivascular areas, but also tissues distant from the vessels. At the same time there have been areas of almost complete absence results immunohistochemical reaction. Apparently, this group celebrated oppression eNOs directly in the endothelium against the backdrop of some activation in periodontal tissues.

While reducing the intensity of staining agents eNOs, observed activation iNOs with the advent of diffuse staining of periodontal tissues. Study drug treatment groups shows that the use of light therapy and Tivortin favorably affects morphofunctional state of soft tissues. In each subgroup, a decrease ischemia zones, reducing the intensity of edema, lower severity of cellular response to the statement NOT.

Favorable effects of light therapy and Tivortin can be explained by positive changes morphofunctional state MCB endothelial status. Thus, the study of animals derived from the experiment on day 2 found that in the groups studied blood suply vascular bed more uniform compared to animals not receiving any therapy, vascular emptity and slept little, no sharply expanded vessels, blood clots are rare, no signs of edema.

In groups of animals derived from the experiment on the 4th day of uniform blood supply vessels, perivascular hemorrhage absent, the distribution of vessels in the lamina propria uniform. In animals, derived from the experiment on the 6th day of the MCB condition with fewer changes compared to animals receiving no treatment. MCB vessel density is uniform enough, spasm of arterioles, capillaries precapillaries and slept in these groups are virtually none. Dilatated capillaries are isolated, no hemorrhage. When staining with Rego ischemia zone insignificant. Identify activity

eNOs indicating the restoration of its synthesis, while activity iNOs moderately expressed.

Described changes morphofunctional state MCB confirmed by morphometric analysis. Comparison of morphometric data on the stages of simulation showed that the net MCB groups receiving corrective therapy takes a larger specific volume as the application Tivortin and light-therapy (the difference is from 25,64 ± 4,32% at deduced on the second day of the experiment to 49,84 ± 6,82% at deduced on the sixth day of the experiment, $p < 0.05$ in all groups). Vessels of different diameter as well in animals treated and untreated correction. By the second day of the most significant increase in the diameter, compared with the comparison group, observed in the capillaries under the application of periodontal Tivortin (at 23,41 ± 3,64%,), to a lesser extent when the arterioles phototherapy (at 16,27 ± 3,52 %, $p < 0.05$).The described changes are confirmed and cytophotometry which indicates a greater intensity of accumulation of endothelial NO-synthase in vessels of animals treated with light therapy and Tivortin.The results of the peroxidase reaction with inducible NO-synthase fraction showed an even greater difference in the groups studied. In the comparison group expressed staining observed with the presence of areas of greater and lesser intensity distribution pattern which reveal only a fraction preparations with inducible NO-synthase fails. Cytophotometric study shows a significant reduction of almost twofold reaction to iNOs in the groups studied.

Thus, we can assume that the basis of all links MCB recalibration when applied NOT make changes relations between large and small vessels periodontal increase of the fine in the resistive and exchange links and major in offtake. This fact, in our opinion, we conclude that occurs resorption of water from the vascular bed. Compression stress exposure period lead to increased tone of precapillary sphincters and smooth muscle arterioles, that this, in turn, accompanied by circulatory decompensation atoniej capillaries. Part of the plasma and blood cell counts by diapedesis enter the interstitium forming extravasates while expanding venous sinuses. Treatment dentition anomalies using fixed orthodontic appliances (NOT) causes long-term physical and psycho-emotional stress, the effects of which are particularly noticeable

in the child's body. Application NOT leads to disruption of homeostasis oral hygienic condition worsens organs and tissues of the mouth, reduces the functional resistance of hard dental tissues may contribute to inflammation of tissues surrounding periodontal. Simultaneously there is a violation of one of the main functions of the endothelium - the synthesis of nitric oxide, a potent endogenous vasodilator, which is confirmed by decreased activity of immunohistochemical reaction with eNOs. It is known that inhibition of NO-synthase constitutional leads to the activation of inducible fractions, accompanied by their damaging effects. At the same effects of light therapy and applications Tivortin indicates that it is one of the possible ways of correcting endothelial dysfunction.

CONCLUSIONS. 1. Application NOT leads to significant changes in the MCB and periodontal endothelium that may underlie the development of complications of this type of orthodontic treatment.

2. Light therapy and applications Tivortin can reduce adverse effects on morphology and function NOT MCB contribute to the restoration of endothelial function.