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MICROHEMODYNAMIC CHANGES AS INDICATOR OF PSYCHOEMOTIONAL STRESS AT DENTAL TREATMENT

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ABSTRACT — The article deals with studies on microcirculatory changes as indicators of psychoemotional stress development. Diagnosis of the capillary blood flow was made by studying LDF-grams obtained by carrying out laser Doppler flowmetry. The study was carried out in the area of the inflamed periimplant oral mucosa in the patients with psychoemotional stress (30 people). To obtain normalized characteristics, the control group comprised patients with postprothetic complications after dental implants without any psychoemotional disorders. It was revealed that under stress capillary blood flow changes both at the oscillatory and non-oscillatory levels. Increased blood inflow and disordered venous outflow were noted against the blood vessels vasodilatation. When analyzing high and low frequency oscillations with the method of wavelet transformations, it was noted that endothelium activity increased, but sympathetic adrenergic vasomotors and precapillaries tone decreased.

Laser Doppler Flowmetry (LDF) can be applied as a diagnostic method for stress situations at dental treatment.

KEYWORDS — microcirculation, stress, periimplant area, inflammation, diagnostics.

INTRODUCTION

The relevance of modern diagnostic methods in applied dentistry is determined by the high prevalence and intensity of dental diseases. The knowledge of diagnostic approaches, the principles of constructing and making a diagnosis is of great importance for medical practice, since the formulated diagnosis is the rationale for the tactics of therapeutic and preventive measures [1–10].

Diagnosis of psychoemotional stress is a vitally important indicator, as it is a non-specific basis of numerous diseases including dental ones. Psychoe-

motional disorders resulting from stress cause chronic long lasting inflammatory diseases including diseases of the oral cavity [11]. Complications following dental implantation that manifests in inflammation of the periimplant tissue is not an exception. Patients are not able either eat normally or speak and all this affects their life. In this case psycho-physiological condition of these patients also changes. Early discovery of the stress factor and later the development of psychoemotional disorders is one of the important purposes of a dentist as it prevents development of complications during dental treatment.

At present, numerous methods exist to determine a person's psychoemotional condition. These are mainly various questionnaires that patients fill. In the era of modern technologies a software on Android platform examines microhemodynamics and determines the degree of stress: low, medium or high one within a few seconds. Though, more objectively, stress diagnostics can be carried out with laser doppler flowmetry by studying a few parameters. The method makes it possible to promptly and noninvasively reveal specific numerical indices by calculating the oscillation spectrum of different origin, essentially by increasing or decreasing the amplitudes of endothelial, myogenous and neurogenous oscillation [12].

Aim

To investigate changes in the microdynamics of the oral mucosa under psychoemotional stress using the data acquired with laser Doppler flowmetry.

MATERIAL AND METHODS

30 volunteers with inflammation of the periimplant tissue of the oral mucosa participated in the study. The study was approved by the Regional Committee of Ethics, Protocol No 2115/1-2019 of April 19, 2019. Prior to LDF-metry, all patients with mucositis were given questionnaires that were analyzed using the method of psychological stress measure PSM-25. The results were interpreted and the data processed by calculating the total amount of points after answering all the questions. 125 points and higher showed a high level of stress, 100–125 points — a medium level and less than 99 points — a low level of stress.

Laser doppler flowmetry was performed while the

patient was sitting on the dental chair. The sensor was placed on the inflamed periimplant area to study hemodynamics of the oral mucosa. Capillary blood flow was monitored for 10 minutes. At the first stage the indicator of microcirculation, the root-mean-square deviation and coefficient of variation were estimated and at the second stage the contribution and oscillation of high and low frequency flux motions were studied.

RESULTS

Based on the data obtained from the questionnaires, it can be said that all the patients were in a stress situation. So, 12 patients (40%) showed 130 points, 10 patients had 160 points (33,3%), 5 patients — 180 points (16,7%) and 3 patients showed 195 points (10%). The average amount of points were $154,8 \pm 4,2$ that was the evidence of a high level of stress.

To obtain normalized indices of LDF-gram, while carrying out LDF-metry, there was a control group of normal people who did not suffer from stress. The absence of a psychoemotional factor was also confirmed by questioning. The patients under stress conditions showed blood vessels dilatation against lower activity of the sympathetic vasomotors and decreased tone of precapillaries, increased amplitude of endothelial, neurogenous and myogenous oscillations. So, increased amplitude of endothelial oscillations (VLF by 57%, $p < 0,05$) characterizes a higher activity of endothelial secretory function, development of endothelium-dependent dilatation of the vessels. Increased number of flux motions of the myogenous origin (LFM by 64%, $p < 0,05$) characterizes a lower tone of precapillaries, increased amplitude of neurogenous oscillations (LFH by 54%, $p < 0,05$) is the evidence of a lower activity of sympathetic adrenergic vasomotors and development of sympathetic vasodilatation. Increased oscillations of the pulse and respiratory waves occur against pulse acceleration and respiratory impact on the vegetative heart nerves alongside with the inflow of arterial blood and difficulty in venous outflow. The study of the non-oscillatory indices showed the increase of the microcirculation index M by 37%, but the root-mean-square deviation and variation index are 35% lower and makes $5,32 \pm 0,3\%$. Lowered speed of the local blood flow is associated both with weakened active factors of blood flow regulation and decreased flux motions energy.

DISCUSSION

Thus, the analysis of the data obtained is the evidence of expressed microcirculatory changes in a stress situation. Laser doppler flowmetry is a noninvasive method of examination that shows objectively

the state of microhemodynamics and can be used as a diagnostic method of psychoemotional condition at dental treatment.

CONCLUSION

Investigation of microcirculation parameters in patients with dental implant complications has revealed disturbances of microhemodynamics. Therefore, further studies may help find the cause/effect relationships that justifies the need for such studies in the future.

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