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INTEGRATIVE APPROACH TO THE TREATMENT OF DISEASES OF THE ORAL MUCOSA USING LASER THERAPY

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Introduction

Among dermatoses, the manifestations of which are observed on the oral mucosa (OM), lichen planus (LP) is often found - a disease characterized by a rash of small polygonal forms of keratinized papules [1]. Skin lesions are characterized by a rash of flat, pinkish-bluish polygonal papules 0.2–1.0 cm in diameter with an umbilical depression in the center, localized mainly on the flexor surfaces of the limbs and trunk. The morphological element in the oral cavity are whitish-pearl (as if with a polished surface) or grayish-white papules, more common on the buccal mucosa, lateral surfaces of the tongue, in the area of the floor of the mouth, less often on the mucous membrane of the gums. LP can occur at any age. More often, the age of patients in whom this disease is first detected ranges from 30 to 60 years, sometimes LP occurs at an older age [6]. Recently, however, “rejuvenation” of those suffering from this disease has been discovered [1]. This may be due not only to improved diagnostics, but also to significant changes in the body's reactivity, environmental damage, increased contact with a viral infection, and an excessively high frequency of psychoemotional stress [4]. Unexplained questions of the etiopathogenesis of lichen planus determine the use of numerous medications for its diagnosis and treatment, the appointment of which is empirical or symptomatic [7]. However, modern diagnostics and therapy do not always provide a good result; treatment, as a rule, is delayed for a long period [5]. With a huge number of new methods for diagnosing and treating diseases of the oral mucosa, the dentist faces the task of making the right, reasoned choice, improving non-invasive diagnostic methods aimed at studying pathogenetic links [3]. For this purpose, the use of laser Doppler flowmetry (LDF) is promising. In this method, the output signal is continuously recorded during the research time, and the diagnosis of the state of blood microcirculation is based on the analysis of a graphical record of perfusion changes, which is called the LDF-gram [2]. The microvasculature is under multilevel control, which is organized through a feedback system. In the process of blood flow self-organization, endothelial activity, neurogenic and myogenic control mechanisms, pulse and respiratory rhythms form positive and negative feedbacks. The work of active control mechanisms is

determined by the local physiological needs of tissues. An increase or decrease in the amplitudes of passive rhythms may be a consequence of the manifestation of the functioning of active control mechanisms and vice versa.

PURPOSE OF THE WORK

To conduct a comparative analysis of the amplitude-frequency spectrum of fluctuations in the blood flow of the oral mucosa in patients with lichen planus in relation to the control (healthy) group.

RESEARCH METHODS

The study involved 60 patients aged 38 to 65 years. The duration of the disease with erosive-ulcerative form of lichen planus ranged from 3 months to 3 years. Clinical examination of patients included the collection of complaints, anamnesis of the disease, the task of which was to determine the possible causes of the disease, the nature of its course and frequency of exacerbations, and the effectiveness of previous treatment. During the clinical examination of patients, a medical record was filled out, which indicated the date of birth, the duration of the disease, the presence of somatic pathology, the localization of the pathological focus in the oral cavity and its detailed description at the time of treatment, the dynamics of clinical observation. During the examination, special attention was paid to the sanitation of the oral cavity. LDF-metry of patients was performed in a dental chair in a sitting position. To register the blood flow in the mucous membrane, a domestic device LAKK-OP was used. The blood flow was studied not only in the focus of direct inflammation, but also in the clinically unchanged mucous membrane of symmetrical areas. Necessary examination factors: the absence of any impact on the hard tissues of the teeth, the mucous membrane of the mouth and gums (brushing teeth, eating hard food, chewing gum, etc.) and psycho-emotional stress at least an hour before the examination. Erosive and ulcerative lesions were most often localized on the buccal mucosa and lateral surfaces of the tongue. The calculation of the amplitude-frequency spectrum of fluctuations in the blood flow of the oral mucosa in patients with lichen planus was carried out in the affected area (group I), on the mucous membrane of a symmetrical area without clinical signs of changes (group II). The control was our own data obtained as a result of a survey of 30 healthy individuals (group III). The rhythmic structure of fluxmotions is detected using the amplitude-frequency spectrum of LDF-grams and is the result of various (neurogenic, myogenic, respiratory, cardiac and endogenous) influences on the state of microcirculation. We analyzed the frequency and amplitude of very low frequency fluctuations (VLF) associated with periodic contractions of

endotheliocytes; low-frequency oscillations due to the activity of smooth myocytes in arterioles (LF); high-frequency oscillations (HF) due to pressure changes in the venous bed and pulse (CF) oscillations due to changes in intravascular pressure, synchronized with the heart rate of blood flow fluctuations.

RESULTS AND DISCUSSION

The most significant in the LDF wavelet analysis is the ability to assess the influence of myogenic and neurogenic components of microvascular tone. The nature of neurogenic tone (NT) is associated with the activity of α-adrenergic receptors in the membranes of smooth muscle cells of the muscular layer of the vascular walls, the excitation of which leads to vasoconstriction. A decrease in the amplitude of fluctuations on the LDF-gram means an increase in the tone and rigidity (decrease in elasticity) of the vascular wall, and vice versa, an increase in these amplitudes is a consequence of a decrease in vascular tone. As shown by the Wavelet method, transformations of the amplitude of oscillations in the neurogenic and myogenic range prevail in the control group. Averaged Distribution of Amplitudes of Blood Flow Rhythms Analysis of the rhythmic components of tissue blood flow oscillations, performed using the amplitude-frequency spectrum, in the control group showed that the vasomotor rhythm was dominant. Thus, the amplitude of oscillations in the neurogenic and myogenic ranges (LF oscillations) was 54%; endothelial (VLF oscillations) - 21%; respiratory wave (HF) - 13% and pulse (cardiac) wave (CF-fluctuations) - 12%. The state of the microcirculatory bed of the unchanged mucous membrane in patients with lichen planus differed from healthy individuals, and microcirculation disorders in the area of erosive and ulcerative lesions had a common focus. Statistical analysis of the data of LDF-metry of the cheek did not reveal significant differences between the comparison groups ($p > 0.05$). Analysis of the world circulation at symmetrical points of the oral mucosa and in the lesion showed a low degree of asymmetry. With LDF-metry in patients with lichen planus in the lesion, there was a sharp decrease in the variability of tissue blood flow (more than 2 times compared with the norm), which is associated with a deterioration in tissue perfusion with blood. The rhythmic structure of blood flow oscillations also changed - the amplitude of low-frequency oscillations decreased, which is associated with a weakening of the vasomotor rhythm and, as a result, an increase in the heart rate to a greater extent. Thus, the amplitude of LF oscillations was 35%; VLF - 30%; HF- and CF-oscillations - 17 and 18%, respectively. The use of spectral analysis of the rhythmic components of blood flow made it possible to establish that in pathology (group I) and on the symmetrical side (group II), the ratio of active (LF, VLF) and passive (HF,

CF) components of tissue blood flow oscillations is disturbed. The power of the spectrum of LF oscillations of blood flow, estimated by its contribution to the total spectrum of fluxmotions, progressively decreases in the lesion, which characterizes the state of the muscle tone of the precapillaries that regulate blood flow into the nutritive bed. This means that a decrease in vasomotor amplitudes causes an increase in muscle tone and, consequently, a decrease in nutritive blood flow. The contribution of CF oscillations is the most significant. An increase in the amplitude of the pulse wave compared to the control group indicates a decrease in elasticity vascular wall, an increase in the inflow of arterial blood into the microvasculature. HF fluctuations increased by 1.5 times, which indicates a decrease in microcirculatory pressure, deterioration of blood outflow, manifestation of stagnation in the microcirculatory bed. Obviously, the recorded amplitudes of blood flow oscillations of endothelial, neurogenic, and myogenic endothelial-independent origin are directly related to the size of the microvessel lumen, and, consequently, to muscle tone. A decrease in the amplitude of oscillations is combined with an increase in the tone and rigidity of the vascular wall itself, and vice versa, an increase in amplitude is a consequence of a decrease in vascular tone. Since there are differences in the regulation of the tone of arterioles and precapillary sphincters, this allows non-invasive assessment of the ratio of shunting and nutritional blood flow in the microvascular network. The bypass index (PI) is determined by the ratio of myogenic to neurogenic tone. The higher the amplitude of neurogenic oscillations and the lower the amplitude of myogenic oscillations, the greater the PN values, and vice versa. This formula is applied under physiological conditions, when the dominant oscillations of the blood flow in arterioles are the oscillation waves of the neurogenic range. Thus, the bypass rate in the control group was 1.0; in groups I and II - 0.8. If the PN value is less than 1, then this means that a significant amount of blood has entered the nutritional link of the microcirculatory network against the background of spasm of shunts (precapillary sphincters).

CONCLUSION

According to the wavelet analysis, in patients with lichen planus, a significant decrease in the main amplitudes of vascular wall oscillations was found. Of all the amplitudes, only the pulse and respiratory waves increased significantly - by 1.3 times in comparison with the control. This increase may be due to a decrease in the elasticity of the vascular wall. The magnitude of the pulse wave amplitude can be positively related to the amplitudes of blood flow fluctuations due to the functioning of neurogenic and myogenic mechanisms, on which the diameters of the lumen of

arterioles and arteriolovenular anastomoses depend. An increase in the amplitude of the respiratory wave indicates a decrease in microcirculatory pressure. The deterioration of the outflow of blood may be accompanied by an increase in blood volume in the venular link. This circumstance leads to an increase in the amplitude of the respiratory wave in the LDFgram, which indicates the manifestation of stagnation in the microvasculature. Laser Doppler flowmetry reflects the deterioration of microcirculation not only in the focus of direct inflammation, but also in the clinically unchanged mucous membrane of symmetrical areas. This indicates the involvement of the entire microcirculatory bed of the oral mucosa in the process of inflammation in the erosive and ulcerative form of lichen planus. The LDFgrams recorded during the studies may differ in different patients in the same area of research due to the individual characteristics of the microvasculature.

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