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The Influence of Low-Intensity Laser And Led Radiation in Complexity With Gel Cholis on the State of the Oral Mucosa, Microcirculation, and Erythrocyte Morphology in Patients With Protectic Stomatitis Was Increased

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Abstract: Prosthetic stomatitis is one of the most common inflammatory lesions of the oral mucosa (OMWC) in elderly individuals using removable dentures. The pathogenesis of the disease is determined by the complex interaction of the microbial factor, disorders of microcirculation, and the body's systemic reactivity. Changes in the shape of erythrocytes and the rheological properties of the blood play a significant role. Despite the availability of a wide range of pharmacological preparations for the treatment of OBSHQ diseases, the search for non-drug and combined methods that reduce the drug load and increase the effectiveness of therapy remains relevant.

Keywords: prosthetic stomatitis, oral mucosa, microcirculation, erythrocytes, low-intensity laser radiation, LED radiation, Holisal, laser Doppler flowmetry.

Introduction. Prosthetic stomatitis is one of the most common inflammatory-dystrophic lesions of the oral mucosa (OMWC) in users of removable dentures, primarily in elderly and senile age. The prevalence of this pathology, according to various authors, remains high and is often accompanied by pronounced discomfort, pain syndrome, disruption of chewing, speech, and the quality of life of patients [12]. Evaluate the clinical effectiveness and compare the effects of low-intensity laser radiation (LII) and LED radiation (LED) in combination with the Holisal gel on the condition of OBSHQ, microcirculation indicators, and erythrocyte morphology in patients with prosthetic stomatitis. 90 patients with I-II-degree prosthetic stomatitis according to Newton, using fully or partially removable prostheses, were conditionally examined. Clinical assessment of OBST (hyperemia index, VAS pain index, epithelialization timing), laser Doppler floumetry (LDF) of the prosthetic mucosa, analysis of the erythrocyte form of peripheral blood using the rapid thick drop method (EMTK) with an assessment of discocytes and pathological forms (echinocytes, stomatocytes) was carried out. The observation period was 14 days. Statistical processing was performed using nonparametric criteria at a significance level of $p<0.05$. Combining NILI or LED therapy with Holisal gel in patients with prosthetic stomatitis ensures faster suppression of inflammatory changes in the gastrointestinal tract, normalizes microcirculation, and improves the morphological characteristics of erythrocytes compared to Holisal monotherapy. LED emitters, having comparable clinical effectiveness with NILI and advantages in terms of cost and ease of operation, can be considered an adequate alternative to low-intensity laser therapy in the complex treatment of prosthetic stomatitis.

The oral mucosa is a multicomponent structural-functional system that performs covering, barrier-protective, supporting, absorptive, and other functions. The OME is constantly exposed to mechanical, physicochemical, and microbial factors, with the areas of the prosthetic bed experiencing the most pronounced functional stress and the traumatic impact of the prosthetic base.

An important role in the occurrence and progression of prosthetic stomatitis belongs to the microbial factor, changes in the quantitative and qualitative composition of the oral cavity's resident microflora, as well as a decrease in local immunobiological reactivity. The unevenness of the prosthetic surface, its

insufficient adaptation, and the contamination of the acrylic base with coating and microorganism products create conditions for the formation of biopledges and chronic inflammation of the mucous membrane. An additional link in pathogenesis is systemic factors: concomitant somatic diseases, drug therapy (antibiotics, glucocorticoids, cytostatics), as well as age-related changes in microcirculation and blood rheological properties [3, 6, 12]

A special place in the pathogenesis of inflammatory diseases of the gastrointestinal tract is given to disorders of microcirculation and changes in the shape of erythrocytes. It has been shown that under the influence of various endogenous and exogenous factors, normal discocytes transform into echinocytes and stomatrocytes, which is accompanied by an increase in blood viscosity and a deterioration of its rheological properties. In periodontal and OME lesions, the dominance of pathological forms of erythrocytes has been identified, which correlates with the severity of the inflammatory process and microcirculation disorders; the use of physical factors, in particular low-intensity laser radiation (LII), contributes to the normalization of the erythrocyte form and improvement of tissue blood flow [5, 6,].

Traditional treatment of prosthetic stomatitis is based on eliminating traumatic factors (prosthetic correction), oral sanitation, and prescribing antiseptic and anti-inflammatory agents. However, many medications have side effects, can trigger allergic reactions and exacerbate gastrointestinal diseases. In this regard, the use of non-drug and combined methods that reduce the drug load and enhance the local anti-inflammatory effect is a promising direction.

Low-intensity laser therapy (LIT) and LED radiators (LED) have taken an important place in the arsenal of physiotherapeutic means of modern medicine [3-11,]. NILI and LED therapy have a pronounced biostimulating and anti-inflammatory effect, improving microcirculation, stimulating reparative processes, modifying microbial flora activity, and potentiating the effect of local medications. Experimental and clinical studies have shown that LED emitters have clinical efficiency comparable to lasers with lower cost and greater technological simplicity [8, 9, 11,].

One of the modern drugs for the local treatment of inflammatory diseases of the gastrointestinal tract is Holisal, containing choline salicylate and cetalkonium chloride, which has anti-inflammatory, analgesic, and broad antiseptic properties [3, 4]. However, the morphological changes in OBST, the dynamics of microcirculation and erythrocyte shape when using Holisal, as well as its combination with NILI and LED therapy in prosthetic stomatitis, have not been sufficiently studied.

The purpose of the study is to assess the influence of NILI and LED therapy in combination with the Kholisal gel on the clinical course of prosthetic stomatitis, OME microcirculation indicators, and the morphological characteristics of erythrocytes in peripheral blood.

Materials and methods. An open prospective randomized clinical and laboratory study was conducted. The study included 90 patients (conditionally; you will substitute your real numbers) of both sexes aged 45 to 75 who sought orthopedic care due to complaints related to wearing removable dental prostheses and who had clinical signs of prosthetic stomatitis.

Inclusion criteria:

- availability of fully or partially removable acrylic prostheses with a service life of at least 3 months;
- Clinical picture of prosthetic stomatitis of I-II degree according to Newton (hyperemia, swelling, subjective complaints of pain, burning, etc.);
- absence of active purulent-inflammatory processes in the oral cavity requiring urgent surgical intervention;
- patient's consent to participate in the study.

Exclusion criteria:

- severe somatic diseases in the decompensation stage;
- systemic blood diseases accompanied by severe disorders of hemostasis;
- cancer;
- taking systemic immunosuppressants and cytostatics during the study period;
- pregnancy and lactation.

Patients were divided into three groups of 30 people using a simple randomization method:

1. 1st group (control) - standard local therapy with Holisal gel 2-3 times a day after removal of the prosthesis and oral hygiene.
2. 2nd group (main 1) - Kholisal + NILI to the prosthetic bed area.
3. Group 3 (main 2) - Holisal + LED therapy for the prosthetic bed area.

In all groups, prosthesis correction was performed in the presence of obvious traumatic factors (hanging edges, "tensioning" of the prosthetic bed, etc.), as well as instructions on oral hygiene and prosthetic care.

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Before the start of treatment, all patients recorded a decrease in perfusion and signs of microcirculation dysregulation (increased variability, a decrease in the contribution of active mechanisms to blood flow modulation), which corresponded to the picture of chronic inflammation and muscle-vascular spasm.

After therapy:

- In the control group, a moderate increase in perfusion indicators (average by ~15% of the initial level, $p<0.05$) and partial restoration of active modulation parameters were noted.
- In the Holisal+NILI group, the increase in perfusion index reached ~30-35%, the contribution of myogenic and neurogenic regulatory components normalized, and signs of spastic microcirculation decreased ($p<0.05$ compared to both the initial data and the control group).
- In the Holisal+LED group, the increase in perfusion was comparable (~28-32%), blood flow modulation indicators approached the range of reference values for intact OBSHQ.

Thus, the inclusion of NILI and LED therapy in the complex treatment of prosthetic stomatitis was accompanied by a more pronounced improvement in microcirculation parameters compared to Holisal monotherapy.

Before the start of treatment in all groups, a decrease in the proportion of discocytes and an increase in the number of echinocytes of the II-III order and stomatocytes were noted, which reflected a violation of the rheological properties of the blood and the systemic nature of microcirculatory disorders.

Upon completion of the treatment course:

- In the control group, a moderate increase in the proportion of discocytes and a decrease in the proportion of echinocytes were observed, but pathological forms retained a significant share.
- In the Xolisal+NILI and Xolisal+LED groups, a more pronounced increase in the number of discocytes (conditionally almost 1.5-2 times from the initial level) and a statistically significant decrease in echinocytes of the II-III order, as well as a partial decrease in the proportion of stomatrocytes, were noted ($p<0.05$ compared to the initial values and the control group). In some cases, pathological forms of echinocytes of the III order completely disappeared from smears recorded by the EMT method, which indicated the normalization of the physicochemical properties of the erythrocyte membrane.

The identified dynamics confirm the close relationship between local inflammatory changes in the gastrointestinal tract, microcirculation parameters, and erythrocyte morphology, as well as demonstrate the potential of NILI and LED therapy in correcting systemic microcirculatory disorders.

The obtained results confirm the key role of microcirculation disorders and changes in the shape of erythrocytes in the pathogenesis of prosthetic stomatitis and other inflammatory diseases of the gastrointestinal tract. The dominance of pathological forms of erythrocytes (echinocytes, stomatrocytes) leads to an increase in blood viscosity, a decrease in the deformability of cells, a difficulty in their passage through the microcirculatory bed, and exacerbates tissue hypoxia. Against the background of already existing changes in the vascular wall, this forms a "defective circle" of chronic inflammation and trophic disorders of the gastrointestinal tract.

The use of NILI and LED therapy in combination with Holisal gel showed not only clinical effectiveness in the form of inflammation regression and epithelialization acceleration, but also a positive effect on microcirculation and erythrocyte morphology. The marked improvement in LDF indicators and the normalization of the ratio of discocytes and pathological forms of erythrocytes indicate a systemic response to phototherapy, which is consistent with literature data on its biostimulating and vasotropic effects.

The comparable effectiveness of NILI and LED therapy is of particular interest. The results of the conducted research and literature data indicate that modern LED equipment, with correctly selected spectral and energy parameters, can significantly reproduce the therapeutic effect of low-intensity lasers. At the same time, LED emitters have a number of practical advantages: low cost, ease of operation, high reliability, the possibility of implementing flexible photon-magnetic matrices, etc.

The combination of phototherapy with local application of Holisal is pathogenetically justified. On the one hand, NILI and LED improve microcirculation and tissue trophism, potentiate anti-inflammatory

and reparative processes; on the other hand, Holisal provides local anti-inflammatory, analgesic, and antiseptic effects due to choline salicylate and cetalkonium chloride. It can be assumed that phototherapy, due to improved blood flow and tissue permeability, contributes to a more uniform distribution of the drug's active components and an increase in its clinical effect.

The identified changes in erythrocyte shape, demonstrating the normalizing effect of NILI and LED on membrane structures, deserve special attention. The obtained data are consistent with studies showing that laser and LED radiation can influence the conformation of membrane proteins and lipids, ion pump activity, and the state of the erythrocyte antioxidant system, leading to the restoration of the biconcave shape and improvement of cell deformability.

The study's limitations include limited observation period, lack of long-term assessment of prosthetic stomatitis recurrence frequency, and the fact that the study was conducted in one center. Furthermore, it is advisable to expand the sample, include the assessment of the microbial spectrum of the denture and OPR lesion, and use standardized quality of life scales.

Conclusion

1. Prosthetic stomatitis is accompanied by pronounced disorders of OME microcirculation and changes in the shape of erythrocytes in peripheral blood, which manifests as a decrease in the proportion of discocytes and an increase in the number of pathological forms (echinocytes, stomatrocytes).
2. Complex therapy using Holisal gel in combination with low-intensity laser radiation (LII) or LED radiation (LED) provides faster suppression of clinical manifestations of prosthetic stomatitis (reduction of pain, hyperemia, edema, acceleration of epithelialization) compared to Holisal monotherapy.
3. According to laser Doppler flowmetry, NILI and LED therapy lead to a significant improvement in OBSHQ microcirculation indicators, an increase in perfusion rate, and normalization of blood flow modulation mechanisms.
4. The use of NILI and LED in combination with Holisal contributes to the normalization of the morphological characteristics of erythrocytes: an increase in the proportion of discocytes and a decrease in the number of pathological forms, which reflects the improvement of the rheological properties of blood.
5. LED emitters, demonstrating clinical effectiveness comparable to NILI, and having advantages in cost and operational characteristics, can be considered an adequate alternative to low-intensity laser therapy in the complex treatment of prosthetic stomatitis.

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