

STUDY OF THE EFFECT OF LED LIGHTING ON THE DYNAMICS OF SOME INDICATORS OF ENDOCRINE STATUS AND FUNCTIONAL ACTIVITY OF NEUTROPHILS IN PATIENTS WITH NEUROTIC DISORDERS AND STUDENT VOLUNTEERS

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This article is devoted to the study of the effect of led lighting on endocrine response and some of the indicators of the functional activity of the segmented neutrophils in patients suffering from various forms of neurosis and student volunteers. Stress-caused forms of neurotic disorders are accompanied by inhibition of the adhesion ability of neutrophilic granulocytes, while maintaining their metabolic functions in NBT – test. Under the influence of treatment of patients with neuroses with anxiety, antioxidants, immunomodulators and hyperbaric oxygenation, as used in the conditions of influence of led and fluorescent lighting, an increase of the phagocytic activity of neutrophils, stimulation of NBT – test and normalization of some indicators of hormonal status. Fluorescent light sources are statistically significant differences in the functioning of neutrophils in the group of students is not called in this case, the plasma concentration of a hormone of stress-realizing system – cortisol increases. Identified interdependencies between the degree of change in the hormonal profile, functional indices of activity of neutrophil granulocytes and a view of the impact of different light sources allow to examine the immune and endocrine abnormalities as a prognostic marker of adverse external influence of optical factors.

Keywords: led lighting, endocrine reactions, neurotic disorders, functional activity of neutrophilic granulocytes

Investigation of the effect of light sources, including LED light on the endocrine status and the morphological and functional characteristics of neutrophilic granulocytes is a challenge due to the fact, that labile and plastic neutrophils capable of rapid response to any damaging external influences, as well as the endocrine response to quickly react to stress environmental factors, so the violation of these indicators can be used as a predictor of adverse impact of optical factors. [1, 2, 3, 4, 7, 13, 14, 19, 20, 22]. Study of different types of light sources necessary for life safety not only by using the light rays to highlight the premises, but also in connection with their use as therapeutic factors in various diseases [1, 2, 3]. Identified by a number of researchers phase changes of intracellular pH, esterase and phagocytic activity of neutrophils associated with damaging effect of UV radiation on cells, determines the relevance of the study of LED light sources, which are absent in the spectrum of damaging ultraviolet rays [1, 2, 3, 8]. The study of homeostatic parameters of the organism, reflecting the state of the immune and endocrine status, is especially important in patients suffering from stress-induced disorders, as exposed to stressful environmental factors develop disorders of a conjugate between nervous, endocrine and immune systems, as shown in our previous experimental and clinical studies [6, 9, 10, 11, 12, 15, 16, 17, 18, 21].

The purpose of the research – to study the effect of LED light on the dynamics of pituitary hormones, thyroid gland, adrenal glands, as well as the functional activity of neutrophils

in patients with neurotic disorders and students – volunteers to highlight the prognostic markers of the adverse effects of external optical factors.

Materials and methods of research

A simple randomized comparative parallel group study involving 62 patients (37 women and 25 men), mean age $23,3 \pm 3,2$ years, suffering from various forms of neuroses and were hospitalized in the Republic of Mordovia GBUZ "Mordovia Republican Psychiatric Hospital". The criterion for inclusion of patients in the observation was the presence of obsessive-phobic, conversion or asthenic disorders, stress-related, significant for the patient and the relevant ICD 10 (neurasthenia – F 48,0; obsessive-compulsive disorder – F 42,0–42,9; conversion disorder – F 44,0–44,7). The exceptions were identified and acute exacerbation of chronic diseases of internal organs, the presence of organic causes of mental disorder, oncopathology, long prior to receiving psychopharmacological drugs, claustrophobia, used to treat intolerance to drugs. All studies were carried out with the consent of the patients, in accordance with Article 11 of the Law "On psychiatric care and guarantees of citizens' rights in its provision" and the conclusion of the Local Ethics Committee of the Medical Institute of VPO "Mordovia State University N.P. Ogareva" from 09.03.2011, protocol № 7. The first group of patients receiving traditional psychopharmacotherapy, was in a period of 20 days under the impact of the LED light source, the second – under fluorescent lighting conditions. The control group 1 consisted of 30 students-volunteers of the lighting faculty, engaged within 20 days under the conditions illumination LED light sources. Control group 2 consisted of 30 students working under the influence of other light sources. In all treatment groups by conventional methods studied parameters of endocrine status, and determine the total number of peripheral blood leukocytes, the number of segmented and band neutrophils (CR and SF IL).

Morphological properties of neutrophils was studied by NBT-test, and an index of neutrophil activation (IAS) in spontaneous embodiment, phagocytic activity of neutrophils was determined (AFS) against the latex particles, the adhesion of neutrophils. Statistical analysis was performed by conventional methods using a standard statistical software package "Statistics 6.0". [5] was studied the basic statistical characteristics: average, the error of the average. The significance of differences was calculated using the T – Student criterion in the case of equality of variances, modifications (T – test with separate variance estimates) – in the case of inequality dispersions. The critical value of the significance level was assumed to be 0,05 on a PC Authentic AMD. Identified patterns and connections between the groups studied parameters and attributes were significant at the probability of faultless prognosis $p = 95\%$ or more [5].

Results of research and their discussion

The study of the functional activity of neutrophils and dynamics of the plasma concentrations of pituitary hormone – thyroid stimulating, thyroid hormones – thyroxine and triiodothyronine, adrenal hormones – cortisol was performed in patients suffering from neurotic disorders. All subjects were divided into randomized groups into 2 random groups, receiving complex treatment as diazepam, used at a dose of 10 mg (2 ml of 0,5% solution) daily, once a day for 20 days mexidol 200 mg (4 ml 5% solution) intravenously with 200 ml of physiological sodium chloride solution during the first 10 days, followed by transfer to 100 mg (2 ml of a 5% solution) intravenously with 200 ml of physiological sodium chloride solution, 1 time per day to 20 days. Along with this applied immunocorrector timogen 0,1 mg daily intramuscularly first 10 days while using hyperbaric oxygenation, which was conducted at a pressure of 0,8–1,0 atmosphere, during the period of izopression of 40 min. HBO session held once a day for the first 10 days. During the observation period, patients of the group I were under the LED lighting conditions, the patients of the second group were under fluorescent lighting conditions. On admission to hospital in patients with various forms of neuroses were identified neutrophils with low adhesive activity, in reaction of "rosette assay" neutrophil adhesion was $9,5 \pm 1,7\%$, in contrast to the group of healthy donors, where adhesion was $26,1 \pm 2,8$. Indicators of activity of neutrophil phagocytosis, NBT test and activation of neutrophils index amounted to $67,7 \pm 5,2$; $31,3 \pm 5,4\%$ и $0,51 \pm 0,03$ y.e. The index values of activation of neutrophils in patients with neurotic disorders exceeded those identified in donors – $0,42 \pm 0,04$ y.e., that indicates a high intensity recovery of nitroblue tetrazole in the "active" reaction against "oxidative burst" neutrophils and manifests the formation of larger lumps of formazan in the cell cytoplasm. In the study of hypophy-

sis hormones, thyroid gland, adrenal glands on admission revealed, that the level of hormones corresponded to age-matched normative values in both, the first and second groups of observations: thyroid-stimulating hormone was $1,38 \pm 0,09$ and $1,61 \pm 0,05$ nmol/l, free thyroxine – $12,52 \pm 0,31$ and $12,94 \pm 0,22$ nmol/l, with the exception of the stress hormone system implements – kortizol, the level of which has been increased – $580,51 \pm 52,23$ and $544,63 \pm 58,15$ nmol/l, respectively. LED and fluorescent light sources are used as lighting in carrying out daily stress tests during therapy with patients of neurotic disorders did not affect the dynamics of the functional activity of neutrophils. Increased adhesiveness of neutrophils to $23,6 \pm 4,3$ and $22,1 \pm 5,1\%$ when using LED and fluorescent lighting respectively, and decrease in the index of activation of neutrophils to $0,21 \pm 0,07$ and $0,29 \pm 0,05$ y.e., probably due to the influence of therapy by atioxidant meksidol, immunomodulator timogen, hyperbaric oxygenation on functionally and anatomically interconnected neuroimmune and endocrine mechanisms of stress-induced diseases. Under the effect of combined therapy in the conditions of the LED and the fluorescent lighting, the decrease in plasma cortisol concentrations was observed; with only under load tests with LED light sources cortisol was meet normal physiological range. In the first day of the survey a moderate adhesive activity of neutrophils was revealed in students, phagocytic function of neutrophils was $53,7 \pm 6,4\%$, the index of activated neutrophils was $0,15 \pm 0,02$ y.e, which corresponds to the normative values of age. The use of LED lighting was accompanied by increased activity of neutrophils, thus, in spite of the significant differences with the figures of the first day of observation, the parameters studied were within the physiological norm. The index of neutrophil activity was $0,29 \pm 0,01$ y.e., NCT was $19,8 \pm 0,31$ y.e. Fluorescent light sources did not cause statistically significant differences in the functional activity of a group of students. In the study of hypophysis hormones, thyroid, adrenal in students revealed, that the first day of monitoring hormone levels corresponded age guideline values in both, the first and second groups of observation. Changes in hormonal status in the first group showed a decrease in thyroid-stimulating hormone, but it's level remained within the physiological values. The concentration of cortisol in students engaged under fluorescent lighting conditions, remains elevated relative to the level of healthy donors. In the context of the impact by LED lighting, cortisol corresponds to the level of healthy donors by the 15th day of observation.

Conclusion

Optimizing impact of LED lighting seen in the restoration of the concentration of the hormone of the adrenal – kortizol, as in a student-volunteers and as in patients, suffering from neurotic disorders on a background of basic pharmacologic effects. Increased functional activity of neutrophils observed in terms of LED lighting, is regarded by us as a physiological response of ulcerative activation of the immune system. Thus, the morphological and functional parameters of the activity of neutrophils and endocrine responses can be used as prognostic markers of adverse external effects of optical factors.

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