9. Skrypa OL. Chastota diahnostovanykh skronevo-nyzhnoshchelepnykh rozladiv u khvorykh iz perelomamy nyzhnyoyi shchelepy zalezhno vid lokalizatsiyi ta viku. Klinichna stomatolohiya. 2019; (1) :33–9. https://doi.org/10.11603/2311-9624.2019.1.10145. [in Ukrainian].
10. Kannari L, Marttila E, Toivari M, Thorén H, Snäll J. Paediatric mandibular fracture-a diagnostic challenge? Int J Oral Maxillofac Surg. 2020; 49 (11) :1439–44. https://doi.org/10.1016/j.ijom.2020.06.008; PMID:32680807.
11. Ren R, Dai J, Zhi Y, Xie F. Comparison of temporomandibular joit function and morphology after surgical and non-surgical treatment in adult condylar head fractures. J Craniomaxillofac Surg. 2020; (48) :323–30. https://www.ncbi.nlm.nih.gov /pubmed/32113881.https:// doi.org/10.1016/j.jcms.
12. Stähli C, Eliades T, Papageorgiou SN. Functional appliance treatment for mandibular fractures: A systematic review with meta-analyses. J Oral Rehabil. 2021; (48) :945–54. https://doi.org/10.1111/joor.13178; PMID:33963591 PMCID: PMC8362118.
13. Vanpoecke J, Dubron K, Politis C. Condylar Fractures: An Argument for Conservative Treatment. Craniomaxillofac Trauma Reconstr. 2020 March; 13(1) :23–31. https://doi.org/10.1177/1943387520902881. PMID:32642028.
14. Weinberg FM, Speksnijder CM, Forouzanfar T. Articular soft tissue injuries associated with mandibular condyle fractures and the effects on oral function. Int J Oral Maxillofac.Surg. 2019; 48 :746–58. https://www.ncbi.nlm.nih.gov/ pubmed/30773333. https://doi.org/10.1016/j.ijom.2019.01.025.
15. Yaremchuk NI, Oshurko AP, Oliinyk IYu. Age assessment of the dynamics of morphological rearrangement of bone tissue of the articular processes of the human lower jaw depending on the loss of the masticatory teeth. Polski Merkuriusz Lekarski. 2023; LI(2) :120–7. PMID: 37254758. doi:10.36740/Merkur202302103.

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DYNAMICS OF LOCAL IMMUNOLOGICAL INDICATORS ACCOMPANIED BY DIFFERENT TYPES OF REACTIVITY OF THE ORGANISM

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The dynamics of local immunity in the oral fluid in patients with generalized periodontitis after surgery accompanied by normo-, hyper- and hyporeactivity of the body. It was revealed that tension of local (lysozyme, β-lysine, SIgA, IgA, IgG in the oral fluid) immunity with normalization by the end of observation is typical for patients with generalized periodontitis with normoreactivity of the body after surgery. In case of hyperreactivity the dysfunction of local immunity which is shown by the expressed fluctuations of level of lysozyme, β-lysine, secretory IgA, IgA and IgG in oral fluid with their imbalance by the end of supervision is defined. In case of hyporeactivity dysfunction of local immunity is observed that is shown by a later rise and rather low amplitude of changes of the investigated parameters.

Key words: generalized periodontitis, local immunity, body reactivity, postoperative period.

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ДИНАМІКА ПОКАЗНИКІВ МІСЦЕВОГО ІМУНІТЕТУ ПРИ ГЕНЕРАЛІЗОВАНОМУ ПАРОДОНТИТІ НА ТЛІ РІЗНОЇ РЕАКТИВНОСТІ ОРГАНІЗМУ

Вивчена динаміка показників місцевого імунітету в ротовій рідині у хворих на генералізований пародонтит після проведеного хірургічного лікування на тлі нормо-, гіпер- та гіпореактивності організму. Встановили, що для хворих на генералізований пародонтит при нормореактивності організму після проведення хірургічного втручання характерним є напруження місцевого (за рівнем лізоциму, β-лізину, SIgA, IgA, IgG в ротовій рідині) імунітету з нормалізацією показників до кінця спостереження. При гіперреактивності визначається дисфункція місцевого імунітету, що проявляється вираженими коливаннями рівня лізоциму, β-лізину, секреторного IgA, IgA і IgG в ротовій рідині з їх дисбалансом до кінця спостережень. При гіпореактивності спостерігається дисфункція місцевого імунітету, що проявляється більш пізнім підйомом і порівняно низькою амплітудою змін досліджених параметрів.

Ключові слова: генералізований пародонтит, місцевий імунітет, реактивність організму, післяопераційний період.

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Analyzing the possible causes and mechanisms of generalized periodontitis, taking into consideration modern ideas about inflammation as a dynamic self-regulatory system, researchers have shown that the transition of the pathological process to a prolonged chronic course is observed in case of dysfunction of cellular and humoral local immunity [7]. Neutrophils play a key role in the development of inflammation and destruction of periodontal tissues, as they are the first to respond to chemotactic factors from dental plaque, infiltrate a huge number of periodontal tissues and perform their main effector functions – chemotaxis, adhesion, phagocytosis, oxidation [8]. Monocyte-macrophage cells, as well as neutrophils, are actively involved in a specific immune response (presentation of antigens to lymphoid cells, secretion of interleukins and complement components).

Macrophages are the main producers of cytokines that regulate the course of inflammatory and immune reactions in the periodontium [11]. Lymphocytes are the main cells of the immune system that are involved in the main function of acquired specific (adaptive) immunity: the recognition and elimination of foreign macromolecules, as well as the production and secretion of antibodies (immunoglobulins). In the implementation of the humoral response, the main role is played by B-lymphocytes, which under the influence of the antigenic stimulus differentiate into antibody producers [9]. It is shown that patients with generalized periodontitis have immunological reactions which develop both in the system of local immunity of the oral cavity and in the body as a whole [4, 5]. Different clinical variants of periodontitis are characterized by ambiguous disorders of immune status. The condition of systemic immunity depending on the severity of generalized periodontitis is described [1, 2]. Many authors believe that dysfunction of the immune system in patients with generalized periodontitis is either the consequence of genetic predisposition, or develops in case of the presence of some somatic pathology of internal organs, endocrine disorders, chronic viral, bacterial and fungal infections [3, 10]. Recently, there have been studies in which it has been shown that prolonged chronic inflammatory process in periodontal tissues in itself can also lead to the development of immunodeficiency. In addition, there are atypical, "aggressive" forms of periodontitis, for which the failure of immune mechanisms is the main cause of the disease [12]. It is shown that the indicators of immunological status in patients with chronic periodontitis are characterized by a significant decrease in natural killers (CD16), phagocytic activity of granulocytes and immunoglobulins of classes M and G [6].

Summarizing the above-mentioned facts, we can assume that the intercellular and intersystem interaction, involving different populations of leukocytes and substances produced by them, determines the nature and rate of development, intensity and prevalence of the inflammatory process in periodontal tissues.

The purpose was to study the dynamics of local immunity (lysozyme level, concentration of β-lysine, immunoglobulin SgA, IgA, IgG) in the oral fluid in patients with generalized periodontitis accompanied by normal, hyper- and hyporeactivity of the body after the surgery.

Material and methods. 216 people aged 45 between 55 years with the diagnosis of generalized periodontitis of II, III degree of severity, chronic course were examined. The diagnosis was made on the basis of clinical examination, radiography, determination of periodontal samples in accordance with the International Classification of Diseases ICD-10. The patients were divided into three groups: the first one included patients with normoreaction (132 people, 61%); the second group consisted of patients with hyperreaction (46 people, 21%); the third one contained patients with hyporeaction (38 people, 18%). The division of patients into groups depending on the state of reactivity of the organism was performed on the basis of the identified clinical and laboratory differences.

All the patients underwent comprehensive treatment of generalized periodontitis in the amount recommended by the Ministry of Health of Ukraine – Order №566 from 23.11.04. "On approval of the Protocols for the Provision of Medical Care". The patients with generalized periodontitis of II, III degrees of severity after initial therapy, underwent patch surgery according to the indications.

Oral fluid collection was performed on an empty stomach on the 1st, 2nd, 4th, 6th and 9th days after surgery. Oral fluid was collected by spitting into volumetric centrifuge tubes in a volume of 5 ml. The samples were frozen and transported to the immunological laboratory. In order to assess the state of local immunity of the oral cavity humoral factors of nonspecific resistance – lysozyme level and concentration of β-lysine and indicators of the humoral link of the specific immune response – the content of antibodies – immunoglobulins SgA, IgA, IgG were studied. For revealing lysozyme the indicator microorganism Micrococcus lysodeicticus (the research and production association "Biochemicals", St. Petersburg) was used. The studies were performed by the photocolorimetric method based on determining the difference in the degree of extinction at a wavelength of 540 nm (green light filter FEC) after 15 sec and 180 sec. The level of β-lysine (platelet cationic protein) was determined with the help of standard methodology by nephelometric method. The revealing of immunoglobulins was performed by the method of radial immunodiffusion according to Manchini. The test samples were placed into the wells of agar "Difco", which contained antibodies to the appropriate class of immunoglobulins.

Statistical processing of the obtained digital data was performed using the computer program Statistica 8.0 (STA862D175437Q).

Results of the study and their discussion. Given the presence of local immunoregulatory mechanisms in the oral cavity, we considered it appropriate to study the dynamics of non-specific (lysozyme, β-lysine) and specific (SIgA, IgA, IgG) resistance in oral fluid. The results of the assessment of local immunity in patients with generalized periodontitis with normo-, hyper- and hyporeactivity of the body after surgery are given in table 1. As can be seen from this table, in the oral fluid of patients with GP with normoreactivity of the body one can observe the increase of all the studied indicators after the surgical intervention with their maximum

values on the 4th and 6th day. The level of lysozyme became 1.28 times higher, β-lysine – 1.58 times higher, SIgA – 1.07 times higher, IgA became 1.11 times higher, p <0.05; IgG – 1.06 times higher (p> 0.05). This dynamics of local immunity of the oral cavity is explained by the protective-compensatory enhancement of salivary gland function, increased secretion of lysozyme by epitheliocytes of the salivary ducts, as well as cells of the monocyte-macrophage system and neutrophils, which emigrated to the oral cavity with gingival fluid, and also by enhanced release from the platelets of the bactericidal protein β--lysine, enhanced synthesis of immunoglobulins by its own plate of the oral mucosa. The above-mentioned facts indicate the intensity of local immunity in patients with GP with normoreactivity of the body in response to damage, and further (on the 9th day) reduction of these parameters to the initial values – its normalization.

Table 1

Indicators of local immunity in oral fluid in case of normo-, hyper- and hyporeactivity of the body after the surgery (M±SE)

Indices	Periods of observation	Groups of patients		
		Normoreaction (n = 132)	Hyperreaction (n = 23)	Hyporeaction (n = 19)
Lysozyme (mcg / ml)	Initially	532.9±9.3	536.1±14.2	525.9±12.1
	1st day	550.6±9.8	720.2±15.8 * "	538.4±14.0
	4th day	682.1±10.0 *	453.6±12.0 * "	610.5±14.5 * "
	6th day	675.5±10.3 *	397.8±10.5 * "	631.2±15.2 * "
	9th day	528.4±9.5	359.4±10.2 * "	371.1±10.6 * "
β-lysine (relative unit)	Initially	30.6±0.7	31.8±1.5	29.3±1.4
	1st day	38.2±0.8 *	79.2±2.2 * "	34.3±1.6
	4th day	45.5±1.1 *	77.4±2.1 * "	41.2±1.9 * "
	6th day	48.4±1.2 *	51.6±1.8 *	42.8±1.9 * "
	9th day	32.1±0.8	43.5±1.6 * "	35.9±1.5 * "
SIgA (g / l)	Initially	0.429±0.012	0.431±0.020	0.426±0.018
	1st day	0.442±0.013	0.518±0.022 * "	0.431±0.019
	4th day	0.458±0.015	0.429±0.020	0.439±0.019
	6th day	0.460±0.015 *	0.328±0.018 * "	0.442±0.020
	9th day	0.431±0.011	0.216±0.012 * "	0.218±0.014* "
IgA (g / l)	Initially	0.236±0.005	0.241±0.018	0.232±0.014
	1st day	0.242±0.006	0.612±0.026 * "	0.235±0.016
	4th day	0.261±0.008 *	0.598±0.025 * "	0.247±0.018
	6th day	0.255±0.006 *	0.504±0.020 * "	0.250±0.018
	9th day	0.229±0.004	0.488±0.018 * "	0.365±0.020* "
IgG (g / l)	Initially	0.519±0.007	0.525±0.017	0.515±0.016
	1st day	0.533±0.009	0.754±0.021 * "	0.520±0.018
	4th day	0.548±0.010	0.512±0.016	0.538±0.020
	6th day	0.551±0.011	0.454±0.015 * "	0.441±0.021* "
	9th day	0.522±0.006	0.307±0.012 * "	0.296±0.014* "

Note: * – p <0.05 against the initial values, " – p <0.05 against values which are typical for normoreactivity of the organism.

The results of the study of local immunity in oral fluid in patients with generalized periodontitis accompanied by hyperreactivity of the body indicate a number of differences from such parameters in patients with normoreaction (table 1). Thus, after the initial sharp rise of all the studied criteria (p <0.05), by the end of the observations there is a multidirectional nature of their changes. It should be taken into consideration that the amplitude of growth of factors of nonspecific and specific immunity in the oral fluid on the 1st day of observation in patients of this group was significantly higher than that of normoreactivity of the organism (p <0.05). Beginning with the 4th day, there was a sharp decrease in lysozyme content. By the end of observations (on the 9th day), its value was significantly lower than the initial – 1.49 times (p <0.05). The dynamics of secretory IgA and IgG was similar – on the 9th day their content in the oral fluid was lower than the initial, respectively, 1.99 and 1.71 times (p <0.05). In this case, the values of β-lysine and the monomeric form of IgA until the end of the observations remained significantly higher than the initial, respectively, 1.37 and 2.02 times (p <0.05). Thus, the dynamics of the studied indicators shows a dysfunction of the local immunity of the oral cavity in patients with GP accompanied by increased reactivity of the body, which is caused by the depletion of protective and compensatory capabilities.

The results of the study of local immunity in the oral fluid in patients with generalized periodontitis accompanied by hyporeactivity of the body indicate a number of differences from such parameters in patients with normo- and hyperreaction (table 1). Thus, the increase in all the parameters after the surgery was less pronounced than in case of normoreactivity and later than in case of hyperreactivity. In this case, the level of lysozyme, gradually increasing, reached its peak on the 6th day (1.20 times higher than the initial and 1.07 times lower than the corresponding value in the first group, p <0.05), followed by a sharp decrease by the 9-th day of observation. The level of β-lysine also reached its maximum value on the 6th day (1.46 times higher than the

initial and 1.13 lower than that of normoreactivity of the body, p <0.05). However, by the end of the observation, its value remained significantly higher than the initial – 1.23 times (p <0.05). The content of secretory IgA after the surgery on periodontal tissues tended to increase with its maximum on the 6th day (p> 0.05), followed by a sharp decrease to the value which was 1.95 times lower than the initial (p <0.05) one. The values of the monomeric form of IgA also tended to increase gradually with its maximum on the 6th day (p> 0.05). However, in contrast to the dynamics of secretory IgA, by the end of the observation there was a significant increase in the monomeric form of IgA (1.57 times higher than the initial value and 1.59 times higher than the level which is typical for normoreactivity of the organism, p <0.05). This may happen due to increased degradation of secretory IgA molecules. It is known that with an increase in the number of anaerobic microorganisms with high protease activity, splitting of the structure of secretory IgA can occur into individual fragments, including the monomeric form. The content of IgG in the oral fluid, gradually increasing, reached its peak on the 4th day with a subsequent decrease to values which were 1.74 times lower than the initial (p <0.05).

Thus, the dynamics of the studied indicators shows dysfunction of local oral immunity in patients with GP accompanied by reduced reactivity of the body due to reduced functional activity of nonspecific immune factors and significant slowing of antibody processes, as evidenced by later growth and relatively low values [2, 5].

The results of this study showed that the patients with generalized periodontitis accompanied by normoreactivity of the body after surgery have local stress (lysozyme, β-lysine, SIgA, IgA, IgG in the oral fluid) immunity with normalization by the end of observation [12].

In case of hyperreactivity of the organism patients with generalized periodontitis have the dysfunction of local immunity which is caused by exhaustion of protective and compensatory possibilities which is manifested by the expressed fluctuations of level of lysozyme, β-lysine, secretory IgA, IgA and IgG in oral liquid with their imbalance to the end. In case of hyporeactivity of the organism the patients with generalized periodontitis have the dysfunction of local immunity caused by decrease in functional activity of factors of nonspecific protection and slowing down of process of antibody formation which is shown by a later rise and rather low amplitude of changes of the investigated parameters is defined [6-8].

Conclusion

The correction of the changed indicators in patients with generalized periodontitis accompanied by the impaired reactivity of the organism with their decreasing to the values, which are typical for normoreactivity, is considered to be a condition of optimization of healing of a mucous and bone wound after the surgical treatment and the subsequent stabilization of process in periodontal tissues.

Reference

1. Bida VI, Germanchuk SM. Zminy v tkaninah parodonta u hvorih na cukrovij diabet. Aktualni problemy suchasnoyi medytsyny. 2017; 17(1): 288-92. [in Ukranian]
2. Chesnikievich-Guzik M, Yurchinskiy V, Pelka P, Pitko-Polonchik J, Loster. Ushkodzhennya B. mekhanizmiv peryferychnoyi tolerantnosti u patsiyentiv z hronichnym zapalennyam parodontu. Implantologiya, parodontologiya, osteologiya.2019; 4(56): 14-20. [in Ukranian]
3. Markovska IV, Sokolova II, Markovska OV. Osnovni biohimichni pokazniki miscevogo imunitetu ta rN v rotovij ridini shchuriv za umov vplivu elektromagnitnogo viprominyuvannya zminnim elektrichnim polem nizkoyi chastoti. East European Scientific Journal. 2019; 1(148): 29-33. [in Ukranian]
4. Petrushanko TO, Moshel TM, Gancho OV, Popovich IYu, Bubliy TD, Bobrova NO. Efektivnist zastosuvannya NBF Gingival Gel u likuvanni paciyentiv iz hronichnim kataralnim gingivitom. Zaporozhskij medicinskij zhurnal. 2018; 2(107): 216-220. [in Ukranian]
5. Savcl'єva NM, Sokolova II, German SI. Imunologichni aspekti generalizovanogo parodontitu. Visnik naukovih doslidzhen'.2018; 2: 110-115. [in Ukranian]
6. Shnajder SA, Ginzhul IV. Sostoyanie immunologicheskoj reaktivnosti organizma u pacientok s generalizovannym parodontitom i generalizovanym parodontitom na fone raka molochnoj zhelezy. Visnik stomatologiï. 2019; 2(32): 33-38. [in Russsian]
7. Yarov YuYu. Rezultaty tsytolohichnoho doslidzhennia pislia khirurhichnoho likuvannia heneralizovanoho parodontytu na tli riznoi reaktyvnosti orhanizmu. Visnyk stomatolohii. 2023; 121(4): 36–40. [in Ukranian]
8. Yarov YuYu, Silenko YuI, Yeroshenko GA. Dynamics of immunological indices in wound healing accompanied by different types reactivity of the organism. World of medicine and biology. 2021; 2 (76): 258-262.
9. Barros SP, Offenbacher S. Modifiable risk factors in periodontal disease: epigenetic regulation of gene expression in the inflammatory response. Periodontol 2000. 2014; 64: 95-110. doi: 10.1111/prd.12000
10. Loos BG, Papantonopoulos G, Jepsen S, Laine ML. What is the contribution of genetics to periodontal risk? Dent Clin North Am. 2015;59(4):761–780. doi: 10.1016/j.cden.2015.06.005.
11. Meyle J, Chapple I. Molecular aspects of the pathogenesis of periodontitis. Periodontol 2000. 2015; 69: 7-17. doi: 10.1111/prd.12104
12. Razzouk S. Regulatory elements and genetic variations in periodontal diseases. Arch Oral Biol. 2016; 72: 106-15.

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