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STUDY OF THE COMORBID ASSOCIATION OF INFLAMMATORY PERIODONTAL DISEASES AND PATHOLOGY OF THE NERVOUS SYSTEM

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Abstract

To date, periodontal tissue diseases are one of the most common and urgent problems in modern dentistry. Inflammatory periodontal diseases occur in all age groups along with caries and are one of the main mass pathologies of the dentofacial system. Characterized by a latent onset and chronic course, periodontitis in its first stages is a difficult to diagnose pathology of the dentofacial system, and when the process develops, it is a difficult condition to treat. Therefore, untimely diagnosis, inadequate treatment and progression of the process can be a major cause of tooth loss. The main factor influencing the development of inflammatory diseases is the vitality of periodontopathogenic microflora of the oral cavity. Inflammatory diseases of periodontal tissues are accompanied by significant immunological shifts on the part of both the first and second lines of protection of periodontal tissues.

The key role in the development of generalized inflammatory and ischemic periodontal lesions is played by disruption of the microcirculatory bloodstream of periodontal tissues. Hemomicrocirculatory disruptions provoke the development of metabolic disorders, dystrophic and degenerative changes in periodontal tissues, initiating a «vicious circle» of inflammatory reactions.

In a significant number of cases, microcirculatory disorders are associated with cardiovascular, endocrine, systemic diseases, disorders of the gastrointestinal tract, nervous system, etc. Lack of timely diagnostic measures, in turn, predetermines prolonged and unsuccessful therapy of soft tissue periodontal inflammatory diseases. The presence of systemic pathology in the human body brings an important contribution to the etiopathogenesis of inflammatory diseases of the periodontal complex. At the same time, comorbid conditions are characterized by their mutually aggravating course due to their close morphofunctional relationship. Almost all people with age experience a slowdown in metabolic processes and changes in the structure of brain cells, manifested by a decrease in cognitive abilities, memory and concentration of attention.

The aim of the study was to assess the dental, neurological and cognitive statuses in patients with chronic periodontitis.

Keywords: *periodontitis, inflammatory process, immunological shifts, microorganisms, nervous system, comorbid association, neurodegenerative disorders, neurotrophic factor, microcirculatory disorders.*

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INTRODUCTION

To date, periodontal tissue diseases are one of the most common and urgent problems in modern dentistry. Thus, according to the World Health Organization (WHO), in different regions of the world, this pathology occurs from 65,0 to 98,0% (age group 35-44 years) [*Gontarev SN, 2016, Haidarova NB, 2020*].

At the same time, the provision of medical dental care to patients with periodontitis in the general structure of medical and preventive institutions of dental profile is 30% or more of the total number of applicants. Inflammatory periodontal diseases occur in all age groups along with caries and are one of the main mass pathologies of the dentofacial system. Characterized by a latent onset and chronic course, periodontitis in its first stages is a difficult to diagnose pathology of the dentofacial system, and when the process develops, it is a difficult condition to treat. Therefore, untimely diagnosis, inadequate treatment and progression of the process can be the main cause of tooth loss [*Gomes-Filho I et al., 2018*].

The main factor influencing the development of inflammatory diseases is the vitality of periodontopathogenic microflora of the oral cavity [*Tsarev V et al., 2008; Zyryanova N et al., 2009; Zorina O et al., 2011; Lyamina S et al., 2011, 2014; Rabinovich O et al., 2013; Shi B et al., 2015; Glowczyk I et al., 2017*]. However, gingivitis and periodontitis would not be such important problems for dentists, if it were not for the participation in the development of the pathological process of disturbed defence mechanisms of periodontal tissues [*Atrushkevich V, 2010; Abaev Z et al., 2012; Tsepov L et al., 2018*]. Inflammatory diseases of periodontal tissues are accompanied by significant immunological shifts on the part of both the first and second lines of protection of periodontal tissues [*Bulkina N, Ostrovskaya L, 2011*]. At the same time, it is known that the chronic inflammatory process, as well as the aggressive course of inflammation, are accompanied by a perverted immunological reaction [*Tebloeva L., 2015*]. At present, the leading role of periodontopathogenic microorganisms in the initiation of inflammation is not questioned, but the rate of clinical symptoms and their severity are determined by the protective potential of periodontal tissues and the whole organism of the patient [*Gerasimova LP et al., 2017*].

In addition, the presence of systemic pathology in the human body brings an important contribution to the etiopathogenesis of inflammatory diseases of the periodontal complex. Microcirculatory disorders that are associated with cardiovascular, endocrine, systemic diseases, disorders of the gastrointestinal tract, nervous system, etc., have attracted special attention [*Bulkina N, Vedyaeva A, Savina E, 2012*]. Lack of timely diagnostic measures, in turn, predetermines prolonged and unsuccessful therapy of soft tissue periodontal inflammatory diseases. At the same time, comorbid conditions are characterized by their mutually aggravating course due to their close morphofunctional relationship.

Almost all people with age experience a slowdown in metabolic processes and changes in the structure of brain cells, manifested by a decrease in cognitive abilities, memory and concentration of attention. These neurodegenerative disorders are directly related to altered levels of nerve growth factor, brain-derived neurotrophic factor and to altered expression of their receptors. To date, a number of neurotrophic factors are known to be involved both in the regulation of growth, development, differentiation and survival of nerve cells and in the processes of their adaptation to exogenous influences. One of these factors is the brain-derived neurotrophic factor. The assumption of the risk of developing microcirculation disorders in periodontal tissues in the early stages of its development (as a result of metabolic disorders of the brain-derived neurotrophic factor) is possible by assessing the neurological status of patients with cognitive scales and identifying risk groups. In addition, the brain-derived neurotrophic factor is an additional way to assess the dynamics and effectiveness of neurological treatment [*De Almeida Claudino F at al., 2020*] and can be used as an element of forecasting, as well as early diagnosis of comorbid inflammatory diseases of periodontal tissues and the nervous system.

In this regard, the **purpose of the study** was to assess the dental, neurological and cognitive statuses in patients with chronic periodontitis.

MATERIALS AND METHODS.

The research was carried out on the basis of the departments of orthopedic dentistry; neurology and medical genetics of the Perm State Medical

University named after Academician E.A. Wagner. Two groups of middle-aged and elderly people from 44 to 65 years old (WHO) were formed to conduct the study: the main group consisted of 32 people (1st subgroup – 16 people (6 men, 10 women), 2nd subgroup – 16 people (9 men, 7 women)) and the control group – 16 people (8 men, 8 women), comparable in gender and age. The main group, the first subgroup, included patients with a generalized form of mild and moderate chronic periodontitis in remission, associated with neurological and cognitive changes. The second subgroup included patients with a generalized form of mild and moderate chronic periodontitis in remission, without neurological and cognitive changes. The control group consisted of persons whose dental status at the time of examination was not burdened by inflammatory diseases of periodontal tissues. Dental, neurological and cognitive statuses were assessed in all patients. The collection of complaints, life and disease history was carried out according to questionnaires of disease histories (medical history of a dental patient). The clinical dental examination was carried out according to the generally accepted methodology, with the use of basic and additional examination methods. The index assessment of the periodontal tissue condition was carried out using the communal periodontal index (modified), the level of oral hygiene – using the Silness-Loe plaque index and the gingivitis index. The assessment of neurological status was supplemented with the use of recommended scales, tests and questionnaires. To study emotional and personal characteristics, the Spielberger-Khanin test was used [*Spielberger and Khanin, 1976*], the severity of depression and anxiety was studied using the CES–D questionnaire [*Radloff, 1977*], the hospital anxiety and depression scale [*Zigmond A. and Snaith R., 1983*]. Assessment of cognitive impairment - using the Montreal Cognitive Assessment scale [*Nasreddin Z., 1996*], a simplified scale of instrumental activity of everyday life [*Lawton M., 1969*], a questionnaire of functional activity and mini–mental state examination [*Folstein M., Folstein S., 1975*]. To assess the quality of life of the observation groups, the OHIP-49-RU questionnaire was used [*Gileva O. et al., 2009*]. The diagnosis of the disease was made in accordance with the International Classification of Diseases (ICD-10). Statistical processing of the obtained research results was carried out using generally accepted standard methods: median (Me), first quartile (Q1) and third quartile (Q3) were found. Due to non-normal distribution, non-parametric statistical methods were used. To assess the relationship between indicators in one sample, the Chaddock correlation coefficient was used. The Mann-Whitney test was used to assess differences between groups. The critical level of significance when testing statistical hypotheses was considered equal to 0.05.

Results

The dental status of patients in the main group was characterized by statistically significant differences from the control group in all the criteria parameters carried out in this study (index of caries, communal periodontal index, Silness-Loe, gingivitis index). In the control group, these evaluation criteria were within the limits of normative indicators (table 1).

The intensity of caries in patients was determined using the caries filling extraction index. In the control group, the indicator corresponded to a very low and low level of caries. In the main group, the level of caries was medium and high. A modified communal periodontal index was used to detect bleeding on probing, the presence of hard dental deposits and periodontal pockets of 4 *mm* or more. The communal periodontal index index in patients of the main group according to the results of the survey and questionnaire was increased in 100% of cases (32 people). The level of oral hygiene was determined using two indices: Silness-Loe and gingivitis index. The plaque index (Silness-Loe) was increased in patients of the main group in 97% of cases (31 people). The gingivitis index was used to

Table 1.

Dental status of patients in observation groups

Criteria	Observation Groups, Me (Q1; Q3)		
	1st subgroup	2nd subgroup	Control
Index of caries	12.5 (10;15)	8.5 (7; 10.75)	6 (4.5; 8)
Communal periodontal index	2.5 (2; 3)	3 (2; 3.75)	0 (0; 1)
Silness-Loe	2 (1; 3)	2.5 (2; 3)	1 (0; 1)
Gingivitis index	46.05 (6.25; 45.75)	43.3 (8; 43.75)	7.05 (4; 8)

TABLE 2.

Neurological status of patients in the observation groups

Criteria (scales/questionnaires/surveys)	Observation Groups, Me (Q1; Q3)		
	1st subgroup	2nd subgroup	Control
Spielberger-Khanin test	39 (32.75; 44.75)	15 (7.25; 18.75)	15 (10; 17.75)
CES-D	27 (25; 29)	9 (6; 13.75)	10 (7.25; 14)
Hospital Anxiety and Depression Scale	10 (8; 11)	4 (2; 5.75)	2 (2; 3)
Montreal Cognitive Assessment Scale	23 (21; 24.75)	30 (30; 30)	30 (29.2; 30)
Simplified scale of instrumental activity	4 (3; 4)	4 (4; 4)	4 (4; 4)
Functional activities questionnaire	2 (1; 2)	0 (0; 0)	0 (0; 0)
Mini-mental State Examination	24.5 (20.5; 27.75)	30 (30; 30)	30 (29.25; 30)
OHIP-49-RU questionnaire (before treatment)	28.4 (5; 28.75)	28.4 (5; 28.75)	26.1 (4.25; 25.75)

identify lesions of the gingival papilla, marginal and alveolar part of the gum. The increase in the gingivitis index index was in 100% of cases (32 people). At the same time, the examined persons of the control group did not have any in any case. Differences in the main and control groups were statistically significant for all evaluation criteria.

The results of the assessment of neurological and cognitive statuses in patients are presented in table 2.

Neurological status in patients of the main group according to the results of examination and questionnaire were determined in 22% of cases (7 people), and cognitive impairment was detected in 28% of cases (9 people). At the same time, the examined persons of the control group did not have any in any case. The differences in the main and control groups were statistically significant in all evaluation aspects. At the same time, the neurological status of patients in the main group was characterized by moderate and high anxiety; mild, moderate and severe depression; clinically expressed anxiety (according to the Spielberger-Khanin test: 14 people (43.7%) – an indicator of more than 30; according to the CES-D questionnaire: 16 people (50.0%) – an indicator of more than 17; according to hospital anxiety and depression scale: 14 people (43.7%) – the indicator is more than 7.

The cognitive status of patients in the main group was determined by mild (pre–dement) cognitive impairments, minor need for help, age-related changes in memory and thinking, moderate anxiety and depression of moderate severity (according to the Montreal Cognitive Assessment Scale cognitive assessment: 7 people (22.0%) - an indicator less than 23; according to the simplified scale of instrumental activity of everyday life: 6 people (18.70%) - indicators less than 4; according to the functional activity questionnaire: 10 people (31.30%) - indicators more than 1; according to mini–mental state examination: 12 people (37.50%) - indicators less than 28).

It should be noted that the presence of depressive disorders correlated with a decrease in the quality of life according to the questionnaire (Spearman correlation coefficient is 0.173, the closeness of the relationship according to the Cheddock scale is direct, weak, significance level is $p > 0.05$). At the same time, patients with a generalized form of mild and moderate chronic periodontitis showed a statistically significantly high level of depression according to the CES-D questionnaire, the hospital anxiety and depression scale, reactive and personal anxiety according to the Spielberger-Khanin test. A statistically significant direct correlation between inflammatory periodontal diseases (generalized periodontitis of mild to moderate severity) and cognitive impairment (Spearman correlation coefficient is 0.022, the closeness of the relationship according to the Cheddock scale is inverse, weak, significance level $p > 0.05$) was determined in the patients of the main group with identified cognitive impairment.

DISCUSIONS

Analysis of the dental status of patients of the main group with inflammatory periodontal diseases (generalized periodontitis of mild and moderate severity) is characterized by a statistically significant deterioration in the values of dental indices in comparison with patients of the control group, which indicates a decrease in the resistance of periodontal tissues and the organism as a whole.

The analysis of the neurological status in pa-

tients of the main group in 46% of cases was characterized by a statistically significant high level of anxiety and depression, as well as clinically pronounced anxiety (according to the Spielberger-Khanin test, the CES-D questionnaire and the hospital anxiety and depression scale. Neurological disorders were not detected in any cases in persons of the control group.

The analysis of cognitive status in patients of the main group in 27% of cases was characterized by mild (pre-decent) cognitive impairment, minor need for assistance, age-related changes in memory and thinking, moderate anxiety and depression of medium severity (according to the Montreal Cognitive Assessment Scale cognitive assessment, simplified instrumental activities of daily living scale, functional activity questionnaire, brief mental status assessment scale.

A statistically significant direct correlation between inflammatory periodontal diseases and neurological and cognitive impairments, as well as a decrease in the quality of life according to the OHIP-49-RU questionnaire was determined in the patients of the main group [*Gileva OS et al., 2009*] in 56% (18 people).

Conclusion

The comorbidity of inflammatory periodontal diseases and pathology of the nervous system is of particular interest for modern research at the junction of two specialties (dentistry, neurology). Adverse prognosis or failure of dental therapeutic and/or prosthetic treatment of patients with initial forms of generalized periodontitis may be largely due to problems in diagnosing the underlying disease caused by the pathology, such as that associated with impaired metabolism of the brain-derived neurotrophic factor, which may result in reduced dental and neurological health, quality of life of patients and, as a consequence, their social maladaptation. These facts require the development of new approaches to early diagnosis and optimization of complex specialized stomato-neurological care for patients with such pathological conditions.

Thus, understanding the role of neurotrophic factors in the formation of not only neurological but also dental diseases (periodontitis) can help to optimize the early diagnosis of the latter and provide timely treatment based on the knowledge of a new etiopathogenetic link of inflammatory diseases of the soft periodontal tissues. The results of further research in this direction can be applied in practical healthcare for prognosis and/or assessment of treatment efficacy of comorbid association of functional disorders of neurological nature (cognitive functions) and inflammatory diseases of periodontal tissues.

REFERENCES

1. *Abaev ZM, Domashev DI, Antidze MK, Boriskina OA., Zorina OA. (2012).* [Modern methods of treatment and prevention of periodontal diseases] [Published in Russian]. Journal «Dentistry for all». 2012; 91(4): 72-74.
2. *Atrushkevich VG. (2010).* [Diagnosis and treatment of periodontal diseases in violation of mineral metabolism: abstract. dis. ... Doctor of Medical Sciences: 14.00.14] [Published in Russian]. Moscow, 2010; p. 50.
3. *Bulkina NV, Lukina LV, Ostrovskaya LYu, Kobzeva YuA, Vereshchagina EA. (2011).* [Experience of application of immunocorrecting therapy in the complex treatment of chronic generalized periodontitis] [Published in Russian]. Saratov Scientific and Medical Journal. 2011; 7(1): 280-281.
4. *Bulkina NV, Vedyaeva AP. (2012).* [On the question of the etiology and pathogenesis of rapidly progressing periodontitis] [Published in Russian]. Russian Dental Journal. 2012; 5: 50-52.
5. *De Almeida Claudino FC, Gonçalves L, Felipe Barreto Schuch FB, Sampaio Martins HR. (2020).* [N.S. da Rocha The Effects of Individual Psychotherapy in BDNF Levels of Patients With Mental Disorders: A Systematic Review] [Published in English]. Journal «Front Psychiatry». 2020; 11: 445.
6. *Gerasimova LP, Khaybullina RR, Gilmutdinova LT, Khaybullina ZR. (2017).* [Non-medicamentous technologies in medical rehabilitation of patients with chronic generalized parodontitis] [Published in Russian]. Journal «Physiotherapy, balneology and rehabilitation». 2017; 16(3): 140-144.

7. *Gerasimova LP, Khaybullina RR, Kabirova MF, Usmanova IN, Karimova SR. (2017).* [Microbiological assessment of the state of the oral cavity in patients with chronic inflammatory diseases of parodont] [Published in Russian]. Ural Medical Journal. 2017; 7: 42 - 45.
8. *Gerasimova LP, Usmanova IN, Usmanov IR, Khusnarizanova RF, Al-Kovis MAM. (2017).* [Features of dental and microbiological condition in persons with inflammatory diseases of the parodont in dependence of age] [Published in Russian]. Ural Medical Journal. 2017; 7: 5 - 9.
9. *Glowczyk I, Wong A, Po-tempa B. (2017)* [Inactive gingipains from P. gingivalis selectively skews t cells toward a Th17 phenotype in an IL-6 dependent manner] [Published in English]. Journal «Front. Cell. Infect. Microbiol». 2017; 27 (7): 140.
10. *Gomes-Filho IS, Trindade SC, Passos-Soares JS, Figueiredo ACMG, Vianna MIP, Hintz AM ef al. (2018).* Clinical diagnosis criteria for periodontal disease: an update. J Dent Health Oral Disord Ther. 2018;9(5):354–356. DOI: 10.15406/jdhodt.2018.09.00408
11. *Gontarev SN, Banchuk AY, Nikishaeva AV. (2016).* [About some methods of examination of periodontal tissues] [Published in Russian]. Journal «Stomatology of Slavic States». Belgorod, 2016: 81-83.
12. *Gileva O.S. , Libik T.V., Khalilayeva E.V., Danilov K.V., Khalyavina I.N., Gileva Ye.S. et al., (2009).* [Dental health in quality of life criteria] [published in Russian]. Journal «Bashkortostan Medical Bulletin». 2009; 6 (3): 6-11.
13. *Haydarova NB, Bekenova P, Bekmukhambet A, Nugumanova D, Sapash G, Tagaeva A, Muratbekov D, Baysekina L, Karyakina A, Halelov S. (2020).* [Application of carbon sorbent in treatment] Published in Russian. Magazine «Science and Healthcare». 2020; 4 (22): 133-144.
14. *Lyamina SV, Kruglov SV, Vedenikin TU, Borodovitsyna OA, Suvorova IA, Shimshelashvili SL, Malyshev IU. (2011).* [Alternative reprogramming of m1/m2 of mouse opheron in macro] published in Russian intervenovitro. Journal «Cellular technologies in biology and medicine». 2011; 4 (12): 235-242.
15. *Lyamina SV, Malyshev IY. (2014).* [Macrophage polarization in the modern concept of formation of immune response] [Published in Russian]. Journal «Fundamental Research». 2014; 10: 930 - 935.
16. *Rabinovich OF, Rabinovich IM, Ostrovsky AD, Abramova ES, Budi-hina AS, Arshinova SS. (2013).* [Assessment of mucosal immunity in patients with mouth mucosal mucosa before and after complex treatment] [Published.] Journal «Immunology». 2013; 34 (2): 91-94.
17. *Shi D, Liu YY, Liet W. (2015).* [Association between plasma leptin level and systemic inflammatory markers in patients with aggressive periodontitis] [Published in English]. Journal «Chin. Med. J. (Engl)». 2015; 128(4): 528-532.
18. *Tebloeva LM.(2015).* [Modern immunological aspects in the pathogenesis of periodontal diseases: autof. dis. ... Dr. honey. Science: 14.01.14] [Published in Russian]. Moscow, 2015: 54.
19. *Tsarev VN, Plahty LY, Yanushevich OO, Nikolaeva EN. (2008).* [Etiology and modern approaches to improving the tactics of antibacterial therapy of patients with chronic generalized parodontitis (lecture 1)] [Published in Russian]. Journal «Dentist». 2008; 7: 47-54.
20. *Tsepov LM, Nikolaev AI, Nesterova MM, Tsepova EL. (2018).* [Pathogenetic features of the formation of chronic inflammatory periodontal pathology (review)] [Published in Russian]. Journal «Vestnik of the Smolensk State Medical Academy». 2018; 17 (3): 206-214.
21. *Zorina OA, Kulakov AA, Rebrikov DV. (2011).* .[Quantitative assessment of the ratio of pathogenic representatives of the oral cavity in normal and periodontitis] [Published in Russian]. Journal «Dentistry». 2011; 90 (3): 40-42.
22. *Zyryanova NV, Grigoryan AS, Grudyanov AI. (2009).* [Specific composition of anaerobic microflora of periodontal pocket depending on the stage of parodontitis] [Published in Russian]. Journal «Dentistry». 2009; 4: 43-47.

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