



## The Relationship Between the Periodontal Status and Cardiovascular System According to the Clinical and Laboratory Data

**T Avraamova\* and A Grudyanov**

*National Medical Research Centre for Dental and Maxillofacial Surgery of the Ministry of Health of Russia*

**\*Corresponding Author:** T Avraamova, National Medical Research Centre for Dental and Maxillofacial Surgery of the Ministry of Health of Russia.

**Received:** June 02, 2022

**Published:** June 30, 2022

© All rights are reserved by **T Avraamova and A Grudyanov.**

### Abstract

The study investigated the associated risk of progression of periodontitis, the development of systemic inflammatory response and cardiovascular disease. Additional pathogenic link, reinforcing the link between the periodontitis and the development of cardiovascular disease is a systemic inflammatory reaction with increased hs-CRP in the blood and IL-6. Paired for medical and dental pathology requires dentists and cardiologists' joint effort of modifying common risk factors.

**Keywords:** Periodontitis; Cardiovascular Disease; hs-CRP; Inflammation

### Introduction

The issue of increasing the life expectancy of the population is the dominant task of medicine throughout the world. Along with this task, it is important to ensure the fullness of life itself, especially for a progressively increasing number of elderly people. Since functional and morphological changes in the vascular system progress in the body with aging, it is natural that the cause of deaths is primarily diseases of the cardiovascular system. In this regard, the search for ways to prevent the occurrence and progressive development of CVD is quite obvious. In turn, all, mostly chronic, processes in the body that affect the state of the vascular wall fall under the close attention of cardiological specialists. As a rule, these are diseases of focal inflammation, which, as their duration increases, can significantly aggravate or even be an independent cause of a chronic inflammatory process in the body [3,4,8,9].

Myocardial infarction (MI) is the main manifestation of inflammatory changes in the walls of the coronary arteries. MI is one of

the leading causes of death in the Western world. Can periodontitis or other inflammatory diseases of the oral cavity cause CVD, is there a systemic relationship, a relationship with diseases such as atherosclerosis and diabetes mellitus (DM)? The practice of a dentist is associated with the treatment of a significant number of patients (> 30%) with a history of somatic diseases [5]. The ongoing process of population aging, along with the presence of risk factors, contributes to an increase in the number of comorbidities against the background of a decrease in the body's compensatory capabilities [6].

The problem of the relationship between periodontitis and CVD is quite complex, and if the negative impact of existing cardiovascular pathology on the likelihood of development and the nature of the course of periodontal diseases has been proven in a number of studies [2,5,7], then the reverse effect of existing chronic periodontitis on the risk CVD and its complications are not well understood. Currently, in the pathogenesis of many diseases of internal organs,

more and more importance is attached to the systemic inflammatory response (SIR) associated with both infection and aseptic inflammation [3,4]. With severe local inflammation or failure of the mechanisms that limit its course, hs-CRP rises, cytokines enter the circulation system, leading to the development of SVR [1].

In connection with the above, the purpose of our study was to learn the relationship between periodontitis and the development of CVD at patients with various cardiovascular risks.

**Materials and Methods**

Four groups were formed to perform the study: patients with mild (n = 25), moderate (n = 34), severe (n = 30) periodontitis (P) and patients in the control group without inflammatory periodontal disease (n = 20). In the subgroup of patients with mild P, the age of patients was 45.5 ± 1.85 years, and in moderate and severe cases, 48.6 ± 2.08 and 49.3 ± 1.8 years. The age of patients in the control group was 45.7 ± 2.91 years. There was no difference in age between subgroups of patients. Among patients with mild periodontitis, there were 8 (32%) men and 17 (68%) women. Among the moderate patients, there were 10 (29%) men and 24 (71%) women. In the subgroup of patients with severe P, men accounted for 6 (20%) and women - 24 (80%).

The level of hs-CRP was determined by a highly sensitive immunoturbidimetric method using carboxylated polystyrene par-

ticles on a Sapphire 400 biochemical analyzer, Japan. The level of pro-inflammatory IL-6 - on the analyzer Microplate Washer PW40, "BIO-RAD LABORATORIES SAS", France. The risk of developing cardiovascular diseases was assessed using the SCORE (Systematic Coronary Risk Evaluation) scale, which makes it possible to determine the 10-year risk of fatal cardiovascular events. A high risk is 5% or more, a low risk is 1-4%. ANOVA was used for statistical analysis.

**Results and Discussion**

At the patients with mild, moderate and severe P the risk on the SCORE scale was 0.3 ± 0.11, 1.4 ± 0.41 and 1.6 ± 0.37 points, respectively. In the control group, the same indicator was 0.8 ± 0.37 points. A high risk on the SCORE scale in the control group was found in 5%, and in patients with mild, moderate and severe P, respectively, in 0%, 8.8% and 13.3%. The assessment of significance between groups was carried out by analysis of variance according to Fisher's test. Multiple comparisons showed a significant difference between the groups: with an increase in the severity of P, the risk of developing CVD was higher.

Sensitive markers to characterize the severity of SVR in the acute phase are hs-CRP, IL-6, and fibrinogen. The upper limit of normal for hs-CRP in the blood is 5 mg/l, for IL-6 - 10 mg/ml, for fibrinogen - 4 g/l. The results of studies of these markers in subgroups of patients are presented in table 1.

Indicators	Periodontities			the control groups n = 20	p
	Mild n = 25	Moderate n = 34	Severe n = 30		
hs-CRP, мг/л	3,5 ± 0,28	4,1 ± 0,44	5,8 ± 0,27	2,1 ± 0,30	0,039
IL-6, mg/ml	11,0 ± 3,38	12,8 ± 2,62	14,5 ± 1,40	4,6 ± 1,96	0,016
Fibrinogen, g/l	3,2 ± 0,1	3,4 ± 0,12	4,3 ± 0,08	3,3 ± 0,13	0,64

**Table 1.** Common markers of inflammation at patients with P of varying severity and in the control group.

**Note:** \*-Assessment of significance between groups was carried out by analysis of variance according to Fisher's test.

With an increase in the severity of periodontitis in the blood, hs-CRP consistently increased. Compared with the control group, in mild, moderate and severe periodontitis, the level of hs-CRP increased by 66.7% (p < 0.05), 95.2% (p < 0.01) and 2.8 times (p < 0.001), respectively. A similar situation was observed for IL-6.

Exceeding the upper limit of the norm was noted for the content of IL-6 in patients already with mild severity of chronic periodontitis (11.0 ± 3.38 mg/ml). In a pairwise comparison with respect to the same indicator in the control group, a significant increase in the level of IL-6 in the blood was found in patients with mild

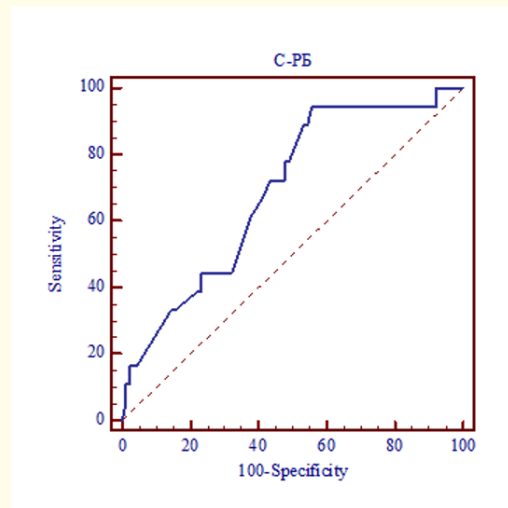
(2.4 times), moderate (2.8 times) and severe (3.2 times) severity ( $p < 0.05$ ). Regarding fibrinogen, its statistically significant increase was revealed in patients with severe chronic periodontitis compared to the control group by 30.3% ( $p < 0.05$ ). At the patients with mild to moderate periodontitis, there was only a tendency to increase fibrinogen.

Thus, at the patients with P, SVR markers increased according to the severity of periodontitis.

Taking into account that P is an inflammatory disease, and recently it is generally recognized that there is a connection between two processes - inflammation and atherosclerosis, then the integral factor of inflammation - hs-CRP can act as mediators between these processes [5,8,9]. In 2005, the results of the work of two independent research groups were published, which concluded that hs-CRP is actively involved in the processes of arterial blockage and, consequently, in the occurrence of stroke and acute myocardial infarction. The authors emphasize that the higher the content of hs-CRP, the greater the likelihood of cardiovascular complications [8,9]. According to the decision of the American Heart Association (AHA), hs-CRP is recommended to be included in the screening plan for patients with a moderate risk of cardiovascular disease [8].

To clarify the diagnostic significance of the concentration of hs-CRP in the blood in determining the risk of cardiovascular disease, we undertook an ROC analysis. Among the CGP patients, patients were selected who had severe periodontitis and a high risk of SCORE. The condition of such patients was ranked 1 and their level of hs-CRP in the blood was determined. The rank of patients with mild to moderate CGP and low risk on the SCORE scale was regarded as 0. As a result, the following results were obtained. The differential blood hs-CRP cut-off point, or cut-off point, was 3.4 mg/L. When this level was exceeded at P patients, the risk of developing severe periodontal disease and developing CVD complications increased with a diagnostic sensitivity of 94.4% and a specificity of 47.8%. The area under the corresponding ROC-curve (AUC, Area Under Curve) had a high value ( $AUC = 0.690 \pm 0.064$ ) with statistical significance  $p = 0.0029$  ( $z = 2.98$ ), which confirmed the predictive value of the test for risk assessment.

Thus, in patients with CGP, to prevent the progression of periodontitis and prevent the development of CVD, it is necessary to monitor the content of hs-CRP and IL-6 in the blood. Further, to-



**Figure 1:** ROC-curve of the hs-CRP level to determine the risk of developing CVD among patients with P.

gether with the cardiologist, to reduce the risk, it is necessary to take measures to modify systemic inflammation. To reduce the systemic inflammatory response of the body, the dentist needs to conduct an effective comprehensive periodontal treatment. The priority group for carrying out specific preventive measures to prevent CVD are patients with a high risk of their development. According to the current theory of the development of atherosclerosis, risk factors for cardiovascular disease lead to endothelial dysfunction and initiate an inflammatory response. Subclinical inflammation is caused by a successive cascade of mutually regulated factors, including cellular, humoral immunity, inflammatory mediators interferon, interleukins, proteins of the acute phase of inflammation.

## Conclusions

- The obtained results allow us to regard inflammatory periodontal diseases (IDD) as one of the additional risk factors for the development of cardiovascular diseases (CVD) based on the fact that as the chronic generalized inflammatory process in the periodontal aggravates, the cardiovascular risk (CVR) increases, respectively, by 8.8% with an average degree of periodontitis and by 13.3% with a severe degree of periodontitis ( $p = 0.04$ ).

- Considering that chronic severe periodontitis is associated with high cardiovascular risk and is an additional risk factor for the development of CVD, when considering the combined course of both diseases, in the study of subclinical atherosclerosis and the state of periodontal tissues, it is necessary to evaluate the prognostic significance in young people within order to identify among them groups with an increased risk of developing CVD, as well as to carry out targeted preventive measures.

## Bibliography

1. Boitsov SA. "The structure of risk factors, organ damage targets and metabolic changes in patients with arterial hypertension in different age groups". *Cardiology* 4 (2009): 19-24.
2. Grudyanov AI. "Inspection of persons with periodontal diseases". *Periodontology* 3 (1998): 8-12.
3. Grudyanov AI, et al. "The relationship of periodontitis and diseases of the cardiovascular system". *Dentistry* 96.1 (2017): 4-7.
4. Gusev EYU. "C-reactive protein: pathogenetic and diagnostic value". *Ural Medical Journal* 1 (2014): 113-121.
5. Kirsanov AI. "Mechanisms of interrelation of pathology of internal organs and periodontal". *Parodontologiya* 1 (1999): 35-36.
6. Leontiev VK. "Prevention of dental diseases". *Medicine* (2006): 416.
7. Trukhan DI and Viktorova IV. "Changes in the organs and tissues of the oral cavity with diseases of internal organs". *Practical Medicine* (2012): 208.
8. Lockhart PB, et al. "Periodontal disease and atherosclerotic vascular disease: does the evidence support an independent association? A scientific statement from the american heart association". *Circulation* 125.20: 2520-2544.
9. Straka M and Trapezanlidis M. "Periodontitis and stroke". *Neuroendocrinology Letters* 34.3 (2014): 200-206.