

# Methods for Assessment and Improvement of the Condition of the Mucosa of the Oral Cavity in Patients with Coronavirus Complicated with Cardiovascular Disease

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## ABSTRACT

At the present stage of the development of medicine, there is a high prevalence and intensity of dental diseases among the population, the simultaneous development of dental pathologies caused by caries and nocarosis, as well as inflammatory diseases of the periodontal and oral mucosa. It is now known that the infectious process, including COVID-19, can lead to the development of decompensation of chronic cardiovascular diseases (heart failure - HF, IHD, increased risk of thrombotic complications). Against the background of COVID-19, acute myocardial damage can also develop. Dysregulation of the renin-angiotensin-aldosterone system (RAAS) is considered the main mechanism of respiratory failure, hypoxia, oxidative stress, mitochondrial dysfunction and inflammation. Objective of the study: to get acquainted with the literature on the assessment of the state of the oral mucosa in patients with complicated cardiovascular pathology and methods of its correction and to analyze the results.

**KEY WORDS:** COVID-19, heart failure, inflammatory diseases of the oral mucosa

Many viral infections cause oral manifestations, including disorders in odontogenesis, resulting in dental malformations. In this review, based on current knowledge, we will discuss the likely dental and oral consequences of COVID-19. In this article, we review currently available data associated with vertical transmission of COVID-19 and odontogenesis, oral manifestations, and the impact of COVID-19 pandemic on a diagnosis of oral diseases. Owing to the severity of the pandemic, the population's anxiety and fear of becoming infected with COVID-19 may underestimate the signs and symptoms of serious illnesses, besides discourage patients from seeking health, medical or dental services to determine the diagnosis of oral lesions. Thus, the COVID-19 pandemic could be an additional and aggravating factor for the delay of serious illness diagnosis, such as oral squamous cell carcinoma resulting in higher morbidity and worse prognosis. Several changes and oral lesions have been described as oral manifestations of COVID-19, such as dysgeusia, oral ulcers, petechiae, reddish macules, desquamative gingivitis, among others. Besides, it can cause major systemic changes and predispose opportunistic infections. As with other viral infections, oral manifestations, including dental anomalies, can occur as a direct result of SARS-CoV-2 infection [4, 7]. However, further studies are needed to guide and clarify possible oral change. It is now known that an infectious process, including COVID-19, can lead to the development of decompensation of chronic cardiovascular disease (heart failure - HF, IHD, increased risk of thrombotic complications).

Against the background of COVID-19, acute myocardial damage may also develop. Renin-angiotensin-aldosterone system (RAAS) dysregulation, respiratory failure, hypoxia, oxidative stress, mitochondrial dysfunction, and inflammation are considered to be the main mechanisms. The virus is thought to enter the cell by binding to angiotensin-converting enzyme-2 (ACE2) receptors. After being infected with the virus, the virus spreads through the mucous membrane of the respiratory tract, causing a significant increase in the release of cytokines and the body's immune response. There is a decrease in the number of lymphocytes in the blood, especially T-lymphocytes.

The first problem raised with respect to COVID-19, is related to the easy spread of viral agents in the air during dental procedures [2, 4, 7, 8, 20]. Hence, aerosol is the most aggressive source of COVID-19 as well as other viral infections, placing dentists and their collaborators at the first line of the exposure to risk scale within the context of healthy personnel. The second problem is related to the persistence of the biological agent in operating rooms. The aerosol produced by high rotation instruments and ultrasound could remain for several hours in the air and on the surfaces [5, 9, 10, 12, 23]. Although it can save the operator, if well protected, during the therapeutic acts, it means that the air will be contaminated, thus presenting a risk for operators after removing the PPE (personal protective equipment) and for the next patients [6, 9, 18].

The purpose of the study is to evaluate the condition of the oral mucosa in patients with cardiovascular pathology and to review the literature reviewing the methods of its correction and to analyze the results.

In recent years, there have been positive trends in our country in increasing the effectiveness of endodontic dental treatment in connection with the introduction of modern technologies that allow predicting the results of dental treatment [3, 5, 17].

Dental health for workers in various industries is currently very relevant [3], since maintaining health is an important state, medical and social problem [5]. According to most studies, it was found that a complex of occupational factors contributes to the development of chronic diseases of the oral cavity, such as inflammatory diseases of the oral mucosa, periodontal tissues, carious and non-carious lesions of hard dental tissues [8, 10, 19].

Diseases of the oral cavity are often the first clinical signs of systemic diseases [3, 5, 18]. To study the interactions between different classes of dental and general somatic diseases, several studies have been conducted on this problem [4, 5, 6, 20].

In the literature, there are isolated reports on the pathogenic effect of certain environmentally unfavorable environmental factors on the state of the dentition in children. However, issues related to the prevention and treatment of diseases of congenital malformations are the most important medical and social problem in children with combined exposure to the body of pesticides, mineral fertilizers and other industrial toxic compounds in hot climates, so far, have not been resolved, which served as the main goal of this work. [1, 4].

Recent scientific evidences suggest a relevant role of the oral cavity in the transmission and pathogenicity of SARS-CoV-2. A literature search was performed in PubMed, up to April, 2020, focusing on SARS-CoV-2, COVID-19, oral cavity, and antimicrobial agents. Oral viral load of SARS-CoV-2 has been associated with the severity of COVID-19, and so a reduction in the oral viral load could be associated with a decrease in the severity of the condition. Similarly, a decrease in the oral viral load would diminish the amount of virus expelled and reduce the risk of transmission, since during the first ten days, the virus mainly accumulates at the nasal, oral,

and pharyngeal area; the number of angiotensin-converting enzyme receptor is greater in the salivary glands as compared with the lungs; and salivary droplets represent the most relevant transmission route. To reduce the oral viral load, antiseptic agents may be used, although the authors found the evidence on its efficacy to be indirect and weak. Further well-designed studies are required [6, 7, 16, 23].

Due to the use of intensified therapeutic methods possibly aggravated by SARS-CoV-2, an increase in cases with oropharyngeal symptoms/conditions, dental-oral problems associated with soft tissues, and saliva production (dry mouth) as side effects could be predicted, even after recovering from COVID-19. *Candida albicans* is a normal inhabitant in many mouths; diagnostic confirmation of infection is often based on a successful response (i.e., resolution of lesions) to antifungal medications. This form of diagnostic confirmation can be further enhanced by culturing the pathogen, preparing a fungal smear, or even by an incisional biopsy [2, 4, 18].

The problem of the impact of chronic foci of oral infection on the development of diseases of the cardiovascular system remains relevant for all countries of the world (WHO, 2003). According to a number of authors [1,3,5], the etiology of the impact of odontogenic foci of infection on the development of pathology of the cardiovascular system, periodopathogens are associated with the ability to infect endothelial cells of the coronary arteries, stimulate platelet aggregation [3,5], and research on this topic has been conducted for a long time [9,11,12]. It is known that antiarrhythmic and antihypertensive drugs cause dryness of the oral cavity in [7, 17], which contributes to the formation of bad breath, accelerates the formation of tooth plaque. Attitude worsens the course of dental diseases and adversely affects the condition of the cardiovascular system. It is noteworthy that in COVID-19 infection, the most common comorbidities are treated with ACE inhibitors. Human pathogenic coronaviruses SARSCoV and SARS-CoV-2 bind to their target cells via ACE 2, where the epithelial cells of the lungs, intestines, kidneys, and blood vessels are the first to be damaged. ACE 2 expression is significantly increased in patients with type 1 or type 2 diabetes treated with ACE inhibitors and type I angiotensin receptor blockers (ARBs).

Given the prevalence of ischemic heart disease, it is necessary to comprehensively assess the dental condition of such patients, identify odontogenic inflammatory foci, periodontal inflammatory diseases and their sanitary status, develop recommendations for individual oral hygiene, taking into account the possibility of dry mucous membranes. The traditional inclusion of chlorhexidine-based pastes and rinsing agents in complex treatment can lead to adverse effects such as dysbiotic changes, discoloration of the tongue and teeth, and taste disturbances [7,10,13]. When we analyzed all the literature on this topic, the pathogenesis of pathological processes occurring in the oral mucosa in SARS-CoV-2 pathology has not been studied. Therefore, it is important to conduct research to determine the characteristics of the dental status of patients with coronary artery disease and SARS-CoV-2, to evaluate the effectiveness of regularly used personal oral hygiene products that have anti-inflammatory, antiseptic and moisturizing effect but do not cause dysbiotic changes in the oral cavity [7, 15, 16].

In this study, for the first time, COVID-19 is evaluated for compliance with the criteria of a sanitized oral cavity with the actual dental status of patients complicated by cardiovascular pathology. In 100% of the examined patients, it was found that the hygienic condition of the

oral cavity needed to be strictly corrected. It was found that the value of periodontal indices depends on the hygienic condition, to a greater extent on the presence of cardiovascular disease. It was found that none of the patients examined in the follow-up group used the individual oral hygiene tools they needed. It was found that none of the patients examined in the follow-up group used the individual oral hygiene products they needed. For the first time, the dimensions of the interdental brushes required for adequate oral hygiene were determined. For the first time such a "drug" was identified, that daily consumption of a natural drug leads to positive dynamics of the hygienic condition, periodontal indices, normalization of the microbial landscape, elimination of most anaerobes and loss of halitosis.

This work has the potential to benefit from the day-to-day practice of medical facilities. Based on the results obtained, practical recommendations were developed for dentists to optimize hygienic care for patients with gingivitis and cardiovascular disease. It is recommended to pay special attention to informing patients that the rate of bleeding when brushing teeth is not related to the reception of drugs that regulate the rheological properties of the blood, but to the lack of adequate hygienic care. It is recommended to include in the daily hygienic care protocol a natural preparation for gums "Chamomile and propolis" and make sure that you choose a sufficient amount of hygiene products. This allows a significant reduction in the severity of inflammatory periodontal changes without the side effects typical of chemotherapeutic drugs such as tooth staining, dysbiotic changes, and taste disturbances.

## **CONCLUSION**

When we analyzed all the literature on this topic, the pathogenesis of pathological processes occurring in the oral mucosa in SARS-CoV-2 pathology has not been studied. For the first time involved in our study, COVID-19 is used to assess compliance with the criteria of a sanitized oral cavity with the actual dental status of patients complicated by cardiovascular pathology.

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## **CONFLICT OF INTEREST**

The authors declare that they have no competing interests.

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