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CONDITION OF THE MUCOSA OF THE ORAL CAVITY, CHANGES IN ORAL FLUID IN COVID-19

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Abstract. The SARS-CoV-2 virus has led to a global crisis caused by the COVID-19 pandemic, negatively impacting all areas of healthcare. COVID-19 is an infectious disease first reported in Wuhan, China. It is caused by a newly discovered coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1). The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020. As of January 20, 2021, 96,866,468 cases and 2,072,466 deaths have been reported worldwide. The first confirmed cases in Canada were reported on February 10, 2020. Since then, the total number of infections has reached 723,908, and the death toll has reached 18,421 (90).
Keywords: coronavirus infection, saliva, salivary gland diseases, herpes, stomatitis, oral microflora, candidiasis, gingivitis, periodontitis, COVID-19 therapy for oral diseases.

Introduction. Coronaviruses are a group of large RNA viruses, among which the most dangerous are the betacoronaviruses—SARS-CoV and SARS-CoV-2, which can cause severe respiratory distress syndrome (2, 3). These viruses have single-stranded RNA and range in size from 80 to 120 nm. Four main types of coronaviruses are known: α-, β-, γ-, and δ-coronaviruses (4). SARS-CoV-2 is a betacoronavirus, like its predecessors SARS-CoV and MERS-CoV. The genetic similarity between SARS-CoV-2 and SARS-CoV is approximately 79%, and 96% with bat coronaviruses (MG772933) (5). Since 1960, six coronaviruses capable of infecting humans have been identified. In 2002, the SARS-CoV outbreak led to severe acute respiratory syndrome (SARS) and claimed approximately 10,000 lives (4). Ten years later, another pathogenic coronavirus, MERS-CoV, spread in the Middle East (4, 5). SARS-CoV-2 became the seventh member of this family to infect humans (4). Its genome is highly similar to bat viruses, particularly Bat-CoV and Bat-CoV RaTG13, found in Rhinolophus affinis in Yunnan Province, China (6). The coronavirus's structure is relatively simple and includes four key proteins: the envelope protein (E), the spike protein (S), the membrane protein (M), and the nucleoprotein (N). The E, S, and M proteins are involved in the virus's entry into cells, its replication, and spread. The virus's genetic material (RNA) is associated with the nucleoprotein (N), which also plays a key role in the formation of viral particles (7). Transmission Routes and Clinical Manifestations. SARS-CoV-2 is spread both directly (through infected person's bodily fluids, saliva droplets, and respiratory secretions) and indirectly (through contact with contaminated surfaces) (8). COVID-19 symptoms include respiratory and extrarespiratory manifestations. The most common respiratory symptoms include cough, fever, and shortness of breath (9–11). Extrarespiratory manifestations include oral mucosal lesions, loss of taste and smell, headache, and myofascial pain. Therefore, these symptoms are now considered diagnostic criteria for COVID-19.

Coronaviruses (CoV) are a large group of viruses that cause illnesses of varying severity, ranging from the common cold to severe infections such as SARS and MERS. The novel coronavirus (nCoV) is a strain previously unknown to science. Its primary function is to inject its genetic material into a host cell, after which the host cell begins to produce viral proteins. As a result, a single infected cell can synthesize up to 100,000 viral particles.

During replication, the virus undergoes frequent mutations, as the RNA copying mechanism is associated with a high error rate. This explains the emergence of new strains similar to SARS-CoV-2, which was first identified in 2019. The average incubation period for COVID-19 is approximately three days (8). The most common symptoms of the disease include fever (87.9%), cough (67.7%), and fatigue (38.1%) (9,10). Laboratory abnormalities include lymphopenia (11), elevated ALT and AST levels (12,13), and increased concentrations of proinflammatory cytokines (IL-1β, IL-6, TNF-α) and blood coagulation markers (D-dimer, C-reactive protein) (14,15).

The oral barrier is the gateway into the human body. The oral mucosa and saliva are high-risk sites for higher viral loads, and dentists are considered a high-risk group. Oral lesions caused by COVID-19, as well as loss of taste and smell, are common clinical complaints in dental settings. The SARS-CoV-2 virus has been found to cause a wide range of non-specific lesions of the oral mucosa. but specific diagnosis of these mucocutaneous lesions as COVID-19 lesions will facilitate SARS-CoV-2 prevention in dental settings and assist in appropriate patient management. The oral mucosa is the initial site of contact. Commensal microbes, airborne antigens/allergens, and food products initially encounter it before entering the gastrointestinal (GI) tract and often the respiratory tract. As at other barrier sites, the local immune system maintains a delicate balance, maintaining effective immune surveillance without excessive inflammatory responses while remaining tolerant of commensals and harmless antigens [1]. The nasal cavity, nasopharynx, oropharynx, and oral cavity have been identified as potential sites for SARS-CoV-2 viral replication (10, 11). Rich in saliva and an oral microbiome, the oral cavity is a known host for various types of respiratory viruses (12, 13). Oral saliva has been found to contain high levels of viruses, suggesting that the salivary glands are active sites for the spread of this virus (14, 15). Furthermore, xerostomia and taste loss may be associated with salivary gland dysfunction associated with COVID-19 (16, 17). However, these signs are often masked by more life-threatening respiratory signs and symptoms, which in most cases require urgent medical attention. The aim of this review was to provide histological characteristics of the oral mucosa and its functional significance in SARS-CoV-2 infection, focusing on orofacial manifestations and their impact on the dental profession. Clinical changes in the oral cavity.

The role of the oral cavity in the pathogenesis of COVID-19. The oral cavity represents an important barrier protecting the body from pathogens. Saliva and the oral mucosa can contain high viral loads, making dentists a high-risk group. Mucosal lesions caused by COVID-19 are accompanied by changes in taste, xerostomia, and the development of ulcers, erosions, and inflammation. The salivary glands play a key role in the pathogenesis of infection, as they act as an active viral reservoir. Research confirms that SARS-CoV-2 can bind to angiotensin-converting enzyme 2 (ACE-2), expressed in epithelial cells of the oral mucosa. This explains the development of symptoms such as loss of taste and smell, fissured tongue, candidiasis, petechiae, and inflammatory gum disease.

Diagnosis and Prevention. Saliva is a convenient biological sample for COVID-19 diagnostics, as its collection does not require invasive procedures, reducing the risk of infection for healthcare personnel. The SARS-CoV-2 virus is detected in saliva with high accuracy (up to 92%), making this method effective for mass testing.

Dentists and medical staff must implement strict protective measures, including the use of masks, gloves, protective screens, and thorough instrument disinfection. High-speed dental handpieces without anti-retraction valves can promote the spread of aerosols, so it is important to use protective barriers and aspiration systems. Research also confirms that antiseptic mouth rinses can reduce the SARS-CoV-2 viral load (21). Pre-rinsing the mouth before dental procedures helps minimize the risk of infection transmission (22).