

PERIODONTAL MANIFESTATIONS OF COVID-19: A LITERATURE REVIEW

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ABSTRACT
The SARS-CoV-2 virus that is causing the COVID-19 pandemic has sparked worries about several systemic effects, including dental health, in addition to respiratory symptoms. According to recent research, COVID-19 patients may need to be very concerned about periodontal symptoms. COVID-19 has been linked to several periodontal symptoms. These can show up as minor signs like gingivitis or as more serious disorders like periodontitis. The cause of these periodontal symptoms is not precisely understood. The oral mucosa has a high expression of angiotensin-converting enzyme 2 (ACE2) cell receptors, which allows the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) to infect them. The World Health Organization now includes gustatory impairment and olfactory changes as symptoms of Covid-19, but more research is necessary to establish a connection between reported additional periodontal symptoms and Covid-19. Dental professionals may come across individuals with Covid-19 and may need to recognize various oral manifestations of the disease This study looks at the pathogenesis, clinical manifestations, and therapeutic approaches in order to provide an overview of the state of knowledge about the periodontal consequences of COVID-19.

KEYWORDS: Covid-19; gingivitis; immune response; periodontitis; Xerostomia.

INTRODUCTION
The respiratory system is the main target of COVID-19, which is brought on by the SARS-CoV-2 virus.^[1] Nevertheless, an increasing body of research indicates that the virus may potentially affect oral health, including periodontal tissues. Numerous investigations have documented periodontal problems in SARS-CoV-2-infected patients since the start of the COVID-19 epidemic. In addition to being a sign of illness, these symptoms add to the patients' general discomfort and morbidity.^[2] Examining the periodontal symptoms seen in COVID-19 patients, this review emphasizes the significance of oral care in this situation. The literature on COVID-19 periodontal symptoms has changed dramatically over time, offering important new information about how the virus and periodontal disease interact. A fundamental understanding of this relationship is established by the study by Pisanelli et al. (2021),^[3] which shows a significant correlation between the severity of periodontal disease and unfavorable outcomes in COVID-19 patients. Indicators like bleeding on probing and clinical attachment loss correlated with

higher oxygen requirements and mortality, according to their real-time clinical examination. These findings raise the possibility that periodontal health may have a major impact on COVID-19 prognosis.^[4,5]

After that, (de Cássia Negrini et al., 2021) broaden the discussion by examining the wider implications of dental health in relation to COVID-19.^[6] According to their research, COVID-19 patients frequently have a variety of oral health problems, such as dry mouth and taste loss, which can be made worse by pre-existing periodontal diseases. The authors highlight the connection between COVID-19 and pro-inflammatory cytokines and oxidative stress in periodontal disease, and they hypothesize that certain symptoms of the viral infection may be lessened by periodontal therapy. Moreover, they emphasize the possibility that oral symptoms could function as preliminary markers of COVID-19, emphasizing the necessity of improved oral hygiene protocols.^[7] Mancini et al. (2022) add to the increasing corpus of research by investigating the particular effects of COVID-19 on peri-implantitis and periodontitis.^[8]

They describe how COVID-19 and periodontal diseases are both inflammatory conditions and suggest that having periodontitis could make the inflammatory reaction that the virus causes worse. According to their narrative review, the facilitation of SARS-CoV-2 entry by the angiotensin-converting enzyme-2 (ACE-2) receptor may exacerbate periodontal health issues and make COVID-19 patients more vulnerable to gingival inflammation and plaque buildup. This connects the bacterial and viral inflammatory pathways and supports the idea that people with periodontal disease are more likely to experience complications.^[6] When taken as a whole, these studies highlight the crucial connection between COVID-19 outcomes and periodontal health, indicating that periodontal disease may both act as a comorbidity and affect how severe COVID-19 symptoms are. In order to improve patient outcomes, integrated healthcare approaches that address both periodontal and viral health are necessary, as evidenced by the ongoing investigation into the oral cavity's role in the disease process.^[2,3]

Pathophysiology of COVID-19 and Periodontal Disease

The ACE2 receptor-mediated entrance of SARS-CoV-2 into host cells is connected to the etiology of these periodontal symptoms. The spike (S) protein is one of the structural proteins of the virus, is essential to this process. Periodontal symptoms are partly brought on by the inflammatory reaction that the virus causes.

Inflammatory response: The presence of COVID-19 leads to increased inflammation, which could exacerbate periodontal inflammation and the advancement of the disease.^[4,7]

Microbial dysbiosis: the rise of the pandemic has caused more stress and alterations in oral care routines, leading to an imbalance in the oral microbiome, which is linked to periodontal disease.^[9]

Immune system modulation: The periodontal tissue homeostasis can be disrupted by the immune response in COVID-19, which can result in an elevated vulnerability to infections.^[6]

MATERIAL AND METHODS

A search of relevant literature papers from January 2020 to September 2024 was carried out using PubMed and Scopus databases. Only studies focusing on the periodontal manifestations of SARS-CoV-2 infection were included. The search terms used in the search were limited on "Title and Abstract": (Periodontal) and (COVID-19 OR SARS-CoV-2). Review articles that relied on participants' self-reported oral health were not included in the analysis. A total of twenty-four articles (from 9-32) were obtained for final analysis.

Periodontal Manifestations of covid-19

Following a reviewing and gathering of relevant data, the collected knowledge was organized and categorized.

1. **Gingivitis:** Gum inflammation is a common symptom that COVID-19 patients experience. This condition may be exacerbated by the systemic inflammatory response to the virus and poor oral hygiene.^[9,10]
2. **Periodontitis:** Patients with COVID-19 have been reported to have severe periodontal disease. The immune system's and the inflammatory response's effects from the virus can make periodontal diseases worse.^[11-16]
3. **Bleeding on probing:** Probing has revealed increased bleeding, which suggests increased inflammation and possible periodontal disease progression.^[11,17,18,19]
4. **Mucosal changes:** Certain COVID-19 patients have been reported to exhibit alterations in the mucosal tissues, such as ulcerations and petechiae.^[17,18,20,21,22]
5. **Periodontal abscesses:** In COVID-19 patients, there has been an increase in the incidence of periodontal abscesses, which may be related to changed immune responses.^[23-26]
6. **Tooth mobility:** There have been reports of increased tooth mobility, which may be related to the inflammatory effects on periodontal ligaments.^[13,17,27,28]
7. **Necrotizing periodontal diseases:** Necrotizing ulcerative gingivitis (NUG) and necrotizing ulcerative periodontitis (NUP) in patients with severe COVID-19 have been shown in certain cases.^[14,18,29,30]
8. **Xerostomia:** Another sign of COVID-19 in patients is dry mouth (xerostomia). Speaking and swallowing issues as well as a higher risk of dental cavities and periodontal disease may result from this.^[31,32]

DISCUSSION

It has been demonstrated that ACE2 is the main receptor interacting with the virus spike protein, facilitating cell entry,^[5] which is necessary for SARS-CoV-2 to be contagious. Since the oral cavity is one of the body's entry points and a possible route for viral infection, SARS-CoV-2 may enter the body through it.^[18] Additionally, it's possible that SARS-CoV-2 could enter human cells through the oral mucosa.^[11] The SARS-CoV-2 cellular entry receptor ACE2 is present in oral mucosal tissues such as the tongue and floor of the mouth. On the other hand, ACE2-positive cells have also been demonstrated to exist in other oral mucosa tissues, such as buccal and gingival epithelial cells. Furthermore, several authors have suggested that the periodontal pockets could act as a reservoir for SARS-CoV-2, allowing the virus to proliferate throughout the body and persist in saliva. When taken together, this suggests a

link between COVID-19 and periodontitis.^[12,22] This begs the question of whether COVID-19 risk factors, such as diabetes, cardiovascular disease, and other periodontal diseases, should also be considered. More generally, since periodontal therapy reduces both the local and systemic inflammatory states as well as periodontopathic bacteria,^[18,22] it may also lessen COVID-19 patients' inflammatory states. Therefore, managing periodontitis could be a component of a plan to stop the spread of severe COVID-19 strains.

The SARS-CoV-2 virus was believed to be distributed in saliva in the human oral cavity, according to the first half of a 2020 study.^[18] More recent studies, however, have shown that, as with saliva, the tongue, or the nasal cavity, the distribution of SARS-CoV-2 is markedly elevated in effusion from the gingival sulcus.^[11,28] According to some research, oral signs and symptoms such as bleeding, candidiasis, geographical tongue, ulcers resembling thrush, and tongue ulcers should be considered in COVID-19 patients.^[22,24] According to Noh *et al.*, periodontitis-related gingivitis stimulates ACE2 activity. It is believed that the COVID-19 virus's proliferation and ACE2 expression in oral tissue are related to this symptom.^[10]

Overall, this literature review offers potential biological mechanisms which appear promising for future studies, especially clinical or experimental research behind the relationship between SARS-CoV-2 and periodontal diseases, despite being primarily composed of hypotheses. Furthermore, it is important to acknowledge that the existing published data does not encompass novel variants, which warrant further investigation to gain a more comprehensive understanding of their effects on the periodontal level.

Management considerations

In COVID-19 patients, managing periodontal manifestations requires practicing good oral hygiene, treating pain and inflammation symptomatically, and receiving the right dental care for specific conditions like periodontitis. It's critical to schedule routine dental examinations and dentist consultations to monitor and treat these symptoms.

CONCLUSION

Systemic and oral health are interdependent, as demonstrated by the periodontal manifestations of COVID-19. Minimizing the impact of COVID-19 on periodontal health requires proactive management techniques and increased awareness. Future research needs to concentrate on the long-term implications and the necessity of thorough dental care for COVID-19 patients.

Conflict of interest

None declared.

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