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# Covid 19 and Periodontal Disease Interlink- A Review

**[1]Dr Kishori Gadewar, [2]Dr Ashish Soni, [3]Dr Priyal Billaiya, [4]Dr Junaid Kapadia,**
**[5]Dr Hiroj Bagde, [6]Dr Ashwini Dhopte**

[1] Senior lecturer, Department of Periodontology, HKDET's Dental College, Humnabad
[2] Reader, Department of Periodontology, New Horizon Dental College and Research Institute,Bilaspur , Chhattisgarh
[3] MDS, Private Practitioner, Bhilai, Chhattisgarh
[4] Associate Professor,Department of Public Health Dentistry,Bhabha College of Dental Sciences, Bhopal, MP.
[5]Associate Professor,Department of Periodontology, New Horizon Dental College and Research Institute, Bilaspur, Chhattisgarh
[6] Senior lecturer, Department of Oral Medicine and Radiology, New Horizon Dental College and Research Institute, Bilaspur, Chhattisgarh

## 1. Introduction

Covid-19 is a global virus that has posed a threat to every part of our lives, including healthcare, the environment, journalism, and education. The rapidity at which the spread spread revealed a problem for health care professionals, politicians, and medical schools.[1]Coronaviruses are members of the Nidovirales order, which also includes the families Roniviridae, Arteriviridae, Mesoniviridae, and Coronoviridae. Coronaviruses have a unique RNA genome that causes a wide range of systemic diseases in mammals, including respiratory infections, enteritis, and even fatal human respiratory illness.[2]

Covid-19 is a fictional character. SARS-CoV-2 is a new form of coronavirus that causes respiratory disease. Coronavirus gets its name from the latin word "corona," which refers to the image of the virus under an electron microscope, which looks like the solar corona. These coronavirus-related viruses were first discovered in humans in 1965. Coronavirus is a member of the Coronaviridae family of viruses that cause mild respiratory illnesses in humans.

The human population has recently been exposed to three major coronaviruses that have triggered major disease outbreaks: the first is SARSCoV, which first emerged in 2002, followed by the Middle East respiratory syndrome coronavirus (MERS -CoV) in 2012, and the third and most recent: extreme acute respiratory syndrome coronavirus (SARS-CoV). [3]

SARS-CoV2 is a coronavirus that causes respiratory syndrome. Several cases of pneumonia with an unknown aetiology were recorded in Wuhan, China, in December 2019. The outbreak started in early December, and the number of cases quickly grew. By March 15, 2020, China had

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recorded over 80,000 cases, with over 3,000 deaths.[4]COVID 19 quickly became a pandemic. While the majority of COVID-19 cases have a mild to moderate pathological response, about 20% of cases have an extreme pathological response, and the fatality rate appears to be dependent on age and sex (a higher percentage in the elderly and in men).[5]

Oral diseases, such as carries and periodontal disease are among the most common diseases worldwide, making them a major public health concern that imposes significant health and economic pressures on the socio-economic interface, populations, and individuals.[6]

Periodontal diseases are a category of inflammatory pathologies in which microbial etiologic factors mediate inflammatory events in susceptible subjects, resulting in tissue destruction.[7]In 2017, the global prevalence of extreme periodontitis was estimated to be nearly 800 million people.[8]

Periodontitis is a multifactorial chronic inflammatory infectious disease that affects not only the dental unit's supporting tissues but also has nefarious systemic consequences.[9]Since periodontal disease is a chronic low-burden inflammation, there is mounting evidence in the literature that it is linked to a number of chronic systemic diseases. Diabetes, metabolic syndrome, and obesity, cardiovascular disorders, hypertension, chronic obstructive pulmonary disorder, autoimmune diseases, Alzheimer's disease, and cancer are among these pathologies.[10-13] With the exception of old age and smoking, all of these systemic diseases have been identified as risk factors for serious COVID-19 infections. [14]

The aim of this paper is to highlight common pathological and inflammatory pathways between periodontal disease and COVID-19 severity, as well as to suggest that periodontitis may be a contributing or exacerbating factor for COVID-19 severity.

## 2. COVID-19 epidemiology and periodontal disease

SARS-CoV-2, a beta-coronavirus with a genomic sequence similar to that of the 2003 severe acute respiratory syndrome coronavirus (SARS), has been identified as the outbreak's causative agent. It is most likely derived from bats, but an intermediate host could amplify it.[3] The propagation mechanisms of the COVID-19 pandemic were initially thought to be through population exposure to wet markets [4], but as the number of people who developed the disease without exposure to wet markets increased later in March 2020, it was proposed that a man-to-man spread of the COVID-19 was more possible.[15] The primary mode of transmission, as with other respiratory viruses, is by direct or indirect droplet contamination. The spread of SARS-CoV-2 has been lightning fast. About 16 crores people have now been infected; with almost 34 lakh people dying as a result of the disease.[16] The risk of developing a serious type of COVID-19 infection is higher in the elderly and those with co morbidities.[17]

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Periodontal disease, the most frequently diagnosed oral disease, is another resource-intensive disease in the world. Gingivitis and periodontitis are the two stages of periodontal disease. The first stage may be reversed with dental prophylaxis, while the second stage, which is permanent, is an inflammatory disorder of the tooth's deeper supporting structures.[9]

When oral periodontopathogenic bacteria bind to the teeth in the gingival socket and cause an immune response in the host, periodontal disease develops. Bacteria can be found in planktonic form or as part of a bacterial plaque or biofilm [18] which is made up of salivary glycoproteins and extracellular polysaccharides.
According to some reports [6, 19, 20]periodontal disease is one of the most prevalent diseases in the world, affecting 20 percent to 50 percent of the global population. When we look at the prevalence of periodontal disease, we can see that it rises in lockstep with age, and that men have a higher prevalence and severity than women.[19]
Age, gender, genetic factors, diabetes mellitus, and smoking are the most significant risk factors for periodontitis. Periodontal disease has been related to some systemic conditions like pregnancy and menopause, as well as certain systemic diseases like atherosclerosis, diabetes mellitus, and autoimmune disorders (such as AIDS or rheumatic diseases) through an elevated amount of serum C- reactive protein (CRP), a marker used to determine the level of inflammation throughout the body.[21] These same factors have been linked to COVID-19, with the addition of smoking as a major risk factor, and because CRP levels suggest systemic proinflammatory status, it's possible that periodontal status will predict COVID-19 risk and severity.

**3. Covid-19 ethiopathogenic pathways and diagnosis**
Coronaviruses are a family of associated RNA viruses with a unique and complex genome that cause a wide range of systemic diseases in mammals, including respiratory infections, enteritis, and even fatal human respiratory illness.

The membrane, envelope, nucleocapsid, and spike proteins make up the structure of a coronavirus; these last proteins are essential because they mediate the membrane passing process by interacting with a particular cell receptor from the host.[22] SARS-CoV-2 has been shown to interact with angiotensin converting enzyme 2 (ACE2) and dipeptidyl peptidase 4 (DPP4) in the literature.[23] This receptor is found in abundance in enterocytes, renal tissues, and cardiovascular tissues.[24-26] Nasal goblet cells, ciliated airway cells, type II alveolar pneumocytes, enterocytes, renal tissues, and cardiovascular tissues

The oral mucosa, vocal cords, salivary glands, and sinuses have the highest ACE2 expression patterns, while tonsils, pharyngeal, and laryngeal epithelium has lower levels.[27]

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Fever, dry cough, shortness of breath, gastrointestinal and other symptoms such as stomach pain, diarrhoea, anorexia, vomiting, myalgias, headaches, dizziness, anosmia, dysgeusia, sore throat, nausea, and chills can all be symptoms of SARS-CoV-2 infection. However, pulmonary inflammation is the most common clinical symptom, and in more serious cases, tachypnea, dyspnea, and severe pneumonia may occur, leading to respiratory failure, septic shock, and multiorgan failure.[28]

In Covid-19, there are two phases to the immune response. The first step is the body's immediate response to the viral infection, while the second is the cytokine storm, which causes autoimmune damage to the lungs, gastric mucosa, brain, and other structures. SARSCoV-2 infection causes a complex activation of neutrophils, T helper 17 (Th17) cells, Th1 cells, dendritic cells, and higher levels of Immunoglobulin-1 (IL-1), IL-6, and IL-10, among other things.

IL-1, IL-4, IL-10, Interferon- (INF-), Tumor Necrosis Factor– (TNF-), interferon gamma-induced protein 10, and monocyte chemoattractant protein 1 were identified, and this information led to the conclusion that high levels of ACE2 expression after infection were linked to immune system dysregulation and followed the cytokine storm.[29] A compromised innate immune system results in a higher SARS-CoV-2 viral count, adaptive immune system overreaction, and cytokine storm. Another study confirmed the connection between C-reactive protein and vitamin D, and discovered that vitamin D deficiency can intensify the cytokine storm response.[30] High iron levels, lyphocytopenia, a low platelet count, and a high ESR (erythrocyte sedimentation rate) are all symptoms associated with Covid-19.[31]

Increased platelet-leukocyte interactions lead to morbidity by increasing platelet reactivity and thrombotic reaction. When compared to adults, children with COVID-19 have milder effects. Acute chest infections, pyrexia, dry cough, sore throat, sneezing, myalgia, and lethargy are the most common symptoms. Multisystem inflammatory syndrome[32] is another significant syndrome linked to SARS-CoV-2 in infants.

A molecular or antigen test that detects viral RNA and a suggestive clinical history, including exposure history and clinical manifestations of SARS-CoV-2,[33] are used to confirm a positive diagnosis of COVID-19. Since the early stages of Covid-19 are clinically similar to influenza, parainfluenza, coronavirus, adenovirus, HIV, and bacterial pneumonias, infection with SARS-CoV-2 must be distinguished from influenza, parainfluenza, coronavirus, adenovirus, HIV, and bacterial pneumonias. COVID-19 patients should have a chest X-ray or CT scan because pulmonary inflammation is the most common pathologic manifestation.
C-reactive protein, lactate dehydrogenase, ferritin, procalcitonin, creatine kinase, alanine aminotransferase, aspartate aminotransferase, and albumin levels are all elevated in abnormal blood tests. [34]

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## 4. Covid-19 and Periodontal Disease Interactions

Periodontitis is an inflammatory condition linked to a number of chronic systemic diseases, including diabetes, metabolic syndrome, asthma, cardiovascular disease, hypertension, cancer, renal disease, autoimmune diseases, Alzheimer's disease, and viral hepatitis. Both of these systemic conditions, as well as smoking, have been identified as risk factors for serious SARS-CoV-2 infections.[5,7, 35]

Age is another important factor that can contribute to the connection between COVID-19 and periodontitis. Periodontal disease affects the elderly because they have certain risk factors such as poor oral hygiene, long-term treatment, and chronic conditions, and patients over 65 years constitute a higher risk group according to COVID-19.
Hypertension is the leading cause of cardiovascular disease, and epidemiological studies have found a connection between hypertension, heart disease, and periodontitis.[36] CRP with a high density is a proxy for cardiovascular disease as well as periodontitis, where cytokine production is increased. One of the most common comorbidities among COVID-19 patients is hypertension.[37]

Oral dysbiosis is described as a loss of microbial community equilibrium in the mouth, and it is linked to a variety of oral diseases such as periodontitis, candidiasis, and others. The most common bacteria

Porphyromonasgingivalis, Tanerella forsythia, Treponema denticola, Prevotella intermedia, Selenomona, Aggregatibacter, and other bacteria are implicated in the appearance of periodontitis. [38]

A mechanism known as polymicrobial synergy occurs in the oral cavity and leads to oral dysbiosis, in which bacteria associate and cause tissue damage and complex inflammation.[39]

Patients with Covid-19 had higher levels of ACE2 on the oral mucosa, as well as a higher presence of Prevotella, Fusobacterium, and Veillonella, suggesting that there is a correlation between periodontitis and Covid-19.[40]

Rheumatoid arthritis is a chronic inflammatory disorder that has been linked to periodontal disease.[41]Some studies have shown that people with rheumatoid arthritis who still have periodontitis have a worsening systemic statusRheumatologists' biggest concern with the Covid-19 infection is rheumatoid arthritis patients' vulnerability to developing more serious symptoms. Treatment with hydroxychloroquine for rheumatoid arthritis, on the other hand, has been identified as an effective treatment for some cases of Covid-19, but further research is needed to determine its efficacy in these patients. [42]

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Although the ethiopathogeny of cancer is not well known, some studies suggest that it may occur as a result of microorganisms that cause increased inflammation in the body. However, there is insufficient evidence in the literature to determine a causal relationship between cancer and periodontal disease.[43] Cancer patients, on the other hand, have a higher risk of developing Covid-19 infection due to their suppressed immune response, as well as a worse prognosis due to many other systemic issues such as respiratory infections, dietary issues, and vitamin and mineral absorption deficiencies. [44]

Smoking is the most significant risk factor for periodontal disease, and it has an effect on disease development as well as treatment response. [45] Smoking disables main pathways that would give us an advantage in the battle against periodontal disease and Covid-19. These mechanisms include the host's immune response, regular periodontal tissue function, and a powerful microenvironment to combat pathogens. Furthermore, smoking increases ACE2 expression and is a risk factor for Covid-19 development, but more research is needed to assess the true risk of Covid-19. [46] Among smokers many studies have found a possible correlation between Covid-19 infection and periodontitis, beginning with the bacteria involved in COVID-19 infection, which appear to be the same as those found in the oral cavity. Owing to the clinical manifestation of prolonged ulcerated regions, periodontal infected tissues represent a large entry point for bacterial or viral pathogens like SARS-CoV-2. Periodontitis also raises the burden of systemic inflammation, which results in the release of proinflammatory cytokines and tissue damage mediators in the circulatory system [47]

The cytokine storm triggered by COVID-19 infection is very close to the cytokine imbalance that occurs during periodontitis formation, implying a possible correlation between COVID-19 and periodontitis complications [48] Chemokines are responsible for the recruitment of inflammatory cells in both Covid-19 and periodontitis. Serum levels of IL-1, IL-7, IL-10, IL-17, IL-2, IL-9, Th17, IFN-gamma, GM-CSF, G-CSF, IL-8, TNF-, MIP1B, MCP1, MIP1A, and IP10 were found to be elevated in Covid-19 patients admitted to the intensive care unit.[29]

**5. Professional advice from a dentist**

The easiest way to cure someone is to keep them from being sick in the first place. To avoid spreading the infection, it is important to maintain social distance and isolation. Hand washing, home quarantine if sick, travel restrictions, and the use of masks to cover both mouth and nose while talking, sneezing, or coughing are the most important ways to minimise the risk of infection.

During the SARSCoV-2 pandemic, medical personnel should avoid and monitor infections, and the methods of infection prevention should be thoroughly explained to each patient. Patients should be told not to visit a medical, dental, or other form of practise if they are experiencing

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symptoms of Covid- 19. Another crucial factor is the use of triage procedures, which enable medical personnel to decide if the patient requires a physical doctor's appointment or can be investigated using telehealth strategies. Since certain periodontal procedures, such as the use of water-air spray, sonic and ultrasonic scaling, polishing with rotary instruments, and other aerosolgeneratingmanoeuvres, are considered high risk, practitioners are advised to restrict these procedures as much as possible during these periods, and even delay them if the patient is suspected of SARS-CoV-2 infection. Any patient must be extensively investigated for symptoms of Covid-19 infection by doctors and assistants, and these investigations must take place outside the clinic, in a separate building.[46]

Patients and employees should be given alcohol-based 60-95 percent hand sanitizers as well as tissues for personal use. Patients with Covid-19 symptoms should be evaluated independently, rather than waiting for him to be investigated alongside other patients.

Oral mouthwashes are one of the other strategies for preventing SARS-CoV-2 infection since they have the ability to reduce microorganism load within the oral cavity. [47] There are a variety of mouthwashes available, but those containing chlorhexidine 0.020 percent are the most effective, as it kills Gram positive and Gram negative bacteria as well as viruses such as influenza A, parainfluenza, herpes virus 1, cytomegalovirus, and hepatitis B. Mouthwashes based on hydrogen peroxide, cetylpyridinium chloride, andiodopovidone can also be used. [48]

**Conclusion:**

Until now, it has been unclear if Covid-19 infection confers immunity or how long it lasts. Another problem is that the existence of antibodies does not always imply immunity. It's all in all; the only way to stay safe is to follow the preventive steps.

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