COVID-19 Pandemic: Oral Health Challenges and Recommendations

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Abstract

The aim of this article is to shed light on coronavirus disease 2019 (COVID-19) and its oral effects and risk of nosocomial transmission to update the knowledge of dental health care workers. A thorough literature search of the PubMed/Embase/Web of Science/Cochrane central database was conducted to identify the impact of COVID-19 on oral health. We reviewed the recommendations on the recent guidelines set by the Centers for Disease Control and Prevention infection control practices for dentistry, American Dental Association, and the World Health Organization. According to the available evidence, COVID-19 may have a negative impact on the oral health due to the infection itself and due to various other consequences such as therapeutic measures, xerostomia, and other complications of the COVID-19. In light of the above facts, dentists should be wary of the disease, its identification, mode of spread and impacts on the oral health. The dental personnel have been identified as at the highest risk of getting COVID-19 due to cross infection from contact with their patients and aerosols generated in routine dental procedures. As such, they should be aware of the modifications that need to be made to the practice to prevent transmission of the disease. It is evident that COVID-19 has a negative impact on the oral health and at the same time a significant transmission risk to the dental personnel and patients who visit the clinic. If the recommendations issued by the regulatory authorities are meticulously followed, the risk of disease transmission can be lessened.

Keywords
- coronavirus
- SARS-CoV-2
- COVID-19
- oral health
- recommendations
- guidelines
- dental practice

Introduction

Coronavirus disease 2019 (COVID-19) is a respiratory disease, initially detected in 2019 in Wuhan, China. COVID-19 has caused a global pandemic as declared by the World Health Organization (WHO)[1] and is currently a major public health problem globally. The causative agent of the disease, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was isolated a month later. The immune inflammatory response induced by SARS-CoV-2 is an established cause of disease severity and death.[2] The SARS-CoV-2 is genetically similar to the two bat-derived coronaviruses, the SARS coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV). It is assumed that SARS-CoV-2 is zoonotic and that the COVID-19 outbreak originated in Chinese horseshoe bats[3] and was transferred to humans through an intermediate host, the pangolin.

A single animal-to-human transmission initiated the COVID-19 outbreak, followed by sustained human-to-human transmission.[4,5] Current evidence suggests interpersonal

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transmission, mainly via respiratory droplets and contact routes.[6] Little evidence exists regarding the possible modes of transmission via the stool of an infected patient.[7,8] Other modes, such as blood or saliva are possible, though not reported to date.[9,10]

SARS-CoV-2 invades the human cells by binding to the human angiotensin-converting enzyme-2 (ACE2) receptor. A similar binding mode has been reported for MERS-CoV[11] and SARS-CoV.[12] Current evidence demonstrates that ACE2 is expressed on the mucosa of the oral cavity, particularly the tongue, indicating that the oral cavity is a potentially high-risk transmitter and a portal of entry of SARS-CoV-2 infection.[13,14]

Symptoms vary widely, ranging from being asymptomatic to more severe respiratory infection such as pneumonia, acute respiratory distress syndrome (ARDS), and shock. The array of symptoms include fever, sore throat, dry cough, shortness of breath, confusion, muscle ache, fatigue, headache, vomiting, and diarrhea. Some patients may develop serious complications, such as ARDS, arrhythmia, and shock.[15]

The histopathological findings are similar to SARS-CoV[15] and MERS-CoV,[16] suggesting similarities in the pathogenesis and the mechanisms of tissue damage and the inflammatory response to coronavirus infections. However, findings were limited to light microscopic examination and to tissue from the lung, liver, and heart.[17]

The diagnosis of COVID-19 is based on a combination of history, clinical symptoms, computed tomography scan findings, and laboratory investigations (reverse transcriptase polymerase chain reaction tests), according to the standard set by the WHO.[18] Management is mainly supportive and various options have been advocated for the treatment of COVID-19, with oxygen supplementation when required.[18-20]

COVID-19 may have a negative impact on oral health due to the infection itself and various consequences such as therapeutic measures, xerostomia, and other complications. A profound economic effect on dental practice [21,22] and the dental health care sector have also been reported.[23,24] Dentists work in close proximity to a patient's mouth and come in direct contact with patients. In addition, a significant amount of aerosols are generated during routine dental procedures. Dental personnel have been identified as being at the highest risk of acquiring COVID-19 due to transfer from their patients.[25,26] In addition, prediction on the psychological impact of COVID-19 on dental health care workers (HCWs) has also been reported.[24] Dentists should be knowledgeable about the disease, the mode of transfer, effect on oral health, identification of patients with COVID-19, as well as the modifications required to their practice to prevent the transmission of the disease.

The aim of this review is to shed light on the oral effects of COVID-19, based on available evidence to date, and to review current infection control recommendations for dental HCWs.

A literature search of PubMed, Embase, Cochrane Central, and Web of Science was conducted to identify the effect of COVID-19 on oral health. We based our recommendations on the most recent guidelines from the Centers for Disease Control and Prevention Infection Control Practices for Dentistry,[27,28] the American Dental Association,[29] and the WHO recommendations.[30,31]

Impact on Oral Health

Effects of COVID-19 on Oral Health

The effect of COVID-19 on oral health may potentially result from the severe acute infection, its complications, and therapeutic measures. A major adverse effect of COVID-19 on dental health is due to xerostomia. A possible explanation could be the direct effect of SARS-CoV-2 on the salivary glands. Other contributory factors may be mouth breathing due to nasal congestion, anxiety, dehydration, and medication. The consequences are oral health and lower respiratory tract complications.[32] If xerostomia persists, it could lead to more severe effects on oral health, including dental caries, inflammation and fissuring of the lips (cheilitis) and oral mucosa, ulcerations and/or inflammation on the buccal mucosa and tongue, oral candidiasis, parotid gland enlargement, sialadenitis, and halitosis.[33]

It has been reported that SARS-CoV-2 may affect the taste or smell sensations.[34] However, the underlying mechanism of olfactory and gustatory impairment in COVID-19 infection is still unclear. One possible mechanism is transneuronal migration of SARS-CoV-2 where the virus entered the brain through the olfactory bulb, spread rapidly in the brain, and led to neuronal death, as demonstrated by animal studies.[34-36] In addition, several case reports have reported oral ulcers, petechiae, and reddish macules particularly in the palate.[37-42] Other areas include tongue, lips, and the buccal mucosa.[37] Fissured lips and strawberry tongue are a presentation of the multisystem inflammatory syndrome in children positive for SARS-CoV-2 antibodies.[43]

A major complication in patients with severe COVID-19 is the cytokine release syndrome resulting in dysregulation of humoral and cellular mechanisms with elevated levels of serum proinflammatory cytokines (tumor necrosis factor α, interleukin (IL)-2, IL-6, IL-8, monocyte chemoattractant protein 1, granulocyte colony–stimulating factor), IL-10 (an anti-inflammatory cytokine), and inflammatory markers (e.g., C-reactive protein). It may result in ARDS or multiple organ dysfunction and consequently death. It is noteworthy that the cytokine storm can aggravate existing autoimmune conditions,[44] also within the oropharyngeal area.[45] The possibility of initiating periodontitis in susceptible patients or aggravating already existing periodontitis, considering the immune inflammatory nature and elevated levels of proinflammatory cytokines in periodontal diseases[46] should be considered. The impaired immune system and susceptible oral mucosa may result in alteration of oral microbiota, opportunistic fungal infections, ulcerations, and gingivitis.[45]

The COVID-19 pandemic also has an effect on mental health, specifically anxiety and depression, owing to isolation, fear of death, social distancing, loneliness in quarantined people, working from home, and extreme changes in daily life.[47,48] Depression may have a profound effect on oral health including dental decay and tooth loss, with subsequent lower quality of life.[49,50] COVID-19 exerts an indirect negative effect on oral health by affecting the mental health.

Large-vessel stroke and cardiovascular complications have been reported in young patients with severe COVID-19, both complications are associated with oral health.[51-53] Stroke can

have a negative effect on the oral cavity by causing functional disabilities such as speech, mastication, and swallowing problems due to bulbar palsy. There is also evidence that periodontitis[54] and tooth loss are associated with stroke.[55]

Community oral health care could be affected in general, as the lockdown has interfered with access to dental care. Poor oral care in severely affected patients on lifesaving therapies such as ventilators and oxygenation could also affect the oral health of the patients. Access to appropriate care for chronic conditions and medication may indirectly affect oral health, particularly the periodontal health of such patients, considering the reciprocal relationship with systemic diseases and periodontitis.[56-58]

Effects of COVID-19 Treatment on Oral Health

Based on the recommendations of the WHO, various potential treatments for COVID-19 are undergoing clinical trials to assess their efficacy and safety against the disease.[45,59,60] These medication used in the management of COVID-19 may have a significant effect on the oral cavity.[61] These include remdesivir, chloroquine/hydroxychloroquine, a combination of lopinavir and ritonavir, interferon-β, and azithromycin. Remdesivir, an antiviral drug, is still investigational. Chloroquine/hydroxychloroquine is a well-known medication used for the treatment of malaria and certain autoimmune diseases and can result in oral manifestations, particularly allergic lichenoid reaction[62,63] and xerostomia. Combined lopinavir and ritonavir, currently authorized for HIV, can be associated with oral side effects such as xerostomia, stomatitis, and oral ulcers. Systemic interferons particularly, interferon-β,[60,64] is currently authorized for treatment of diseases such as multiple sclerosis, and the most common side effect is dry mouth and monoclonal antibodies against components of the immune system.[65] Azithromycin, a commonly prescribed antibiotic, is also being investigated for treating COVID-19 and is found to have negative oral effects, such as oral thrush and allergic reactions on the tongue and the throat.[66]

Recommendations for Dentistry

The implications for a dental practice is to perform only emergency dental procedures and postpone all nonessential dental examination and procedures until there is sufficient reduction in COVID-19 transmission rates from community transmission to cluster cases or according to official recommendations at national, subnational, or local level.[31]

Before Arrival

It is advisable to contact the patient before the visit and inquire about symptoms, health status in the last 7 days, and travel exposure. If the patient responds positively, the appointment should be rescheduled in a way that would limit contact between patients. Enough time should be allowed between treatments by scheduling longer appointments, to provide sufficient time for infection control measures including environmental cleaning. Once an appointment is confirmed, the patient should be asked to attend alone unless they require assistance. In such cases, the companions should also be screened for COVID-19 during the patient check-in and managed accordingly. A person accompanying a patient should not be allowed entry into the dental operatory.

Upon Arrival

Adequate ventilation in the waiting area should be ensured. The use of split air conditioning or other types of recirculation devices should be avoided and installation of filtration systems should be considered.[31] Approaches such as installation of exhaust fans, whirlybirds, or high-efficiency particulate air filters should be considered with natural ventilation.[31] The use of upper-room ultraviolet germicidal irradiation as an adjunct to higher ventilation and air cleaning rates may also be considered.[28]

All patients and their escorts should be screened for fever and symptoms of COVID-19, before they enter the dental setting. This can be done by staff inquiring about symptoms (cough, shortness of breath, sore throat, fever [>37.5°C]), health status in the last 7 days, and travel exposure. Travel history should include contact with other infected persons or having visited affected areas. This strategy will prevent potentially infected persons' entry to the operating area. The patients with fever should be registered and referred to the designated hospitals. If a patient has a travel history to an epidemic region within the past 14 days, quarantine for at least 14 days should be suggested.

Patients and accompanying persons should be provided with medical masks. Ensure proper compliance is maintained with social distancing. Spatial separation of at least 6 feet or 2 m apart should be maintained between patients. The availability of infection control supplies should be ensured, in particular, an alcohol-based hand rub (ABHR) (60–95% alcohol), tissues, and no-touch receptacles for waste disposal in all areas of the health care facility. Objects that are not easily disinfected such as magazines, reading material, and toys should be removed.

Instructions should be provided to all people in the dental environment regarding covering the nose and mouth with a tissue or their elbow when coughing or sneezing, disposal of used tissues into no-touch receptacles immediately after use, respiratory and hand hygiene, and social distancing for patients at the entrance, waiting area, or elevators with the aid of visual alerts (signs/posters).

Dental Office

Dental Staff

HCWs should apply all standard precautions with every patient consistently as the patient may be an asymptomatic unidentified carrier of COVID-19.

All staff should be screened at the beginning of their shift by measuring and recording the temperature and respiratory symptoms, in particular, shortness of breath, cough, and sore throat. If unwell, they should wear a facemask and leave the workplace. It should be ensured that the staff work at an adequate distance from patients.

HCW should be encouraged to report any potential COVID-19 symptoms that they might have, or the fact that they have been in contact with confirmed cases, to their work place before reporting to work. In general, underreporting of

incidents, mishaps, and near misses by HCW is a well-known challenge in occupational health with regard to building a culture of safety.[31,67] This practice appears vital during this unprecedented pandemic.

Disinfection and Sterilization

Depending on the environmental conditions, the virus can survive from hours to days. Proper disinfection can inactivate the virus. It has been recommended to perform disinfection of nondisposable equipment, such as the dental chair, X-ray equipment, and operating light according to the instructions of the manufacturer. Surfaces must be precleaned routinely, followed by Environmental Protection Agency registered disinfectants as indicated on the product label. Work surfaces and information technology equipment should be protected by protective film. Frequently contacted surfaces such as door handles, desks, chairs, handrails, bathrooms, and elevators should be cleaned and disinfected, and barriers used whenever available. Perform routine precleaning of hand pieces to remove debris, followed by heat sterilization after every patient.

Hand Hygiene

Also, it is essential to perform maximum hand and surface hygiene, given that the virus is completely inactivated by water, soap, and other detergents. Hand hygiene should be performed according to the WHO guidelines. This includes before and after contact with the patient, after contact with contaminated surfaces or equipment, after removing personal protective equipment (PPE), before any cleaning or aseptic procedure is performed, or after exposure to body fluid (WHO). According to the WHO (2020c), hand hygiene includes either cleansing hands with an ABHR or with soap and water for a minimum of 20 seconds. Both methods are equally effective. ABHRs are preferred if the hands are not visibly soiled; if visibly soiled, water and soap are advised.

Protective Eyewear

Protective eyewear, goggles or a disposable/reusable face shield that shields the front and sides of the face, should be worn during treatment. Reusable eye protection must be cleaned and disinfected, according to manufacturer's instructions, prior to reuse and between patients. Disposable eye protection should be discarded after use.

Facemasks

A N95 or higher level respirator must be used when performing aerosol-generating procedures (using a high-speed handpiece, air-water syringe, and ultrasonic scaler) because surgical masks do not provide complete protection against inhalation of airborne infectious agents, though they provide protection from droplet spatter. At minimum, a medical mask (surgical or procedure mask) should be used if working at a distance of less than 1 m from the patient. A combination of a surgical mask and a full-face shield may be used if a respirator is not available. Food and Drug Administration approval of the mask prior to use should be ensured. The seal before putting on a disposable particulate respirator should always be checked. Surgical masks during patient treatment, if the mask became wet, should be changed. If this combination is not available, do not perform any emergency dental care and refer the patient to a clinician who has the appropriate PPE. Disposable respirators should be removed and discarded after exiting the patient's room or care area.

Gown

Members of the dental team should wear a clean, sterile, long-sleeved gown and gloves when a patient enters the care area. In addition, a waterproof apron will be required for some procedures with high fluid volumes, if there is a possibility that the fluid may penetrate the gown. Change the gown if it becomes soiled. Remove and discard the gown in a dedicated container for waste or linen before leaving the patient room or care area. Disposable gowns should be discarded after use. Cloth gowns should be laundered after each use.

Preprocedural Rinses

Regarding the clinical effectiveness of preprocedural mouth rinses to reduce SARS-CoV-2 viral loads or to prevent transmission, there is no published evidence. However, antimicrobial mouth rinses such as chlorhexidine gluconate, essential oils, povidone-iodine, or cetylpyridinium chloride may reduce the level of oral microorganisms in aerosols and spatter generated during dental procedures.[28]

Aerosol-Generating Procedures

The operator should minimize aerosol-generating procedures such as those utilizing ultrasonic scalers, high-speed handpieces, and three-way syringes.[68,69] This can be achieved by employing hand instrumentation, rubber dam isolation, and use of high-volume aspiration (HVA). Proper positioning of the HVA (~6–15 mm) from the active ultrasonic tip should be ensured. Saliva ejectors also assist in lowering the production of droplets and aerosols; however, we should be aware that backflow could occur when using a saliva ejector and which can be a potential source of cross-contamination.[70] A four-handed technique for controlling infection is recommended.

Other

The use of disposable instruments and devices (single use) such as syringes and examination instruments such as mirrors are advised. Antiretraction functions of handpieces may provide additional protection against cross-contamination.

It is advisable to use extraoral imaging whenever possible as intraoral imaging may induce salivary secretion and coughing. When it is mandated to use intraoral imaging, sensors should have a double barrier to prevent cross-contamination.

Patients with Suspected or Confirmed COVID-19

If a patient with doubtful or confirmed COVID-19 present for dental treatment, the dental procedure should be deferred. The patient should be provided with a mask to cover the nose and mouth and advise them to contact a medical provider. Refer the patient to a medical facility, if acutely sick. However,

if the emergency dental care is unavoidable, it is recommended that airborne precautions should be taken, which include an airborne infection isolation room with negative pressure relative to the surrounding area and a N95 filtering disposable respirator for persons entering the room. Dental treatment should be provided in a hospital or other facility with the available precautions.

Conclusion

It is evident that COVID-19 has a negative impact on oral health as well as a significant transmission risk to dental personnel and patients. Following the recommendations of regulatory authorities would significantly reduce the risk of transmission.

Authors' Contributions

All authors contributed in the literature search, analysis, writing of the manuscript, and have read and approved the final manuscript.

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Conflict of Interest

None declared.

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