

## COVID-19: the impact on oral health care

## COVID-19: o impacto na saúde bucal

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**Abstract** *The COVID-19 pandemic has highlighted the economic, social, and oral care health inequities in societies, especially in the developing world. Severe restrictions have been imposed on dental practices, limiting prophylactic and routine oral care health, allowing treatment only for emergencies. Since dental care includes procedures that generate aerosols, the risk of infection for dental personnel has increased significantly. In this review, a comprehensive and updated source of information about SARS-CoV-2/COVID-19 and the impacts it is having on oral health care is presented. The ongoing repercussions in dental practice and in dental education, including the opportunities for practice innovation that are evolving, are also indicated. Also, a discussion of the psychosocial factors that affect health and the quality of life of an individual, such as stress, depression, and anxiety, is provided. This pandemic may be an opportunity to promote the inclusion of well-established prevention measures, together with the use of teledentistry in academic dental curricula, encourage the implementation of new perspectives for the effective instruction and interactions with students, and foster the transition toward e-learning strategies in dental education.*

**Key words** COVID-19, Oral manifestations, Teledentistry, Psychological stress

**Resumo** *A pandemia COVID-19 destacou as desigualdades econômicas, sociais e de saúde bucal, especialmente no mundo em desenvolvimento. Severas restrições têm sido impostas para a prática odontológica, limitando a rotina de saúde bucal, permitindo o tratamento apenas em emergências. Como o atendimento odontológico inclui procedimentos que geram aerossóis, o risco de infecção para a equipe odontológica aumentou significativamente. Nesta revisão, é abordada uma fonte abrangente e atualizada de informações sobre o SARS-CoV-2/COVID-19 e os impactos que têm nos cuidados de saúde bucal. As repercussões contínuas na profissão odontológica e na educação odontológica, incluindo as oportunidades de inovação da prática. Além disso, é fornecido o efeito de fatores psicossociais que afetam a saúde e a qualidade de vida, como estresse, depressão e ansiedade. Esta pandemia pode ser uma oportunidade para promover a inclusão de medidas de prevenção bem estabelecidas, juntamente com o uso da teledontologia nos currículos acadêmicos de odontologia, trazendo novas perspectivas sobre a forma de ensinar e interagir com os alunos, com a transição para estratégias de e-learning na educação odontológica.*

**Palavras-chave** COVID-19, Manifestações orais, Teleodontologia, Estresse psicológico

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## Introduction

Infections due to the COVID-19 coronavirus have impacted and deeply challenged all aspects of existing healthcare systems across the globe. On January 30<sup>th</sup>, 2020, the World Health Organization (WHO) declared the virus to be a worldwide public health emergency, and in March 2020, COVID-19 was declared a pandemic. It is anticipated that the global population will be dealing with the health, economic, and emotional impacts of the disease for many years in the future. This review will discuss the impacts of COVID-19 on the practice of oral health care for the patient and the practitioner, the challenges faced for the education of dentists, the oral manifestations and clinical outcomes, such as the lack of smell and taste, and the psychological impact caused by COVID-19. This literature overview also provides a description of the innovative technologies for e-learning, as well as the importance of teledentistry in dental education.

The route of transmission of the SARS-CoV-2 virus is through the direct inhalation of saliva droplets, fomite, and interpersonal contact. The droplets of saliva that are expelled by coughing or sneezing, or during the face-to-face interaction of healthcare professionals with the patient through contact with the oral and ocular mucosal epithelium, and the nasal epithelium are a major route of transmission<sup>1</sup>. As a result of the facile transmission of the virus, strict modifications to the guidelines and protocols of oral health care have been established to prevent and reduce the contagion due to the aerosolized particles which are continuously generated during routine dental procedures and provide a high risk for virus transmission. Based on these healthcare concerns, in March 2020, the American Dental Association recommended that dentists postpone elective dental treatments and only attend to emergency treatments<sup>2,3</sup>.

A diversity of altered states of oral health have been observed, especially in patients with a compromised immune system, patients who have been hospitalized for a long term, and those who have received prolonged pharmacotherapy<sup>4</sup>. These signs and symptoms in the oral tissues are due to the neurotropic and mucotropic characteristics of the SARS-CoV-2 virus that interfere with the dynamics of the oral environment by altering the microbial balance and function, affecting the salivary glands, causing a loss of taste and smell, and resulting in a lack of integrity of the oral mucosa<sup>5,6</sup>. The incidence of oral mucosa

lesions may be a secondary response to the patient's systemic condition<sup>7</sup>, or they may be associated with the emotional and psychological stress caused by the societal measures to restrict human mobility, limited access to public and private dental care facilities, and social distancing<sup>8</sup>.

In addition to the restrictions for access to oral health care, the risk factors of contagion and the sociocultural and sociodemographic conditions lead to exacerbation of oral health problems. This is especially the case for the most vulnerable populations in society, such as the elderly, patients with disabilities, patients with a history of a chronic diseases, psychological disorders, or those who are already immunocompromised, low-income patients, and patients living in environments with limited access to health care opportunities, among others<sup>9</sup>.

In this global situation it is critical to strengthen the prevention and oral health care programs and campaigns through more aggressive teledentistry, especially for the most vulnerable groups and those with difficulty in accessing private opportunities for their oral health care<sup>10</sup>.

### Impact of COVID-19 on oral health care providers and dental practice

The routine generation of aerosols, droplets, the direct contact with saliva, and the fact that the oral cavity is already a polymicrobial environment, significantly increases the risk of infection by SARS-CoV-2<sup>11,12</sup>.

In the 1980s, when the acquired immunodeficiency syndrome (AIDS) pandemic stressed global health care systems, infection control practices and the use of personal protective equipment (PPE) were reinforced in dental offices<sup>13</sup>. However, the high level of contagion and the rapid spread of SARS-CoV-2, the severity and the diverse and unpredictable effects on health conditions, and the need to reduce societal risk of contagion, has meant that both public and private dental practices have had to suspend the implementation of most dental procedures. Many dental schools suspended their clinical operations with respect to the local population, and those that were open only respond to dental urgencies<sup>14</sup>. From these disruptions of services, the fundamental inequalities of accessibility to dental care have become more evident. The suspension of services has affected dentists and patients in diverse aspects. Among dentists, loss of income due to the suspension or reduction of patient care, difficulties in remunerating auxiliary personnel, and covering mainte-

nance costs, the fear of contagion from asymptomatic patients, and the possibility of infecting their families has increased the stress and anxiety for the professional practitioner<sup>12,15,16</sup>. In addition, the need to reconfigure spaces in dental care facilities and waiting rooms, and the enhanced use of personnel protection equipment (PPE) have increased expenditures<sup>17</sup>. For the patients, the fear of contagion in the dental office environment and the loss of income through increasing unemployment has led patients to delay or suspend routine and preventive dental interventions. Only when there is a return to full activities will patients with more severe oral problems and a greater number of infections seek care<sup>18-20</sup>. This represents an unhealthy paradox, where access to oral health care is limited for patient populations at high risk for COVID-19 or with symptoms of COVID-19, resulting in worsening personal dental conditions and exacerbating the need for oral care<sup>3</sup>.

According to the Economic Commission for Latin America and the Caribbean (ECLAC), the short-term impact of COVID-19 will be higher levels of unemployment, lower wages and incomes, increasing poverty, the fracturing of health care systems, and extended inequalities of access based on income level and place of residence<sup>21,22</sup>.

### **Disruption of dental services**

The World Health Organization (WHO) and the Pan American Health Organization (PAHO) conducted a survey in 128 countries to establish the degree by which attention to Noncommunicable Diseases (NCDs) was disrupted by the impact of the COVID-19 pandemic<sup>23,24</sup>.

The effect of the COVID-19 pandemic on the number of clinical dental consultations has also been examined, and a significant decrease observed. A study in Brazil compared the mean number of clinical dental consultations in the period March-July in the years 2015-2019 with the same period in 2020, and a decrease of 65.6% in dental consultations was found<sup>25</sup>. Another study showed a decrease of 60% on oral cancer biopsies carried out in Brazil, raising concerns about the incidence of undiagnosed oral cancer in the country and its treatment and prognosis<sup>26</sup>.

### **Response of the dental care systems**

Reinforced biosecurity protocols were implemented to reduce the risk of infection and cross transmission between dental personnel and patients. Several Latin American countries such as

Argentina, Peru, Costa Rica, Colombia, Ecuador, Brazil, and Mexico developed guidelines for dental care and clinical practices<sup>27-33</sup>. The biosecurity protocols recommended specific preventive and infection control actions such as the sterilization of dental instruments, equipment, and clinical facilities to promote and implement social distancing guidelines<sup>27-33</sup>. Also, the levels of risk and necessary protection measures, and the definition of dental emergencies were described and presented<sup>27-33</sup>.

To promote effective compliance with the revised service operations, in Brazil, temporary financial incentives were awarded to the States to adjust the services being provided by the Oral Health Teams and by the Dental Specialties Centers<sup>34</sup>. The procedures performed in dental care settings based on strict biosafety principles were updated. The new recommendations for the dental care systems were i) to ensure the continuity of dental health care prioritizing high-risk groups; ii) monitoring of patients through teledentistry; iii) prioritize minimally invasive procedures, limiting the generation of aerosols; iv) and the use of personal protective equipment (PPE). In addition, measures to reduce the production of aerosols from handpieces and ultrasound, and the use of high-powered aspirators, have been implemented to limit the spread of aerosols and the risk of contamination<sup>28,35,36</sup>.

### **Impact of the pandemic on morbidity and lethality rates in dental personnel**

Unfortunately, the health status impact of the SARS-CoV-2 virus on the dental profession at the private and public levels has been seldom reported, formally or informally. In Mexico, on July, 2021 the Secretary of Health indicated that 4,057 health care workers had died of COVID-19, of whom 2% were dentists; at that time there were 240,921 confirmed cases among health personnel, of which 1.6% were dentists<sup>37</sup>. Ensuring universal testing and care is fundamentally important for the safe return to providing complete dental services in a safe environment, with the expectation of a substantial increase in the incidence of severe and urgent dental problems<sup>21,22,38</sup>.

### **Oral manifestations associated with COVID-19**

The coronavirus disease 2019 (COVID-19) pandemic poses a unique and continuing threat to global health. Early diagnosis is an essential

element with respect to incidence and a vital factor to limit the rate of spread of the virus<sup>39</sup>. The oropharyngeal repercussions of infection by the SARS-CoV-2 coronavirus have been widely reported, highlighting the role of the dental professions to act in two main areas of oral health: i) the diagnosis and treatment of oral pathologies specifically associated with COVID-19, and ii) the maintenance of optimal oral health in favor of infected individuals.

Oral infections are involved in several systemic diseases, such as diabetes and cardiovascular diseases, which increase COVID-19 hospitalization rates and mortality. Acute and severe COVID-19 infection, in conjunction with associated treatments, may aggravate existing autoimmune conditions within the oropharyngeal area, leading to opportunistic fungal infections, xerostomia, ulcerations, and gingivitis, due to a weak immune system and/or susceptible oral mucosa<sup>40</sup>. Many of these lesions, such as ulcers and blisters<sup>41</sup>, oral mucositis, diffuse erythema, xerostomia<sup>42</sup>, and acute necrotizing ulcerative gingivitis<sup>43</sup> are painful and require immediate treatment.

#### **Effect of psychological stress during the pandemic**

Since December 2019, the COVID-19 pandemic has dramatically altered the lives of many people in the world with its rampant infectious process, symptoms, high rate of contagion, and over 4.05 million deaths (July 2021). Historical data from previous pandemics reveals that these processes of healing and recovery last several years. Indeed, the pathogens of most of these diseases are still present in various corners of the world and reappear regularly<sup>44</sup>.

During the period of a pandemic, people live in an environment of constant vulnerability and risk that causes uncertainty, confusion, and acute awareness of disease potential, extended sickness, and death. Additionally, there is the economic uncertainty due to a decrease in their salary, the loss of steady employment, and the absence of economic "safety nets"<sup>45-47</sup>. These alterations in fundamental lifestyle can be as severe and stressful as the disease itself due to the social or psychological demands, and affect the nervous, cardiovascular, endocrine, and immunological system, and increasing its susceptibility to several diseases<sup>48</sup>.

In relation to COVID-19, several articles have described these alterations in mental health, as well as post-traumatic stress disorder and anxiety, increasing the observed symptoms from con-

finement in young people or those with chronic diseases<sup>49</sup>. In China, researchers reported moderate to severe depressive symptoms, anxiety, and stress<sup>50</sup>. In Spain, a higher level of stress related to the time of confinement, as well as in individuals under 25 years old, either women or people having a low income, were observed<sup>51</sup>.

The interaction between stressful events and the response of the immune system is well documented, showing that some stressful situations promote the release of corticosteroids, and can increase the morbidity and mortality of diseases. These events typically have an immunosuppressive effect, especially when the stress is chronic and intense. Under these conditions, the secretion of pro-inflammatory cytokines, mainly IL-1, IL-6, and TNF is promoted, causing physiological alterations, similar to those from an infection<sup>52,53</sup>.

In patients under intensive care therapy who are receiving extended drug treatments, and have a compromised immune system, or who are under psychological stress<sup>4,7,8</sup>, may trigger somatic responses such as bruxism and other parafunctional habits<sup>54</sup>. These effects, while having a multifactorial origin, are strongly associated with anxiety, stress, and depression<sup>54,55</sup>.

Bruxism is a pathological condition which causes different oral alterations in the patient. The principal oral signs and symptoms are fatigue and/or pain in the chewing muscles, limitation of jaw movement, periodontal pain, dentition erosion, and fractures in teeth or restorations. Oral and facial pain, headache, or muscle pain in the neck or upper back can also be observed. The incidence of these symptoms in patients has increased in association with the pandemic<sup>54</sup>.

#### **Access to dental care at the global level during COVID-19: a circuitous route to teledentistry**

Lifestyle and other restrictions caused by the COVID-19 pandemic have limited the access of patients to prophylactic and routine dental care procedures, and to interrupt on-going dental treatment plans. In this way, the continuance of dental procedures can be offered, such as diagnostic processes, promoting self-care, guiding the caregiver of patients with disabilities to prevent diseases, and detect injuries that may cause pain or trigger an infection process that affects the well-being of the patient<sup>56,57</sup>.

Teledentistry is a valuable resource for communicating with patients, avoiding person-to-person contact, and thereby preventing

the transmission of the virus. This form of communication has been used previously for patients limited by physical distance who cannot attend dental appointments, who live in rural areas, or who are traveling outside their city. In addition, it is an opportunity to attend to those patients with disabilities, and/or with movement limitations, including those who are bed-ridden or hospitalized<sup>58</sup>. In this way, through a video call, voice messages, texts, or images, teledentistry is an effective and safe means of communication that contributes to the wider distribution of oral health programs.

## Conclusions

The COVID-19 pandemic has created numerous challenges for the field of dentistry and oral health care, many of which will have long-lasting impacts, for the care of patients and economically. Systems for oral health care were already dealing with issues of access to care and integration of medical and dental practices as a way to maintain continuity of care, as well as addressing societal oral health disparities. All of these complex issues have been exacerbated by the COVID-19 pandemic. As the pandemic continues to take its toll in incidence and in deaths, it will be important for dental practitioners and other oral health care providers to continue to assess the emerging issues and to keep finding creative opportunities for patient education regarding self-care, and to provide treatment practice options to the most at-risk and vulnerable patient populations worldwide.

The initial site of impact for the COVID-19 virus is the oral cavity with changes in taste often being an early sign of infection. Dentists are therefore at the front line in making the populace aware that this early clinical sign may indicate an immediate need for testing and isolation. In addition, dental research has an opportunity to investigate how transmission of the virus can be mitigated as an important public health initiative to minimize disease spread.

Restrictions to perform routine procedures in dentistry have limited access to public, private and institutional dental practices, causing an

increase in oral health problems. This situation reaffirms that the most vulnerable in the population are the most affected. Therefore, health authorities should promote programs that guarantee access to dental care, addressing disparities and inequities, to improve the health of the populace.

Teledentistry, as a consultation strategy to establish effective patient communication, has been very useful, however, regulatory authorities must strengthen and regulate the public health policies to reduce the inequities in access to oral care. Also, educational institutions must migrate their programs to online education and consider the implementation of teledentistry guidelines and practices within their educational program to guarantee greater access to oral health and quality of life, particularly for rural communities and in developing countries, including across international borders.

This review highlights the challenges and opportunities related to the physical and emotional well-being of the students, the patients, the dentists, and the dental care team. Exposure to the high risk of contagion to the SARS-CoV-2 virus, and the different associated psychosocial factors such as economic challenges, illness, and the death of loved ones, cause an increase in negative emotions that affect their health and quality of life. The dentist can differentiate the oral lesions associated with stress, depression, and anxiety and promptly refer the patient to counseling services and psychological help.

Despite the myriad of challenges related with the COVID-19, dental education programs developed strategic initiatives to educate and interact with students and other colleagues. The COVID-19 crisis has also shown that dental education must employ innovative technologies including simulators practices, e-dental education, and teledentistry. Furthermore, e-learning technologies enable students to learn and acquire knowledge from any location and to collaborate with other dental institutions nationally and internationally. In addition, the use of the internet and video platforms such as ZOOM, GOOGLE MEET, TEAMS, etc. have fostered the connection for online classes, meetings, and webinars for dental education.

## Collaborations

Original draft preparation by N Cruz-Fierro, A Borges-Yáñez, PCT Duarte, A Rodriguez-Garcia; conceptualization and supervision by A Rodriguez-Garcia; writing-review and editing by GA Cordell and A Rodriguez-Garcia. All authors were involved in drafting the article and approved the final version prior to submission.

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Article submitted 11/03/2021

Approved 20/07/2021

Final version submitted 01/06/2022

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Chief editors: Maria Cecília de Souza Minayo, Romeu Gomes, Antônio Augusto Moura da Silva