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Impact of COVID-19 on Oral and Dental Health Delivery and Recommendations for Continuation of Oral and Dental Health Services

Fatih Özçelik and Dursun Ali Şirin

Abstract

COVID-19, which has caused a great panic by leaving millions of deaths in its wake worldwide, has affected the provision of oral and dental health services as in many fields. Especially dentists, who offer oral and dental health services by working in the oral region of the patients, are under a high risk of encountering the agent. This high risk has justifiably created a concern for them. Therefore, it has been quite challenging to provide oral and dental health services. In order to alleviate these concerns and to sustain oral and dental health services, many health organizations and institutions, especially the World Health Organization, have published recommendations and principles of practice, and announced financial support. In this section, we will examine the recommendations and practices regarding infection prevention and control measures by getting away from standard routine health service practices in order to be protected from COVID-19 epidemic and what areas they cover on a wide scale. By discussing the effects of these recommendations and practices on the provision of dental health services, we will try to determine the practices that will relieve concerns and are aimed at ensuring the provision of safe health services in terms of both patients' health and health professionals' health.

Keywords: SARS-CoV-2, Dental Care Delivery, Recommendations for Dental Service

1. Introduction

The novel coronavirus 2019 is a member of the Coronaviridae family. In fact, this single-stranded RNA virus, whose natural habitat is animals, was reported to be transmittable from animals to humans. The disease caused by this virus, known as SARS-CoV-2, was named Coronavirus disease-19 (COVID-19) because it was first detected in 2019 [1–4]. This virus can involve the liver and the intestinal, respiratory and nervous systems, as well as causing major damage to the lungs in severe cases, and it may also lead to acute respiratory distress syndrome (ARDS) and death [5]. The disease originated in the city of Wuhan in the Hubei province of China due to consumption of animals contaminated with the SARS-CoV-2 virus. Later, it spread around the world, causing millions of people to become ill and

many of them to die. The pandemic caused by the virus changed the social life of all humanity and forced all health groups, including dental treatment providers, professionally [6–9].

All people in the world are susceptible to COVID-19. However, older people (≥ 55 years), those with comorbidities such as diabetes mellitus, hypertension, heart disease, chronic lung disease, malignancy and kidney disease and smokers are more susceptible to COVID-19 disease in comparison to the young and healthy population [5, 9–13]. Additionally, in a study, it was found that COVID-19 had a more severe course in those with poor oral and dental health in conjunction with immune system deficiency [14]. Healthcare professionals come first in terms of the risk of exposure to the virus. Among them, the risk of those working on the oral cavity was found to be higher [15–18]. If this risk is compared to the work done by other healthcare professionals, it is thought to be close to that of staff in laboratories where the virus is directly analyzed, or the bodily fluids of COVID-19 patients are studied. The role and risks of laboratory medicine in times of epidemics of infectious diseases are already well-known [19, 20].

Therefore, in this section, we will first discuss the possible relationships between dental and oral health and the course of COVID-19. Then, we will discuss the precautions that dental providers should take while working and the issues they should pay attention to.

2. Recommendations of international dental organizations

Many dentists have avoided making appointments except for patients in emergency cases due to the COVID-19 pandemic. The American Dental Association (ADA), American Dental Hygienist' Association (ADHA) and Centers for Disease Control and Prevention (CDC) raised a new debate by encouraging dentists and other healthcare professionals to balance the need to provide essential services while minimizing risk in caring for at-risk patients in their area [15, 21, 22]. The Interim Infection Prevention and Control Guidance for Dental Settings During the Coronavirus Disease 2019 (COVID-19) Pandemic, as the topic of discussion, chose the question “Are dentistry facilities safe?” Like these interim guides in the United States, many European and Asian countries have published guidelines based on recent information about COVID-19 or inspired by the countries where the disease was first seen. Most of the recommendations in these updated guidelines are not new. A summary of some recommendations and practices are shown in **Table 1**.

1	Recommended infection prevention and control (IPC) practices for routine dental healthcare delivery during the pandemic
2	Recommended IPC practices during dental healthcare delivery to a patient with suspected or confirmed SARS-CoV-2 infection
3	Resumption of work criteria for healthcare workers with suspected or confirmed COVID-19 (Interim Guidance)
4	Strategies to reduce the lack of health personnel and methods of working alternately
5	Risk assessment and recommendations on working restrictions for dental healthcare providers and other healthcare professionals who are likely to be exposed to the coronavirus disease 2019
6	Termination of measures and treatment due to transmission of COVID-19 during dental care delivery

Table 1.
Some recommendations and practices.

3. Measures to protect individuals from the COVID-19 outbreak

In order to be protected from the COVID-19 pandemic, CDC recommends additional infection prevention and control measures to be applied for all patients in addition to standard routine healthcare practices due to the nature of the pandemic. Some of these guidelines are applicable to all settings where healthcare services are provided, while others are not designed for environments other than healthcare facilities (e.g., restaurants, cafes, shopping malls, entertainment centers). Guidelines generally include information about the ways of transmission of COVID-19, patient care and management, patient triage protocols, complications that may develop due to the disease, telehealth strategies, various transportation vehicles and medical equipment transportation, or laboratory working conditions and raising awareness. For example, while requesting a dental examination for patients with suspected or confirmed SARS-CoV-2 infection, it is recommended to use triage protocols to understand whether this appointment is necessary or whether the patient can be managed from home in quarantine conditions. COVID-19 patients who complete the 14-day isolation period at home can benefit from dental healthcare by following standard precautions. Hand disinfectants containing $\geq 70\%$ alcohol, antiviral-antibacterial wipes and disposable materials are required to be kept in the entrance areas of healthcare facilities and waiting rooms, and patients are required to be informed with various warning signs. Like all citizens, all healthcare professionals, including dentists, are warned about certain safety rules. From the simplest to the most complex, publications are constantly being updated to protect people against the SARS-CoV-2 virus. Accordingly, your dentist and other healthcare professionals working with them should wash their hands before and after each procedure and sterilize the instruments. It is emphasized that especially some dental tools and needles should never be reused. Most dental procedures in dentistry produce significant amounts of droplets ($>5 \mu\text{m}$), as well as aerosols ($5 \mu\text{m}$), although not approved by the World Health Organization (WHO) as a general route of transmission. These droplets and aerosols create a potentially high risk of infection transmission [15–18, 23]. Due to this very close contact, a high viral load may be encountered when transmission through droplets occurs. However, considering that thousands of droplets or aerosols may be spread even while speaking, we need to understand well that we are facing a virus that chose the most difficult form of transmission to be protected from [24]. Transmission may occur by contact other than droplets. Direct contact with urine, tears, respiratory secretions, mouth secretions and blood is considered risky [9, 25–27].

As known, since the morbidity and mortality of COVID-19 is closely related to age, immune system deficiencies, presence of chronic diseases and especially viral load [17, 28], due to the nature of the profession (working in the oral cavity), the field of dentistry is included in the high risk category. For this reason, if procedures that can create aerosol during dental care are applied, four-handed dentistry, high evacuation suction and dental dams should be used to minimize the amounts of aerosols and droplets that are created [15, 16, 18].

In line with IPC recommendations, patients in the 14-day quarantine period based on prolonged close contact with someone with SARS-CoV-2 infection and not yet confirmed to be COVID-19-negative by a polymerase chain reaction (PCR) test should be isolated and not categorized in a cohort with patients with suspected or confirmed SARS-CoV-2 infection. Since dentists generally do not provide inpatient treatment services, while facing such a situation, they should contact their nurses or clinicians for the patient's triage [15].

Among measures to be taken in the dental clinic, the right triage is perhaps the most important. Questions about the health status of the patient calling for an

		Yes	No
1	In the last 14 days, have you had fever, cough, shortness of breath, weakness, widespread body pain, nausea-vomiting, diarrhea, or any complaint that is important to you? If your answer is yes, please state your complaint below. Yes:.....		
2	Have you traveled abroad in the last 14 days?		
3	Have you been to areas where the COVID-19 pandemic is prevalent?		
4	Have you had contact with someone diagnosed with COVID-19 in the last 14 days?		
5	Have you recently attended a meeting, funeral, party or event with many people?		
If the patient's answer to the 2nd and 3rd questions is yes, the dental clinic should postpone the treatment until the incubation period (14 days) is over, unless there is an emergency.			

Table 2.
Questions about the health status of the patient who is calling for an appointment.

appointment should be asked. Dentistry personnel should also call patients and question their current health status before their scheduled appointment (**Table 2**). It is strongly recommended that questions and practices include the following information and rules [7, 11, 12, 15, 16, 25, 29–32].

3.1 Practices and rules for patient appointments

Instruct the patient to wear a facemask when entering the dental clinic and not to remove it unless the dentist instructs them to do so. Have patients have their temperature measured as a routine procedure in dental clinics during the COVID-19 pandemic. Tell patients that they should make an appointment. Make appointments so that patients do not coincidence with each other. Limit the appointments to a certain number of patients. Tell patients that they should not bring any companions except in special cases. If a patient with COVID-19 symptoms has been taken in at the dentistry clinic, isolate the patient in a pre-created area for the necessary evaluations, routine blood analysis (e.g., hemogram and routine biochemical tests) and PCR test. Postpone dental treatment until the test result comes out. In the case of a positive test result, postpone dental treatment until the incubation period (14 days) is over. Postpone treatment for patients hospitalized with COVID-19 for at least 30 days.

3.2 Recommendations for the dentist and working environment

Dentists should talk to their patients using a surgical mask. If the dentist has symptoms like those of COVID-19, they should stop performing dental treatment, take a PCR test and isolate themselves for 14 days if the disease is confirmed or suspected. Moreover, a healthy lifestyle should be maintained during isolation. To avoid cross transmission, ensure that a limited number of patients are admitted to waiting rooms and with a distance of 2 m. Remove all reading and other materials from the waiting room. Make sure that disinfection is ensured every evening after the end of working hours and that the rooms are ventilated. Post your instructions on hand hygiene (cleaning with soap and water) and respiratory hygiene (behavior while coughing or sneezing) in the waiting room and entrances with visual

warnings or signs. Put a hand sanitizer in waiting rooms. Distribute information leaflets to patients. However, remind them that these brochures should not be handed over. Ensure the use of a high-volume exhaust (HVE) filter and a high efficiency particulate air (HEPA) filter to filter contaminated air in dental clinics. Have the filters disinfected every day. Prevent employees from working in the dental care room without adequate protective equipment. It should be mandatory to use protective clothing, caps, respirators, gloves, disposable shoe covers, protective glasses and/or face protective shields to protect the skin and mucous membranes of dentists and other workers from contamination with blood and secretions of patients.

Antimicrobial products are recommended for patients to rinse their mouth before dental operations (gargle with chlorhexidine and similar antiseptic solution), as it will reduce the number of germs in the oral cavity [25, 30].

Dental healthcare personnel (DHCP) should be limited to one patient each time. Contact with more than one patient at the same time will distract the staff and increase the risk of infection. The dental operator should only have clean or sterile supplies required for the dental procedure and should not use auxiliary staff unless necessary. For this reason, the setting should be kept ready so that the required tools are easily accessible. The material remaining after the process should be considered contaminated and subjected to a medical waste management procedure. During the operation, the dentist must be protected by using a shield and an N95 mask. If an aerosol- or droplet-forming procedure will not be applied, shields and surgical masks may be used. Surgical gloves and protective clothing should be changed every time. Therefore, disposable protective clothing should be preferred. Food and drinks should not be consumed during work. The environment should be sterilized with disinfectant spraying devices at the beginning and after the process. All surgical and dental instruments should be sterilized in accordance with the applicable standards, and the necessary number of materials should be available each time, because if a dental tool contaminated with SARS-CoV-2 comes into contact with the oral mucosa, the virus will enter the organism due to the highly expressed ACE-2 receptors, especially in the epithelial cells of the tongue [11, 16, 33]. Therefore, dental procedures to be performed should be designed in such a way that they do not create aerosols, and if possible, only hand tools should be used. This is because dentistry professionals work in the patient's mouth, and this carries a high risk of COVID-19 infection. While working in the mouth, droplets will be scattered with the patient's saliva and inhaled through breathing. Meanwhile, people in the immediate area will be at a high risk of infection. Therefore, all asymptomatic patients should be assumed COVID-19-positive, and action should be taken accordingly. There are recommendations to prevent SARS-Cov-2 virus transmission, such as the use of a suction cannula for rapid spray/saliva aspiration or the use of Tyvek garments and sprays designed for protection of dental care workers [15, 34–37]. Moreover, although there are no data that it reduces SARS-CoV-2 viral load, the mouth should be rinsed with preprocedural mouth rinses (PPMR) containing an antimicrobial product (chlorhexidine gluconate, essential oils, povidone-iodine or cetylpyridinium chloride) before the procedure. Two different studies showed that mouth rinsing before a routine procedure inhibits most bacterial aerosols produced by the usage of an ultrasonic unit, and chlorhexidine is more effective [38, 39]. Furthermore, Kaufman et al. [39] reported that universal barrier measures for protection from infections and effective routine infection control will prevent infections in dentistry. The virus is very sensitive to ultraviolet light and heat, and if it is kept at 56°C for 30 minutes, the virus will be inactive. Lipid solvents such as ether, 75% ethanol, chlorine-containing disinfectants, peracetic acid and chloroform can kill the virus [11, 40]. These lipid solvents are used to disinfect the environment of the dental clinic and the surfaces of objects. As a result, antiviral

mouthwash application of the patient to reduce viral load, use of suction cannula for rapid spraying/saliva aspiration, use of N95 masks as well as dentist's shield, continuous environment disinfection and vaccination are known as the most effective measures. However, since it would be possible to evaluate the effectiveness of the recommendations offered through long term prospective studies, these recommendations should be considered as confidence increasing approaches towards oral and dental health for the time being. In addition, through meta-analysis studies to be conducted by using the data to be obtained from these recommendations that could be applied in different centers, the problems related to the application of these recommendations and the concerns about their effects on the efficiency of oral and dental health can be eliminated. Hence, we believe that these recommendations would be a good topic for research in various areas related to dental health.

In addition to all these precautions above that need to be followed, scientific authorities suggest that vaccination of healthcare personnel working in the front-lines is seen as the most effective method in countering the COVID-19 pandemic [41–43]. According to the results of a study conducted in the UK, vaccination, even if it provides limited protection against infection, can have a significant effect in preventing the spread of COVID-19 and reducing its outbreaks [44].

4. The importance of physical distance in the work environment

It is known that COVID-19, which has caused great concern worldwide, is asymptomatic in many people. Test positivity is quite common before the symptoms of the disease appear. Laboratory findings of these asymptomatic people are also normal. However, since COVID-19 causes hyperinflammation, significant changes such as lymphopenia, high neutrophil to leukocyte ratio, increase in CRP, ferritin, D-dimer and procalcitonin levels are found in the biochemical results of many symptomatic people [45, 46]. People who are asymptomatic are highly effective transmitters in spreading COVID-19. These are called asymptomatic carriers [47, 48]. Moreover, studies have shown that the viral load in the airway samples of asymptomatic patients is similar to that of symptomatic patients [49]. For this reason, dental health and other healthcare professionals should also continue their work in compliance with physical distancing principles (at least one meter) [50, 51] because transmission from healthcare workers to healthcare workers is a danger that should be taken seriously for healthcare institutions [52]. In cases of suspected COVID-19 cases, personnel working together are also recommended to have SARS-CoV-2 PCR tests.

If the patient who is treated in a dentistry clinic shows signs or symptoms immediately (within one to two days) after the treatment, or if they are diagnosed with COVID-19, the situation must be reported to the dental clinic [21]. Procedures for providing this feedback should be established because almost all people are susceptible to COVID-19. The incubation period is usually 3–7 days but may extend up to 14 days. Moreover, many cases showing that it takes up to 24 days have been reported. During this incubation period, patients can transmit the virus to others. It was even found that people may be infected during their recovery period. The symptoms of the disease are usually fever, dry cough and fatigue. These may be accompanied by nasal congestion, runny nose, sore throat, myalgia and diarrhea. In severe cases, acute respiratory distress, septic shocks, metabolic acidosis and multi-organ failure may develop [11, 12, 25, 30, 53, 54].

In a review conducted by Marcelo Coelho Goiato, 47 articles and 9 websites were examined, general information about SARS-CoV-2 was collected, and forms of transmission and measures in dentistry were reviewed. In the review, it was reported that the SARS-CoV-2 virus was transmitted to 213 countries as of May

2020 [8]. With 208 countries registered with the United Nations and an estimated 13 unregistered countries in the world, SARS-CoV-2 has spread almost all over the world, and millions of people have already lost their lives. There are worries that these numbers will increase even more. These figures show that the SARS-CoV-2 virus should be taken seriously. As to be understood from here, it is not possible that oral and dental health services will not be affected by this. The main question is what kind of precautions we can take to maintain these healthcare services. In clinical practice, oral and dental healthcare providers continue their profession with fear, as they come into contact with many patients every day and are exposed to many infection risks, including SARS-CoV-2 [11, 27]. The best way to overcome this fear is to have a broad knowledge of COVID-19 and follow the recommendations of the authorities working on this issue. This way, dentists will protect both their own health and the health of their patients and other people.

Another fear of all healthcare professionals, including dentistry professionals, is the possibility of transmitting this infection to their close relatives, since they work closely with infected patients [11, 16, 54]. In a study by Sabino et al., the finding that 29% of 138 patients who received hospital treatment in the city of Wuhan in the Hubei province of China for COVID-19 were healthcare workers [26] justifies this concern.

5. Oral and dental healthcare practices for the COVID-19 outbreak in Turkey

With the first cases in Turkey at the beginning of March 2020, the Turkish Ministry of Health, Coronavirus Science Board members took urgent measures in accordance with the available recommendations of international organizations, 'guidelines for working in health institutions and Infection Control Measures' were published, and individuals were instructed to comply with these guidelines and measures [55]. Accordingly, during the pandemic, it was recommended to intervene in emergency cases and avoid aerosol-producing procedures in dental practices. According to this guide, emergency and compulsory services in dental practices are defined. These are summarized below:

- Severe toothache caused by acute pulp diseases and pericoronitis,
- Osteitis or alveolitis,
- Dental abscess or bacterial infection with localized pain and swelling,
- Traumatic jaw and tooth fractures, avulsion/luxation,
- Broken brackets and dental wires causing pain and infection in patients receiving orthodontic treatment,
- Temporomandibular joint luxation,
- Acute painful ulcerations of the oral mucosa and severe uncontrolled bleeding,
- Oral infections that narrow the respiratory tract,
- Treatment of patients who are planned to receive or receiving organ transplantation, radiotherapy and chemotherapy,

- Dental consultations requested for severe medical problems,
- Taking stitches from the wound site after an intervention,
- Treatment of restoration and removable denture fractures in a way that does not create droplets and aerosols,
- Making feeding plates for newborn patients with cleft lip and palate,
- Biopsy performed for suspicion of malignancy.

In the normalization period, it was reported that planning was made by giving priority to emergency and compulsory services to manage the patient density that may occur in all institutions providing oral and dental health services.

The Turkish Ministry of Health was one of the best among the health departments of countries in the management of the COVID-19 pandemic in terms of the measures it took, the rules it set and its supply of healthcare materials. Furthermore, more positive results were obtained thanks to the cooperation with the World Health Organization (WHO). These practices encouraged all healthcare professionals, including dental healthcare professionals, to ensure the smooth continuation of healthcare services, except for minor problems. In this context, dentists were also included among healthcare professionals who directly combat COVID-19. They contributed significantly to the fight against this disease by participating in contact-tracing teams and working in the job of taking a throat and nose swab for PCR tests. The effective factors that enabled dentists to offer this contribution were provision of adequate protective equipment as well as the knowledge and skills provided by training programs. According to a study conducted by Tokuc and Coskunes [56], dentists in Turkey reporting that they have significant knowledge and skills about COVID-19 and its clinical symptoms are the proof of this. However, the opposite case was reported in a similar study conducted in Pakistan [57].

6. Importance of financial and social support

During the epidemic period, the Turkish government directly supported all healthcare professionals at high risk of contact with COVID-19, including those working in oral and dental health, as well as providing a significant quantity of medical equipment and device support to health institutions. Additionally, it took measures that would lead to improvements in the social status of healthcare personnel and encouraged them to increase the respect in the society for healthcare professionals. This attitude has had a doping effect in the fight of healthcare personnel against COVID-19. Of course, in a period when the economy and work life were unstable due to the COVID-19 pandemic, the financial support provided to fight against the pandemic had strained the Turkish economy. However, the psychological gain it created has prevented economic difficulties. Additionally, considering the humanitarian aspect and the long-term reflections of the outcomes gained from the lives that were saved, from the bodies that were freed from pain and from the brains that were restored to their normal thinking capacity, it is certain that the fight against the COVID-19 pandemic will be worth all kinds of economic difficulties. Considering the economic, psychosocial and health losses suffered by the USA, which is accepted as the most developed country in the world but caught unprepared for the pandemic due to its wrong decisions in terms of health [58], the value of the support to be given to the field of health has been understood

better. Additionally, in a study on the effect of COVID-19 on healthcare workers, it was emphasized that healthcare workers should be encouraged to continue to provide high-quality and effective healthcare services [59]. In another study, it was determined that the rapid spread of COVID-19 and the lack of personal protective equipment, as well as witnessing deaths caused by the pandemic, fear of carrying the virus to family members and the deaths of colleagues, have seriously affected the mental health of healthcare professionals. For this reason, it was reported that the mental health of all healthcare professionals should be supported during and after the COVID-19 pandemic [60]. All these points show that it is important to support all healthcare professionals, including oral and dental healthcare professionals, financially and socially throughout the pandemic period.

Developments related to COVID-19 and many issues that remained in the dark initially caused anxiety in Turkey's dentistry community. However, as uncertainties and lack of information about COVID-19, which were a cause of fear, disappeared, and the necessary measures were taken, the desire to fight replaced anxiety. The measures taken, the training programs provided, and most importantly, the support of the Turkish state to healthcare professionals have enabled the people to come out of this process. The SARS-CoV-2 virus will continue to be effective for years to come. For this reason, the struggle against the pandemic should continue responsibly. As dental service providers, we exemplify our own struggle in this regard.

7. Conclusion

Scientific evidence shows that the oral cavity and its components have a very important role in the pathogenicity and morbidity of SARS-CoV-2. Since dentists work in the mouth area, they carry a high risk of COVID-19 disease. Therefore, by providing adequate personal protection equipment and administering vaccination to all staff, as well as rational practices, the concerns of dentists and other healthcare professionals about the COVID-19 pandemic may be alleviated. Additionally, financial and social support should be continued. This way, it may be ensured that dental treatment services can be maintained without any problems.

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