

Dental Care Implications in Coronavirus Disease-19 Scenario: Perspectives

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ABSTRACT

Aim: The aim of this review is to discuss the implications of COVID-19 on various aspects of dental care.

Background: The COVID-19 pandemic had suspended dental practice globally for over 3 months. While dental practice is being resumed cautiously, standard infection control protocols that were traditionally overlooked are now being strictly implemented. Post-COVID-19, dental care is expected to see a drastic change in the way it is practiced.

Review results: With a view on the natural history and disease dynamics of COVID-19, this review reports various aspects of dental care, viz., patient triaging, engineering and work practice controls, and administrative, financial, and ethical aspects of dental care during and after COVID-19 pandemic. Current evidence-based recommendations with regard to infection-control practices are discussed. A call for universal oral health care with suggestions regarding integration of medical and health care is also proposed.

Conclusion: COVID-19 is expected to be a watershed moment in the field of dentistry. While we expect to see positive changes in safe delivery of dental care, an increase in cost of availing care is imminent.

Clinical significance: The practice of dentistry and dental infection control has undergone dimensional changes due to bloodborne infectious diseases such as hepatitis B virus infections and human immunodeficiency virus epidemic. Due to these pandemics, many regulatory organizations have provided safety recommendations and guidelines that impact the dental practice. Currently, we are faced with a highly infective disease with a high mortality rate among people with comorbidities and of predominantly droplet transmission and no concrete safety recommendations and guidelines. This manuscript addresses multiple issues, gaps, and pragmatic solutions in controlling transmission of SARS-CoV-2 in dental settings, during and after the pandemic.

Keywords: COVID-19, Dental care, Ethics, Infection control, Occupational safety.

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NATURAL HISTORY OF CORONAVIRUS

Coronaviruses belong to the Coronaviridae family in the Nidovirales order.¹ Corona shows crown-like spikes on the outer surface of the virus.² They are minute in size (65–125 nm in diameter) and contain a single-stranded RNA as a nucleic material. The Coronavirinae are further subdivided into four genera, the alpha, beta, gamma, and delta coronaviruses.¹ The International Committee on Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and the disease as COVID-19.^{3,4} This novel coronavirus has shown a case fatality rate ranging from 0.1 to 16.2%.⁵

COVID-19 causes a respiratory infection with a highly variable clinical course that is dependent on multiple factors. Mild disease observed in 81% of patients manifests as self-limited respiratory symptoms similar to a viral pneumonia, including fever, cough, dyspnea, and sore throat.⁶ Other symptoms could include fever or chills, cough, dyspnea, fatigue, muscle or body aches, headache, recent loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea.^{7,8} Individuals most vulnerable to developing severe disease include those of advanced age or with significant comorbidities conditions such as cardiovascular disease, chronic obstructive pulmonary disease, and hypertension.⁹ The median estimated incubation period is about 5.1 days (95% CI,

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4.5–5.8 days), and 97.5% will develop symptoms within 11.5 days (CI, 8.2–15.6 days) of being infected.^{9,10}

COVID-19 AND DENTAL CARE

Charting the Patient for Dental Care

The current trends in the COVID-19 disease dynamics R_0 [R naught] ~ 1–6 based on different studies.^{11,12} Absence of an effective vaccine against COVID-19 could prolong presence of the disease over time as it is highly improbable that the virus will die out soon.¹³ R_0 is a mathematical expression of how contagious a disease is in infecting others. As R_0 for COVID-19 is 2–3, it means each person infected with COVID-19 has a potential of spreading the disease to two to three other people.

Resuming of the dental practice cannot wait due to reasons ranging from patient's rights for regular/elective dental care, the dentists' responsibility to provide routine elective care, and the economic factors of maintaining clinical practice. But, due to transmission of this disease from the upper respiratory tract, the oropharynx, the nasopharynx, and the oral cavity, and also the proximity of the dental professionals being within 1 foot of the oral and nasal cavity during care for extended periods, dental professionals are at an increased risk of contracting the virus from patients if the latter are presymptomatic or asymptomatic, yet infective. Given the limited availability of required personal protective equipment (PPE) and other control measures in controlling the disease, most regulatory bodies worldwide have limited treatment of non-emergent cases.¹⁴ Further, triaging of patients, utilizing meaningful engineering controls, administrative controls, and implementing rigorous work practice measures, will become a necessity during and after this pandemic.¹⁵

Triaging of Patients

The first control measure before allowing any patient is communication. The clinic should post a prominent message on the website, on the front door, and the check-in area that if they are not feeling well or are having symptoms related to COVID-19, not to enter, but schedule a teleconsult. This would provide an additional window of opportunity to screen patients through phone/video calls/text or e-mail messaging. Members of the dental team must also monitor themselves each day and not come to work if sick or positive for any of the symptoms. If any of staff are at high risk for COVID-19 (comorbidities or a caregiver of a high-risk family member), they should be allowed to limit their presence in the clinic. After providing emergency care, the patient must be told to inform the clinic if the latter becomes sick with COVID-19 within 14 days after receiving emergency dental care so that the dental care providers may take the necessary action of self-quarantine and/or seek testing and care.

The second control measure is patient flow. It is recommended that dental practice needs to be appointment-based at least for the foreseeable future or until a vaccine is developed. This basic screening can be based on three pertinent questions: recent exposure to a known or a suspected COVID-19 patient, recent travel history to any of the COVID-19-affected areas with particular attention to local epidemic regions or hotspots (hotspot is a place of significant prevalence of COVID-19 cases), or presence of severe acute respiratory illness (a combination of fever, cough, and/or shortness of breath), or all symptomatic ILI (influenza-like illness—fever, cough, sore throat, runny nose). Taking the body temperature to determine fever at the time of check-in is essential and it should be less than 100.4°C.¹⁵ Owing to the dynamic nature of the pandemic,

new hotspots could be declared on any given day and may need to be identified from the local health authorities. Additionally, the final screening must be done at the time of appointment. While the term “recent” in the above statements may sound ambiguous, present understanding suggests the incubation and convalescent period could be in the range of 1–3 weeks. A positive response to any of these questions calls for a cautious approach. A teleconsultation augmented with a photograph/video of the affected tooth/area (if appropriate) could help in a provisional diagnosis. If only elective procedures are indicated, it may be deferred to a later date when elective procedures can be performed safely. In the instance of having to encounter with a “walk-in” patient without prior appointment or if any patient is insistent on having a consultation in the dental office, a detailed screening should ensue. This would require providing a detailed self-reported medical history and a COVID-19 questionnaire consisting of questions regarding their contact with or potentially suspected patients and/or relevant travel history. An assessment of body temperature is a “must” with a noncontact digital thermometer. Initial verbal consultation should be done maintaining an adequate physical distance. An intraoral examination may not be performed at this stage unless it is a dire necessity. Elective procedures may be delayed for further 2 weeks. Recall/reappointment should be arranged once COVID-19 is better controlled in the local population and after the rules governing dental practice are relaxed to provide elective care. If the patient requires treatment for urgent or emergent needs such as severe pain, pain not subsided after a regular course of antibiotics and analgesics, or an abscess requiring drainage, intraoral examination and procedures deemed appropriate will need to be performed with additional transmission-based protective measures. Patients symptomatic of COVID-19 should be referred to a facility equipped with either negative air pressure rooms for dental care or where adequate and appropriate PPE is used. Patient's attendants are not to be allowed into the operatory, and no more than one patient is allowed in the waiting area. While treating minors and others who cannot provide an informed consent, legal guardians may be allowed after providing them with at least a level 1 to level 3 surgical mask. Staggered appointments will help (one patient per dental team per hour to facilitate adequate time for decontamination procedures of the clinical area). Mask wearing should be made mandatory, and masks should be supplied to patients till they are treated. In the waiting area, ensure enough physical distance between individuals.¹⁶ Objects such as magazines, other reading materials, and toys should be removed due to its potential for cross-contamination.¹⁷ Maintaining a daily log of patients is imperative. This log will contain information on cases consulted through telephone/e-mail/text messages and follow them up with regular consultation and treatment once it is deemed safe to do the procedure. Pharmacological management through teleconsultation would at times require prescribing of drugs and obtaining a verbal informed consent. Online prescriptions should be written based on the country's prevailing rules and regulations. Many clinics are manned by a single dentist with consultants on call. Predictably, some of them could have constraints in space to implement social distancing measures and achieving adequate ventilation of their operatories. In such clinics, staggered and appointment-based consultation appears to provide the least risk when providing dental care.

In dental schools, while resumption of activities is expected to begin in a phased manner, it is important that the strict triaging protocols are followed. Mandatory daily screening of patients, faculty, staff, students, and other visitors should be undertaken.¹⁸

To facilitate triaging, screening should be established in area outside clinical treatment area that has adequate space and ventilation. Use of physical barriers such as cough/sneeze guards should be placed between the patient and staff at check-in.¹⁹ Institutions should plan and identify an isolation area where patients with any positive response to the triaging questions and who require an emergency consultation/treatment could be located. These simple actions could minimize the potential for spread of virus. Hospitals and dental schools equipped with multiple dental workstations will need to make structural and systemic changes to implement engineering and work practice controls.²⁰ Additionally, masks, hand sanitizers, disposable paper towels, and trash cans with lids should be available for patients to discard their masks and gloves.

Charting of patients for dental care also involves making decision on which treatments are safe to be performed and those that need to be deferred. While the American Dental Association (ADA)²¹ were the prime movers in classification of cases as urgent, emergent, and elective, many countries and organizations follow similar classification. It is pragmatic to follow local guidelines anywhere and modify it based on the capacity and needs. Examples of the classification are listed as follows:

EMERGENCY (situations that increase the patient's death risk/threat to life)

- Uncontrolled bleeding
- Cellulitis or diffuse bacterial infections leading to intraoral or extraoral edemas and potential risk of damage to airways
- Facial bones trauma, which may damage the patient's airways

URGENT (situations that require priority care but do not increase the patient's death risk)

- Acute dental pain (Pulpitis)
- Pericoronitis
- Alveolitis
- Dental or periodontal abscesses
- Dental care needed for another critical medical procedure
- Cementation fixed prosthesis or crowns
- Biopsies to determine life-threatening conditions
- Adjustments of orthosis and prosthesis that cause pain and compromise occlusion and chewing where the prosthesis may need to be removed or modified using high-speed cutting instruments
- Changing intracanal medication
- Removal of extensive dental caries or restorations that cause pain
- Mucositis
- Dental trauma with avulsion or luxation

These examples summarize the exercise of triaging patients and are essential in the present circumstances to ensure minimal risk to the dental healthcare workers from exposure to COVID-19 and ensure judicious use of PPE.

Engineering and Work Practice Controls in Dental Safety during COVID-19

A paradigm shift in work culture is expected in post-COVID times. Standard infection control protocols that have been traditionally overlooked before should be addressed and strengthened and must include the current disease transmission-based additional precautions.²² A few general recommendations in the practice of dentistry are addressed as follows:

- Stay focused on the chief complaint.
- Patient visit duration should be as short as possible.
- Procedures should be as minimally invasive as possible and avoid or reduce generating aerosols.
- Single-use disposable supplies and devices should be used whenever possible, to limit cross-infection or cross-contamination.
- Isolation with rubber dam in combination with use of high-volume evacuation is necessary to control the spread of microorganisms through splash/spatter and bioaerosols.
- Intraoral radiographs should be limited in favor of extraoral imaging, in order to reduce salivation and gag reflex.

Aerosol-generating Dental Procedures (AGDP)

The COVID-19 virus was recently identified in saliva of infected patients.^{23,24} Saliva can have a pivotal role in the human-to-human transmission. Dentists and other healthcare professionals performing aerosol-generating procedures may unknowingly provide care to COVID-19-infected patients who have not been diagnosed.²⁵ Inhalation of airborne particles and aerosols produced during many elective dental procedures on patients with COVID-19 is risk due to the duration of and proximity of a procedure.^{14,21,26}

Any clinicians working in the upper aerodigestive tract, which includes dentists and dental specialists, are at increased risk of being exposed to COVID-19.²⁷⁻³¹ They are also at high risk of developing severe illness from the infection. Given the current information on COVID-19, a respiratory disease due to high viral loads in the upper respiratory tract,³² oral health professionals are at an increased risk of contracting COVID-19 during the dental procedures.³³ It has also been shown that clinicians exposed to high viral loads such as during an aerosol-generating procedure are more likely to suffer more severe illness than compared to a person contracting the virus in the community, due to the release of cytokine storms in these settings.³⁴ A similar picture was seen with a significant number of doctors who became infected and even died in Wuhan, China, who were anesthesiologists/critical care doctors, ophthalmologists, and otolaryngologists, with the possibility being that this may be due to the high viral shedding from the nasal and oropharyngeal cavity.³⁵

There have been reports of healthcare professional from various disciplines being exposed to the virus and being in a critical condition with some having fatal consequences. Most of these clinicians have been working in and around the upper respiratory tract with a report from Wuhan mentioned that 14 medical personnel were infected from a single endoscopic transsphenoidal pituitary case and another report of four otolaryngologists in the United Kingdom having been infected from asymptomatic patients.^{32,36}

Common AGDPs

- Any procedure that will agitate patient's saliva by mechanical force—such as high-speed handpiece, ultrasonic/air scalers, air-water syringe.
- Use of rotary instruments on an item that is coated with patient saliva—such as trimming of a special tray tried in patients' mouth, acrylic bases, or polishing.
- Use of conscious sedation
- Use of laser and electrocautery that may generate plumes
- Dental implant surgery
- Oral surgery requiring use of rotary or ultrasonic devices to cut teeth and bone

Aerosols, both visible and invisible to the naked eye, are generated during surgical and nonsurgical dental procedures that include procedures in all dental disciplines ranging from crown preparations, restorative procedures, endodontic therapy, and surgical procedures—extractions, periodontal therapy/surgery, oral prophylaxis using ultrasonic and piezo scalers that require irrigants and coolants. Procedures to control exposure to bioaerosols being currently used are high-volume evacuators with or without a rubber dam, antimicrobial mouth rinse (rinse may not be adequate, and may need patients to gargle as well, as it also spreads from the oropharyngeal region), decontamination procedures for the dental water system, and use of PPE. COVID-19 has shown some infected patients being asymptomatic, more transmissible, has no treatment or vaccine, has no definitive proof of immunity once infected,³⁷ and lack of protection if only “standard precautions” (for controlling bloodborne pathogens) are followed.²⁹

The big issue with the COVID-19 infection is that it appears that active transmission has been documented in asymptomatic cases.³⁵ This obviously is worrisome as it has huge implications for oral health professionals with respect to personal protection. COVID-19 has led to health and safety authorities in releasing guidelines and recommendations that include “transmission-based precautions (additional precautions)” on the use of PPE in procedures that are aerosol generating and where standard precautions are not adequate in protecting against bioaerosol-containing viral particles. The four-handed technique is beneficial for controlling infection. The dental environment is unique—because of the proximity of the dentist to the patient and exposure time of about 30 minutes per procedure and the potential of exposure to both bloodborne pathogens and bioaerosols. Bacterial and viruses can be spread through breathing, speaking, coughing, sneezing, gagging, salivation, and oral bleeding to release viruses through droplets and aerosol.

Engineering controls are systems in place where mechanical devices are used to control exposure to a particular risk. In nonair-conditioned facilities, rooms are to have adequate natural ventilation with open windows²⁹ or to have adequate air exchange environmental controls. In facilities equipped with air-conditioning, it is necessary to either actively evacuate the air out of the facility, recirculate the air using devices with high-efficiency particulate air (HEPA) filter, or a HEPA + ultraviolet (UV) light C exposure. The number of air exchanges should also be increased to facilitate removal of suspended bioaerosols. Rooms are to be left unused between procedures, for a minimum decontamination time and air exchange using engineering controls that either evacuate the air, filter the air using medical-grade HEPA filter and UV light chamber in the wavelength of 200–280 nm (UVC).^{29,30,38} Ultraviolet germicidal irradiation (UVGI) is helpful in controlling contamination in treatment facilities.³⁹ While the popular belief is utilizing wavelength of the UV at about 260 nm, a lower wavelength of about 222 nm could be another approach where the viruses will get denatured but is less harmful to human tissues.⁴⁰ The number of air exchanges per hour, distance from the UV source, and filtration efficacy of the HEPA filter within the clinical area are also major factors that determine efficacy in physically reducing viruses in bioaerosols. Minimum efficiency reporting values, or MERVs, at the rating of “16” (99.97% filtration efficacy of 0.3 micron-sized particles), are most efficacious.⁴⁰

Work practice controls are control measures that must be followed with respect to transmission-based precautions in ramping up “work practices.” These include behaviors and practices such as hand hygiene, rigorous decontamination procedures, and

appropriate level of PPE based on transmission risks of the disease. Hand hygiene before and after gloving with a medical-grade hand soap (chlorhexidine 2–4%).⁴¹ Both, high-touch surfaces and common surfaces should be decontaminated between patients with an approved water-based, intermediate-level, hospital disinfectant with both a hydrophilic and a lipophilic virus kill claim [choices such as hypochlorous acid of 3000–5000 + ppm^{42,43} or a 0.5% accelerated hydrogen peroxide disinfectant⁴⁴ with a US Environmental Protection Agency (EPA) registration number⁴⁵ that is required to be marketed as a disinfectant, and for use in dentistry for decontaminating the noncritical surfaces it should be classified as an intermediate-level disinfectant].

There are many recommendations from various parts of the world and invariably there tend to be variations in the details; however, there appears to be a consensus to support the use of N95 masks or higher and associated aerosolized mist precautions for all aerosol-generating procedures regardless of COVID-19 testing.⁴⁶ Some guidelines go even further to suggest the use of powered air-purifying respirators (PAPRs).⁴⁷ With respect to asymptomatic cases, there is emerging data to suggest that asymptomatic infections are possible. In one investigation of the Diamond Princess Cruise ship revealed that about 33.3% of infected individuals were asymptomatic at the time of testing.⁴⁸

Post-COVID Routine Practices

Post-COVID routine practices must incorporate the following:

- Proactive communication with patients
- Daily monitoring the clinical team members’ health status
- Point-of-care risk assessment
- Social distancing at in the reception and waiting room with patients and carriers advised to wait in their vehicles or other areas till they are required or called in
- Contact, droplet, and aerosol precautions
- Hand hygiene
- Bioaerosol control
- Diligent decontamination procedures
- If suspected or confirmed COVID-19, N95, gown, eye protection, and gloves use while performing AGDPs in an emergency, otherwise elective procedure to be postponed to a time when the patient is confirmed to be free from COVID infection.

Therefore, it is crucial for dentists to refine control measures in reducing exposure by utilizing a combination of both engineering and work practice controls.

Ethical Considerations of Dental Care

The COVID-19 has posed significant challenges for dentistry. With the sudden outbreak of the COVID-19 pandemic, access to regular dental care has been significantly limited or ceased. COVID-19 outbreak is inflicting devastating consequences on delivery of dental care. In the absence of a clear picture of the disease dynamics, dental care has been propelled to provision of emergency care only in most countries at the early stage of the pandemic.

Providing dental care is a primary ethical duty of the dentist.⁴⁹ But this ethical duty conflicts with an advisory note of deferring elective procedures or even suspending dental practice. Denying dental care is causing harm, even though temporarily, thereby compromising principles of ethics.⁵⁰ However, this conflict is explained by utilitarianism principle (the greatest amount of good for the greatest number of people)⁵¹ wherein not practising or

denying dental care will protect many people in the community from spread of coronavirus infection. It can be propounded that the greater good of saving many lives is imperative than suspending dental service. And by not performing dental services during the pandemic, it can be contended that dentists are upholding the principle of nonmaleficence (do no harm),⁴⁹ by preventing risk of infection to the patients and the dental team.

Regardless of medically advanced or not so medically advanced country, availability, access, and affordability of oral health care is limited.⁵² Even in pre-pandemic era, dental care is often sought by many at emergency healthcare facility due to lack of dental insurance or financial constraints, instead of regular dental healthcare facility.^{53,54} One of the consequences of a pause in regular dental care in these challenging pandemic situations would be an exponential increase in proportion of patients with dental conditions, seeking emergency dental care only, due to closure of regular dental services. Post-pandemic shutdown relaxations, regular dental check-ups, and backlog of dental care will increase and expect their dentists to provide safe and high-quality care.

The “emergency-only” mode of dental care delivery may have rippling effects. First, it increases prescription of antibiotics/analgesics, opioid analgesics leading to opioid use, overdose, and abuse, which are often prescribed in pain relief measures in dentistry.⁵⁵ Second, post COVID-19, there may be higher proportion of patients seeking elective dental care, which increases the burden on existing oral health systems. Third, postponing of elective dental care, for example periodontal care or prosthesis, would affect the systemic health and complicating existing comorbidities like diabetes. Lack of regular dental care may deteriorate the existing noncommunicable diseases in patients as they share common risk factors.^{56–58} Dental services may be among the last to relaunch in post-pandemic relaxations since dental procedures are at high risk of transmission.

The pandemic may also result in serious financial problems for dental offices due to the prolonged periods of inactivity and of loss of practice income. Due to high risk involved while carrying out aerosol-generating procedures, dental practices will need to significantly change the way they practice. This will invariably increase the cost of dental services, which will have to be recouped. Dentists are facing serious financial challenges for their livelihoods and their allied services like dental hygienists, technicians, and dental industry. The risk of closure of many dental practices may be imminent due to the burden of repayment of loans. The stand-alone and single dental practices may be worst affected, and survival may be at stake. Some governments have initiated financial incentives measures to dentists in the form of soft loans.^{59–61} Dental education will also be affected as many dental schools have stopped dental practice. Switching to online mode of teaching can be envisioned; however, the resources and use of the online training mode is questionable in these challenging times in low-resource settings. There should be a psychological support system to dental students resuming the dental practice and education during this COVID-19 pandemic situation. Dentistry as a career also will take a hit with reduced uptake due to long-term uncertainty of the profession.

Post COVID-19 pandemic, the cost of dental care may increase, as changes warranted to meet the challenges. Infection-control measures will need to ramp up to mitigate the risk of cross-infection. Patients may scrutinize the dental safety issues. There may be modifications of dental operatory to meet infection-control and

safety measures. There will be expectations from dental operatory to use disposable gowns, face shields, face masks, and gloves. The structural and procedural changes in the dental practice will result in an increase in the cost of dental care. The increase in the cost will pass on to patients. It is practical to foresee that the COVID-19 situation will remain at least the same for the next 2 years or until an effective vaccination is in place.

The anticipated increase in the cost of dental care in post-COVID-19 situation may increase the effort of inclusion of oral health in universal health care.⁶² Increased infection-control strategies lead to strong justification of the medical-dental integration^{58,63} or reduce the divide between medicine and dentistry.

Risk to Dentist

In any epidemic situations, health professionals are directly at risk of illness. The ethical dilemma to a dentist is when he has to make a choice between providing patient care and ensuring own safety. Balancing the professional commitment to provide needed care in a pandemic with responsibility to one’s family is dilemma. Dentists need to think carefully about what a decision to not to show up for work will mean and what burdens it will place on their patients and the colleagues who will have to pick up the slack. Following strict infection-control measures at home should be a first choice. The risk to the dentist would have to be very compelling to justify a decision not to go to work, a decision that a dentist should make on his/her own.

Obligations

Among ethical obligations in situations of epidemic, the foremost is the obligation to “provide urgent medical care during disasters,” an obligation that holds even in the face of greater than usual risk to physicians’ own safety, health, or life. There exists an implicit social contract exchanging service-in-trust for professional autonomy and its attendant benefits. Next is the consent-based obligations that a dentist assumes by joining the profession to combat disease and improve the health.⁶⁴ It is his ethical duty to work because his function cannot be replaced by anybody else as the society looks to them to serve this function.

Take-away Points

- Unless there is definitive information about natural history of coronavirus (COVID-19), the dental practice will be under occupational risk.
- The cost of dental care may increase to meet the challenges of the post-COVID-19 situations for enhanced infection-control measures.
- The anticipated increase in cost of dental care in post-COVID-19 situation may increase the effort of inclusion of oral health in universal health care.
- Increased infection-control strategies lead to strong justification of the medical-dental integration.

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