

Dentistry during Coronavirus Disease 2019 Pandemic: A Review

Captain Azhar Khan¹, Colonel S. K. Rath², Colonel Manish Mukherjee³

¹Dental Officer, 326 Field Hospital, Damana, Jammu and Kashmir, India, ²Department of Periodontology, Command Military Dental Centre (Eastern Command), Kolkata, West Bengal, India, ³Department of Periodontology, Army Dental Centre (R and R), Dhaula Kuan, New Delhi, India

Email for correspondence: dr.azhar.khan17@gmail.com

ABSTRACT

Coronavirus disease 2019 (COVID-19) has emerged as a global pandemic and has posed as an immediate threat to both patients, frontline healthcare professionals and paramedical staff. The uncertainty, limited knowledge and varying data on its transmission and infectivity has seen a paradigm shift in treatment protocols and personal protective measures ushering in a new age of medical and dental practice. Dental professionals are at an immediate risk and are highly susceptible to COVID-19 transmission due to the nature of working within close proximity to the respiratory outlets of patients and the nature of creating aerosols through certain necessary and vital dental equipment. The article emphasizes the need to adapt to newer personal protective techniques and protocols ensuring maximum safety to both Dental healthcare professionals and patients and preventing nosocomial based transmission to both patient and healthcare professionals. The present article talks about the protocols and the precautions that are to be followed by dental community to tackle coronavirus and to carry out a successful treatment without becoming the hotspot for the spread of coronavirus.


Key words: Dental emergency, dentistry, infection control, patient management, severe acute respiratory syndrome coronavirus 2

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has spread throughout the world in a blink of an eye. It is a highly transmissible and pathogenic viral infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Its emergence was in city of Wuhan located in central China considered as ground zero for COVID-19 pandemic. As of July 2020, SARS-CoV-2 has affected more than 200 countries, resulting in more than 10 million identified cases with 5,08,000 confirmed deaths. As per Union Health Ministry data, the recovery rate in India is 61.5%. Data from the Integrated Disease Surveillance Programme, in India reveals that 60% of COVID-19 patients have

at least one comorbidity and nearly 78% of infected population is under 50 years of age.

Coronavirus belongs to the *Coronaviridae* family and is of the *Nidovirales* order. COVID-19 popularly known as corona (in Latin meaning crown) characteristically got its name from the crown like protein spike present on its surface. Coronavirus is minute in size having diameter of 65–125 nm. It contains a single-stranded RNA as a nucleic material (size ranges from 26 to 32 kbs in length). The subgroups of coronavirus family are alpha, beta, gamma, and delta. The SARS-CoV, H5N1 influenza A, H1N1 2009, and Middle East respiratory syndrome coronavirus (MERS-CoV) cause acute lung injury and acute respiratory distress syndrome which leads to pulmonary failure and result in fatality. Recently at the end of 2019, Wuhan which is an emerging business hub of China experienced an outbreak of the novel coronavirus (nCoV) that killed more than eighteen hundred and infected over seventy thousand individuals within the first 50 days of the epidemic.^[1] The SARS-CoV-2 is different from SARS-CoV, but receptor to which

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they bind is same, that is., human angiotensin converting enzyme-2 (ACE-2).^[2]

On February 11, 2020, WHO named the novel viral pneumonia as “COVID-19”, while the international Committee on Taxonomy of Viruses suggested this coronavirus be named as “SARS-CoV-2” due to the phylogenetic and taxonomic analysis of this nCoV.^[3] This name was chosen because the virus is genetically related to the coronavirus responsible for the SARS outbreak of 2003.^[4] The US Center for Disease Control and Prevention refers to it as 2019 nCoV (2019-nCoV).^[5] The present outbreak of the 2019 coronavirus strain (COVID-19) constitutes a public health emergency of global concern.^[6] SARS-CoV-2 differs significantly from the 2003 SARS-CoV and MERS-CoV not only in genome sequence but also in its spike protein structures (Ren *et al.*, 2020), which exhibit higher affinity to the cellular entry receptor ACE-2, rendering it much easier for SARS-CoV-2 to enter human cells than SARS-CoV and MERS-CoV. Consequently, COVID-19 spreads much faster than SARS and MERS and has caused more deaths than SARS and MERS combined.^[7] Based on findings of genetic and epidemiologic research, it appears that the COVID-19 outbreak started with a single animal-to-human transmission, followed by sustained human-to-human spread.^[8] The primary mode of transmission is through droplets produced when an infected person coughs, sneezes, or talks.^[9]

The practice of dentistry involves the use of rotary dental and surgical instruments such as hand pieces or ultrasonic scalers and air-water syringes. These instruments create a visible spray that can contain particle droplets of water, saliva, blood, microorganisms, and other debris.^[10] SARS-CoV-2 transmission may also occur indirectly, when a person comes into contact with fomites such as the hand or clothes of an infected patient or the door handles, counter surfaces, and other objects touched, used, or soiled by respiratory droplets from an infected patient. It is believed that SARS-CoV-2 cannot penetrate the keratin layer of intact human skin but may enter human body through mucosal surfaces when contaminated hands touch the mouth, eyes, and nose.^[7]

The majority of patients experience fever and dry cough, while some also had shortness of breath, fatigue, and other atypical symptoms such as muscle pain, headache, sore throat, diarrhea, and vomiting.^[8] Many patients remain asymptomatic throughout and never develop any symptom. These

asymptomatic carrier patients can also spread the virus. Complications include respiratory distress syndrome, arrhythmia, and shock which are more frequently associated with older age and in the presence of co-morbidities.^[11] The present review summarizes the information regarding coronavirus and to explain why it is a topic of concern for dental professionals and management of cases in the dental setting by a dental professional.

WHY COVID-19 IS OF CONCERN IN DENTISTRY?

COVID-19 transmission occurs through contact with droplets and aerosols generated during dental clinical procedures. Dentists are often the first line of diagnosis, as they work in close contact with patients. On March 15, 2020, the New York Times published an article entitled “The workers who face the greatest coronavirus risk,” where an impressive schematic figure described that dental professionals are most exposed to the risk of being affected by COVID-19, much more than nurses and general physicians.^[2] Several dental instruments aerosolize saliva and blood to the surroundings, especially the instruments that are being operated with compressed air and water. It is possible that the whole dental setting could be contaminated by the SARS-CoV-2 after these procedures and it is not surprising that dental hygienists are more exposed to this infection than actual dentists. The SARS-CoV-2019 can remain viable in aerosol for over 3 h and can be detected on several surfaces even after 72 h, although at a greatly reduced virus titer. Glove puncture can also pose a high risk to dental practitioner, but this eventual risk can be notably reduced following the same practices that have been followed by the dental community for the protection from several blood-borne pathogens. Furthermore, one should remember that this risk does not only come with symptomatic patients but also from asymptomatic patients.^[12]

Challenges affecting dental education include lockdowns of clinics, no student has access to clinical learning experiences, and no patient has access to dental treatment in clinics, millions of people be it practitioners and dental auxiliaries are in losses and financial shortfalls, interruption in research activities and grants, cancellation of scientific conferences and convocation ceremonies, drastic changes in planned initiatives and activities, including hiring of new academics and scientists; social isolation; and psychological impacts on staff and students.^[13]

WHAT CONSTITUTES A DENTAL EMERGENCY?

Dental emergencies are potentially life threatening and require immediate intervention to stop ongoing tissue bleeding, alleviate severe pain or infection, and include uncontrolled bleeding, cellulitis and trauma.

Urgent dental care focuses on the management of conditions that require immediate attention to relieve severe pain and/or risk of infection and to alleviate the burden on hospital emergency departments. These should be treated as minimally invasive as possible, for example, severe dental pain, pericoronitis, dry socket, tooth fracture resulting in pain or causing soft tissue trauma, dental trauma with avulsion/luxation, dental treatment required before critical medical procedures, final crown/bridge cementation if the temporary restoration is lost, broken or causing gingival irritation and biopsy of abnormal tissue.

Other urgent dental care procedures also includes extensive dental caries or defective restorations causing pain which should be managed with interim restorative techniques when possible, suture removal, denture adjustments or repairs, snipping or adjustment of an orthodontic wire or appliances piercing or ulcerating the oral mucosa.^[14]

PATIENT MANAGEMENT

Tele Screening

Initial screening through telephone to identify patients with suspected or possible COVID-19 infection should be performed at the time of scheduling appointments. Patient in need of emergency treatment only should be given appointment.^[15]

Waiting Area

Installation of glass or plastic barrier at the reception desk preferably with a two-way speaker system should be preferred.^[16]

Display visual alerts at the entrance of the facility and in strategic areas (e.g., waiting areas or elevators) about respiratory hygiene, cough etiquette, social distancing, and disposal of contaminated items in dustbins.^[16]

Patients should be asked to follow the cough etiquette. Cover their mouths/nose when coughing or sneezing, use tissue and dispose it off in a container with lid, and perform hand hygiene after contact with secretions while coughing or sneezing.

Patients with such respiratory symptoms should be made to sit in a separate room or can be asked to stay in their car till their turn. The sitting arrangement of patients in waiting area should be well planned with at least 6 feet distance in between them. Patients should be given appointment in such a way that social distancing norms can be maintained. Magazines should not be kept in the waiting area. All patients should be wearing their mouth masks and those without mask should be given one before they enter the clinic.

When patient arrives in dental clinic, patients should complete a detailed medical history form, COVID-19 screening questionnaire and assessment of a true emergency questionnaire.^[15] Patient's body temperature should be measured using a non-contact forehead thermometer or with cameras having infrared thermal sensors. Patients who present with fever and/or respiratory disease symptoms should have elective dental care deferred for at least 2 weeks. Such patients should be asked to consult their physician to rule out the possibility of COVID-19.^[15] Non-contact infrared thermometers are held 3–15 cm away from the patient and typically measure temperature on the forehead or temple.^[16,17]

PRECAUTIONS DURING DENTAL TREATMENT

Dentists should follow standard precautions including the appropriate use of personal protective equipment (PPE) and hand hygiene practices. All the components of PPE should be worn in the respective series—shoe cover, surgical gown, head cap, mouth mask, goggles, face shield, and gloves. All these components are one time use, except the goggles and face shield, which experts say may be reused following standard disinfecting procedure.^[18]

Hand hygiene after removing PPE should be an unsaid rule and should be followed religiously so as to remove any pathogens that might have been transferred to bare hands during the removal process. Hands are considered a common vector for the transmission of healthcare associated infections and have been implicated in the transmission of respiratory infections.^[19] Good hand hygiene before and after patient contact is imperative to prevent transmission of infection.^[20]

VENTILATION AND AIR QUALITY MANAGEMENT IN DENTAL CLINICS

- a. Keep windows open in the clinic so as to promote cross ventilation as exchange of air is important

in closed spaces like our clinics. Other than this an exhaust fan is also useful to extract the air into the atmosphere

- b. Ceiling fan should be avoided while performing procedures
- c. Table fan should be placed behind the operator and airflow should be toward the patient. A strong exhaust fan to be so located so as to create a unidirectional flow of air away from the patient
- d. The air conditioning system should be frequently serviced and filters should be cleaned
- e. Indoor portable air cleaning system/air purifier equipped with high efficiency particulate air (HEPA) filter and ultraviolet light may be used.^[16]

Air purifiers can also be used in clinics. Most air purifiers employ HEPA for filtration of particles. The filtration efficiencies of HEPA are high enough to remove such virus-laden aerosols. According to our previous measurements, the efficiencies of HEPA are more than 95% for aerosols of diameter between 0.25 and 1.0 μm and nearly 100% for those with diameter larger than 2.5 μm . The portable and affordable air purifiers have the potential to reduce the exposure of healthcare workers to virus-laden aerosols and serve as a useful supplement. Furthermore, the air purifiers with disinfection capability may be more effective for combating the virus and could be considered for use in clinics. These air purifiers will be little costly and will consume more energy but this is perhaps of a less concern under the current pandemic situation.^[21-25]

If the tooth needs to be extracted, absorbable suture should be preferred. It is recommended to rinse the wound slowly and use the saliva ejector to avoid spraying. Life-threatening cases with oral and maxillofacial compound injuries should be admitted to the hospital immediately and chest computed tomography (CT) should be prescribed if available to exclude suspected infection because the reverse transcription polymerase chain reaction (RT-PCR) test, besides time-consuming, needs a laboratory with pan-coronavirus or specific SARS-CoV-2 detection capacity.^[8] Use alcohol-based hand rub with 60–95% alcohol or wash hands with soap and water for at least 20 s. If hands are visibly soiled, use soap and water before returning to alcohol-based hand rub.

The following face mask should be used – FDA approved surgical mask, NIOSH certified

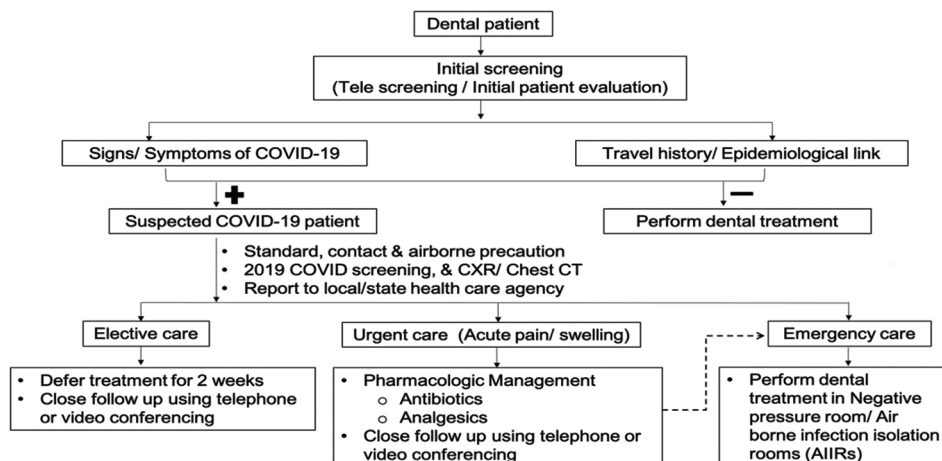
N95 mask, European Union standard FFP2, N95 equivalent mask KN/KP95, PFF2, P2, and DS/DL2 as per ADA. Make sure the mask forms an airtight seal and no leakage is there around the mask.^[21]

No scientific evidence indicates that pre-procedural mouth rinsing prevents clinical infections among dental health care personnel or patients, but studies have demonstrated that a pre-procedural rinse with an antimicrobial product (e.g., chlorhexidine gluconate or povidone-iodine) can reduce the level of oral microorganisms in aerosols and splatter generated during routine dental procedures with rotary instruments.^[22]

Disposable instruments such as probe, mouth mirror, tweezer, and syringes should be promoted to prevent cross infection.^[15] Dentist should opt for pharmacological management than going for any intervention unless the case demands emergency treatment. Prioritize minimally invasive/atraumatic restorative techniques. Rubber dam can be used as with it there is reduction in bacterial contamination of the atmosphere.^[23] The dental dam can effectively reduce the amount of aerosol formed. It has been reported that the rubber dam can reduce airborne particles by 70%. Rubber dam should be used in any procedure that allows doing so.^[3] Dentists should minimize the use of ultrasonic instruments, high-speed handpieces, and 3-way syringes to reduce the risk of generating contaminated aerosols in addition to splatter. Aerosols are liquid and solid particles (<50 μm diameter) suspended in air for protracted periods. Splatter is a mixture of air, water, and/or solid substances (50 μm to several millimeters diameter).^[24] After every patient, there should be a gap of 15 min so that a proper disinfection can be carried out.

Procedures that are likely to induce coughing should be avoided if possible or performed cautiously. Intraoral periapical radiography is the most commonly used radiographic imaging technique in dentistry; however, it can stimulate saliva secretion and coughing. Therefore, extra-oral dental radiographies, such as panoramic radiography and cone beam CT are appropriate alternatives during the outbreak of COVID-19.^[15]

The patient who has come from a red zone or has chances of infection or is a case of COVID-19 should be given last appointment so that after him proper disinfection of clinic can be carried out and infection to other patients in the waiting area also



can be avoided. A bin with lid should be available where patients can discard used paper tissues.^[16]

Biomedical waste management (BMWM) should be followed religiously as per the guidelines laid down by Central Pollution Control Board. Separate color coded bins/bags/containers should be kept inside clinics and maintenance of proper segregation of waste should be done as per BMWM rules. We should be very particular in collection of biomedical waste separately before handing over the same to Common Biodegradable Waste Treatment Facility (CBWTF). Use a dedicated collection bin labeled as “COVID-19” to store saliva and blood contaminated waste and keep separately in temporary storage room before handing over to authorize staff of CBWTF. General waste which is not contaminated should be disposed as solid waste as per Solid Waste Management Rules. Maintain a separate record for the waste generated from COVID-19 isolation wards. Use dedicated trolleys and collection bins in COVID-19 isolation wards. A label “COVID-19 Waste” to be pasted on these items also. The inner and outer surface of containers/ bins used for storage of COVID-19 waste should be disinfected with 1% sodium hypochlorite solution on daily basis. Report opening or operation of COVID-19 ward and COVID intensive care unit ward to state pollution control board and respective CBWTF located in the area. Dedicated sanitation workers should be deputed for biomedical waste and general solid waste so that waste can be collected and transferred timely to temporary waste storage area. If these guidelines are not followed then all the efforts to prevent the spread of COVID-19 will go down the drain.^[26] Sharps (blades, needles, etc.)

should be handled with great care. They should be disposed of in a puncture resistance tight container. Needles should not be recapped using both hands as can cause needle stick injury and to avoid it one handed scoop technique should be practiced.

An overview of patient screening for COVID-19 and dental management.^[15]

CONCLUSION

COVID-19 has put a spotlight on broken healthcare system that leaves healthcare worker with ethical obligation to treat all patients but they themselves are inadequately protected. It has unmasked the large structural inequalities in our society that has always been present. The cases in India are still on the rise. Universal precautions are important to minimize the spread of this virus and its associated disease. As presented in this review, further precautions are necessary that includes careful prescreening of patients and additional measures if treatment of patients with confirmed COVID-19 is deemed necessary. While waiting for our operatories to reopen, we should redesign our infrastructure so as to make sure the safety of our students, staff, and patients, ensure academic and research continuity while taking into account the work-life balance and mental health of our learners and staff. It is advisable to assess the emergencies on a case-by-case basis and make use of clinical judgment to aid in decision making. Furthermore, the dentist should keep himself updated regarding the recent status, guidelines, and protocols regarding coronavirus.

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