

REVIEW ARTICLE



Maneuvering dentistry in COVID-19 era

Sansriti Narain¹, Sandeep Singh², Dinesh Kumar Saini³, Frankantony P. Britto⁴,
H. Sharath Chandra⁵

¹International Student Program, University of Colorado School of Dental Medicine, Aurora, Colorado, ²Private Practice, Lawrence, MA Massachusetts, ³Department of Prosthodontics, Army Dental Centre, Army Hospital Research and Referral, New Delhi, India, ⁴Department of Oral Pathology, SJM Dental College and Hospital, Chitradurga, Karnataka, India, ⁵Department of Pediatric and Preventive Dentistry, SJM Dental College, Chitradurga, Karnataka, India

Correspondence:

Dr. Frankantony P. Britto, Department of Oral Pathology, SJM dental college and hospital, Chitradurga, Karnataka, India.
E-mail: frankantony126@gmail.com

Received 14 June 2020;
Accepted 31 July 2020

doi: 10.15713/ins.ijcdmr.152

How to cite the article:

Narain S, Singh S, Saini DK, Britto FP, Chandra HS. Maneuvering dentistry in COVID-19 era. Int J Contemp Dent Med Rev, vol.2020, Article ID: 040720. doi: 10.15713/ins.ijcdmr.152

Abstract

Background: The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has annulled the routine practice of dentistry and due to the uncertainty of this unique situation, there is a need for procedural restructuring as well as effective reduction of the aerosol-rich environment in which dentistry is practiced and taught until wide scale testing and vaccination is achieved. **Aim:** The aim of this article is to review additional measures which would help in reduction of spread of infectious viral pathogens in a dental setting and also to address the requirements for effectively continuing dental education during this period. **Conclusion:** The COVID-19 era presents a fluid state of affairs in which new information of the disease is daily updated but basic steps outlined in the article can help in reducing the cross-infections in a dental setting which will result in maintaining the trust and safety of the patients till we achieve mass scale vaccination or immunity. **Clinical Significance:** The article addresses additional measures apart from maintaining the universal precautions for infection control which need to be adhered to reduce the SARS-CoV-2 infection potential to the patients and dental health-care professionals.

Keywords: Aerosol, coronavirus, dental, severe acute respiratory syndrome coronavirus 2

COVID-19 nomenclature

An initial account of specific pneumonia of unknown etiology was declared on December 31, 2019, in Wuhan, China. As per the phylogenetic analysis and taxonomy, coronavirus study group of the International Committee on Taxonomy of Viruses declared the novel coronavirus similar to severe acute respiratory syndrome coronavirus (SARS-CoV) and thus designated it as SARS-CoV-2.

Microbiology

Coronavirus is single-stranded RNA viruses which are enveloped and can infect humans and animals. Coronaviruses are divided as four genera: alpha-CoV, beta-CoV, gamma-CoV, and delta-CoV. Alpha-CoVs and beta-CoVs infect mammals while gamma-CoVs and delta-CoVs infect other animals such as birds, fishes, and only a few mammals.^[1]

Four strains of human coronaviruses (229E, OC43, NL63, and HKU1) cause mild-to-moderate respiratory tract infections in humans. The other two strains SARS-CoV and MERS-CoV are zoonotic in nature which caused human

respiratory infections of epidemic proportions in China (2003) and Saudi Arabia (2012). SARS-CoV-2 has been accounted for as the 7th strain of human coronavirus.^[2-4] COVID-19 was declared as a pandemic by the World Health Organization on March 11, 2020.

SARS-CoV-2 Transmission and Interaction

Initially, the spread of COVID-19 was thought to be through zoonotic or environmental sources. Through further investigation, it was concluded that it spreads through human-to-human contact leading to pandemic spread.^[5] The interhuman contact is known to occur through various methods with incubation times of 2–10 days which include droplets, direct and indirect contact through surfaces. The virus has also been isolated in saliva, blood, serum, urine, and stool.^[6,7]

R₀ (R naught) mathematically determines the infectious capacity of a disease, recent study has estimated R₀ of for SARS-CoV-2 to be 5.7 which means that one infected person can infect more than 5 individuals and thus has a pandemic potential.^[8]

SARS-CoV-2 has a receptor-binding domain on the S-protein which allows virus attachment to angiotensin-converting

enzyme 2 in humans, this mechanism is similar to SARS-CoV transmission.^[9]

Dental Aerosols

The sources of bioaerosols in a dental clinic are ultrasonic scalers, high-speed handpiece, air turbines, and air water syringe. The size of aerosol/droplet particles generated during a dental procedure is reported to be $<5\ \mu\text{m}$ – $20\ \mu\text{m}$. About 90% of $20\ \mu\text{m}$ size aerosols are trapped by the body surface or face of the patient and are unlikely to reach the breathing zone of dental health care worker.^[10] Aerosol with higher bacterial load was found within 1.5 m from the oral cavity of the patient as compared to 1 m vicinity.^[11] The procedures in which high-speed handpiece or ultrasonic handpiece are used leads to more air contamination as compared to an orthodontic procedure.^[12]

Aerosols have the capacity of carrying microorganisms or viruses by air as they consist of droplet nuclei ($1\text{--}5\ \mu\text{m}$) or droplets ($>5\ \mu\text{m}$). Droplet nuclei can stay airborne and get carried to considerable distance, thus leading to contamination of surfaces, droplets are known to spread to an area of 3 ft.^[11] Another study showed that aerosol in a dental setting can travel horizontal distance of 100 cm, vertical distance of 50 cm from the patient's oral cavity and can remain suspended in the air for 20 min.^[13]

There is a high risk of COVID-19 transmission through the aerosol created by high-speed dental handpiece, the aerosol might contain oral saliva, blood, or other secretions. Nine cases of COVID-19 were reported among 169 dental health care workers by Li and Meng, 2020.^[14]

Recommendations to Reduce Infection Rate

Till date, there are no set of guidelines which can completely eliminate the risk which dental health care workers are exposed to, but an effort can be made to recommend certain precautions which can reduce the chance of infection, especially in the challenging scenario projected by COVID-19.

In Office Recommendations

According to a study published in New England Journal of Medicine, asymptomatic transmission is quoted as the major reason for the COVID-19 pandemic.^[15] Another recent study quotes that 40–45% of SARS-CoV-2 infections might be asymptomatic and can continue to spread the virus longer than 14 days.^[16] Hence, to minimize the chances of a dental practice becoming the source of the spread of the disease, all incoming patients and dental health care workers should be tested for SARS-CoV-2 on a daily basis. Until we have quick and FDA approved SARS-CoV-2 testing kits, an effort should be made to provide wide scale real-time (rt) reverse transcriptase (RT) polymerization chain reaction testing kits and training to dental health facilities, till we achieve high test standards apart from

universal precautions for infection control, following are the recommendations which can help reduce the cross-infection potential in a dental setting.

- a. Divide the clinical area into high- and low-risk area according to the aerosol production. The procedures involving the use of high-speed handpiece and ultrasonic scaler should be done in a negative pressure room with self-closing doors to maintain correct pressure differential.^[17-19] Negative pressure in the room would make sure that hazardous particulate matter air from the dental operatory would not circulate elsewhere in the clinic
- b. Parametric monitoring can be done to determine the airflow direction and pressure, air changes per hour and filter efficiency. Particulate sampling can be done to determine the effectiveness of HVAC system (heating, ventilation, and air conditioning) with emphasis on filter efficiency to reduce aerosols.^[20]
- c. All necessary supplies for the dental procedure in the operating room should be brought from the separate sterile storage area
- d. UV light sterilization of the entire operating area can be considered as it is known to reduce air borne and surface pathogen load. The maximum effect is achieved after the surfaces are cleaned through standard operating protocol.^[21,22] Till date, the UV light sterilization equipments are not standardized for infection control
- e. An attempt should be made to use disposable personal protective equipment but being on reasonable grounds clothing used in the clinic should be laundered at a central site and must not be worn outside the clinic area.^[23]
- f. Separation of the waiting area as well as the office reception by self-closing doors so as to minimize the cross-infection rate. A distance of 6 feet should be maintained between each seating spot
- g. Instructions and reminders to all patients to seek an alternative appointment if feeling sick or not well. All appointments should be set through video or teleconferencing in advance so as to avoid symptomatic patients in schedule
- h. The office and the dental operating room should be designed in a manner such that it would have minimal areas which would trap aerosol or dirt and is easy to clean
- i. Chairside placement of portable air filter can aid in reducing the load of aerosol based hazard to the dental health care worker.^[10] Portable air filters are not yet standardized for infection control at a dental clinic
- j. Povidone-iodine pre-operative antimicrobial oral rinse should be made mandatory. About 1–5% povidone-iodine (PVP-1) *in vitro* exposure has been shown to inactivate SARS-CoV-2 following a 60 s exposure.^[24] As per the Center for Disease Control, there is not much evidence that pre-procedural mouth rinse can effectively control the SARS-CoV-2 viral loads to prevent transmission, however, PPMRs with antimicrobial products such as chlorhexidine gluconate, povidone-iodine, or cetylpyridinium chloride may reduce the load of pathogens in aerosols and splatter

- k. All dental procedures should be addressed after pre-screening of the patient, which should include tele-screening and physical screening for symptoms which should include temperature monitoring, symptom questionnaire, and travel history. An attempt should be made that all emergency dental procedures not limited to extraction of teeth should be performed under rubber dam isolation so as to reduce the exposure to viral load if present.

Monitoring and Managing Dental Health-care Personnel^[25]

1. The sick leave policies should not be punitive and adhere with the local health guidelines
2. DHCPS should be encouraged to self-monitor for symptoms of COVID-19 and if they have any symptoms of the disease, self-quarantine at home should be an option without penalties
3. If DHCPs were exposed to COVID-19 during work without proper PPE should self-quarantine for 14 days
4. If DHCP suspects they have COVID-19 symptoms, they should not come to work, if at work, they should put on a face mask and leave the workplace and notify the health-care authority for a diagnostic test which should be prioritized
5. Ensure updated training and education on recent measures of infection control to reduce chances of COVID-19 infection.

Critical changes in Dental School Education

At this time, it is hard to predict when the COVID-19 would end and the protocol would return to the previous routine. The following steps can reassure the student about the availability of the educator and the study material.

1. Maintain constant, informative contact with students by reminding the students of the availability to the faculty usually within 24–48 hours. Utilize of online software platforms such as Learning Management System (CANVAS) for upcoming events, classes, examinations, or assignments
2. Recent updates on university policy or guidelines can be shared by social media like Twitter or Facebook
3. Being compassionate to the students as not all have the capacity to absorb all the information through an online session, so information can be delivered in smaller chunks through mini-lecture modules
4. Instead of using classic model of conducting timed examinations, critical thinking question pattern can be devised for individual or groups for extended period of time
5. Imparting online lectures which could be even recorded ahead of time, those lectures can include active participation from the students online for their response of feedback
6. Consider designing an online simulation laboratory which could include clinical procedural information particular to the subject.

At this time of economic reopening, all efforts should be made by the dental professionals to avoid even a single case of

spread through a dental practice so as to maintain the trust of the patients and the community.

Conclusion

A standardized protocol should be formulated for universal dental practice which has to be followed so as to avoid infections spreading from dental area setting. Concrete steps taken in this direction would make sure of keeping the trust and safeguarding the patient community.

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