



Review Article

Oral health care, COVID-19 and challenges

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ABSTRACT

Oral health-care providers are at risk of transmitting and contracting COVID-19 mainly because of the proximity of the care provider to the patient's oropharyngeal region, exposure to saliva and blood, a lot of aerosol-generating procedures involved, and a fear of cross-contamination among patients. The role and challenges of disinfection, sterilization and control of nosocomial infection have increased in the present era when new pathogens are emerging and older have developed resistance against antimicrobials. Prevention of oral health problems, timely check-ups, and prophylactic dental therapies may be one way of reducing the need for dental procedures. This paper intends to highlight the clinical, practical and economic impact COVID-19 is imposing on the oral health-care sector and the challenges that need to be answered in the future. Brainstorming and research are required to find out affordable, yet effective alternatives to sustain dental profession in the present as well as the future.

Keywords: Aerosol, COVID-19, Oral health care, Dentistry

INTRODUCTION

The entire world is practically brought to a standstill by a highly contagious viral disease COVID-19 caused by severe acute respiratory syndrome coronavirus (SARS-CoV-2).^[1] The coronavirus belongs to a family of single-stranded RNA viruses known as *Coronaviridae*, is zoonotic, and is similar to SARS-CoV that caused SARS in 2002 and MERS-CoV that Middle Eastern respiratory syndrome (MERS) in 2012.^[2,3] Declared a public health emergency by the World Health Organization (WHO) in late January 2020, this novel coronavirus disease initially originated as a new pneumonia outbreak in Wuhan City of China in late December 2019.^[4,5] Since then, it has affected all equally, transcending the barriers of socio-economic status, nationality, education level, race, or profession.

Like all the other professions, it has severely hit the oral health-care sector, bringing all routine dental health care and dental education to a halt.^[6] Oral health-care providers are at a massive risk of transmitting and contracting this disease mainly because of the proximity of the care provider to the patient's oropharyngeal region, exposure to saliva and blood, a lot of aerosol-generating procedures involved, and a fear of cross-contamination among patients.^[7,8] The role and challenges of disinfection, sterilization and control of nosocomial infection have increased in the present era when new pathogens are emerging, and older have developed resistance against antimicrobials. Rautema *et al.*^[9] opined that often faster-rotating instruments, better cutting devices, and equipment are added to the already existing old facilities and settings. This has further added to the risk of cross-contamination and nosocomial infections.

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The oral health-care sector in India caters to a vast population. It harbors more than 300 government-run and private dental colleges,^[10] with approximately 30,000 students graduating each year.^[11] The government-run colleges are crowded and witness a humungous number of patients attending the OPDs daily. On the other hand, a significant percentage of dental graduates run their private clinics and hospitals, which they have to sustain by their own earned money. Thus, it is of paramount importance to retrospect and self-analyze how much are the oral health-care providers equipped to carry on their duties among the health crisis of this stature and what will be the economic implications of these kinds of pandemics. Moreover, modifications will be needed in practice set-up and treatment planning not only in this present scenario but also in times ahead. This paper intends to highlight the clinical, practical, and economic impact COVID-19 is imposing on the oral health-care sector and the challenges that need to be answered in the future.

METHODOLOGY

Related literature was searched using the MEDLINE/PubMed database and Google scholar, with an emphasis on peer-reviewed dental journals till April 2020. The databases were searched using keywords “SARS-CoV-2” “COVID-19;” “Aerosol;” “COVID-19 AND Aerosol;” and “DENT* AND COVID-19.” Only articles in the English language were included, but no other restrictions were applied. In the search engine MEDLINE/PubMed, the MeSH term “SARS-CoV-2” revealed 2142 results, and “COVID-19” revealed 5174 results, “aerosol” revealed 56,161 results, “COVID-19 AND Aerosol” revealed 64 results, and “DENT* AND COVID-19” revealed 76 results.

ROUTES OF INFECTION

Why oral health-care professionals are at risk?

The most common route of infection of SARS-CoV-2 is either through direct transmission or inhalation of droplets when an infected person sneezes or coughs; or contact transmission from droplets of SARS-CoV-2 present on metal or plastic surfaces if someone touches these surfaces, or it might come in contact with the oral, nasal, and eye mucus membranes.^[12] The duration of the viability of this virus on various inanimate surfaces may last from 3 h to 3 days.^[13] Another critical concern is the fact that an asymptomatic person may also be a potential disease transmitter.

Studies have shown that SARS-CoV-2 has the potential to bind to human angiotensin-converting enzyme (ACE-2) receptors, which are highly concentrated in the salivary glands and respiratory tract, this explains the spread through aerosol or fecal-oral route.^[14] Aerosols or bioaerosols are the suspensions of liquid or solid particles of size <50 μ, which

may remain suspended in the air for a long time and can travel with airflow at long distances and are an overlooked occupational health hazard. These are generated during majority of the dental procedures and are a source of microorganisms, allergens, or toxic substances.^[15] It is of even greater concern when giving dental treatment to patients who are a reservoir of respiratory viruses or bacteria such as patients with tuberculosis, pneumonia, Legionnaire’s disease, influenza, or SARS.^[16] Majority of the routine and emergency dental procedures starting from the oral examination, use of three-way syringes, tooth cleaning by ultrasonic scalers, cutting of tooth structure during cavity preparation, crown and bridge preparation with high-speed arotors, root canal treatment, irrigation of infected/purulent abscess areas, electrocautery, periodontal and oral surgical procedures, implant procedures, etc., generate a considerable amount of aerosol. Even currently used, minimal invasive laser dentistry is not free of viral transmission risk due to laser plumes.^[17] The microbial content of this bioaerosol has its origin from dental plaque, calculus, saliva, nasopharyngeal secretions, and even dental unit waterlines.^[18] Many microbiological samplings have shown that the highest microbiological contamination due to splatter is seen on dentist’s and assistant’s masks, surfaces close to a spittoon, and unit lamp. Still, the composition of the air in a dentist’s breathing space between a dentist and a patient is left unchecked during the microbiological analysis.^[15] Kobza *et al.*^[8] says that there is no current consensus regarding the acceptable level of air contamination in dental clinics, but an IMA index for air contamination proposes counts of 25100–45000 CFU/m² for surgeries.^[19]

RECOMMENDATIONS FOR DENTAL TREATMENT

On March 16, 2020, the American Dental Association (ADA) recommended that all elective dental procedures should be deferred for at least 3 weeks and laid down guidelines regarding any emergency procedures if need to be carried out during this crisis.^[20] Similarly, all other specialty societies have very comprehensively outlined the treatment protocols for specific dental treatments.^[21–25] [Table 1] outlines the guidelines by various dental societies and associations for dental practitioners on COVID-19. ADA recommends that all dental health-care personnel should be vaccinated for seasonal flu, and duties should be designated, keeping in mind the medical health status and age of the personnel.^[26]

Before treatment

An initial telephonic-triaging, teleconsultation, and pharmacologic management of the pain condition with antibiotics and analgesics to provide symptomatic relief are suggested. The dental offices should arrange triage staff

Table 1: Guidelines by various dental societies and associations for dental practitioners on COVID-19.

| Association or society | Guidelines | Web link |
|--|--|---|
| Centre for Disease Control | CDC Guidance for Providing Dental Care During COVID-19 | https://www.cdc.gov/oralhealth/infectioncontrol/statement-COVID.html |
| American Dental Association | ADA Interim Guidance for Minimizing Risk of COVID-19 Transmission | ADA_COVID_Int_Guidance_Treat_Pts-1.pdf |
| Indian Dental Association | Indian Dental Association's Preventive Guidelines for Dental Professionals on the Coronavirus Threat | https://www.ida.org.in/pdf/IDA_Recommendations_for_Dental_Professionals_on_the_Coronavirus_Threat.pdf |
| American Association of Endodontists | Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care | https://www.jendodon.com/article/S0099-2399(20)30159-X/fulltext |
| FDI | COVID-19 OUTBREAK: GUIDANCE FOR ORAL HEALTH PROFESSIONALS | https://www.fdiworlddental.org/covid-19-outbreak-guidance-for-oral-health-professionals |
| Indian Endodontic Society, Indian Dental Association and International Federation of Endodontic Associations | Joint Position Statement Endodontic and Dental Practice during COVID-19 Pandemic | https://www.ies.org.in/pdf_server.php?file=dental-practice-covid-19 |
| American Academy of Periodontology | COVID-19 RESOURCES | https://www.perio.org/members/COVID-19 |
| National health services (NHS) | NHS England and NHS Improvement coronavirus | https://www.england.nhs.uk/coronavirus/primary-care/ |

and area. The triage area should have clear signage, hand hygiene equipment, and charts displaying infection control protocols.^[27] If at all, a patient has to be seen in the dental office, he or she is required to fill a detailed medical history form and assessment of true emergency form. The medical history should mandatorily ask about any symptoms of fever, cough or respiratory stress, and recent travel history (WHO 2020a questionnaire).^[3] It is also advised that dental professionals should measure the patient's body temperature with a non-contact forehead thermometer or with cameras having infrared thermal sensors. Patients with fever more than 100.4° Fahrenheit and respiratory symptoms or convalescing patients who need elective dental care should be recalled after at least 2–3 weeks.^[28] If there is a suspected COVID-19 individual, they should be taken care of as per the Centre for Disease Control (CDC) guidelines and should be seated in a well-ventilated waiting area at least six feet from the healthy patients.^[29]

During treatment

Personal protective equipment

The ADA describes the use of standard transmission-based precautions and personal protective equipment (PPE).^[30] Standard Precautions include Hand hygiene, use of PPE, respiratory hygiene/etiquette, sharps safety, safe injection practices, sterile instruments, and devices, clean, and disinfected environmental surfaces. If available, Oral health-care providers should implement transmission-based precautions, which include patient placement (e.g., isolation), adequate room ventilation, respiratory protection (e.g., N-95

masks or other high-level respirators) for all personnel, or postponement of non-emergency dental procedures. The oral health-care providers should be instructed to strictly follow hand hygiene^[31] and know the correct method of donning and doffing of the PPE.^[32]

Peng *et al.*^[11] have suggested a three-level protective measure of dental professionals. Primary protection, i.e., the standard protection (disposable masks and caps, working clothes, face shield, and gloves) in a clinical setting, secondary or advanced protection (disposable masks and caps, working clothes, face shield, gloves and outer disposable wear over the workwear), and tertiary or strengthened protection (disposable masks and caps, working clothes, face shield, gloves, appropriate protective outerwear, and impermeable shoe cover) when in contact with suspected or confirmed COVID-19 case. The National Centre for Disease Control, India, also says that the PPE should be selected according to the risk of the procedure being performed. The extent of contact anticipated with blood, body fluids, respiratory droplets, and open skin defines high-risk scenarios.^[33]

Pre-procedural mouth rinse

Before starting an oral examination or any intraoral procedure, a pre-operative rinse is highly recommended, especially in cases where rubber dam isolation is not possible. As SARS-CoV-2 is susceptible to oxidation, oxidative agents such as 1% hydrogen peroxide or 0.2% povidone are advised for reducing the salivary load of oral microbes.^[34] In the previous outbreaks, 0.2% povidone was found to be effective against SARS and MERS viruses.^[35] According to

the Guidelines for the Diagnosis and Treatment of Novel Coronavirus Pneumonia, chlorhexidine may not be effective against SARS-CoV-2.^[1]

Radiographs

Extraoral imaging techniques such as OPG or CBCT are preferred over intraoral radiographs as intraoral techniques may result in gag reflex, coughing, and more contact with the patient's saliva.^[36]

Armamentarium

When and where possible, the use of single-use, disposable instruments and handpieces should be encouraged. In cases of extraction, contusion, or trauma, it is advisable to use absorbable sutures, if required.

Rubber dam isolation and high vacuum suction

A rubber dam is a readily available option, which can significantly reduce the production of saliva, and blood loaded aerosols by up to 70% in a three-foot diameter of the operational field.^[37] Furthermore, the use of high volume suction devices reduces the dispersion of aerosol and splatter. In cases, where rubber dam isolation is not feasible, manual scaling, and chemo-mechanical agents or hand instruments such as spoon excavators are advisable for caries removal. After that, a pulp devitalizer can help to alleviate the pain.^[1]

Anti-retraction handpieces

There is a risk of contamination of dental unit waterlines due to aspiration of debris and fluids and can be a source of cross-contamination. In a study, it was seen that the use of anti-retraction handpieces significantly reduced the backflow of oral bacteria and the hepatitis B virus into the tubes of the handpiece and dental unit.^[38] Peng *et al.*^[1] suggest that the use of dental handpieces without anti-retraction function should be prohibited during this outbreak.

Use of negative pressure, well-ventilated, and isolated rooms

It is advisable to treat suspected or confirmed SARS-CoV-2 patients in a negative pressure treatment room or Airborne Infection Isolation Rooms (AIIRs).^[39]

After treatment

Sterilization of the used equipment and disinfection of the environment and surfaces should be meticulously done per the CDC guidelines. According to the FDA guidelines on sterilization and disinfection during the COVID-19 outbreak,^[40] the coronaviruses being a single-stranded

RNA virus enclosed in a lipid bilayer is the least resistant to standard methods of chemical disinfection. The Environment Protection Agency (EPA) lists that hydrogen peroxide in combination with peroxyacetic acid available in the form of wipes and solution, quaternary ammonium in combination with isopropanol and sodium hypochlorite in combination with sodium bicarbonate when used for a contact time of 0.5 min is effective against human coronaviruses when used on hard non-porous surfaces.^[41] The chemical disinfection should be carried out for the instruments and the surfaces such as the dental chair; chair handles, dental unit light handles, the tabletops, surgical trolleys, and door handles. An essential step, which often overlooked, is the disinfection and heat sterilization of the dental handpieces when reused between patients.

The dental personnel should be instructed to change from scrubs to personal clothing before returning home. On arriving home, they should take off shoes, remove, and wash clothing separately from other household residents, and immediately take a shower.

Pharmacological considerations

The Scottish Dental Clinical Effectiveness Program has published a systematic and situation-based (whether urgent, emergency, or non-urgent) flowchart for the management of dental pain or in patients during the COVID-19 outbreak.^[42] The guidelines for antibiotic prescription remain the same as for an immunocompetent patient. The use of antibiotics should be made in cases where a large swelling extending up to eye or other facial spaces, malaise, and other signs of systemic illness are present. According to the ADA guidelines as of now, it is safe to take ibuprofen in combination with acetaminophen for the alleviation of dental pain; this can be combined with the use of chlorhexidine mouthwash, warm saline rinses, and hydrogen peroxide mouthwash (for necrotizing ulcerative gingivitis patients).^[43]

CHALLENGES

Even after this viral outbreak is overcome, it will not be easy for the dental personnel to return to their normal way of practice. A question will remain that for how much time, we should wait to declare that now it is safe to practice aerosol-generating procedures. A fear of contamination or cross-infection, if not from SARS-CoV-2, but any other microbial forms will always be there. One should remember that the above guidelines hold true not only for the present scenario but also for any similar situation in the future.

A major percentage of dentists graduating each year start up their own private practices, which require a lot of capital investment and credits. Practicing all the above-mentioned guidelines is undeniably critical to keep our patients safe,

and ourselves but that also implies that the cost of carrying out dental procedures will significantly increase. Many of private dental clinics are located in crowded commercial places, in close vicinity to residential neighborhoods, and even eating points. The aerosol generated in these areas is also a concern. Most of the dental clinics do not have a very large waiting room or operator, so keeping an isolated area or maintaining physical distancing of 6 ft will be a challenge. Not only in private practices but also even in government-run hospitals, it will be a daunting task as even though hospitals have large premises, the number of patients attending these is huge. To date, very few dental hospitals have a facility of negative pressure or AIIRs, which are ideally advised for treating any patient with a high infectious load. After the 2003 SARS outbreak in Hong Kong, Chow *et al.*^[39] in 2006, proposed a method of converting a positive pressure operator into a negative pressure one in by incorporating two strong exhaust fans next to the original exhaust system, so similar efforts can be made in other parts of the world too.

The current situation implies that dental personnel should wear a face shield and protective eyewear, N-95 or any other high-end respirator, and impermeable outerwear (or the Hazmat suits in high-risk patients) whenever performing any aerosol-generating procedure in the future too. The expense of protective gear per patient will be reasonably high and will add to the treatment cost, as they need to be changed (only face shield or goggles can be disinfected and reused) between patients. This economic burden will have to be borne by the patient. Furthermore, methods of aerosol reduction such as an extra-oral high volume suction and those of air disinfection such as high-efficiency particulate air pre-filters,^[16] and ultra-violet radiation 250–265 nm (UV-C)^[44] are advisable for filtration and destruction of virus, respectively. These methods do ensure protection but come with an added cost. Some modifications in the seating arrangements in waiting area for physical distancing, provision of extra ventilation, change in the door design (swing doors preferred as they need to be touched less), and water faucet handles (elbow or foot pedal operated preferable) will also have to be considered for reducing infection transmission.

Another major challenge will be habit-breaking and habit-building among oral health-care providers. In a recently published editorial, Pant^[45] opined the need for embracing the “new normal” for oral health-care professionals. The dental personnel and dental students need to imbibe and follow all the practices of disinfection, and sterilization protocols rigorously. Ideally, a separate area, away from patient work and wait area, should be assigned for instrument decontamination, sterilization, and reprocessing. The instruments should be divided into disposable, critical (invades tissues, vascular system, e.g., scalers, burs, hand

tools, and impression trays), semi-critical (does not penetrate the tissues, e.g., mouth mirrors and handpieces), and non-critical (does not come in direct contact with patients, e.g., light handles, and radiographs).^[46] It should be remembered that monitoring the sterilization process (chemical or biological indicators) and storage of the sterilized instruments (clean dry conditions, and use of UV chambers) is also as important as the sterilization procedure itself. The dental procedures involve the use of a large number of instruments, namely, hand instruments, endodontic files, and reamers, scalers, extraction forceps, handpieces, burs, and impression trays. Thus, though compulsory disinfection and sterilization of each instrument each time is not an easy task to do, and needs to be monitored closely. Several cross-sectional and knowledge-attitude-practices surveys conducted among dentists to study their knowledge and practices of infection control suggest that though postgraduate dentists had better knowledge, the undergraduates and dental students still lacked in same.^[47,48] Similarly, studies suggest that still a large number of dental practitioners do not use rubber dam routinely. The most common reasons cited were extra time required, extra expense, and patient compliance.^[49,50]

One of the often ignored parts is dental unit waterlines (DUWLs), the handpieces, and the water coming out of the handpieces. The water from the handpiece should match the criterion for potable water, and even regular microbial monitoring of water is recommended.^[15] DUWLs should be rinsed at the beginning of workday to eliminate microflora due to night stagnation, and in between patients to prevent cross-contamination. It is also advisable to use closed water systems, which is easy to monitor and disinfect.^[42] Personnel from the workforce should be identified and designated to carry out these steps of disinfection. We should prepare and modify our operator as much as possible to meet the needs of infection control and breaking the transmission and should strictly follow the principle “Do not disinfect when you can sterilize.”

Infection control protocols, the importance of triaging,^[51] and a very meticulous history taking should be taught to the students from the pre-clinical training stage itself.^[52] The hospitals and clinics should have standard operating procedures prepared for these, which can be displayed as charts and posters in the operator, classrooms, and other areas for ready reference. The oral health-care providers should educate and instruct patients regarding the importance of preventive home care methods for maintaining good oral health during COVID-19 pandemic.^[31,53] Furthermore, when we are working only on emergency cases, the time can be utilized for training of the clinicians, technicians, hygienists, support staff, and dental students through online webinars and discussions. Biggest challenge in providing dental treatment as compared to any other

health-care service is that a dentist has to work near patient's open mouth. Dental robotics in future may be an option to combat such situations.^[54]

CONCLUSION

Infection control and prevention of disease transmission have always been an integral part of dentistry, but the current scenario asks for a more rigorous, mandatory, and effective implementation of the same. Definitely, it will have economic implications, but both the dentist and their patients will have to understand and accept the fact that it is the only way to be safe. Prevention of oral health problems, timely checkups, and prophylactic dental therapies may be one way of reducing the need for aerosol-generating procedures. Hence, stress should be made on patient awareness drives and programs for the same. Furthermore, certain brainstorming and research are required to find out affordable, yet effective alternatives to sustain dental profession in the present as well as the future.

Declaration of patient consent

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Conflicts of interest

There are no conflicts of interest.

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