SARS-CoV-2 and Oral Health: Implications and Recommendations for Dental Practice Reformation Post Pandemic

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Abstract

Dental clinics can play a crucial role in spreading the SARS-CoV-2 infections because of the nature of close contact with the patient's oral cavity and aerosol generating essential dental procedures. Dental practices in regions affected with SARS-CoV-2 are needed to take utmost precautions and follow strict effective infection control protocols even when the movement control/lockdown is gradually lifted post pandemic. Thus, we aim to summarise the current research findings on SARS-CoV-2 in dental settings and relevant international guidelines and recommended management protocols for the dental clinica. The knowledge on the viral properties of SARS-CoV-2 and epidemiologic characteristics are essential to implement proper mitigation strategies against transmission of Covid-19 infections via dental clinics.

Keywords: *SARS-CoV-2, Covid-19, dental clinic, dentistry.*

Introduction

The ongoing pandemic caused by severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) has caused more than 2,60,00,00 cases and claimed over 180000 deaths worldwide as of April 23, 2020.(1) On Feb 11, WHO named this disease as "Corona Virus Disease (COVID-19)" and later the International Committee on Taxonomy of Viruses (ICTV) named this virus as "SARS-CoV-2" based on the phylogenetic and taxonomic analysis(2). The characteristic symptoms of the Covid-19 illness are fever, myalgia and cough with headache, diarrhoea and haemoptysis as less frequent symptoms.(2,3)

Previous outbreaks of coronavirus infections included severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS), emerged as a significant public health threat and were controlled effectively, though SARS-CoV-2 behaviour does not match its predecessors. After the initial pandemic wave, the behaviour of the SARS-CoV-2 and possibility of another seasonal epidemic wave are not yet elucidated.(3,4)

Properties of SARS-CoV-2: Coronaviruses belong to the family of RNA viruses *Coronaviridae* and order

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Nidovirales.[5] Among four genera of coronaviruses, α-CoV and β-CoV mainly infect the humans and mammals.[6] Many subtypes have been known to cause respiratory diseases in humans.[7,8] Unfortunately, the fatal diseases were reported only by the SARS-CoV and the Middle-East respiratory syndrome coronavirus (MERS-CoV), which belong to β-CoV.[9] The envelope of coronaviruses is coated by surface glycoprotein that leads to their characteristic crown-like (Latin: corona) appearance of the particle. Coronaviruses share a typical genome in which the replicase gene covers the 5′-two thirds of the genome.[10] Spike proteins in their envelope help to bind receptors on host cells and helps in entering into the cells.[10,11]

Oral Cavity as Target of SARS-CoV-2: Angiotensin-converting enzyme 2 (ACE2),expressed in human airway epithelialcells, oral mucosa, especially tongue epithelium and epithelial cells of minor salivary glands are the most important receptor for SARS-CoV-2highlightingthe possibility of salivary glands being a potential reservoir of SARS-CoV-2.[12, 13]Therefore the probability of oral mucosa and salivaacting as a reservoir of viral particles in asymptomatic Covid-19 patients cannot be ignored.Moreover,peak infectivity was noticed before the patient is symptomatic.[4]Positive rate of SARS-CoV-2RNA detection in hospitalized patients' saliva was as high as 91.7%.[14]

SARS-CoV-2 Transmission in Dental Clinics: Common routes of SARS-CoV-2 are through direct transmission (sneeze cough and droplets) and contact transmission (oral, nasal, and ocular mucous membrane).[15]Besides, experts have suggested that it can be transmitted directly or indirectly through saliva owing to the consistent detection of SARS-CoV-2 in saliva.(14)The incubation period of SARS-CoV-2 is reported to be 5 -6 days on average; nevertheless, it can be as long as 14 days which is currently considered as observation/quarantine period for exposed/potentially exposed individuals.[16] Dental practitioners encounter close contact with patient's oral cavity for extended hours during various aerosol/splatter generating procedures (AGP) or non AGP. Splatters (larger than 50μm) and aerosols (less than 50 μm) are particle droplets of saliva, blood and microorganisms generated while using rotary dental and surgical instruments and air-water syringes.[13,17] Travelling for short distances, splatter settle over inanimate surfaces and exposed parts of the dentist or the patient whereas aerosols remain airborne for extended periods and may be inhaled.[18,19] Humidity and temperature have also been shown to be significant determinants of particle size and viability of other airborne viruses.[11,19] It has been shown that SARS-CoV-1 and 2 can remain infectious from 2 hours up to 9 days at room temperature depending upon the relative humidity.[20] Having air-conditioned settings, these factors can play an important role in the survival of viruses in dental clinics.

Suggested Advisory to Dental Clinics: Reopening of dental clinic requires several careful considerations which starts right from giving appointment till the patient leaves the dental clinic.

a) **Appointment through tele screening:** Web/app-based technologies should be explored for initial screening, followed by scheduling appointment of patients to distribute the patients throughout the clinical hour avoiding gathering. Investigation of the patient details should always start with answering a set of questionnaires (Figure 1)asked by trained personnel during teleconsultation. "Yes" to any of the questions would categorize the patient as a probable suspect. Thedentist can defer the treatment procedure in such patients until a minimum of 14 days to a maximum of 24 days. Such patients should be advised for self-quarantine and consulting physicians. "No" to all questions would qualify the patient for scheduling the appointment.

b) **Patient evaluation at the reception of the dental clinic:** Once the patient scheduled for appointment arrives at the clinic, there will be a sign on the door with the dental assistant's phone number. Calling the dental assistant before entering the clinic is essential. The patient should enter the dental clinic after washing hands in the basin kept outside the dental clinic. At the reception, reaffirmation of the questions should be done, followed by the patient's signature. The dental assistant should record the body temperature by the non-contact thermometer or infrared thermal sensors. Except for minors and specially-abled patients, no accompanying person is allowed with the patient. In these cases, the accompanying person also has to go through the screening test. Point of care rapid screening kit may be incorporated at this stage. Reception area of the dental clinic should adequately display respiratory etiquettes and hand hygiene through several posters available at "www.cdc.gov/flu/protect/covercough.htm" and "www.cdc.gov/ncidod/dhqp/pdf/Infdis/RespiratoryPoster.pdf",

c) **Clinical examination in the dental clinic:** Standard precaution, as mentioned in the Centre for Disease Control and Prevention (CDC)(21), such as hand hygiene,Personal protective equipment (PPE), handling contaminated materials or equipment to prevent cross-contamination, using engineering and work practice controls, respiratory hygiene and cough etiquettes and safe injection practices. [21,22] Choice of antiseptic agents, duration and technique of hand scrubbing, techniques for drying and gloving can influence the effectiveness of the surgical hand antisepsis. CDC's 2002 guidelines and WHO provides complete information on hand hygiene.[23]

Owing to the modes of transmission of Covid-19, three categories of precaution such as droplet, contact and airborne are recommended for every patient. Therefore, gloves, masks, eye protection with side shields, protective fluid repellent gowns and N95 respirators are required while examining the patient's oral cavity. Extraoral radiographs are preferable to intraoral ones. Extra barrier should be followed when intraoral imaging is essential.

d) **Treatment procedure:** Only essential staff should be allowed in the room during operative procedures. AGP demand strict use of personal protective equipment. Although CDC 2007 guidelines donot recommend eyewear for closely examining the patients it may be used by the dentist during splatter or AGP.[22]Selection of PPE depends upon the type of clinical exposure anticipated, durability and appropriateness of task as well as fit. Respiratory protection is the most important component of PPE which can be achieved through particulate respirators, half or full-face elastomeric respirators and powered air-purifying respirators (PAPR). WHO recommends the use of a particulate respirator as a U.S. National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Union (E.U.) standard FFP2, or equivalent when performing AGPof managing critically ill patient[24]which should be followed in a dental clinic. There is no evidence regarding the safety of either N95 or the equivalent FFP2 or even higher grade respirators while performing the aerosol-generating procedure in a suspected case of COVID-19. EUFFP3 respirators conforming to European standard 149 offers a filtration rate of 99% of all particles measuring up to 0.6micron. [25]SARS-CoV-2 measures around 0.12micronand aerosol particles range from 3-100nm. Therefore, the safety of these respirators in protecting dentist from SARS-CoV-2 during aerosol-generating procedures is questionable. Uses of such respirators require adequate training through annual respiratory program. Higher level of protection may be achieved through PAPR while performing AGP. PAPR as opposed to N95 does not require testing, can be worn with facial hair, reduced patient anxiety but high cost makes it unaffordable by the dentist, especially in India. For additional information dentist may explore http://www.cdc.gov/niosh/npptl/respirators/respsars.html and http://www.cdc.gov/niosh/topics/respirators. Donning and doffing should follow OSHA guidelines at http://www.osha.gov/SLTC/dentistry/index.html.) Donning of PPE should start with the gown followed by respirator/mask, goggles or face shield, and gloves. Sequence for doffing starts with gloves followed by face shields/goggles, gown and mask/respirators. Optimizing the availability of PPE is essential. Healthy subjects wearing PPE are reported to show hyperthermia, tachycardia, hypercapnia developing stress and work intolerance among dentists.[26]

Efforts to reduce bio-aerosol can be achieved by isolation of the operative site by rubber dam, pre-procedural mouth rinse and air cleaning systems. Cochran et al[27]28 have demonstrated a 90% reduction in bio-aerosol though protective eye wear and head cap are compulsory while using rubber dam.[29]Conditions where rubberdam placement is not feasible, pre-procedural mouth rinse with 1% hydrogen peroxide and 0.2% povidone-iodine can reduce the bio-aerosol. [30]

High volume evacuator (HVE) and high-efficiency particulate arrester (HEPA) filters are suggested method for controlling airborne infection in the dental clinic. Avasthi et al. [31][32] in 2018 have reported a substantial efficiency of HVE filter in reducing bio-aerosol whereas Desarda et al.[33] have contradicted this. Ergonomic limitations of HVE can be overcome by Nubird HVE.[34] HEPA filter is 99.97% effective in reducing aerosol particles measuring 0.3 μm in diameter though less used being expensive and difficult to clean. Aerosol contamination due to dental unit waterlines can be overcome by chemical and non-chemical treatment of dental unit waterline biofilmanddental chair unit design modifications.[35]

e) Disinfection of patient care items: Critical items can be single-use disposable or heat sterilized. Heat sterilization or high-level disinfection after every use is required for semi-critical items. Barrier protection should be used at a minimum. Non-critical items can be disinfected by FDA-cleared sterilant or high-level disinfectants and EPA-registered disinfectants.[36] SARS-CoV-2is a lipid virus having least resistance to germicidal chemicals.[37] Therefore,regular disinfection and sterilization should minimize the viability of SARS-CoV-2 on these patient-care items.

f) Disinfection of clinic and waste management: Surface disinfectants like 62%–71% ethanol, 0.5% hydrogen peroxide, and 0.1% (1 g/L) sodium hypochlorite (20) and otheroxidizing disinfectants may be used to decontaminate the clinical contact surfaces after each patient. Dental waste consisting of majorly extracted teeth; saliva/blood-soaked gauze surgically removed tissues and contaminated sharp items should be disposed in a leak-resistant biohazard bag with secured closure.[38]

Preparedness of Dental Practitioners: We propose a checklist to evaluate the preparedness of the dentist to resumeclinic (Figure 2). Dental procedure in the current scenario will be more expensive than before to afford strict disinfection program as well as PPE for almost every patient. Reducing taxes on dental materials and equipment, reduction of electricity tariffs and free sanitization programme in dental clinic and reducing the premium of health insurance for dentists at least till the emergence of a vaccination programme, are few considerations which the representatives of dental organizations should put forward to Government.

Tele-screening questionnaire for scheduling appointment

Name of the interviewer: **Date of call:**

Name of the patient: **Age/Gender:**

Date of birth:

Address with contact number:

Screening questionnaire	Yes	No	Assessment of emergency	Yes	No
Have you ever been diagnosed with COVID-19?			Chief complaint:		
If yes, date of last negative test result:					
Do you have travel history to known Hot-Spots?			Pain?		
Have you been exposed to a known COVID-19 positive person?			Pain level:		
Do you have Fever?			Pain since when:		
Do you have Cough/Sore Throat?			Swollen gum/face?		
Are you facing any difficulty in breathing?			Trouble swallowing?		
Are you having any body ache?			Trouble opening mouth?		
Are you suffering from Diarrhoea or GI Discomfort?			Trauma?		
Have you observed any diminished sense of smell or taste recently?			Ulcer?		
Do you share a workplace, classroom or household or come in contact with large gatherings regularly?			If yes, ulcer since when:		
			Bleeding?		

Figure 1- Questionnaire for tele screening

Dental practitioner's preparedness assessment

1. Education and job specific training to all employees at Dental office	Yes	No
Signs and symptoms of Covid19		
Techniques of hand washing, respiratory etiquettes and wearing face masks		
Self-monitoring for Covid19 specific symptoms		
Process of reporting suspected or confirmed cases of Covid19		
Patient placement		
2. Facilities at reception area of the clinic	**Yes**	**No**
Notification for patients to take appointment through tele-screening process		
Adequate signs posted regarding respiratory etiquettes, social distancing, mask wearing and symptoms of respiratory infection		
Provision of face mask		
Alcohol based hand sanitizers		
Tissue papers and no-touch receptacles for their disposal		
Social distancing in the waiting area		
3. Availability of Items to maintain Standard precaution for infection prevention	**Yes**	**No**
Gloves		
Fluid repellent coveralls		
Eye protection		
Hand wash		
EPA approved disinfectants		
4. Availability of Items to maintain Transmission based precaution for infection prevention	**Yes**	**No**
High level respirators		
Rubber dam		
Mouth rinse		
Dental unit waterline maintenance		
Air filtration system		
5. Adequate training in donning and doffing of PPE		
6. Registered for annual respiratory protection program		

Figure 2 Checklists to evaluate the preparedness of the dentist to start the clinic

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