

COVIDentistry: Combating Corona Virus Spread in Dental Setup-Indian Prospective

Amit Bhandari^{#,*}, Vanshika Jain[#] and Rashi Bhandari^S

[#]DRDO-Institute of Nuclear Medicine and Allied Sciences (INMAS), Timarpur, Delhi - 110 054, India

^SPrivate Practitioner, Timarpur, Delhi - 110 054, India

*E-mail: amitbhandari1093@gmail.com

ABSTRACT

Making its first presence in humans in China in late 2019, SARS-CoV-2 has been identified as a highly contagious viral particle causing distress of lower respiratory system, named COVID-19. Since January 2020, there has been a worldwide increase in the number of COVID-19 cases and associated deaths. Owing to the contagious nature of the disease and socializing human culture, the disease has spanned over continents resulting in some countries being more severely affected than others. Since the first knowledge of the disease, interim guidelines have been constantly issued by competent authorities to safeguard the interest of masses and healthcare professionals. As and when new details are procured, these guidelines are adequately modified and circulated. As a standard measure, all individuals are expected to maintain social distancing, cover their face with a mask during any outdoor activity and practice hand hygiene and cough etiquettes. Respiratory droplet spread is the most potential source identified for this uncontrolled disease spread. Being of smaller size, aerosols produced during medical treatment too act a potential source of viral particle dissemination. Almost all dental procedures involve production of aerosols in some form or the other, irrespective of the kind of instrumentation used. Additionally, proximity to the oral cavity, one of the sources of droplet production, poses a high risk of disease contraction by dental healthcare workers and visiting patients. With consideration to dental practice, various guidelines have been issued to minimise and control the spread of COVID-19. This article is written with an aim of reviewing these guidelines and sensitizing and encouraging the dental fraternity to follow them and contribute in the current world health crisis.

Keywords: COVID-19; SARS-CoV-2; Coronavirus; Dental measures

1. INTRODUCTION

Coronavirus disease (COVID-19) is a novel, highly contagious infection caused by recently discovered coronavirus. The virus belongs to family *Coronaviridae* and is officially named “severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)” by International Committee on Taxonomy of Viruses (ICTV). Novelty and high infectivity rate made COVID-19 a concern of worldwide healthcare emergency¹. According to a report by *South China Morning Post*, first Coronavirus case can be traced to 17 November 2019 in Wuhan city in Hubei province in Central China²⁻³. Officially, on 31 December 2019, Wuhan Municipal Health Commission, China reported cluster cases of pneumonia to World Health Organisation (WHO) with eventual identification of the virus⁴. First case of COVID-19 outside China was reported in Thailand on 13 January 2020 and the disease was declared pandemic on 11 March 2020⁴⁻⁶. Huge number of COVID-19 cases have been reported worldwide with countries like United States, Italy, Iran, Spain etc to be more severely affected⁷.

India reported first few COVID-19 cases around 27-31 January 2020 in Kerala. Since March 2020, India saw a constant rise in cases which initiated from contact transmission

from a group of Italian tourists³. On the day of writing this paper, more than 15 crore samples from potential cases and their contacts were tested in India with almost 11 lakh samples being tested per day⁸. Currently there are 3.14 per cent active cases with death rate of 1.45 per cent⁹. To increase testing, door-to-door screening, quarantining of suspected individuals and implementation of lock down with functionality of essential services is being undertaken. “AAROGYA SETU” mobile application was launched by the Government of India for citizen awareness and sensitisation. According to WHO, on the day of writing this report, cases reported in India were classified as “cluster of cases” as the mode of transmission⁷.

Centers for Disease Control and Prevention (CDC) identified dental practitioners to be at very high risk of exposure due to inevitable aerosol generation during procedures. Indonesian Medical Association reported COVID-19 associated deaths of at least 24 medical professionals of which six were dentists. This was attributed to non-issuance of advisories by the Indonesian Dental Association (PDGI) to close or postpone non-emergent dental treatments unlike other national dental associations¹⁰. Temporary shutting of teaching dental institutions is also posing hindrance in practical skills development of upcoming dentists, thereby, emphasizing the need of alternative learning methodologies.

This article focuses on dynamics of COVID-19, its effect on dental patients and dental healthcare workers, and measures to safeguard them. It also discusses how dentists and dental community can help in controlling COVID-19 spread and disseminating awareness in the current situation along with the potential effect of the disease on dental practice and training.

2. COVID DETECTION

2.1 Disease Characteristics

COVID-19 is a pneumonia like infection, affecting lower respiratory system with mild to moderate severity and approximately 6.1 per cent cases proceeding to critical condition.¹¹ Patients present with various combinations of flu like signs and symptoms of fever, malaise, chills, cough, shortness of breath, sore throat, sputum production, headache, muscle ache, chest pain, rhinorrhoea and confusion with few presenting gastrointestinal symptoms like diarrhea and vomiting¹²⁻¹⁴. Recently, loss of taste or smell was added as a new disease symptom by CDC. In some cases, disease can have a rapid spread leading to acute respiratory distress syndrome, respiratory failure, arrhythmic shock, acute kidney injury, acute cardiac injury, liver dysfunction, secondary infection, septic shock, multiple organ failure and even death¹¹⁻¹². Basic reproduction rate (R_0) of SARS-CoV-2 (2.6 to 4.71) is found to be significantly higher than the previously known R_0 of SARS (1.77)¹²⁻¹⁵.

Disease incubation period is 1 to 14 days (average: 4.8 ± 2.6 days) with high contiguity during latency period. Individuals of any age can be affected; however, the median age of patients is 47-59 years. Older individuals (≥ 65 years age) or those with underlying medical conditions, especially if uncontrolled, like diabetes, chronic lung disease, heart conditions etc, people living in nursing homes or long-term care facilities and children, specially less than 2 years of age are particularly susceptible to contracting COVID-19.

2.2 Transmission Routes of SARS-CoV-2

COVID-19 virus is speculated to be a native habitant of bats because of 96 per cent phylogenetic similarity of SARS-CoV-2 with previously known SARS-like CoVs found in them¹⁶. Intermediate animal hosts of virus are being searched for to accurately identify the path that led to humans becoming the final host¹⁵⁻¹⁶.

Human-to-human direct or contact transmission of virus is secondary and the most commonly reported form of disease spread¹⁵. Direct transmission is through respiratory droplets, i.e., droplets with a particle size of more than $5 \mu\text{m}$ to $10 \mu\text{m}$ ¹⁷. Humans can produce respiratory droplets while breathing, talking, coughing, sneezing and activities like singing¹⁸. Being more than $5 \mu\text{m}$ in diameter, these droplets rapidly settle in the surrounding environment with a maximum traversed distance of 1 m. Virus can also enter body via epithelial surface (oral, nasal or ocular mucous membranes) interaction with these droplets. Fomites too contribute in transmission as they can harbor virus for up to 9 days; however, further evaluations are underway to confirm the same¹⁹⁻²¹. Virus was also detected in aerosols generated during medical procedures and in patient's stool, thus acting as potential disease source^{17,22}.

3. RISK OF SPREAD OF COVID-19 VIRUS IN DENTAL SETUP

SARS-CoV-2 is shown to be constantly present in saliva of infected patients²³. Angiotensin-converting enzyme II is the said receptor binding domain for SARS-CoV-2, which is present in lungs, esophagus, ileum, colon, liver, bladder, salivary glands and tongue, thus acting as potential virus entering points^{12,20}. Apart from early loss of taste sensation, any other signs and symptoms and associated gross or microscopic changes related to tongue and salivary glands are yet to be reported¹⁴.

Doremalen *et al.*, compared viability of SARS-CoV-2 and CoV-1 present in aerosols on four surfaces; plastic, stainless steel (SS), copper (Cu) and cardboard²⁴. SARS-CoV-2 particles were detected with increased stability, for up to 72 hours on plastic and SS although, overtime its titers significantly decreased. No viral viability was detected after 4 hours and 24 hours on Cu and cardboard, respectively. Their experimental setup lacked ventilation thereby, failing to accurately comment on viral load found in aerosolised conditions in real situations. In another study, viral load presence in patients surrounding, in quarantine facilities was checked using real time polymerase chain reaction. Positive presence of viral particles was reported on object surfaces like exercise and medical equipment, cellular phones, reading glasses, bedside tables and rails etc. Air sampling too confirmed viral shedding in these facilities²⁵.

Airborne (droplet) transmission by particles $< 5 \mu\text{m}$ diameter, which can travel a distance of more than 1m is possible under specific circumstances and medical procedures¹⁷. Bacterial aerosols and splatters of this size are produced by dental procedures involving use of low or high speed handpiece, hand instruments, air-water syringe, ultrasonic scalers, air polishers and prophylaxis angles, lasers and electrosurgery units²⁶⁻²⁸. Aerosols remain suspended in air for duration of over 20 minutes post treatment and are found in increasing densities at distance of 100 cm horizontally and 50 cm vertically from the patient's mouth²⁸. Cases with heavier plaque and calculus deposits generate more bacterial load compared to milder deposit cases. Depending on ergonomic factors such as a dentist working alone and their handedness, higher bacterial concentrations was found on the side opposite to dentist's working side. This indicates toward increased amount of bacterial aerosols surface deposition on dentist's and dental assistant's body, making them susceptible to infections²⁸.

3.1 Precautions in Dental Operatory to Restrict COVID-19 Spread

Understanding the gravity of situation, rapid disease spread and potential risk of transmission during dental procedures, appropriate guidelines were issued by competent authorities to protect healthcare personnel and patients. Our recommendations are based on guidelines issued by, American Dental Association (ADA)²⁹⁻³⁰, Indian Dental Association (IDA),³¹ CDC³² and Ministry of Health and Family Welfare (MoHFW), Government of India³³⁻³⁴.

- When possible, teledentistry or other remote modalities should be opted to screen emergencies and minimise contact.
- All elective and non-emergent procedures, surgeries and



Figure 1. Display posters in dental setup for patient awareness.



Figure 2. Performing hand hygiene.

dental visits should be postponed along with sensitisation of the staff to stay home if sick³⁵.

- Regular inventory check for supply of personal protective equipment (PPE) should be ensured, assuming that supplies maybe unavailable in future.
- Adequate supply of infection control etiquettes which includes, alcohol-based rub with 60 per cent - 90 per cent alcohol, tissues and no-touch receptacles for disposal.
- Facemask should be worn at all times while in the dental setting.
- In absence of basic PPE, including surgical facemask, no dental procedure should be performed irrespective of patient emergency³⁶.

3.2 Preparation of Dental Clinic

As the first step, adequate signs and instructions should be placed at the entrance to dental practice setup, instructing the patients with symptoms of respiratory illness to themselves defer and reschedule appointment and immediately contact their physicians. These are also to be followed by patients showing similar illness symptoms in past the 48 hours.

Visual alert icons in form of posters, signs etc, in a language well interpreted by patients should be placed at entrance and strategic places associated with setup like cafeteria, waiting area and elevators (Fig. 1). These should provide information about when and how to perform hand hygiene, respiratory hygiene, cough etiquettes (including use of tissue and method

to discard it) and social distancing. Steps for providing disposable surgical face mask, tissues and no-touch receptacles for disposal of used tissue should also be made³⁷.

3.3 How to Perform Hand Hygiene?

Hand hygiene should be done for at least 20 seconds using either soap and water or an alcohol-based hand rub containing 60 per cent - 95 per cent alcohol. All surfaces of hand (dorsal and palmer) including area between fingers and nail beds should be thoroughly cleaned. Hand hygiene should also be done after coughing or sneezing (Fig. 2)³⁸.

3.4 Cough Etiquettes

A tissue should be used while sneezing or coughing as it will minimise the spread of generated splatter and can be immediately discarded, thereby, preventing disease spread. In case of immediate non-availability of tissue, an individual should cough or sneeze by covering the facial area with their arm as this part of the body comes in minimum contact with surroundings, thus, limiting the spread.

3.5 Operatory Floor, Adjunct Surfaces, Room and Instrument Disinfection and Sterilisation

Prior to beginning of work each day, operatory should be cleaned using water, detergent and Environment Protection Agency (EPA) approved hospital-grade disinfectant, in accordance with "list N" (Annexure 1)²⁶. Cleaning should be undertaken in a systematic manner starting from higher surface to floor and cleaner surfaces/ areas to soiled counterparts³⁹. Magazines, periodicals, toys, carpets, cloth upholstered furnishing like sitting arrangement for patient attendant and any other objects which are not necessary, can be touched by other people and are difficult to disinfect should be removed from and in the area around operatory. Measures should be taken to avoid direct touching of elevator buttons by users, to avoid contamination⁴⁰.

Measures to maintain the operatory environmental condition is known as heating, ventilation, and air conditioning (HVAC) system. Air circulation with natural air by frequent opening of windows or use of exhaust blower should be maintained³⁴. Ultraviolet germicidal irradiation (UVGI) using UV-C at wavelength of 253.7 nm helps in disinfection, acting as supplement to mechanical ventilation in form of no touch method for room disinfection. Purifying room air by passing through UV rays leads to destruction of bacterial and viral nucleic acid with varying effectiveness⁴¹. UVGI can be used in form of upper-room air lamp or as part of HVAC. It is effective within 6 feet of distance, vertically and horizontally⁴². Such devices should not be installed in areas having direct contact with skin and eyes due to potential UV-C associated health risks. HVAC should not be shut down except for repair or maintenance⁴³.

Instruments, depending on their potential risk of disease transmission (critical, semi-critical and non-critical) should be disinfected and sterilised. Prior to sterilisation, debris should be removed, instruments be dried, wrapped and packaged/ placed in containers. Debris removal can be done either with mechanical scrubbing using soap and water or by using

ultrasonic cleaners. 15 minutes exposure to UV-C at 3 cm distance is shown to have successful inactivation of SARS-CoV⁴⁴. Formalin and glutaraldehyde, as disinfectants, showed favorable results, with former removing most SARS-CoV particles within 1 day at concentration of 1:4000 at 25°C and 37°C while the latter completely deactivated the virus in 1 day at 37°C and in 2 days at 25°C.⁽³⁷⁾ Approved reagents for various equipment are mentioned in Annexure 1.

Post cleaning, instruments should be subjected to heat-based sterilisation. Autoclaving is the most commonly employed method⁴⁰. The recognised exposure periods are either 121°C (250°F) for 30 minutes in gravity displacement type autoclave or 132°C (270°F) for 4 minutes in pre-vacuum autoclave steriliser⁴⁵.

Following sterilisation, the instruments should be stored in closed or covered cabinets after inspection for any breach in form of tearing of cloth or punctured packet. They should be opened only when required to be used⁴⁰.

4. PATIENT EVALUATION

Dental personnel should always be alert and be able to identify patients with symptoms of acute respiratory distress when they arrive. Patient triage should be performed at the first interaction which involves assessment for symptoms like fever, tiredness, presence of dry cough. Some patients may also present with aches, runny nose, nasal congestion, or sore throat⁴⁶. Physical barriers (glass or plastic), preferably with two-way speaker system can be installed to minimise direct contact³⁴. During patient screening, face mask, eye shield and at least non-sterile examination gloves should be used the inspecting personnel.

Contact details, including address and telephone number should be recorded, signed by patient (parent/ guardian in case of children) and screening personnel and carefully stored for all visiting persons. This should be collected along with COVID-19 consent form issued by IDA⁴⁷.

All patients should be first screened for temperature readings using non-contact forehead thermometer (normal range; adults: 97°F to 99°F; children: 97.9°F to 100.4°F) and asked a detailed travel and health history. Emergency treatment should be proceeded with after following appropriate protocols and PPE in place only if the patient is found afebrile (temperature <100.4°F) with negative travel history and absence of COVID-19 consistent symptoms. A questionnaire can be prepared to avoid missing any essential detail. Steps identifying emergent and urgent situations have been modified from MoHFW and ADA guidelines, a summary of which is presented in (Fig. 3)^{34,36}.

As guided by ADA, patients with possibility of being COVID-19 positive should be isolated in single-patient room and counselled for getting tested. They should be given detailed instructions about measures to be followed, where and when they should visit for testing, how should they justify testing need to the testing facility and how they should inform dental clinic when the results come. If any of the results reported by such patients are positive, then, all patients treated after the concerned patient should be informed about potential exposure³⁶.

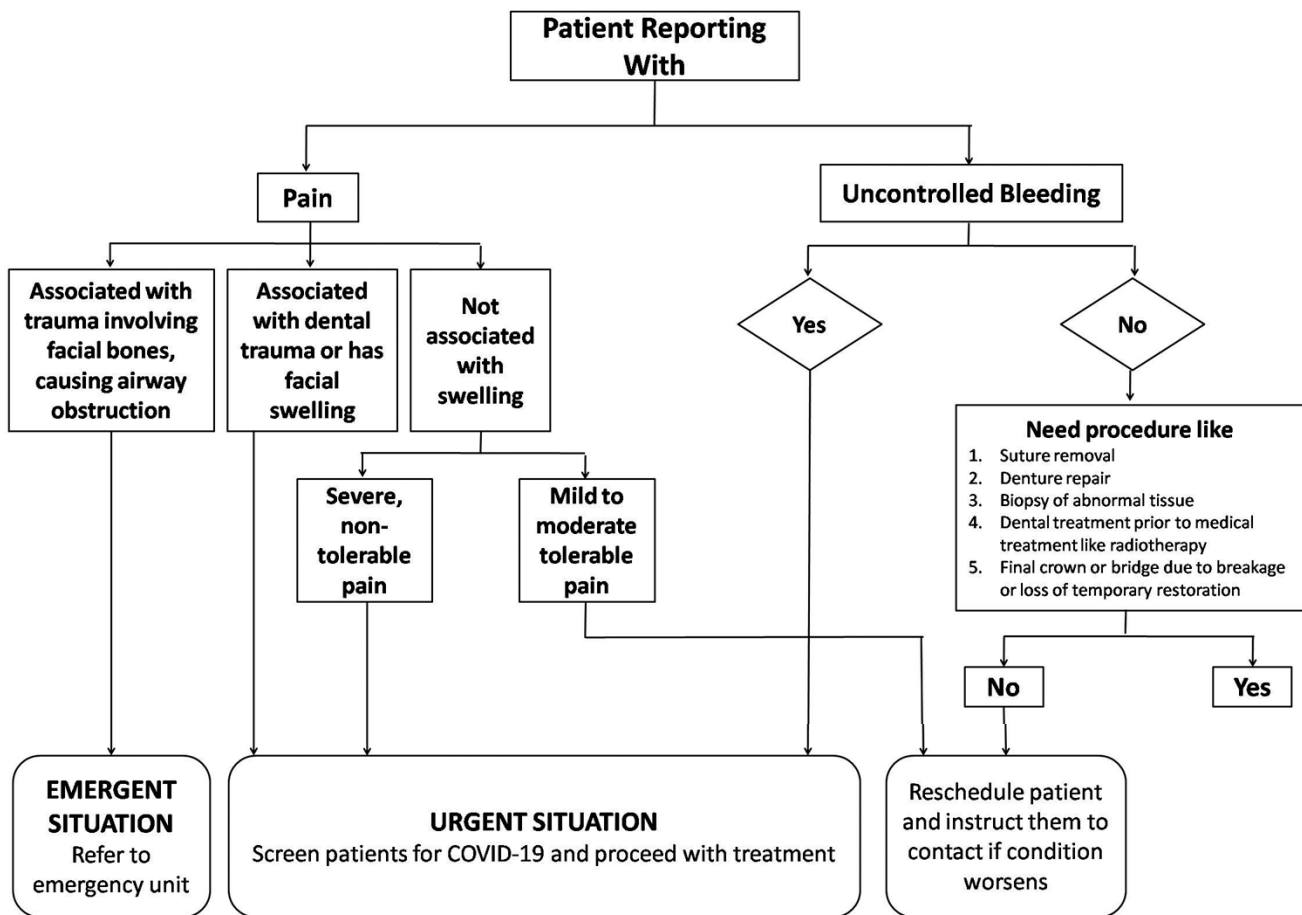


Figure 3. Systematic approach to treating a dental patient.

In India, patients can contact any of the 453 (332 Government, 121 private) Indian Council of Medical Research (ICMR) approved laboratories, spread over 34 states and union territories⁴⁸. Patients and individuals can also use AAROGYA SETU mobile application or contact on MoHFW launched, central and state specific helpline numbers, to get authentic details.

Central helpline number: +91-11-23978046

Toll-free number: 1075

Complete list of state specific helpline numbers can be accessed on <https://www.mohfw.gov.in/pdf/coronavirushelplinenumbers.pdf>

Individuals should be discouraged from accompanying patients except in case of pediatrics, elderly or patients with special needs. In such instances the attendant should also be screened during check-in and be prohibited from entering if found positive with any of the previously mentioned signs and symptoms⁴⁹. When possible, the attendant should wait either in waiting area or outside the clinic, in their vehicle³⁶.

In accordance with ADA's guidelines, in case of more than one patient appointment on a single day, subsequent patient(s) should be scheduled such that minimum contact is possible between visiting patients. If under certain circumstances, more than one patient must simultaneously occupy the waiting room, then, arrangement should be made to ensure a minimum distance of at least 6 feet (2 m) between them. In case of

lack of space, subsequent patient should be asked to wait in their vehicle and be called when the operatory has been re-prepared⁴⁹.

5. DENTAL TREATMENT FOR PATIENTS WITH

5.1 Resolved COVID-19

5.2 Lab Positive Asymptomatic, Self-Quarantined Patients

5.3 Symptomatic Patients Guided for Self-Care at Home

Only emergent treatment should be given priority, deferring all elective procedures. This will help in reducing risk of post-recovery transmission, but all instances of secondary spread cannot be prevented. Patients should be encouraged to continue following social distancing and face mask use. Quarantined patients can be seen in dental setup after adhering to the mentioned guidelines and use of protective gears^{36,50}.

- At least 3 days (72 hours) have passed since recovery (defined as fever resolution without the use of fever-reducing medication); AND,
- Improvement in respiratory distress symptoms like cough, shortness of breath etc; AND,
- At least 7 days have passed since the symptoms appeared for the first time.

Table 2. N95 equivalent respirators in different rating systems

Standard	Country	Respirator face mask	Filter performance (%)
Bureau of Indian Standards (BIS)	India	FFP2 or FFP3	≥94
NIOSH-42CFR84	United States	N95 or higher	≥95
EN149-2001	Europe	FFP2 or FFP3	≥94
GB2626-2006	China	KN95	≥95
AS/ NZ 1716:2012	Australia/ New Zealand	P2 rating or higher	≥94
KMOEL-2017-64	Korea	Korea 1 st Class	≥94
Japan JMHLW-Notification 214, 2018	Japan	DS2	≥95
ABNT/NBR 13698:2011	Brazil	PFF2 or PFF3	Not available
NOM-116-2009	Mexico	N95 or higher	≥95

6. SAFEGUARDING OF DENTAL HEALTHCARE PERSONNEL (DHCP)

Those of older age and at higher risk of contracting COVID-19 such as pregnant person, individual with underlying disease, should be exempted from visiting the setup. All working DHCPs should be monitored for temperature at least twice a day, regardless of presence of COVID-19 consistent symptoms.

6.1 Vaccination and Prophylaxis

All DHCPs should have received their annual dose of influenza vaccine⁵¹. According to CDC's Advisory Committee, the vaccine should usually be taken by end of October (time when community influenza generally begins) as the body requires about two weeks to develop protective antibodies. No preference is given to one vaccine over another and any available vaccine can be given such as inactivated influenza vaccine (IIV), recombinant influenza vaccine (RIV) or live attenuated influenza vaccine (LAIV)⁵².

In accordance with MoHFW guidelines, all asymptomatic healthcare workers involved in care of confirmed or suspected COVID-19 patients should undergo hydroxychloroquine prophylaxis. The prescription should be written by a registered medical practitioner. Recommended dose is as follows³⁴:

- 400mg twice a day for day 1
- 400mg once weekly for next 7 weeks, to be taken with meal

Depending on medical history of the concerned person, the dose can be modified by the prescribing practitioner, as necessary.

6.2 Use of Protective Gears During Procedures

DHCP should wear PPE with respiratory (N95 or equivalent) (Table 2) and eye protection with solid side shields or a face shield to protect mucous membranes of mouth, nose and eyes⁵³⁻⁵⁴. Quantitative analysis have shown less surface contamination on inner surface compared to outer, indicating their effectiveness during dental procedures²⁸. To maintain sterility and avoid contamination, proper steps should be followed while donning the PPE⁵⁵.

N95 or equivalent are level 3 masks preferred for use in dental operatory as they provide maximum fluid resistance and filtration of airborne biological agents. A surgical N95 respirator is superior to N95 respirator in terms of fluid resistance, i.e., ability to repel synthetic blood directed at it under varying high pressure, and thus should be preferred. Surgical face mask belong to level 2 category, failing to provide this high level of protection^{36,56,57}. Disposable particulate respirators based on their ability to protect against oils are rated as N, R or P. Significance of each rating is mentioned in Table 3.

Prior to proceeding with the use of the mask, it should be checked for NIOSH (National Institute for Occupational Safety and Health) approval which is guided under Title 42 Code of Federal Regulations (CFR) Part 84^{58,59}. Markings for a NIOSH approved mask are presented in Fig. 4. Mentioning of lot number is recommended but not required. An additional label, marking or instruction, printed on paper should also be distributed with manufacturer's user instructions. It

**Figure 4. Filter facemask with markings.**

Table 3. Significance of “N”, “R”, “P” rating

Rating	Significance
N	Not resistant to oil
R	Somewhat Resistant to oil
P	Oil Proof (strongly resistant to oil)

should contain NIOSH and Department of Health and Human Services (DHHS) emblems, applicant's name and address, NIOSH assigned approval number, protection provided by the device, cautions and limitations of the device use (Fig. 4)⁵⁸⁻⁵⁹. A list of NIOSH approved, respirator manufacturers is available on https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/. In India, the guidelines for manufacturing of face masks and other PPEs is dictated by the Bureau of Indian Standards (BIS), the National Standards Body of India, which includes IS 9473:2002, IS 16289:2014 and IS 5983:1980 for filter face masks, surgical face masks and eye protectors, respectively⁶⁰.

To ensure that the mask has been properly worn, a user seal check should be performed before proceeding ahead. This seal check can either be positive or negative pressure check⁶¹. Apart from the standard seal check methodology, manufacturer guidelines should be followed for specific respirators.

If any breach in mask is noticed or is visibly soiled or breathing through mask becomes difficult, then, the mask should be removed, safely discarded and replaced with a new one. Before and after all patient contact, hand hygiene should be performed as previously mentioned.

7. MEASURES DURING PROCEDURES AND POST-OPERATIVE PATIENT CARE

- 1 per cent - 1.5 per cent hydrogen peroxide or 0.2 per cent povidone should be used as a pre-procedural rinse for all cases.
- Extraoral radiography (panoramic radiographs, cone beam computed tomography) should be given preference over intra oral radiographs as the latter can stimulate saliva secretion and coughing⁴⁹.
- Four handed dentistry helps to control infection; however, the personnel present during procedure should be limited to only those essential for patient care and procedure support.
- Aerosol production should be minimised with prioritised use of hand instruments. All procedures should be preferably performed under rubber dam isolation and high-volume evacuators. Former helps in significant reduction of aerosol splatter⁶². Saliva ejectors should be discouraged as they can cause backflow and lead to cross contamination. It is advisable to perform aerosol generating procedures in airborne infection isolation rooms⁶³.
- 3-in-1 syringe use should be discouraged as it can produce additional aerosol due to forcible injection of water/ air.
- When required, surgical suturing should be done using resorbable sutures to avoid follow up appointment.
- Ibuprofen and other NSAIDs combination can be used for

pain management as done in regular practice. In cases of intra-oral swelling, depending on availability of treatment, the need for use of antibiotic should be determined.

8. OPERATORY PREPARATION AFTER PATIENT/ AT THE END OF THE DAY

- In between patient appointments, PPE should be cleaned with soap and water or if visibly soiled. Depending on reusability, facial protective equipment should either be discarded or cleaned and disinfected.
- Non-dedicated and non-disposable equipment like x-ray unit, dental chair and light should be disinfected as mentioned in Table 1.
- Water and air should be discharged for 20 seconds to 30 seconds after every patient from any device that is connected to the dental water system and enters patient's mouth⁴⁰.
- All generated waste is considered highly infectious and should be handled and segregated with utmost care. Waste should be collected in two bags to maintain double layer and bags should be labeled⁶⁴⁻⁶⁵.
- Used instruments and handpiece should be cleaned for visible dirt and debris before proceeding for sterilisation (Table 1). Saliva, blood or other contaminants can act as shield for present microorganism and compromise disinfection and sterilisation process. Debris can be removed by either scrubbing with surfactant/ detergent and water or by automated processors like ultrasonic cleaner. In case of manual cleaning, pre-soaking of

Steps of Removing Personal Protective Equipment (PPE)

1. Start removing PPE under the guidance of a trained person. Before starting with doffing, make sure that waste containers are available in the area.
2. Perform hand hygiene on gloved hands.
3. Remove PPE in an inside-out manner. Start by removing the head and neck covering.
4. Unzip the overall completely and start removing from top to bottom.
5. After freeing the shoulders, remove the sleeves by pulling the arms out.
6. Remove the mask from behind the head by pulling back the strings. The lower string should be pulled first and removed over the head followed by the upper string.
7. Remove rubber shoes or overshoes without touching them.
8. Remove gloves in an inside-out manner without touching the outer surface

**Figure 5. Steps for removing PPE.**

instruments helps prevent drying of instruments if not washed immediately and help facilitate cleaning. Wear puncture proof gloves, mask, protective eye wear or face shield and gown during cleaning to avoid contamination with generated potential splatter.

- Clean and disinfect the operatory floor and surfaces as mentioned in Table 1. Room fogging can be done as an additional measure using no touch methods in form of hydrogen peroxide vapors or UV light devices⁴².
- Prior to returning home, DHCP should change from PPE/scrubs to personal clothing. Even at this time, DHCP should at least wear a cloth face covering mask. On reaching home, he/ she should take off shoes, remove and wash clothes separately from those of other household residents and take a head bath immediately (Fig. 5)⁴⁹.

9. ACCIDENTAL EXPOSURE TO/ TREATMENT OF COVID-19 PATIENT

Such a condition is a high-risk scenario. On getting to know about it, DHCP and associated team members should proceed to 14-day quarantine. They should contact their physicians and obtain appropriate medical care in case of appearance or worsening of symptoms. Additionally, the individual can approach authorised testing facilities or contact on launched helpline number as previously mentioned.

10. EFFECT OF COVID-19 ON DENTAL TEACHING AND POSSIBLE ALTERNATIVE

Understanding the gravity of the situation, not only practicing dentists have been advised to temporarily suspend elective procedures but educational dental institutes have also been asked to temporarily suspend dental classes and training.⁶⁶ This presents as a huge learning loss for all. In such situations, use of virtual reality (VR) technology can act as a huge boon to the field of dentistry. VR helps in training students and professionals in various pre-clinical and clinical procedures which are augmented by potential complications that one may encounter during such procedures. This will help in providing the upcoming and practicing dentists with unhampered learning modality and enhance their clinical skills.

11. CONCLUSIONS

Novel coronavirus is a state of medical emergency, requiring combined efforts of all individuals to combat and control its spread. With the limited information available at the moment, it is necessary that strict adherence to released guidelines be maintained, proper sanitisation and use of protective equipment be followed and masses be sensitised about the gravid risks the current situation carries. Dentists cannot deprive patients of essential dental care, but, at the same time they cannot lose guard. Following proper precautions, we can treat dental emergencies, preventing morbidity to our clientele in this global crisis.

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CONTRIBUTORS

Lt Col Amit Bhandari: He is an oral & maxillofacial surgeon and serving in the Indian Army since 2007. He is currently posted as the head of the Department of Dental Research and Implantology in INMAS, DRDO, New Delhi. Contribution in the current study is conception, design, data acquisition, analysis and interpretation, drafted and critically revised the manuscript and gave final approval.

Dr Vanshika Jain: A BDS undergraduate, working in the field of dentistry and research since 2018. She is currently working as a Senior Research Fellow in the Department of Dental Research and Implantology in INMAS, DRDO, New Delhi. Contribution in the current study is conception, design, data acquisition, analysis and interpretation, drafted and critically revised the manuscript, gave final approval.

Dr. Rashi Bhandari: A BDS undergraduate, Currently she is running her private clinic in New Delhi. Contribution in the current study is conception, design, data acquisition, analysis and interpretation, drafted and critically revised the manuscript, gave final approval.

Annexure 1

Disinfectants for various surfaces and objects in dental operatory

Disinfectant to be used	Contact time	Frequency of repetition	Comments
Operatory area and surfaces			
Floor of dental operatory	Step 1: Use of detergent and water	Allow air dry	Let it completely dry before proceeding to next step
	Step 2: Any of the following can be used <ul style="list-style-type: none"> Freshly prepared 0.1% (1000ppm) or 1% sodium hypochlorite^{†‡} 70-90% ethanol ≥0.5% H₂O₂ 	10 minutes	After any patient or major splash or after every 2 hours In case of blood and body fluid spills, 0.5% (5000ppm) concentration of hypochlorite solution should be used
Remaining surfaces of dental operatory	Freshly prepared 1% sodium hypochlorite ^{†‡}	10 minutes	<ul style="list-style-type: none"> Before starting work daily After every procedure After finishing daily work
Room fogging	<ul style="list-style-type: none"> 20% working solution of commercially available 11% (w/v) hydrogen peroxide stabilized with 0.01% silver nitrate H₂O₂ vapor system (HVP) (30-35% H₂O₂) Aerosolized H₂O₂ (aHP) systems (5-7% H₂O₂ with <50ppm silver cations) UV-C devices with wavelength between 200-270nm 	<ul style="list-style-type: none"> Fogging time of 45 minutes followed by contact/ dwell time of 1 hour HVP requires 1.5-2.5 hours aHP requires approximately 8 hours 	At the end of the day's work before closing the operatory <ul style="list-style-type: none"> After completion of dwell time, room should be opened, fans switched on for air circulation and wet surfaces be cleaned with sterile cloth before closing the operatory. UV-C devices should be placed within a height of 6 feet from the floor
Reusable PPE, boots, heavy duty gloves	<ul style="list-style-type: none"> 0.5% chlorine solution 	Dipped for 30 minutes followed by rinsing and drying	Before storage after day's use
Biomedical Waste Holding containers/ bins/ transport trolleys			
Inner and outer surface of bins/ containers, buckets	Freshly prepared 1% sodium hypochlorite ^{†‡}	Allow air dry	<ul style="list-style-type: none"> Before placing new bag After removing the placed bag
Waste transport trolley			Buckets should be stored in an inverted fashion when not in use to let it drain completely
Equipment and Instruments			
Delicate electronic equipment, dental chair, dental chair light handles etc	<ul style="list-style-type: none"> Alcohol-based rub/ spirit (60-90% alcohol) Intermediate level disinfectant like chlorine containing products,^{†‡} quaternary ammonium compounds with alcohol, phenolics, iodophors 	Allow air dry	Before each patient contact/ use <ul style="list-style-type: none"> Surface should be wiped using swab In case of dental chair and its parts such as light and head rest, disposable covers or plastic wraps can be used which should be changed after each patient use

	Disinfectant to be used	Contact time	Frequency of repetition	Comments
3-in-1 syringe, water outlet, handpiece water pipeline, ultrasonic scalers	<ul style="list-style-type: none">• Water and air in the pipeline• Intermediate level disinfectant	30-40 seconds	<ul style="list-style-type: none">• Before starting work daily• After every procedure• After finishing daily work	<ul style="list-style-type: none">• Constant flush of disinfectant containing water is preferred and should be maintained for the said time• Water-air discharge should be conducted even if the system is fitted with anti-retraction valves
Critical instruments such as scalers, surgical instruments	Heat sterilization	121°C (250°F) for 30 minutes in gravity displacement type autoclave or 132°C (270°F) for 4 minutes in pre-vacuum autoclave sterilizer	After every use	<ul style="list-style-type: none">• When possible, disposable instruments should be opted for• Should never be reused after cold sterilization under any circumstances
Semi-critical instruments like mouth mirrors, handpiece, digital radiography sensor etc	<ul style="list-style-type: none">• Heat sterilization (preferred)• High level disinfectants like glutaraldehyde, glutaraldehyde with phenol, hydrogen peroxide, hydrogen peroxide with peracetic acid and orthophthaldehyde• Intermediate level disinfectants• Alcohol-based rub/ spirit (60-90% alcohol)	12-90 minutes complete immersion with high-level disinfectants or 12 hours of complete immersion with intermediate-level disinfectants	After every use	<ul style="list-style-type: none">• In case of handpiece, if heat-sensitive, the device should not be dipped in chemical disinfectant. Instead it should be surface wiped and allowed to air dry.• High-level disinfectants should be used with caution as they are highly toxic.• In case of digital radiography sensors which cannot be either heat sterilized or subjected to chemical disinfection, clear plastic wraps should be used which can be discarded after every use.
Non-critical instruments like radiograph head/ cone etc	<ul style="list-style-type: none">• Intermediate level disinfectants• Alcohol-based rub/ spirit (60-90% alcohol)	Allow air dry	After every use	Surface should be wiped using swab

H₂O₂: Hydrogen peroxide, **ppm**: Parts per million, **UV-C**: Ultraviolet C, **PPE**: Personal protection equipment

*Use of high-level disinfectants should be avoided as either holding agents for instruments or for environmental surface disinfection.

[†]Hypochlorite solution is readily inactivated in presence of organic material, thus, when it is used, it is important to first clean the surface with soap-water solution

[#]In absence of chlorine-based products, a fresh solution of sodium hypochlorite (eg: household bleach) with 1:100 dilution of 5.25% bleach and tap water is an effective alternative.