



Covid-19 and Dentistry: An Unfolding Crisis

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ABSTRACT

Importance: The coronavirus COVID-19 has emerged as a global pandemic affecting around 209 countries around the world with approximately 1,703,018 confirmed infected cases where fatality rate ranging from 0.2 % to 21.9 % depending upon the age of patient.

Observations: After entering into human body, the Coronavirus majorly abounded in nasopharyngeal and salivary secretions of infected patient. It is transmitted from person to person through droplets of salivary or nasal discharge while coughing or sneezing or through contact transmission. Such scenario puts dentist at a greatest risk as they directly deal with oral cavity and even the specificity of dental procedures producing aerosols makes it extremely hazardous.

Conclusions and Relevance: Present scenario stresses on need to understand the transmission and risk factors involved in Covid-19 pandemic for a dental professional and his team. They need to be trained to identify the symptoms, appropriate triage and to provide treatment with all safety measures. A strict and effective infection control in dental setup to mitigate the spread of coronavirus and to evade cross infection to other patients. This article provides a comprehensive review on advances in Covid-19 diagnosis and treatment planning strategies in dental practice along with safety measures to incorporate while treating a dental patient.

Keywords: Coronavirus, Covid-19 dental, infection control, aerosols, pandemic disease

INTRODUCTION

Novel Coronavirus disease 2019 or COVID-19 is an infectious disease, caused by severe acute respiratory syndrome coronavirus 2 / SARS-CoV-2 mainly attacking the respiratory system of infected human.^[1]

The disease was first identified in late December 2019 in Wuhan, China which spread massively and hurriedly around world that on 30 January 2020 World Health Organization (WHO) declared the outbreak to be a Public Health Emergency of International Concern and on 11 March 2020 recognized it as a pandemic.^[2]

The term "coronavirus" is derived from Latin word corona means "crown" or "wreath", belonging to a

family of single-stranded RNA viruses known as Coronaviridae.^[3,4] The genetics of this virus has been found similar to SARS CoV and MERS that are considered as zoonotic infection that is believed to be originated in animals later transmitted to humans.^[5,6]

Infected Patients usually present with mild flu symptoms like fever, cough, weakness and headache but as disease progresses, the symptom may get worse. In some cases, patient develops pneumonia type symptoms with difficulty in breathing and dry cough.^[7] The virus possess life threatening situation for patients above 60 years or with pre-existing chronic

illnesses such as cardiovascular disease, diabetes or immune-suppression.^[8,9]

The mode of transmission, long incubation period, high aptitude of transmission even from asymptomatic patient and hasty doubling time with high reproductive number of novel coronavirus presents a great hazard to the Medical and dental healthcare professionals.^{[4][9]} A dentist and his personnel deal directly with the house of infection in human body that is the oral cavity. Considering this, in March 2020, the Centre for Disease Control and Prevention (CDC) American Dental Association (ADA) as well as Indian Dental Association (IDA) recommended the dental facilities worldwide to postpone all elective procedures, surgeries, or any non-essential dental visits and to prioritize emergency dental procedures only.^[10,11]

As the understanding of transmission of this coronavirus is developing, it is evident that the mode of working of dental professionals to deal directly with infection may play an important role to combat the spread and prevent cross-infections and to keep patients and environment safe. The clinical significance of article is to provide brief information on this pandemic so that the dentists are conscious of their role in disease control and be prepared to handle this life-threatening virus.

Mode of transmission of Covid-19 and dental practice:

In dental practice, the dental healthcare professional require a face to face communication exposing him to virus transmission through salivary droplets while patient coughs or sneeze during procedure, the

production of fomite leads to another mode of virus transmission.^{[4][12]} The contact transmission is also an integral part of dentistry as novel coronavirus is believed to be viable on various surfaces such as plastic, metal or steel varying from few hours to many days promoting cross-infection.^[13] Furthermore, the production of aerosols which may directly inhaled or may persist suspended in air up to 3 hours or may get deposited on various surfaces turning into potential source of infection.^{[4][6][14]} Therefore, following are the risk factors involved in dentistry are as following (figure-1):

- Inhalation of aerosols containing salivary droplets using air rotor during cavity preparation and access opening for root canal treatment^[15]
- Use of ultrasonic cleaners causing aerosol production that contaminates areas of face especially around nose and inner corner of eyes^[16]
- Contaminated surfaces touched by infected patients^[13]
- Use of three-way syringe leading to air and water spray to break salivary droplet and splatter^{[14][17]}
- Direct Spitting or water gargle by patient into dental chair spittoon which may spill to floor and become a source of contamination^[15]
- Exposed to Blood during extraction or any surgery including periodontal or dental implants surgeries^{[14][17][18]}
- Dentist may get hurt while using contaminated sharp instruments^{[13][19]}
- Taking dental x-rays that leads to increase salivary flow and may induce coughing too.^[17]

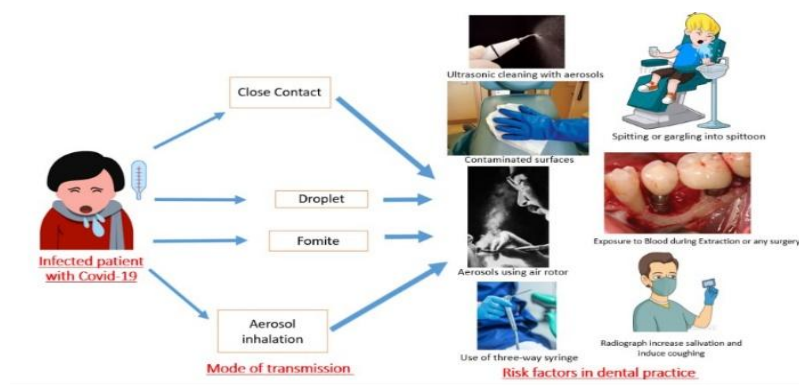


Figure 1: Illustration to describe the mode of transmission of coronavirus and risk factors involved in Dental practice

Recommended guidelines for Dentistry to deal with Covid-19:

The Centre for Disease Control and Prevention (CDC)^[10], the American Dental Association (ADA)^[11] and Indian Dental Association (IDA)^[12] in collaboration with Indian Endodontic society (IES)^[19] have presented with recommendations and strategies for dental professionals aiming to:

- To **postponed all elective or non-essential dental services with immediate effect** to protect dentist and dental personnel to prevent spread of infection
- To limit the dental services for urgent/emergency patients
- Protect other patients to prevent cross-infection and to constrain community transmission
- Follow the concept of “**social distancing**” into practice that is the pre-requisite for limiting spread
- A thorough disinfection of clinic and surfaces to combat infection transmission
- To keep a healthy and clean environment of clinic with proper biomedical waste management

Thus, the following protocols are need to be updated as per adaptation of specific recommendations:

- 1) Identification and evaluation of patient
- 2) Specific recommendations for treatment need of patients and decision making
- 3) Specific Recommendations for dental procedures
- 4) Use of Protective **Preventive Equipment PPE**
- 5) Recommendations for Infection control protocols in Dental clinic
- 6) Recommendations for Infection control protocols for Covid-19 while treating patients

1. Identification and evaluation of patient:

The responsibility of a dentist in contributing towards disease control begins even before the patient enters the dental clinic.

- A walk-in flow of patients should be restricted and facility for **telemedicine, text monitoring system or video conferencing or telephonic consultation** should be available for patients^[20]

- A poster or a paper with a **warning sign or Covid-19 alert health message regarding travel history and symptoms of flu or respiratory distress within past 14 days** at entrance of clinic to pre-warn patient and to understand the urgency to address the issue^[20]

- A **microphone/ intercom facility** outside the dental setup to talk to the staff/ dentist inside the clinic regarding his present dental situation and past travel and medical history to avoid unnecessary exposure^[21]

- A **questionnaire** to assess the past travel and medical history including fever, respiratory distress or any other symptom developed in past 14 days along with reason for dental visit. Details about epidemiologic information and geographic location need to be recorded^{[4][21]}

- **Patient triaging** to determining the priority of patients' treatment needs based on the severity of their condition^[22]

- A **triage area or isolated room** for patient evaluation and assessing treatment seeking need, to avoid contamination to entire clinic set

- **Thermal screening** using thermal cameras or digital thermometers for each patient at entrance of clinic^{[4][20][21]}

- **Basic protective facility** to provide hand wash, surgical gloves, mask and alcohol-based hand rub containing 60-95% alcohol and tissues.^{[20][22]}

2. Specific recommendations for treatment need of patients and decision making:

“All patients should be considered as potential asymptomatic carriers, if not already a known case of COVID-19”. Keeping this fact in mind, all dental procedures to postpone and only emergency dental care need to be operational to alleviate the burden of dental emergencies on hospital emergency departments.^[11]

Based on the guidelines by the American Dental Association, to limit the number of patients the emergency severity assessment category has been allocated for patient triage include three groups for dental conditions and respective advised treatment protocol (Table-1).^{[19][23]}

3. Specific Recommendations for dental procedures:

In dentistry, most of dental procedure involves the use of high-speed hand piece which lead to excessive heat generation that could harm the pulpal tissue of teeth. To counter this heat, water is used along as a coolant leading to production of aerosols while working. These aerosols are mixture of patient's saliva or blood in water that have potential to be present in air for a considerable amount of time and be inhaled by the dentists or dental personnel around.^[27] Considering this pandemic phase, few standard recommendations and protocols has been developed for dental procedures that includes various modifications in techniques or substitution of materials used to carry out a dental procedure (Table 2).

4. Use of Personal Protection Equipment:

Based on mode of transmission of Covid-19 infection in dental practice, three-level protective measures are recommended-

(1) **Primary or standard protection** mainly for dental staff while working- wearing disposable head cap, disposable surgical mask, and working clothes, protective goggles or face shield, and disposable gloves

(2) **Secondary or advanced level protection** by wearing disposable head cap, disposable surgical mask, protective goggles, face shield, white apron and disposable surgical clothing with disposable gloves.

(3) **Tertiary or strengthened protection** while in direct contact with suspected or confirmed Covid patient.^{[4][18]}

A PPE kit is strongly recommended for **ALL** healthcare workers or any other who is coming in close contact with infected patients of novel coronavirus. PPE includes gloves, medical masks, goggles or a face shield, and gowns and aprons.^{[10][22]}

a. Protective eyewear and face shields to protect eyes and nose from hazardous aerosols and debris during dental procedure as the direction of dispersion radiates towards dentist.

b. Mask: A triple-layered surgical mask for staff within 1–2 meters of infected patient and respirators like N95 or FFP2 for specific procedures involving aerosol production. N95 mask is respiratory protective device providing appropriate facial fit and

highly efficient filtration of airborne particles, may block 95% very small particles of 0.3 micron.^{[36][37]}

Reuse: If N95 can be used safely many times depending upon multiple factors like no exposure to aerosolizing procedures, hung to dry or stored in a breathable container in between uses. Various **decontamination/reprocessing methods** has been suggested for respirators including heating the mask at 70 C for 30 minutes which decontaminates adequately along with preserving filter integrity, precise dosing of UV radiations and Hydrogen Peroxide Vaporization which is approved by FDA as a method for N95 decontamination for healthcare personnel during the COVID-19 pandemic.^[37]

5. Recommendations for Infection control protocols in Dental clinic:

According to WHO, if an effective infection prevention and control measures are carried out, the risk of health care-associated infection transmission is reduced by at least 30%.^[38] Moreover, COVID-19 is believed to survive on a metal surface up to 48 hours, on plastic for 72 hours, and on cardboard for 24 hours.^[39] Thus, in dental practice a strict and effective infection control is recommended along with disinfection of each surface in operatory to reduce spread of infection, prevent cross-infection and to maintain safety of staff and patients.^{[10][11][20][22]}

- 1) The first and most pre-requisite for dentist and dental personnel to be immunized with seasonal flu vaccine
- 2) Any of the dental staff is with fever or cough, he should be exempted from dental practice
- 3) Any dental staff above age of 60 years should be relieved from his duties during pandemic
- 4) Install hand wash facility at entrance along with providing surgical gloves, tissues, alcohol rub containing 65-95% of alcohol and masks to all the coming patients
- 5) Install physical barriers like glass or plastic windows at reception areas to limit close contact with potentially infectious patients.
- 6) Make appropriate measures to maintain at least 1-1.5 meter to maintain social distancing Separate isolated room or any single room should be used for waiting for suspected or infected patients

- 7) Disposable water glasses for drinking and single use pens should be kept to fill questionnaire
- 8) The personal protective equipment PPE kit should be available and used in appropriate manner
- 9) Place Visual Alerts through running videos or posters regarding COVID19 for patient's awareness, explaining cough etiquette and hand hygiene practices
- 10) Tissue paper dispenser and foot operated waste bin

11) Remove magazines, reading materials, toys and other objects that may be touched by others and which are not easily disinfected

12) The clinic area should be highly ventilated using fans and exhausts

13) Avoid use of centralized/split/ window air conditioners or must be equipped with High Efficiency Particulate Air (HEPA) filters^[40]

6. Recommendations for Infection control while treating patient:

1) **Standard Transmission-based Precautions** like Hand hygiene, use of PPE, respiratory hygiene/etiquette, sharps safety, safe injection practices, sterile instruments and devices, clean and disinfected environmental surfaces, should be followed.^[10]

1.1 Hand hygiene:

a) To follow **two-before-and-three-after hand hygiene guideline**: wash hands before patient examination, before dental procedures, after touching the patient, after touching the surroundings and equipment without disinfection, and after touching the oral mucosa, damaged skin or wound, blood, body fluid, secretion, and excreta.^[11]

b) To follow **OSHA's guidelines** for hand wash:

- Frequently wash hands with soap and water for at least 20 seconds.
- Use alcohol-based hand sanitizer that contains at least 60% alcohol — if soap and running water are not available.^[41]

1.2 Use of Personal Protection Equipment^{[4][10][22]}

2. **Anti-microbial mouth rinse** to reduce the load of microorganisms in dispersed in aerosols

a) As coronavirus is believed to be vulnerable to oxidation thus, **1% hydrogen peroxide solution** or **0.2% povidone-iodine** mouth rinse are found effective.^[4]

b) Most efficient Chlorhexidine mouth rinse has been found ineffective against coronavirus.^[20]

3. Cover all possible surfaces of dental chair and other equipment with **disposable covers** to prevent contamination^{[13][38]}

4. **Reduce production of aerosols** as much as possible through use of hand instrumentation^[14]

5. **Rubber dam application** during cavity preparation has showed a significant reduction in the spread of microorganisms by 90%^[27]

6. Use of face shields, goggles, plastic sheets or any other kind of **physical barriers** to avoid exposure of salivary droplets while working with use of high- or low-speed drilling with water spray^{[10][20]}

7. **Use high-speed evacuation** for dental procedures producing an aerosol^{[14][26]}

8. **Avoid intraoral radiographs** to prevent increased salivary flow and chances of coughing and to **prefer extra-oral dental radiographies**, such as panoramic radiography and cone beam CT as alternatives if needed during the outbreak of COVID-19^[32]

9. **Use N95 masks** by assistant or any other dental team member within six feet of dental chair that provides a positive seal around nose and mouth^[21]

10. **Sterilization of instruments**: All the instruments used in dental practices including hand pieces need to be cleaned and sterilised/ autoclaved after each patient. Other heat sensitive instruments should be washed and cleaned with strong disinfectant like 2% Gluteraldehyde.

11. **Disinfection protocols**: As novel coronavirus survives on environmental surfaces such as plastic, metal or fabric for various periods of time depending upon temperature and humidity so effective disinfectants containing 62%–71% ethanol, 0.5% hydrogen peroxide, and 0.1% (1 g/L) sodium hypochlorite should be used.^[31]

a) **Floor disinfection**: cleaning using Three-bucket Technique- clean twice a day floor mopping with

warm water, detergent and 1% Sodium Hypochlorite. **Broom sweeping should be avoided.**^{[41][42]}

b) **Surface disinfection:** surfaces including chair and stools, dental chair, door handles, water dispenser, electric switches, ac or tv remotes, basin and bathrooms need to clean with disinfectant sprays containing 62%–71% ethanol, 0.5% hydrogen peroxide, and 0.1% (1 g/L) sodium hypochlorite^[42]

c) **Equipment** like blood pressure measuring puff and thermometer: disinfected using 70% ethyl alcohol after every use^[42]

12. Biomedical waste management: According to CDC, biomedical waste generated during treatment of a coronavirus positive patient can be managed using the same standard strategies of wastes management. In case needed, decontaminated waste can be disposed in a sanitary landfill or discharged into a sanitary sewer. All the liquid or blood waste need to be diluted first before dispersal.^[43]

Conclusion:

During outbreak of COVID-19, the health care professionals has been found at great vulnerability and if infected, prodigious source of spread and cross infection. Such crisis has been a challenge for dental professionals where the dental practice involves all possible modes of transmission of Novel Coronavirus. A well-informed dentist and trained dental personnel could play very important in handling such pandemic to deliver essential services along with maintaining safety of their own and other patients. Thus, a clear understanding of risks involved in dentistry and implementation of few special precautions during practice and strict infection control may aid in identification, precise patient triage and justified treatment judgements which directly help to prevent spread and cross-infections.

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<i>Emergency severity assessment category</i>	<i>Dental conditions</i>	<i>Treatment</i>
<i>Emergency dental care</i>	<ul style="list-style-type: none"> • Uncontrolled bleeding • A diffuse soft tissue bacterial infection with intra-oral or extra-oral swelling/ Cellulitis with compromised patient's airway • Trauma of dento-facial bones with patient's airway obstruction 	<ul style="list-style-type: none"> - Potentially life threatening conditions - Require immediate treatment to stop ongoing tissue bleeding, alleviate severe pain or infection ^{[4][23]}
<i>Urgent care</i>	<ul style="list-style-type: none"> • Severe dental pain from pulpal inflammation • Pericoronitis/ third-molar pain • Surgical post-operative osteitis/ dry socket dressing changes • Abscess /localized bacterial infection with localized pain and swelling • Tooth fracture resulting in pain or causing soft tissue trauma • Dental trauma, avulsion, luxation • Dental treatment required prior to critical medical procedures • Final crown/bridge cementation if the temporary restoration is lost, 	<ul style="list-style-type: none"> -To relieve severe pain and/or risk of infection and to alleviate the burden on hospital emergency departments -These should be treated as minimally invasively as possible. ^[23] Treatment options: <ul style="list-style-type: none"> • Pharmacological management ^{[23][25][26]} • Regular Telephonic follow-up ^[24]

	broken or causing gingival irritation • Biopsy of abnormal tissue	
<i>Routine or non-urgent dental procedures</i>	• Routine dental consultations requiring oral examinations • Recall visits including routine radiographs • Routine dental cleaning and preventive therapies • Orthodontic procedures other than those to address acute issues (e.g. pain, infection, trauma) or other issues critically necessary to prevent harm to the patient • Routine extractions • Restorative dentistry including treatment of asymptomatic carious lesions • Aesthetic procedures including composite build-up, veneer or laminates, bleaching	-Counselling through telephone or video conferencing -Reschedule the appointment

Table 1: Emergency assessment criteria for various dental conditions and recommendations for treatment needed during Covid-19 pandemic

<u>Dental procedures to avoid</u>	<u>Alternative treatment advised</u>
1) Aerosol producing procedures. ^{[14-18][20]} • Cavity preparation or caries removal • Tooth preparation • Access opening for root canal treatment 2) Avoid use of ultrasonic or sonic scalers ^[20] 3) Avoid use of three way air- water syringe ^{[2][28]}	• Mechanical or Chemo-mechanical caries excavation methods using spoon excavator or Carisolv ^{[19][31]} • Follow ART (Atraumatic Restorative Techniques) ^[31] • Slow speed micro-motor hand piece without water input ^[31] • Prefer manual/hand scaling and polishing • Rubber dam isolation ^{[4][28]}

<p>4) Avoid performing Intraoral radiographs^[33]</p>	<ul style="list-style-type: none"> • Use of high volume saliva excavators ^[25] • Use of “Four handed Dentistry technique” ^{[20][34]} • Use of chip blower to clean site • To perform Extra-oral radiographs to prevent coughing
<p><i>Dental Emergency requiring treatment with aerosol production:</i></p> <p>Need to be done only in a negative pressure isolation room or AIIR (Airborne Infection Isolation Room) to contain airborne contaminants and to prevent cross-contamination^[34]</p>	<p>If no such room is available, then patient need to be referred to an airborne specialised setup for treatment^[34]</p>
<p><u>Special precautions to be used during pandemic:</u></p> <p>Oral-maxillofacial surgery or extractions</p> <p>Prosthodontics Crown preparation</p>	<ul style="list-style-type: none"> • Advisable to postponed simple extractions or pain free impactions • If done, supine position is to be preferred to keep patient’s breathing away while working^[16] • Sufficient amount and sufficient time should be given to achieve effective anaesthesia • Place sutures to promote good haemostasis • Use resorbable sutures that lasts 3 to 5 days prevent a follow up appointment • Rubber dam application while performing tooth preparation • Use of anti-retraction high-speed dental hand piece to prevent the back flow of debris and microbes from previously treated patient to prevent cross infections ^[4] • Use of extra high volume evacuators

Impression taking	<ul style="list-style-type: none"> • Impression tray selection: Tray can be adjusted or modified for accurate fit along with right amount of impression material • Avoid oversized trays or excess impression material as it may lead to gagging or cough reflex. • Use split-dam technique for isolation of sub-gingival margins of crown prepared ^[35] • Use of oral mucosal anesthesia to palate to prevent gagging
Removable partial denture or try-in	<ul style="list-style-type: none"> • During fabrication of removable partial denture or complete denture, after putting hands inside patient's mouth contacting saliva, avoid touching any object or surface in dental clinic to prevent contamination • Dental prosthesis or impression or bite registration wax need to be disinfected thoroughly ^[20]
Pharmacological management: 1) Analgesics ^{[23][26]} 2) Antibiotics ^[26] 3) Multivitamins containing Zinc and vitamin C 4) Antacids, if antibiotics given	Tab Diclofenac Sodium 50mg TDS Tab Ketorolac Tromethamine 10mg SOS Acetaminophen 1000mg/Paracetamol 500mg TDS In case of infections, Tab Amoxiclav 625 mg TDS

Table 2: Recommendations for dental procedures and special precautions in dental practice