REVIEW ARTICLE

Dental Practice in Covid Times- An Overview

Ajit Vikram Parihar¹, Rojalin Sahoo², Sarita Parihar³

ABSTRACT

In late December 2019, a cluster of cases of pneumonia with unknown etiology started emerging in Wuhan, China caused by a pathogen similar to Coronavirus related to severe acute respiratory syndrome (SARS-CoV) and Middle East respiratory syndrome (MERS-CoV). World Health Organization (WHO) named this Coronavirus initially as the 2019 novel Coronavirus and officially named the disease as Coronavirus disease 2019 (COVID19). Currently, COVID-19 has spread its roots widely across the world and has posed a great challenging situation for several countries. This review sums up a comprehensive information about this pandemic and how this pandemic has impacted the medical fields especially dentistry. In this, we have mainly tried to summarize the exposure risk of dental professionals, modified dental clinics set-up, and the infection control methods and preventive measures to be followed to restrict the spread of this pandemic.

Key words- Coronavirus 2019(COVID-19), SARS-CoV-2, Dentistry and Coronavirus, Epidemiology, Transmission, Clinical, Pathology, Prevention, Infection control, Treatment.

Introduction

In late December 2019, a cluster of cases of pneumonia with unknown etiology(PUE) started emerging in Wuhan, Hubei Province, China¹². On 7 January 2020, the Chinese authorities put forward the genome sequencing of the SARS-CoV-2,³ whose analysis revealed a pathogen of Coronavirus family like Coronavirus related to severe acute respiratory syndrome (SARS-CoV) and Middle East respiratory syndrome (MERS-CoV). World Health Organization (WHO) named this Coronavirus initially as the 2019 novel Coronavirus (2019-nCoV) on 12 January 2020 and officially named the disease as Coronavirus disease 2019 (COVID19)⁴. On 13 January 2020, officials confirmed a COVID-19 case in Thailand, the first case to be recorded outside of China. On 30th January 2020, World Health Organization declared a public health emergency of International concern (PHEIC) over this global pneumonia outbreak⁵. On 11th February, 2020, WHO renamed the novel viral pneumonia as “Corona Virus Disease (COVID19)”, while the international Committee on Taxonomy of Viruses (ICTV) suggested this novel Coronavirus name as “SARS-CoV-2” pertaining to the phylogenetic and taxonomic analysis of this virus⁶. Further, on 11thMarch 2020, WHO officially declared COVID-19 as pandemic.

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Origin of SARS-COV-2 and its genome structure:

SARS-CoV-2, a β-Coronavirus, is an enveloped non-segmented positive-sense RNA virus (Figure 1). Four genera of Coronavirus are known: α, β, γ, and δ. Previous studies have recognized six CoVs as human-susceptible virus among which low-pathogenic α-CoV HCoV-229E and HCoV-NL63, and β-CoVs HCoV-HKU1 and HCoV-OC43 cause mild respiratory symptoms while the rest two known β-CoVs (SARS-CoV and MERS-CoV) cause potentially fatal and severe respiratory tract infections.

The complete genome of Wuhan-Hu-1 Coronavirus (WHCV) is 29.9 kb and reveals some phylogenetic and genomic resemblance to SARS-CoV, principally in the S-glycoprotein gene and receptor-binding domain, demonstrating the capability of direct human transmission. The mutation in non-structural proteins, NSP2, and NSP3 plays a role in infectious capability and mechanism of differentiation of SARS-CoV-2. Tang et al9 performed a population genetic analyzes of 103 SARS-CoV-2 genomes and segregated them into L type (~70%) and S type (~30%). L types, derived from S types are found to be evolutionarily more aggressive and contagious.

Epidemiology of Covid 19- Reservoirs and Transmission:

In previous studies, 49–66% of patients had the contact history of the Huanan seafood market, Wuhan, where several varieties of living wild animals were on sale. Bats are the known natural reservoir of more than 30 corona viruses. The COVID-19 when analyzed throughout the genome to Bat CoV RaTG13 illustrated 96.2% overall genome sequence identity, suggesting the same ancestral origin. Phylogenetic analysis demonstrated the possibility of alternative intermediate hosts, such as turtles and pangolins. Direct contact or consumption of intermediate host/wild animals was suspected to be the main route of SARS-CoV-2 transmission. The usual transmission routes of SARS-CoV-2 inculcate direct transmission like sneeze, cough, and droplet inhalation transmissions and contact transmission like contact with oral, nasal, and eye mucous membranes. The transmission of 2019-nCoV is not limited to the respiratory tract, and eye exposure may provide an effective way for the viral entry. Person to person transmission through direct or indirect contact, or coarse or small droplets formed during medical procedures, has been demonstrated by several studies and it can also be transmitted directly or indirectly through saliva. The fecal-mouth pathway was also reported as a potential route and recently SARS-CoV-2 was also isolated from the urine of a COVID-19 patient. The incubation period is proposed to be 1–14 days, mostly 3–7 days, and the COVID-19 is found contagious during the latency period. 47–59 years is found to be the median age of the patients and females constitute 41.9–45.7% of patients.

Pathogenesis and Immunopathology of Coronavirus: Zhou et al. have put forward that the SARS-CoV-2 uses the same receptor, ACE2, for cell entry as SARS-CoV. The virion S-glycoprotein found on coronavirus surface can attach to the receptor, ACE2 present on the surface of human cells. After fusing with the membrane, the viral genome RNA is released into the cytoplasm, and the uncapped RNA translates two polyproteins and form a replication-transcription complex (RTC) in double-membrane vesicle that continuously replicates and synthesizes a nested set of subgenomic RNAs, which encode accessory proteins and structural proteins that assemble and form viral particle buds mediating endoplasmic reticulum (ER) and Golgi. And finally, the virion-containing vesicles fuse with the plasma membrane to release the virus. A precise regulation of innate immunity is needed to eliminate the virus, otherwise, it will result in immunopathology. A few plasma cytokines and chemokines were found to be ascended in COVID-19 patients, including IL-1, IL-2, IL-4, IL-7, IL-10, IL-12, IL-13, IL-17, GCSF. An anatomy.
report of COVID-19 pneumonia corpse showed an inflammatory response in the lower airway that led to lung injury. The virus particles invade the respiratory mucosa initially and infect other cells, producing cytokine storm in the body.

Clinical Symptoms: Prof. Nan-Shan Zhong’s team studied a sample of 1099 laboratory-confirmed cases and found that the common clinical manifestations included fever (88.7%), cough (67.8%), fatigue (38.1%), sputum production (33.4%), shortness of breath (18.6%), sore throat (13.9%), and headache (13.6%). In addition, few patients manifested gastrointestinal symptoms, with diarrhea (3.8%) and vomiting (5.0%). More susceptible people like the elderly and those with underlying disorders (i.e., hypertension, diabetes, cardiovascular disease), developed rapidly into acute respiratory distress syndrome, septic shock, metabolic acidosis, and coagulation dysfunction, even leading to the death.

Laboratory and Radiologic Findings: Most patients had normal or decreased white blood cell counts, and lymphocytopenia. A significantly higher value of neutrophil count, D-dimer, blood urea, and creatinine levels were also found and the lymphocyte counts continued to decrease. Also, inflammatory factors (interleukin (IL)-6, IL-10, tumor necrosis factor-α (TNF-α)) increase, indicating the immune status of patients. Ground-glass opacity (56.4%) and bilateral patchy shadowing (51.8%) sometimes with a rounded morphology and a peripheral lung distribution can be seen on CT imaging of the. But it is necessary to verify with clinical symptoms and virus RNA detections.

Diagnostic Criteria: Nucleic acid detection in the nasal and throat swab sampling or other respiratory tract samplings by using real-time PCR and further confirmed by next-generation sequencing remain the golden clinical diagnosis method of 2019-nCoV so far. Throat and nasal swab in viral transport media and transported on ice are the most preferred samples for SARS-CoV-2. Alternatively, nasopharyngeal swab, BAL, or endo-tracheal aspirate which has to be mixed with the viral transport medium and transported on ice can be preferred.

Dentistry in COVID-19

According to WHO, this is the first pandemic caused by a Coronavirus. Occupational Safety and Health Administration (OSHA) put forward the worker risk of occupational exposure to SARS-CoV-2 and emphasized that this risk during an outbreak may range from very high to lower (caution) risk as per the Occupational Risk Pyramid (Figure 2). Dentists fall in very high risk zone of this pyramid.

Dental patients and professionals are at the utmost risk to expose Covid-19 infections. Dental procedures using high-speed drills or ultrasonic devices lead to aerosol release, most often exposure to saliva (with high viral loads), blood, close working position, face to face communication can contaminate the dental clinical environment and spread the disease. Dentists have 99% risk to come in contact and spread as “super spreader”. American Dental Association (ADA) conducted a poll on dental practice status in United States of America and found that the majority (76%) of dental clinics are closed for routine practice but seeing emergency patients only. Thus, it is really crucial for dentists to refine preventive strategies to avoid COVID-19 infection.

On 1st April, the ADA and ISO published an Interim Guidance for Management of Emergency and Urgent Dental Care.
Table 1: Emergency and Urgent Dental Care (ADA)

<table>
<thead>
<tr>
<th>Dental emergencies (situations which increase patient’s death risk)</th>
<th>Dental urgencies (situations demanding priority care but do not increase patient’s death risk)</th>
<th>Non-urgent dental treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should be attended by the senior most professional following all necessary precautions</td>
<td>Should be managed based on the signs and symptoms. Non-surgical management of such cases preferred over surgical treatment.</td>
<td>Reschedule routine non-emergency appointments.</td>
</tr>
</tbody>
</table>

- Uncontrolled bleeding
- Cellulitis or any intra-oral or extra-oral swelling that potentially compromises the patient's airway
- Trauma to facial bones, potentially compromising the patient's airway

- Severe dental pain from pulpal inflammation
- Pericoronitis or third-molar pain
- Surgical post-operative osteitis, dry socket dressing changes
- Abscess, or localized bacterial infection resulting in localized pain and swelling
- Tooth fracture result in gingin pain or causing soft tissue trauma
- Dental trauma with avulsion/luxation
- Dental treatment required prior to critical medical procedures
- Final crown/bridge cementation if the temporary restoration is lost, broken or causing gingival irritation
- Biopsy of abnormal tissue

- Initial or periodic recall visits, including routine radiographs
- Routine dental cleaning and preventive therapies
- Orthodontic procedures other than those to manage acute issues (e.g. pain, infection, trauma) or other issues essentially necessary to prevent harm to the patient
- Extraction of a symptomatic tooth
- Restorative treatment of asymptomatic carious lesions
- Aesthetic dental procedure

Figure 3 & 4: Transmission routes of 2019-nCoV in dental clinics and hospitals (Peng et al)

Routes of Transmission of COVID-19 in dental Practice: (Figure 3 and 4)

1. **Airborne spread**: Airborne transmission of 2019-nCoV is the most significant concerns in dental clinics and hospitals because it is very difficult to avoid the production of large amounts of aerosol and droplet mixed with patient’s saliva and blood while performing dental practice. To et al analyzed the viral culture method and found the presence of live viruses in the saliva of infected persons. When such high speed devices are used in the patient’s oral cavity, an ample amount of aerosol and droplets mixed with the patient’s saliva or even blood will be generated that are small enough to remain airborne for an extended period before they settle on environmental surfaces or enter the respiratory tract.
2. Contact spread: Since dental professionals routinely come in contact with human fluids, patient materials, and contaminated dental instruments or environmental surfaces directly or indirectly making this a possible route of spread of viruses^{27}.  

<table>
<thead>
<tr>
<th>Very High Exposure Risk</th>
<th>High Exposure Risk</th>
<th>Medium Exposure Risk</th>
<th>Lower Exposure Risk (Caution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High potential for exposure from known or suspected sources of COVID-19 during postmortem, any medical or laboratory procedures.</td>
<td>High potential for exposure from known or suspected sources of COVID-19.</td>
<td>Those who are in frequent and/or close contact with (i.e., within 6 feet of) people who may be infected but are not known or suspected COVID-19 patients.</td>
<td>Those who are not in contact with known or suspected, infected neither SARS-CoV-2 cases nor frequent close contact with (i.e., within 6 feet) of the general public.</td>
</tr>
<tr>
<td>Healthcare workers (e.g., doctors, nurses, dentists) performing aerosol-generating procedures on known or suspected COVID-19 patients.</td>
<td>Healthcare delivery and support staff exposed to known or suspected COVID cases. (Note: When such workers perform aerosol-generating procedures, the risk level becomes very high.)</td>
<td>Workers have frequent contact with travellers who may return from international locations with widespread COVID-19 transmission.</td>
<td>Workers have minimal occupational contact with the other co-workers and the general public.</td>
</tr>
<tr>
<td>Healthcare personnel collecting specimens from known or suspected COVID-19 patients.</td>
<td>Medical transport workers (e.g., ambulance vehicle operators) moving known or suspected COVID cases in enclosed vehicles.</td>
<td>Workers may have contact with the general public (e.g., schools).</td>
<td>***</td>
</tr>
<tr>
<td>Morgue workers performing autopsies, which generally involve aerosol-generating procedures, on the bodies of people who are known or suspected cases at the time of their death.</td>
<td>Mortuary workers involved in preparing (e.g., burial or cremation) the bodies of known or suspected cases at the time of their death.</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>

3. Contaminated surfaces spread: Human Coronavirus such as SARS-CoV, MERS-CoV can persist up to a couple of days on surfaces like metal, glass, or plastic^{25}. Droplets and aerosols from infected patients derived during dental procedures are likely to contaminate the whole surface in dental offices. Therefore, maintaining a clean and dry environment in the dental office would help lessen the survival and persistence of 2019nCoV. 

Infection Control Protocols to be followed in Dental Clinics: The guidelines to be followed by the dental practitioners and the dental auxiliaries can be categorized into three parts:

1. Before starting the dental procedure: Thorough medical history over the phones and pre-scheduled appointments should be made mandatory. Relevant questions should be asked related to travel history, history of close contact with any person who has travelled, or has been sick, history of recent fever, cough, running nose, bodyache, difficulty in breathing arrest. If there is a positive history, please refer the patient to COVID-19 check up from a medical consultant before his dental visit is scheduled. If the patient is suspected to be from a high-risk category from history, try to treat the patient's emergency problems with medication before they get themselves medically examined and proved to be COVID-19 negative. All elective procedures should be postponed. Diclofenac Sodium [50mg], Diclofenac Sodium [50mg] with Paracetamol [500mg], Ketorolac Tromethamine [10mgQID], Acetaminophen 2500mg in divided dosages can be prescribed if analgesics^{26} are required while prescription of ibuprofen should be avoided as per WHO advisory^{26}. Appropriate choice of antibiotics should be used, if necessary in case of infections only. The dental health care personnel (DHCP) must get themselves vaccinated with their seasonal flu vaccine. DHCP experiencing influenza-like illness (ILI) (fever with either cough or sore throat, muscle aches) ought not to report to work as per...
ADA recommendations\textsuperscript{25}. Dental practitioners and auxiliaries who belong to older age, or have any medically compromised condition or are pregnant are at a greater risk of getting infected from known or suspected COVID-19 patients’ contacts.

2. **During Dental Procedure:** Standard Precautions including proper hand hygiene, use of PPE, respiratory/cough etiquette, sharps safety, safe injection practices, sterile instruments, and devices, clean and disinfected environmental surfaces should be followed. CDC\textsuperscript{32} recommends the use of surgical masks, face shields and, eye protection to protect mucous membranes of the eyes, nose, and oral cavity during procedures that are likely to produce spattering of blood or any other body fluids. Chlorhexidine is found ineffective against Coronavirus. According to CDC,\textsuperscript{35} it has been suggested that since, the virus may be vulnerable to oxidation, a pre-procedural mouth-rinse with an oxidizing mouthwash such as Hydrogen peroxide, povidone-iodine, or Hypochlorous acid may prove worthwhile. However, high viral loads have been detected in the oropharynx of infected patients, as well as in the asymptomatic subjects. There is some limitation to the effect of such pre-procedural mouthwash even if it was valuable in reducing the viral load because Coronavirus is expelled from the lungs at each exhalation.

10% Povidone- Iodine\textsuperscript{13} has been suggested as an irrigate in high-speed hand pieces and ultrasonic scalers. Prefer extra oral dental radiographs to intraoral dental radiographs. Dentists must try to reduce aerosol production as much as possible. The use of rubber dams is must if an aerosol- producing procedure is being performed to help minimize aerosol spatter. High-volume evacuators should also be preferred. Minimize the use of a 3-in-1 syringe that may create droplets from the forcible ejection of water. 6 hand dentistry should be practiced: 3 staff to be present in operatory with complete PPE (6 hand dentistry)\textsuperscript{36}. 2 staff to perform the procedure and one to act as a runner and to help maintain disinfection protocol. Resorbable sutures should be used to eliminate the need for a follow-up appointment.

3. **After the Dental Procedure:** Reusable facial protective equipment (e.g., protective eye wear or face shields) should be disinfected between patients. Non-disposable equipment (like hand pieces, dental x-ray equipment, dental chair, and light) should be disinfected. CDC\textsuperscript{32} recommends that hand pieces should be cleaned and made debris free, followed by heat- sterilization after each patient. Routine cleaning and disinfection of frequently touched surfaces should be done. 1% freshly prepared Sodium Hypochlorite left for a contact time of at least 10 minutes, can be used as a disinfectant. Isopropyl 70% or ethyl alcohol 70% can be used to disinfect surfaces where the use of bleach is not suitable. UVC (Ultraviolet C) disinfection is often used as a multi barrier approach to ensure that whatever pathogen is not “killed” by one method is inactivated by another. Hypochlorous Acid (pH of 6.3) can be used for disinfecting surfaces and floors. Thus,

- For disinfection of hard, non-porous surfaces, use 10% diluted bleach solution or an alcohol solution with at least 70% alcohol
- For disinfection of soft, porous surfaces (such as carpeted floor, drapes), visible contamination should be removed first and then cleaned with appropriate cleaners indicated for these surfaces and then launder items in accordance with the manufacturer’s instructions. If laundering is not possible, use a Sodium Hypochlorite Spray everyday on it. Commercially available preparation of ethanol and propanol. E.g.-Bacillol 25 (25 seconds action on micro-organism) can also be used.\textsuperscript{35}

**MODIFIED DENTAL SET-UP IN COVID-19**

- **Waiting Area**
  - It should be spacious and arrangements of chairs should be done following the norms of Social Distancing (Fig.- 5).
  - Fomite bearing articles like magazines should be removed from the waiting area.
  - An arrangement of proper hand hygiene practice (Sensor-based Sanitizer dispenser) should be kept at the entry of the waiting area.
  - One staff with Infrared Thermal Scanner at the entry of the waiting area should be appointed for thermal scanning.
  - Covid-19 awareness signage as per MOHFW\textsuperscript{38} of India to be printed and pasted in the waiting area for the public awareness.
Operating Area

- It should be spacious with windows/vents to allow air circulation.
- Only those equipment/materials that are to be used at that point of time should be kept outside.
- All fomite bearing surfaces to be covered with plastic sheets.
- All instruments to be immersed in Sodium Hypochlorite Detergent Solution for 24 hours and then transferred to Ultrasonic cleaner the next day.
- High-speed evacuation should be used while using the high-speed hand piece, three-way syringe, ultrasonic scaler, or any procedure that could cause splatter.
- All the bins with respective biomedical colour coding to be filled with diluted sodium hypochlorite.
- High-speed evacuation should be used while using the high-speed hand piece, three-way syringe, ultrasonic scaler, or any procedure that could cause splatter.
- All the bins with respective biomedical colour coding to be filled with diluted sodium hypochlorite.
- It should be equipped with air filters like HEPA filters and so on.

Changing Area

- Changing area should be there to change from personal clothing to Surgical Scrubs.
- Doffing area should be maintained properly where PPE and Surgical Gown can be removed and immersed in a disinfectant solution or disposed of as per recommendation.
- Facilities of proper hand hygiene to be present in the doffing area.

Covid-19 Consent: Additional COVID19 consent to be obtained and maintained in records. Reasons for COVID19 Consent are: Patient may acquire an infection while travelling to and fro from the dental clinic; Patient can hide travel history/history of exposure to the positive case. Written consent may induce a sense of seriousness about the situation. Even after all the precautionary measures by the health care staff, there still remains the probability of infection transmission from dental setup and patient and the risk has to be pre-informed to them.

Patient Discipline: Patients need to follow certain guidelines to ensure their complete safety. It’s only after telecommunication with the doctor that all patients should visit dental clinic. Appointment based practice should be followed. Only patient to visit the clinic unless age, physical/mental morbidity demands so. “No mask, No entry” should be followed strictly for every patient and relative visiting the Clinic. Every patient to perform hand hygiene measures before entering the clinic. Patients should strictly follow all post-operative instructions. Telemedicine can be used for recall and follow-up.

Armamentarium required for prevention of transmission of Covid-19 infection in dental clinics:

1. Sensor attached Automatic hand sanitizer dispensers should be preferred to reduce covid-19 transmission.
2. Non-contact infrared thermal device helps to record the body temperature while maintaining a distance of 3 to 15 cm away from the patient and can be used in mass screening.
3. HEPA filters - The covid-19 virus has a diameter of approximately 0.125 microns and it falls squarely within the particle size range that HEPA filters capture with extraordinary efficiency: 0.01 microns and above. Therefore, in dental environments where more aerosol generation occurs, the droplets become aerosolized particles and this lie in a very fine mist in the air for a longer duration, these HEPA filters work best there.
4. Arbat safety box for trauma care mainly prevents the aerosol transmission from patients to health care workers during surgical procedures and it can be easily disinfected and reusable.
5. Plasma Air Sterilizers can be utilized for air disinfection in office rooms and waiting rooms as the plasma has the potential to oxidize the viruses, disabling their mechanism for entering into cells and alter its tendency to infect.
6. Fogger Machine with sodium hypochlorite can be used efficiently in sterilizing the usually contacting surfaces like dental chairs, tables, cloths and can be repeated 2 to 3 times a day in clinic to minimize the transmission of covid -19.
7. Hazmat suit can be especially useful for the surgeon who deals with aerosol-generating procedures and emergency dental treatment for COVID positive patients.
8. Personal Protective Equipments (PPE) are protective gears which are designed to minimize the exposure of a health worker to a biological agent. The rationale for the use of each component of PPE as per the MoHFW\textsuperscript{40} is as follows:

- **Face shield and goggles** to prevent contamination of mucous membranes of the eyes, nose, and mouth due to droplets produced by cough, sneeze of an infected person or during aerosol-generating procedures carried out in a clinical setting.

  ⇒ **Masks/Respirators** to protect the airway from the particulate matter generated by droplets/ aerosols. Since viruses remain suspended in aerosol, so for one’s own safety, the mask should not be removed inside the clinic. Medical surgical masks can be used routinely as long as no aerosols generating procedures are carried out. The WHO recommends the use of a particulate respirator like the US National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Union (EU) standard FFP\textsubscript{2}, or equivalent when performing aerosol-generating procedures such as dental drilling. Such masks should be reused in exceptional circumstances (maximum 4-5 times) and stored for 4 days in a well-ventilated location before reusing. Proper disposal of masks is also important and the abandoned masks should be put into a clean, airtight bag and thrown into yellow trash in a hospital.

  ⇒ **N-95 mask**: “N” indicates oil-resistant particles; “95” denotes to the NIOSH standard under the detection conditions, the filtration efficiency reached 95\%. Respirators are referred to as “N,” if they are Not resistant to oil, “R” if somewhat Resistant to oil, and “P” if strongly resistant (oil Proof).

  ⇒ **KN95 masks** are those being manufactured in China and meet the corresponding Chinese standard GB2626-2006. KN means suitable for resisting non-oily particles, such as various types of dust, smoke, while RP means suitable for resisting non-oily particles and oily particles.

  ⇒ **FFP masks** are those that follow the European standard EN149-2001 and are appropriate for both oily and non-oily particles.

  ⇒ **Respirators** types that are available are full face and half-face respirators. The advantages of respirators are the mask is reusable, they have long-lasting filters, easy to breathe, fewer chances of fogging of the glasses. 3M provides 6035P3R filters that can last for a full pandemic wave as claimed.\textsuperscript{41}

- **Gloves**: Nitrile gloves are preferred over latex gloves because of their resistance to chemicals and a high rate of an allergic tendency and contact dermatitis. Non-powdered gloves should be preferred to powdered gloves.

- **Gowns** are designed to provide 360-degree protection to healthcare workers. Adequate-sized gowns comprised of 30 grams of polypropylene, with elastic cuffs and collar, that ensure completely covered hair and ears should be preferred.

- **Shoe covers** made up of impermeable fabric should be used over shoes to promote personal protection.

- **Head covers** should be used ensuring that hair and hair extensions should fit inside the head cover.

### Table 3: Sequence for donning and doffing of PPE (CDC)

<table>
<thead>
<tr>
<th>Donning PPE</th>
<th>Doffing PPE</th>
<th>Red zone</th>
<th>Orange zone</th>
<th>Green zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform hand hygiene</td>
<td>Remove shoe covers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put on shoe covers</td>
<td>Remove shoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put on gown</td>
<td>Remove goggles or face shield</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put on mask/respirator</td>
<td>Remove gown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put on goggles or face shield</td>
<td>Remove mask/respirator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put on gloves</td>
<td>Perform hand hygiene</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: Dental Services In Different Zones

<table>
<thead>
<tr>
<th>Zones and Dental Clinics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The dental clinics will remain closed in the CONTAINMENT ZONE, but they can continue to provide tele triage. Patients in this zone can seek ambulance services to reach to the nearby COVID Dental Facility.</td>
</tr>
<tr>
<td>2. For the availability of dental services in Red, Orange, and Green zones, check Table 4.</td>
</tr>
<tr>
<td>3. The Centers for Disease Control and Prevention (CDC) recommends that dental facilities should defer elective procedures, and prioritize emergency and urgent visits and procedures now and for the upcoming several weeks until new policy/guidelines are issued.</td>
</tr>
</tbody>
</table>
Infection Control and Prevention Measures:

1. **Hand hygiene (Fig.6)** - The WHO guidelines on hand hygiene in healthcare (2009) suggest that hand hygiene is the single most important measure for the prevention of infection\(^\text{42}\). Evidence suggests that the hands of the healthcare workers are the most common vehicle for the transmission of pathogens from patient to patient and within the healthcare environment. If hands are visibly soiled, use soap and water (minimum 40 seconds) for hand wash, otherwise use hand rub (minimum 20 seconds). The infection control department of the West China Hospital of Stomatology, Sichuan University, propose “two-before and-three-after hand hygiene guideline” (hands to be washed before patient examination, before performing any dental procedure, after touching the patient, after coming in contact with the surroundings and equipment without disinfection, and after touching the oral mucosa, any wound, blood, any secretion, and excreta).

![Hand Hygiene Technique (WHO)](http://www.who.int/gpsc/5may/How_To_HandWash_Poster.pdf, accessed 0 July 2019)

2. **Mask etiquette** - Mask should properly cover mouth and nose and tie securely to minimize any gaps between the face and the mask. Avoid touching the mask when in use. The appropriate technique should be used during mask removal like the front part shouldn’t be touched and remove the lace from behind only. After removal or whenever inadvertently touched, clean hands by using an alcohol-based hand rub or soap and water. Replace masks when they become humid/damp. Discard single-use masks after each use. Appropriate use and disposal of mask are mandatory to ensure the effective result and prevent any increase in the risk of transmission.

3. **Cough and sneeze etiquette/Respiratory etiquette** - WHO emphasizes to limit sneezing and coughing using tissue or flexed elbow. Immediately after use, the tissue should be thrown in a closed bin and the hands should be washed properly.

4. **Social Distancing** - Maintaining a distance of 1 meter (3 feet) between two individuals at all times.

5. **Avoid touching** face, nose, or eyes as hands may be contaminated after touching any contaminated surface.

6. **Home quarantine** and self-isolation

   Based on the possibility of the spread of 2019-nCoV infection, three-level protective measures of the dental professionals are recommended for specific situations\(^\text{51}\) (Table 5).

<table>
<thead>
<tr>
<th>Primary protection</th>
<th>Secondary protection</th>
<th>Tertiary protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard protection for staff in clinical settings</td>
<td>Advanced protection for dental professionals</td>
<td>Strengthened protection when contact patient with suspected or confirmed 2019-nCoV infection</td>
</tr>
<tr>
<td>Wearing disposable working cap, disposable surgical mask, and white coat, using protective goggles or face shield, and disposable latex gloves or nitrile gloves if necessary.</td>
<td>Wearing disposable doctor cap, disposable surgical mask, protective goggles, face shield, and white coat with disposable isolation clothing or surgical clothes outside, and disposable latex gloves.</td>
<td>Although 2019 nCoV infected patient is not expected to be treated in the dental clinic, but if does occur, the dental professional cannot avoid close contact, and demands special protective outweigh. If protective outweigh is unavailable, working clothes with extra disposable protective clothing outside should be worn along with disposable doctor cap, protective goggles, face shield, disposable surgical mask, disposable latex gloves, and impermeable shoe cover.</td>
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**Table-5:** Three Level Protective Measures of dental Professionals\(^\text{51}\)
Corona Tracking Special APPS-

The AYUSH Karach app has extended home-based treatment facilities through which Ayurveda, homeopathy and Unani experts can be consulted for prevention of diseases by calling and provides information on Covid-19 prevention, disease resistance enhancing measures, live yoga, and control measures at the state level. Aarogya Setu introduced by the National Informatics Centre under the Ministry of Electronics and Information Technology that aims to spread COVID-19 awareness by using the smartphone's GPS and Bluetooth features and to determine the risk if one has been near (within six feet of) a COVID-19-infected person and whether the location one is in belongs to one of the infected areas based on the data available. Coronatracker.com is a community-based project that aims to track the latest news about COVID-19 and ensures reliable sources with minimal fake news, in best interest of the public.

Prophylaxis of SARS-CoV-2: The National Taskforce constituted by Indian Council for Medical Research44 for COVID-19 recommends the use of hydroxychloroquine for prophylaxis of SARS-CoV-2 infection for asymptomatic healthcare workers caring the suspected or confirmed cases of COVID-19 and Asymptomatic household contacts of laboratory confirmed cases. Asymptomatic healthcare workers caring the suspected or confirmed cases of COVID-19: 400 mg BD on Day 1, followed by 400 mg once weekly for the next 7 weeks. For asymptomatic household contacts of laboratory confirmed cases: 400 mg BD on Day 1, followed by 400 mg once weekly for the next 3 weeks; to be taken with meals. This prophylaxis is contraindicated under the age of 15 years, in persons with hypersensitivity to such agents, retinopathy, epilepsy, porphyria, pre-existing maculopathy, G6PD deficiency, recent myocardial infarction, and QTc >500 msec; but not contraindicated in pregnancy. Patients taking these drugs should be frequently monitored for hematological parameters, blood glucose, serum electrolytes, hepatic and renal functions and routine ECG.

Treatment of COVID-19
1. Antiviral Therapy - SARS-CoV-2 viral loads in sputum peaks at around 5-6 days after onset of symptoms and lasts up to 14 days and if antiviral drugs are administered shortly after the onset of symptoms, it can decrease infectiousness to others by reducing viral shedding in the respiratory secretions of patients. Remdesivir, a 1’-cyano-substituted adenosine nucleotide analog prodrug, exhibits broad spectrum antiviral action against several RNA viruses and has potential to interfere with the NSP12 polymerase even in the setting of intact Exon proofreading activity. The first US case of COVID-19 is reported to be successfully treated by it. Also, protease inhibitors like Lopinavir have found to be a strong inhibitor of the protease enzyme present in SARS-CoV which is essential for the life cycle of this virus. Chloroquine65,48 has immunomodulatory effects, suppressing the production/release of TNF-α and IL-6 and acts as an autophagy inhibitor that interfere with viral infection and replication. Chloroquine exhibits broad spectrum antiviral action against several RNA viruses and has potential to interfere with the NSP12 polymerase even in the setting of intact Exon proofreading activity. Also, it inhibits the quinone reductase-2, making it a broad antiviral agent and prevents the spread of infection in the post infection period. Remdesivir and chloroquine combination efficiently inhibited SARS-CoV-2 in vitro. The protease inhibitors Lopinavir and ritonavir used to treat infection with human immunodeficiency virus (HIV), could improve the outcome of MERS-CoV and SARS-CoV patients. The β-Coronavirus viral load of a COVID-19 patient in Korea has been reported to significantly decrease after lopinavir/ ritonavir treatment.

2. Current Therapy - The National Health Commission of the People’s Republic of China49 recommends primary focus on symptomatic and respiratory support due to the lack of effective antiviral therapy against COVID-19. WHO recommended extracorporeal membrane oxygenation (ECMO) to patients with refractory hypoxemia and nearly all patients accepted oxygen therapy. Some critical cases are being delivered rescue treatment with convalescent plasma and immunoglobulin G.

Vaccination: Various clinical trials are being carried out around the world for vaccine development and hopefully, the results will give us more insight on prophylaxis and better prevention of COVID 19 and help in decreasing the transmission of this widely spreading disease. Since there is no medicine for COVID-19 as of now, it will be wise to take some preventive measures to boost our immunity like increased physical activities, meditation, follow healthy diet like increased antioxidants (Vitamin C, E, carotenoids) consumption.
Conclusions

This review article summarizes the possible transmission routes of 2019-nCov, such as the airborne spread, contact spread, and contaminated surface spread and several informative practical strategies to block virus transmission to prevent the transmission of 2019-nCov during dental diagnosis and treatment, including patient evaluation, proper hand hygiene, personal protective measures for the dental professionals, mouth rinse before dental procedures, rubber dam isolation, disinfection of the clinic settings and more effective management of medical waste. So far, scientists have made appreciable progress and are working extensively on the therapies and vaccines against the virus. A lockdown only pushes the severe cases into the future and hardly can prevent them. We are much more hopeful for the development of vaccines, but it seems they will take time, and probably with the vague protective immunological response to infection, it is not certain that vaccines will be very efficient. To summarize, COVID-19 is a disease that is highly infectious and spreads rapidly through society.

Now, the Bhagavad Gita is more relevant than ever in the midst of this pandemic. The healthcare worker may be symbolized as Arjuna, hospitals as battlegrounds for the war against the virus and misinformation, the lack of a cure or an effective containment strategy, and a system that has failed us. Amidst this havoc, dharma is guiding the healthcare worker for a profound sense of purpose to do what is right and not become disheartened and paralyzed by the outcome. We need to ponder that clinicians cannot have full control over a clinical situation, but they can rise to perform their clinical duties and service with serenity. Although we must try our level best to act in the foremost interest of our patients, but we must also accept the vulnerability and uncertainty of life, and respect the fact that neither life nor death is in our command.

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