



## Review Article

## COVID-19 and facility preparedness in the field of prosthodontics

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## ABSTRACT

Dental clinics are a hotspot for nosocomial transmission of coronavirus disease (COVID-19). Prosthodontics stands at an entangled position in dentistry because of service to elderly patients, procedures such as tooth preparation that leads to aerosol generation, involvement of labs for dentures, crown fabrication. Moreover most of treatments requiring multiple sittings. These procedures range from low to very high risk of COVID-19. This review article aims to provide brief information pertaining to possible source of spread of COVID-19 in Prosthodontics setup regarding patient management and clinical strategies. Thus, the aim of this article is to present a brief overview of the history, symptoms, and routes of transmission of COVID-19 and specific recommendations for prosthodontic practice

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## 1. Introduction

Coronavirus disease 2019 (COVID-19) is an highly infectious acute respiratory disease, which is caused by a novel coronavirus, (SARS-CoV-2).<sup>1</sup> It is the third documented outbreak of an animal coronavirus to humans in only two decades that has resulted in a pandemic. In spite of global efforts to restrict the disease spread, the spillover is still on a rise because of the community spread pattern of this infection. Dental professionals, including prosthodontists, may come across patients with suspected or confirmed SARS-CoV-2 infection and will have to actively engaged to provide care and to prevent nosocomial spread of infection. Thus, the aim of this article is to provide a brief overview of the epidemiology, symptoms, and routes of transmission of this novel infection. In addition, specific recommendations for dental practice are suggested for patient screening, infection control strategies, and patient management protocol.

## 1.1. Coronavirus

In 1965 when Tyrrell and Bynoe<sup>2</sup> isolated a virus from the respiratory tract of an adult with common cold and named it B814. After that, an ether sensitive RNA virus(229E) was isolated among medical students who suffered from URI in the winter of 1962.<sup>3</sup> McIntosh et al<sup>4</sup> recognised multiple strains, 2 of which appeared to be ether-stable and were detectable only by their ciliary immobilizing effect in organ culture. The remaining 6 were detected when organ culture harvests were examined by electron microscopy. Since these were grown in organ culture, they were designated as “OC” group.

In late 1960s a new group of viruses was recognised by a group of eight virologists. They found that this virus was round in profile, having a rounded or petal shaped fringe like characteristic projections. This appearance resembled “solar corona”. Due to this characteristic appearance they named it as “coronaviruses” which was later approved by the Vertebrate Virus Committee of the ICNV.<sup>4</sup>

In the first decade of 21<sup>st</sup> century, SARS(severe acute respiratory syndrome) infection was reported in 29 countries

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in North America, South America, Europe and Asia. The cause of this infection was again corona virus.

### 1.2. COVID-19

In December 2019, Wuhan city in China came into limelight, as many unexplained cases of pneumonia were reported. COVID-19 is caused by SARS-CoV-2, formerly known as 2019 novel coronavirus or 2019-nCoV.<sup>5</sup> On 30 January 2020, this outbreak was declared an international public health emergency by the World Health Organization<sup>6</sup> (WHO)

### 1.3. Symptoms

The most common symptoms at the onset of illness are fever, cough, dyspnoea and myalgia or fatigue less common symptoms are sputum production, headache, haemoptysis, and diarrhoea.<sup>5</sup> Reduced sense of smell (hyposmia), and abnormal taste sensation (dysgeusia)<sup>6</sup> have also been reported. Most of the patients possess mild flulike symptoms. These asymptomatic patients can act as “carriers” and also serve as reservoir for re-emergence of infection. Incubation period ranges from 0-24 days, This increased incubation period can lead to transmission of disease prior the appearance of any symptoms. (estimated median incubation period was 7.76 days the 90th percentile was 14.28 days the estimated probability that the incubation period is longer than 14 days was between 5 and 10%).<sup>7</sup>

### 1.4. Transmission

SARS-CoV-2 infections spread mainly through contact or respiratory droplets, so the social distancing is recommended to minimise the spread. Virus has been also found on the inanimate objects near the infected individual so handwashing and disinfection are the major preventive methods. In addition, studies have shown the presence of SARS-CoV-2 in both saliva and faeces of the affected patients.<sup>8,9</sup> Therefore, there is a potential for transmission of COVID-19 via aerosol, fomites, or the feco-oral route that may contribute to nosocomial spread in the dental office setting.

### 1.5. Testing

Currently two methods are used most frequently for the detection of COVID-19. The real time polymerase chain reaction (RT-PCR) is considered as the “gold standard” and is characterized by rapid detection, high sensitivity, and specificity.<sup>10</sup> The sample for RT-PCR is obtained by a nasopharyngeal swab or sputum, as well as saliva.<sup>11</sup>

The second one detects antibodies produced in response to infection. Another option to identify the COVID-19 is assessment of lung damage via either a computed tomography (CT) scan or low oxygen uptake saturation.

## 1.6. The basic safety protocols can be discussed under the following headings

### 1.6.1. Tele-Consult and Tele-Screening

Telephone screening is preferred as the first point of contact with the patient or reception office is encouraged. Past and current medical history should be taken carefully, specially pertaining to the symptoms of COVID-19. Any positive responses should raise concern, and treatment should be deferred except in dental emergencies.

### 1.6.2. Personal care

N95 face masks, protective eyewear/face shields and gloves along with cover all should be worn for High Risk and very high-risk procedures. After every splatter related or aerosol generating treatment fumigation is mandatory. Use of rubber dam is encouraged. The 4-handed technique is beneficial for controlling the infection. All asymptomatic treatments/elective procedures should be deferred.

Proper donning and doffing protocols of PPE should be followed (Please refer to the attached schematic instruction as recommended by CDC, Figures 1, 2 and 3). The discarded PPE should be disposed of without causing any contamination. 2.5% sodium hypochlorite or 0.5% hydrogen peroxide can be added to the water reservoir of the dental chair. Fees should be preferred to be paid by Digital means. Personal health assessment should be done periodically and immediate self-quarantine if any of the symptoms develop. It is advised to inform the concerned authorities.

### 1.7. Patient care

Wearing of face mask is mandatory. Every patient should have the body temperature checked by thermos gun without making contact and should use a sanitiser on the entrance of the clinic. They should be instructed not to wear jewellery. The patient should be provided with a mouth wash rinse with 10 ml of the 0.5% solution of PVP-I solution (standard aqueous Povidone Iodine antiseptic solution based mouthwash diluted 1:20 with water). They should be instructed to distribute it throughout the oral cavity for 30 seconds and then gently gargle at the back of the throat for another 30 seconds before spitting out. Patients consent should be taken on paper before proceeding with the treatment.

### 1.8. Clinic and operatory care

Windows should be kept opened so as to maintain the circulation of the air. Ceiling fan should not be used while performing procedure. A table fan should be placed behind the operator and airflow should be allowed towards the patient.<sup>12</sup> Visual alerts should be displayed at the entrance of the facility, waiting room and in operating areas about respiratory hygiene, social distancing and disposal

**SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)**

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

- 1. GOWN**
  - Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
  - Fasten in back of neck and waist
- 2. MASK OR RESPIRATOR**
  - Secure ties or elastic bands at middle of head and neck
  - Fit flexible band to nose bridge
  - Fit snug to face and below chin
  - Fit-check respirator
- 3. GOGGLES OR FACE SHIELD**
  - Place over face and eyes and adjust to fit
- 4. GLOVES**
  - Extend to cover wrist of isolation gown

**USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION**

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene



Fig. 1:

**HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 2**

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

- 1. GOWN AND GLOVES**
  - Gown front and sleeves and the outside of gloves are contaminated!
  - If your hands get contaminated during gown or glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Grasp the gown in the front and pull away from your body so that the ties break, touching outside of gown only with gloved hands
  - While removing the gown, fold or roll the gown inside-out into a bundle
  - As you are removing the gown, peel off your gloves at the same time, only touching the inside of the gloves and gown with your bare hands. Place the gown and gloves into a waste container
- 2. GOGGLES OR FACE SHIELD**
  - Outside of goggles or face shield are contaminated!
  - If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield
  - If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container
- 3. MASK OR RESPIRATOR**
  - Front of mask/respirator is contaminated — DO NOT TOUCH!
  - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
  - Discard in a waste container
- 4. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE**

**PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE**




Fig. 3: 1,2,3: Centers for Disease Control and Prevention recommendations for putting on and removing personal protective equipment for treating COVID-19 patients. From: <https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>

**HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 1**

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

- 1. GLOVES**
  - Outside of gloves are contaminated!
  - If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
  - Hold removed glove in gloved hand
  - Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
  - Discard gloves in a waste container
- 2. GOGGLES OR FACE SHIELD**
  - Outside of goggles or face shield are contaminated!
  - If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Remove goggles or face shield from the back by lifting head band or ear pieces
  - If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container
- 3. GOWN**
  - Gown front and sleeves are contaminated!
  - If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
  - Pull gown away from neck and shoulders, touching inside of gown only
  - Turn gown inside out
  - Fold or roll into a bundle and discard in a waste container
- 4. MASK OR RESPIRATOR**
  - Front of mask/respirator is contaminated — DO NOT TOUCH!
  - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
  - Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
  - Discard in a waste container
- 5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE**

**PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE**



Fig. 2:

of contaminated items in trash bins. Waiting chairs should be kept a meter apart. Changing room should be available for staff and all workers to wear scrubs and clinic shoes. A trained person should be available for invigilating and testing the quality of sterilisation as per the standard norms. There should be sufficient space for storage of additional PPE kits and sterilisation and disinfection instruments and chemicals. Washrooms should be equipped with Sensor taps and paper towels.

**Surface Disinfection:** For disinfection of tables/platforms, floors and sinks, sodium hypochlorite based solution should be used preferably.

**Floors:** 2 Step Cleaning Procedure should be followed (Detergent and freshly prepared 1% sodium hypochlorite with a contact time of 10 minutes. For rest of the surfaces freshly prepared 1% sodium hypochlorite is used. Frequency: before starting daily work, after every procedure and after finishing daily work. Delicate Electronic equipment should be wiped with alcohol-based rub/spirit (60-90% alcohol) swab.

Clinicians should be encouraged the clinics to move to digital platform and use of intra oral scanners instead

of regular impressions whenever possible. Impression compound, Zinc oxide eugenol (ZOE), Polyvinylsiloxane and polysulfide impression materials are immersed in a 5.25% sodium hypochlorite solution for 10 minutes after thoroughly rinsing (9-12). Alginate and polyether impressions should be rinsed under water, sprayed with a 5.25% sodium hypochlorite solution and sealed in a plastic bag for at least 10 minutes. It has been found that 2% glutaraldehyde did not affect the accuracy and dimensional stability of polyether and polyvinyl siloxane impression materials after immersion for 30 or 60 minutes.<sup>13</sup> Twenty minute immersion in 2% ID 210 solution (Durr Dental, Bissingen, Germany) has no adverse effects on the dimensional stability or surface detail reproduction of rigid material such as an impression compound, impression plaster, and zinc oxide-eugenol impression material.<sup>14</sup>

#### 1.9. Disinfection of wax bites/occlusal rims, bite registrations

Wax, ZOE, and resin centric relation records should be rinsed under water and sprayed with a 5.25% sodium hypochlorite solution and placed in a plastic bag for 10 minutes.<sup>15</sup>

#### 1.10. Disinfection of casts

Stone casts are the most difficult item to be disinfected without causing any much damage. Casts requiring disinfection are sprayed with a 5.25% sodium hypochlorite solution and allowed to sit for at least 10 minutes.<sup>16</sup>

#### 1.11. Disinfection of dental prostheses

Complete dentures and provisional restorations that leave the operator are immersed in a 5.25% sodium hypochlorite solution for 10 minutes. Removable partial dentures with metal bases should be sprayed with 2% glutaraldehyde solution and held in a plastic bag for 10 minutes.<sup>16</sup>

Large, non-sterilizable items used in the operator, such as impression material dispensing guns, articulators, face bows, water bath, silicone spray bottles, tooth shade, and mold guides should be disinfected by wiping, spraying, or immersion with the appropriate disinfectant solution.<sup>17</sup>

#### 1.12. Laboratory care

All lab personnel should follow the proper infection control protocols, including wearing Personal Protective Equipment including mask, gloves, protective eyewear, and protective garment. Labs should be disinfected with disinfectants containing virucidal agents. All packets containing the models etc. need to be disposed off with utmost care and then the material subjected to disinfection procedures. Staff should be instructed to stay at home if they develop any of the Covid-19. All dental prosthesis coming in and

going out of the lab should be thoroughly disinfected. Ensure regular fumigation of the dental laboratory. The laboratory burs should be cleaned and placed in a new bag after every procedure for sterilization. For polishing the lathe, the technician should use individually packaged sterile polishing wheels, designated for use with pumice. Antiseptic containing Octenidine can be added as active agent to conventional pumice so as to reduce the number of microorganisms during polishing. The mix of steribim and water also reduces the number of bacteria by 99%.<sup>18</sup>

## 2. Conclusion

The risk of COVID-19 transmission in dental practices is considered high. The reasons are the close contact with the patient, saliva, blood, spatter and aerosol exposure. Elective dental treatments were suggested to be postponed but increased safety measures are suggested to all patients since every patient can be potentially contagious. Though, there is a little known regarding COVID-19 therefore, the present recommendations are based on evidence from similar diseases, such as SARS and MERS.

The described recommendations were suggested for the COVID-19 pandemic only. Before vaccination is available, strict recommendations are required to prevent infection and nosocomial transmission in dentistry. As the rapid test kits are available now, their extensive use prior to dental care procedure is helping in determining the health status of the patients. The duration of the pandemic cannot be predicted at the moment and elective treatments cannot be indefinitely postponed, testing may represent a positive turning point in management of dental patients during pandemic.

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## 4. Conflict of Interest

The authors declare they have no conflict of interest.

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