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## Original Research Article

## COVID-19 and paradigm shift in prosthodontic practice

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## ABSTRACT

Since COVID 19 has been declared as a pandemic, regulatory bodies are unsure about its effect on prosthodontic services. Response has varied from complete stoppage of service to rendering only emergency care. This has been majorly due to severity of disease across the globe and lack of preparedness on account of the aggressive nature. But not rendering prosthodontic/dental care is increasing the suffering of patients, burden on emergency department which aren't able to deliver quality/standard treatment. With new variants continuously emerging, the only option is to re-start prosthodontics practice, albeit with strengthening and modification of preventive measures. Suggestions for preparation of standard guidelines for patient, operator and operatory management during and after the COVID-19 pandemic are detailed in this article.

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## 1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) a zoonotic infection is caused by corona virus. Originating in Wuhan, China, the first COVID-19 case was reported to the WHO country office in China on 31 December 2019.<sup>1</sup> Spreading over the entire world this zoonotic infection has an incubation period of 2 and 14 days with most common symptoms being fever, tiredness, dry cough and shortness of breath. Loss of taste and smell have recently been added by Indian Council of Medical Research.<sup>2</sup> Clinically cases have been divided as mild, moderate and severe according to the severity of symptoms. Almost 70% of cases show mild to very mild symptoms and recover with symptomatic management. While moderately and severely ill patients require dedicated hospital care and management. Presence of SARS-CoV – 2 has been detected in saliva and salivary glands of

infected patients. Mixed with respiratory secretions it can be a major source of transmission by droplet infection.<sup>3</sup> Dental treatment involves generation of droplets and aerosol, which is combination of salivary secretions and water. And can be a potent source of spreading the infection. Though not many cases have been reported of spread of COVID 19 due to dental procedures, considering the high transmissibility of disease preventive protocols are required for safety of patients as well as operators.

In China during the pandemic, only 38% decrease was seen in the requirement of urgent dental treatment.<sup>4</sup> Dental treatment is an essential service and there is a need for a proper. Since COVID 19 has been declared as a pandemic, regulatory bodies are unsure about its effect on prosthodontic services. Response have varied from complete stoppage to rendering only emergency care. This has been majorly due to difference in severity of disease across the globe. But not rendering prosthodontic/dental care is increasing the suffering of patients, burden on emergency department which aren't able to deliver

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quality/standard treatment.

Thus, preparation of standard guidelines for patient, operator and operatory management during and after the COVID-19 pandemic is of paramount importance.

### 1.1. Prosthodontic/dental management protocol

The dental treatment to be rendered should involve the following broad categorization:

Step 1: Screening

Step 2: Triage & Prioritization

Step 3: Management

Every patient should be considered an asymptomatic COVID 19 carrier, and all necessary precautions must be taken while performing the procedures. Consider recently recovered patients as potential virus carriers for at least 30 days after the recovery confirmation by a laboratory test

Identify the required dental treatment for each patient and the risks and benefits associated with that treatment.

#### 1.1.1. Step 1: Screening

Tele-screening/ virtual screening to be preferred to minimize contact. A detailed screening questionnaire to be filled before triage (Table 1). This questionnaire should be regularly updated according to recent government guidelines. At the time of screening, thermal scanning to be done using infra-red thermal scanners along with the use of pulse oximeters to evaluate levels of oxygen saturation.<sup>5</sup> Considering the rate and the route of transmission, all patients should be considered asymptomatic carriers and necessary precautions to be taken at each step.

A positive response raises a concern in which case all elective treatments should be deferred and pharmacological management of dental emergencies should be encouraged for atleast 14 days as it is well documented now that incubation period for SARS-CoV-2 can range from 2 to 14 days. Also, the patients should be encouraged to follow self-quarantine and to report the authorities if symptoms appear. A negative response eliminates the initial alarm but still demands proper precautionary measures as all cases are to be treated as asymptomatic carriers in the current scenario. A detailed consent and declaration to be mandatorily filled by the patient before proceeding to triage.

#### 1.1.2. Step 2: Triage/ Prioritization

All the treatment procedures to be broadly categorized into:

1. Urgent treatment: Requiring immediate management;
2. Elective treatment: Not requiring prompt care.

All elective procedures, whether aerosol generating or non-aerosol generating should be deferred till the government guidelines direct otherwise. In the present scenario, focus should be maintained on management of urgent dental needs only, considering the high risk of transmission for the dental professionals and auxiliaries.<sup>6</sup>

Urgent prosthodontics procedures can be further divided into aerosol generating and non-aerosol generating procedures (Table 2).

Following triage, the patients to be scheduled based on the management required on an appointment basis.

#### 1.1.3. Step 3: Management

The management should be inclusive of;

1. Personal protective equipment (PPE) protocol
2. Patient protocol
3. Infrastructure protocol
4. Treatment protocol
5. Laboratory protocol
6. Infection control and BMW disposal protocol

### 1.2. Personal Protective Equipment (PPE Protocol)

Use of PPE depends upon the risk involved with the procedure (Table 3). PPE should be judiciously used and appropriately disposed as per protocol. PPE protocol of donning and doffing should be strictly followed and separate designated areas should be assigned with proper disposal facility.<sup>7</sup> Before entering the clinic setup, the patients to be instructed to follow hand hygiene and appropriate PPE is to be provided to the patients as well such as an overall, head cap, shoe covers, gloves and surgical three ply mask (to be removed during the procedure).

### 1.3. Patient Protocol

A definite patient protocol should be devised and strictly followed before proceeding onto the actual management. The patients to be clearly instructed NOT to visit the hospital/ dental setup for treatment if any symptoms of febrile respiratory illness present such as fever, cough, shortness of breath, nausea, loss of taste/smell or myalgia are present. Such cases should be reported to the concerned authorities. If the patient has to visit for management of any urgent dental needs, a thorough screening and triage is to be followed and the patients have to be scheduled on an appointment basis. Monitoring applications, such as one developed by government of India, to be downloaded and updated by all patients visiting the setup. Scheduled patients to visit at the exact time of appointment to avoid crowding in waiting area. Hand hygiene and respiratory hygiene to be strictly followed. Informed consent form to be mandatorily filled before examination and treatment. A strict no visitor policy to be followed, old patients or children requiring assistance can be accompanied by one visitor. Washroom to be used sparingly when inside the hospital setup to minimize the areas to be visited/ surfaces to be touched. The patient to be instructed to wear the provided PPE at all times inside the clinic. Physical distancing to be maintained at all times. Unnecessary baggage/ items/ papers to be avoided inside the dental setup that can act as fomites. Before examination/

**Table 1:** screening questionnaire to be filled virtually/ in person before proceeding to triage.

Screening Questionnaire		Response
S.No.		
1.	Exposure to a person with known or suspected COVID-19 presentation?	Y/N
2.	Any recent travel history to an area with high incidence of COVID-19?	Y/N
3.	Any symptoms of febrile respiratory illness such as fever, thy cough, shortness of breath, myalgia, nausea, diarrhea, conjunctivitis, loss of taste and smell. shivering. discoloration of fingers or toes?	Y/N
4.	Residence in high risk/ hotspot/ containment areas?	Y/N
5.	Returnee/Migrants?	Y/N

treatment, patients to follow pre procedural rinsing with either 0.2% povidone iodine/ 1% hydrogen peroxide for 30 seconds.<sup>8</sup> Patients to be instructed to inform the authorities and the concerned dental professional if any symptoms surfaces upto 14 days after treatment.

#### 1.4. Infrastructure protocol

To ensure the smooth functioning and maintenance of a safe environment for the dental healthcare workers, various modifications in the infrastructure of the clinic setup is essential.

##### 1.4.1. Reception and waiting area

A designated area for hand sanitization and hand washing to be designated at the entrance and a provision for shoe cover, overalls and head cap and masks for the patients to be arranged. Proper signages to direct the patient's entry and exit to be installed and a single entry-exit path to be maintained for the patients to minimize the areas contacted. Thermal screening to be done at the reception at the time of entry. Chairs to be allocated for seating provision by marking them with an 'X' to minimize crowding in the waiting area.

##### 1.4.2. Donning- doffing area

A separate, sealed and well-ventilated Donning Doffing area to be maintained adjacent to the operatory with provision for waste disposal according to guidelines.

##### 1.4.3. Operatory

Two separate operatories to be maintained; for AGP and NGP (Table 4)

#### 1.5. Treatment protocol

There are four major branches of prosthodontics- Fixed Dental Prosthodontics, Removable Prosthodontics, Implant Dentistry and Maxillofacial Prosthodontics. Treatment modifications are to be made in various procedures pertaining to those branches keeping in mind the risk of transmission involved and ways to minimize it making the procedure safer.

##### 1.5.1. Modifications in FDP treatment procedures

As per the current government guidelines, all elective aerosol generating procedures to be deferred till the disease curve flattens. Removable prosthetic rehabilitation to be encouraged in these times to reduce the transmission of infection by switching from aerosol generating procedures to non- aerosol generating procedures. Aerosol generating procedures to be done using anti-retraction handpieces<sup>9</sup> in specialized chambers like negative-pressure chambers/ airborne infection isolation rooms (AIIRs) with high vacuum evacuators along with the use of rubber dam wherever indicated. Before examination/ any treatment procedure, patients to perform rinsing with 1% hydrogen peroxide/ 0.2% povidone-iodine for 30 seconds. Appointments to be kept as short as possible to reduce the contact time with the patients. 4-handed dentistry for controlling infection and anti-retraction functions of hand pieces may provide additional protection against cross-contamination. Minimize the use of a 3-in-1 syringe as this may create droplets due to forcible ejection of water/air. Before cementing any fixed prosthesis, occlusal adjustments to be preferably done outside the mouth using micro motor inside a closed transparent chamber. Aerosol limiting domes can be used during tooth preparation and other AGP procedures to minimize the aerosol generation.

##### 1.5.2. Modifications in Removable Prosthodontic treatment procedures

Removable prosthetic procedures to be furthered as an alternative to fixed treatment wherever possible. All removable prosthetic procedures to be done in minimum number of appointments to minimize the visits especially in case of elderly and debilitated patients. Minimal visit complete dentures to be promoted.

##### 1.5.3. Modifications in implant treatment procedures

The clinician must decide the importance of rendering implant treatment in this pandemic. If procedure can be postponed, it should be done but necessary treatment should be rendered. In cases where implant treatment is required, it must be practiced with all possible precautions. Guided implant surgery to be preferred wherever possible to decrease the duration of procedure. Low speed drilling

**Table 2:** ategorization of urgent prosthodontics procedures for the purpose of triage

<b>Urgent Treatment- AGP</b>	<b>Urgent Treatment-NGP</b>
Occlusal adjustment for the interferences leading to pain and discomfort	Brokenfill-fitted prosthesis/removable prosthetic rehabilitation in debilitated geriatric patients.
Grinding a sharp tooth causing laceration, pain and discomfort.	Denture adjustments to relieve tissue irritation and ulceration due to ill-fitting removable prosthesis in oncology patients (untreated/ being treated with radiotherapy)
Any ill-fitting/failed prosthesis (Eg; a failed implant, faulty prosthesis adhered to oral structures, crown on a tooth with irreversible pulpitis) leading to pain or swelling or extreme discomfort.	Any Prosthesis to be fabricated to assist an Emergent medical procedure Eg: Surgical Obturator, Radiation Stents to assist in radiotherapy, feeding plates for cleft patients.
Already prepared teeth/ implant abutments to receive crowns.	Repair of a broken prosthesis affecting quality of life, raising functional and esthetic concerns.
A dislodged prosthesis hindering day to day activities like mastication or leading to sensitivity in case of vital teeth.	Screw/superstructure/ attachment loosening (overdentures) in case of implant supported prosthesis. Peri-implantitist implant related complications

**Table 3:** Personal Protective Equipment requirement for the dental professionals

<b>Procedure</b>	<b>Risk</b>	<b>PPE requirement</b>
Aerosol Generating Procedures	High	Disposable coverall (90-120 GSM), protective eye wear, face shield, surgical head cap, shoe cover, surgical gloves, N99 face mask (nioche approved)/FFP3 respirators, three ply surgical mask.
Non-aerosol Generating Procedures	Low	Surgical gown, face shield, surgical head cap, shoe cover, surgical gloves, N95 face mask, three ply surgical mask.
Screening & Triage	Low	Surgical gown, surgical head cap, shoe cover, nitrile diagnostic gloves, N95 face mask, three ply surgical mask.

**Table 4:** Infrastructure requirements for the dental operatories.

<b>AGP Operatory Requirement</b>	<b>NGP Operatory Requirement</b>
Operatory to be fully sealed and well-ventilated with the provision of a window/ exhaust fan.	Operatory to be fully sealed and well-ventilated with the provision of a window/ exhaust fan.
Dental chair to be laminated for the ease of frequent disinfection.	Dental chair to be laminated for the ease of frequent disinfection.
Proper waterline treatment to be implemented.	Proper waterline treatment to be implemented.
HEPA filters to be installed to maintain optimum air exchange per hour.	HEPA filters to be installed to maintain optimum air exchange per hour.
High volume evacuators to be used for AGP procedures.	Closed transparent units to be installed for using the micro motors to minimize the flints and fragments released.
Low speed rotary handpieces/ anti retraction handpieces to be installed and to be used in place of high speed rotary handpieces.	
Aerosol limiting dome to be installed.	

(50 rpm) with minimal irrigation protocol to be practiced whenever possible.<sup>10</sup> Hand instruments to be given preference over rotary. Single stage implant procedures to be preferred along with use of resorbable sutures to minimize patient appointments. Strict oral hygiene protocol to be followed during pre and post- operative care. Digital impression to be preferred with milled prosthesis to be given precedence over conventional casting procedures for better accuracy and reduced intra-oral adjustments. Re-usable implant prosthetic components (healings abutments, impressions abutments) should be sterilized and disinfected before usage.

#### 1.5.4. Modifications in maxillofacial treatment procedures

Extra-oral and intra-oral site to be thoroughly disinfected with povidone iodine before starting the procedure. Impressions to be thoroughly disinfected before pouring models/cast. Oral/nasal discharge to be washed in running water before initiating the disinfection protocol. Intra-oral heat cure resin prosthesis to be preferred, if metal framework is necessary it should be milled to avoid intra-oral adjustment discrepancies associated with casting procedures. Mouth preparation for obturator to be done using low speed handpieces and high-volume suction. Wherever possible, long term soft denture lining materials to be preferred. Cleft lip and palate patients to be treated

in presence of properly PPE donned parents. If extra-oral prosthesis is to be fabricated, patient should preferably keep their mouth/nose covered during the procedure. Complete digital workflow involving computer tomography scans to create 3D reconstructions of the missing body part, followed by 3D printing of the prosthesis to be preferred to minimize appointments. Spectrophotometry to be opted over manual shade matching.

### 1.6. Laboratory protocol

Minimum working staff to be allowed in the laboratory to avoid crowding and physical distancing to be followed. Laboratory personnel should be provided with adequate PPE attire. It is of paramount importance that all the impressions, casts and prosthesis should be thoroughly disinfected prior to handling as well as before delivery. Laboratory surfaces to be disinfected using EPA approved disinfectants such as sodium hypochlorite (1000 ppm or 0.1% for surfaces), 0.5% hydrogen peroxide, 62–71% ethanol or isopropyl alcohol and regular fumigation to be ensured.<sup>3</sup> While using the trimmers, a high vacuum suction to be used to suck out the flints or fragments generated. All the hand pieces to be covered with removable sleeves/cling wraps and to be disposed according to proper disposal protocols. Use of intraoral scanners to be promoted to avoid possible cross contamination with regular impressions.

### 1.7. Infection control and Bio Medical Waste (BMW) disposal protocol

Measures may be taken to ensure optimum infection control:

1. Patient care items to be classified into critical, semi-critical and non-critical and to be sterilized and disinfected accordingly.
2. Color changing sterilization pouches to be used.
3. Disposable instruments to be used preferably
4. Digital radiography sensors should be protected with a Food and Drug Administration (FDA)-cleared barrier to reduce contamination during use.
5. Dental impressions to be thoroughly disinfected with the recommended disinfectants; alginate impressions with 0.5% sodium hypochlorite or iodophors, zinc-oxide eugenol impression paste with 2% Glutaraldehyde or Chlorine compounds and rubber-base impression materials with 2% Glutaraldehyde or Cidex.
6. All frequently touched areas and toilet surfaces to be disinfected repeatedly with chemical disinfectants such as 1% sodium hypochlorite for 10 mins.
7. Daily fogging of operatories and the whole setup using a combination of hydrogen peroxide and peracetic acid.
8. Biomedical waste management area to be equipped with required bins as per government guidelines and

careful disposal of the waste to be followed.<sup>11</sup>

#### 1.7.1. Potential long-term impact of COVID-19 on Dentistry

In the coming times the cost of dental treatment might increase due to increased expenditure on additional PPE, operatory modifications and increased waiting period between patients leading to decrease in number of patients treated per day. Additionally, the increased risk to operators due to aerosol generating procedures and e-services can lead to raise in cost of specialist services. The fear in community due to spread of disease has led to decrease in elective dental procedures and majorly the treatment will be focused on emergency/preventive measures. Social isolation has a been proven to have detrimental effect on mental and systemic health of individuals which can affect their dental health, requiring proper dental care, improved efficient and effective dental services.

It is important to consider the following points in the long-term:

1. Awareness and readiness to modify treatment protocols, with emphasis on cross infection control
2. Patient education and promotion of importance of oral health in pandemics
3. Incorporation of technology and digital advancements in our practices, including tele-consultations
4. Investment and promotion of dental research

## 2. Summary

As health care professionals, it is of paramount importance for us to practice under highest standards of infection control for the well-being of our patients and our own selves. Patient education very important to increase awareness regarding oral health. This review can be perceived as a starting point to aid clinicians in making informed clinical decisions and establishing a standard modus operandi to function in times of SARS CoV-2 pandemic. These standard guidelines for patient, operator and operatory management for the Prosthodontic treatment in COVID-19 pandemic era are essential for the patient management.

## 3. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

## 4. Source of Funding

None.

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