

## Review Article

## Comprehensive review of guidelines to practice prosthodontic and implant procedures during COVID-19 pandemic

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## ABSTRACT

**Objectives:** To present a comprehensive review of current literature available on Corona virus disease and dentistry, modifications required in dental and laboratory settings; and recommended disinfection protocols in current scenario. Special emphasis has been given to discuss guidelines for handling different prosthodontic procedures and implications of this pandemic on prosthodontic practice, education and research.

**Materials and methods:** Relevant literature pertaining to COVID-19 and dentistry was scrutinized on electronic search engines including PubMed, EMBASE and Cochrane. Guidelines given by various organizations, institutions, national and international regulatory bodies and Indian Prosthodontic Society were also consulted to gather information pertaining to the objectives of our review.

**Results:** and observations: A total of 160 articles including cross-sectional studies, in vitro study, narrative reviews, letters to the editor and opinions were found to be relevant in accordance with our search strategy. Documented literature revealed that Covid-19 pandemic has culminated in serious clinical, financial and psychological implications in the field of dentistry. Certain steps such as adoption of teledentistry, judicious use of protective equipment, use of rubber dams, pre-procedural rinses have been suggested unanimously. However, there is a dearth of evidence-based recommendations in literature. Data regarding consequences of delaying prosthodontic procedures and patients' perspectives is also sparse.

**Conclusion:** The COVID-19 necessitates the need to adopt a balanced approach while treating patients and safeguarding the dental professionals at the same time. Risk-benefit ratio has to be assessed along with stringent following of guidelines and disinfection protocols to combat this unprecedented situation.

## 1. Introduction

Covid-19 (Corona virus disease 2019) is a RNA-based virus that came to light in December 2019 when China informed World Health Organization (WHO) of rampant spread of pneumonia-like cases.<sup>1</sup> On March 11, 2020, Covid-19 was declared as a pandemic, a public health crisis that is still having a rippling effect in every sector.<sup>2</sup> Due to its implications, dental healthcare has faced several clinical, psychological and financial repercussions, having unforeseen consequences on dental professionals, patients and lab personnels.<sup>3,4</sup>

Covid-19 virus, having diameter in the range of 100 nm, primarily transmits through person to person contact and direct contact with respiratory droplets.<sup>5</sup> The word 'corona' is derived from its appearance as 'crown-like' while being observed under the electron microscope.<sup>6</sup> It

primarily transmits through person to person contact and direct contact with respiratory droplets. Spread through asymptomatic carriers has also been recently documented and is one of the major reasons for creating fear and dilemma in the minds of dental practitioners.<sup>7</sup> The close proximity to oral fluids, aerosols and long incubation period of the virus, place the dental fraternity at a high risk of contracting and transmitting the virus.<sup>8</sup> Ministry of health and family welfare (MOHFW), India has formulated specific guidelines and is playing a pivotal role to constantly update them with changing dynamics of disease. At present, only emergency and urgent procedures have been recommended to be taken up, with extreme focus on personal protective equipment and disinfection protocols.<sup>9</sup> However, the fleeting nature of specialty-wise guidelines and overlap of recommendations given by various organizations; has convoluted its implementation in

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regular dental setup.<sup>10</sup>

The prosthodontic procedures especially need to be modified during the COVID times. The target population, comprising of the geriatric group with or without co-morbidities, post-cancer immune compromised patients or patients with extra-oral maxillofacial defects requiring prosthetic rehabilitation, makes it imperative to lay down guidelines which are versatile and compliant by the patients and doctors as well.<sup>11,12</sup> The prosthodontist community has to deal with multiple saliva- and blood-contaminating articles which can serve as a potent source of viral transmission. The overwhelming dependence on the aerosol generating instruments during prosthodontic rehabilitation needs urgent and innovative strategies to combat the spread. Sudden lockdown world-wide has left many prosthodontic procedures pending at different steps. The indispensable role played by the laboratory in the prosthodontic reconstruction cannot be undermined and hence extra caution needs to be taken at every checkpoint: collection of the dental impression, pouring of the models, designing and fabrication of prosthesis, finishing and polishing using lathe-driven machines and delivery of the final work at the clinics. Additionally, the consequences can be financially and psychologically devastating for patients, the clinicians and; the lab personnel who have not received their payments owing to incomplete procedures.<sup>13</sup>

Thus, with a basic question in mind that how prosthodontics should be practiced during COVID-19 pandemic, an effort has been made to review the existent literature and guidelines from different national and international sources and suggest implementation of a systematic workflow by the dental professionals to ensure a safe practice.

## 2. Methods and methodology

Extensive search of literature was performed on electronic database PUBMED, EMBASE and Cochrane by three authors (VB, RJ and GP). Fig. 1 depicts the sequential steps involved in procuring the data and

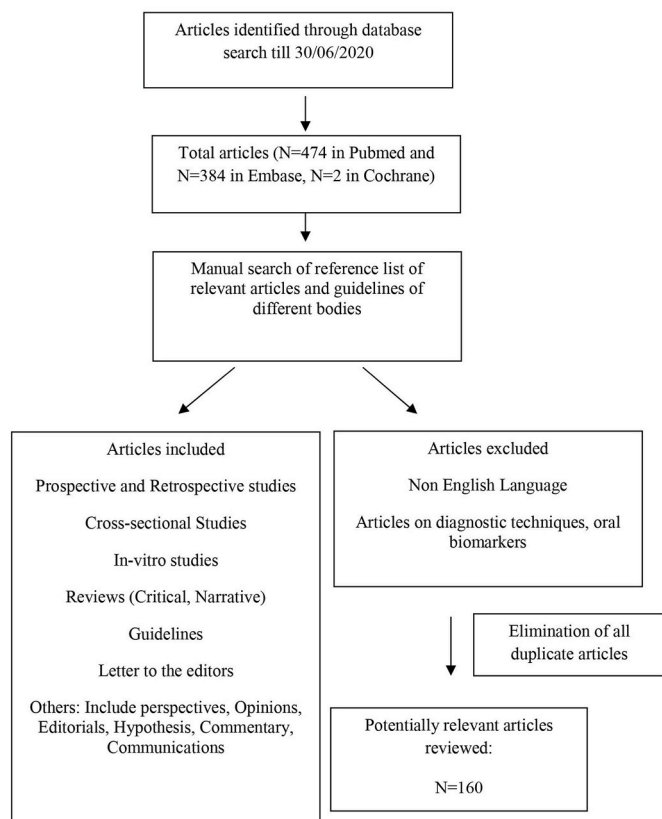


Fig. 1. Flowchart of search strategy and results.

## A SUGGESTED OPERATIONAL CLINIC BLUEPRINT

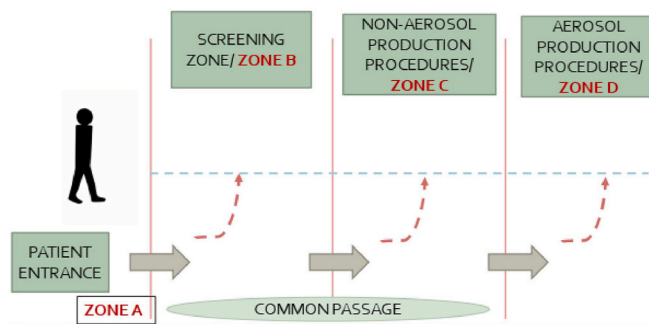


Fig. 2. Suggested blueprint for an operational clinic.

analyzing the shortlisted articles. The keywords/medical subject headings (MeSH) terms used for the search strategies were (“Covid-19” OR “coronavirus”) AND (“prosthodontics” OR “dentistry”) AND (“guidelines” OR “review”). Cross sectional surveys and studies, in vitro studies, retrospective studies, literature reviews and letter to Editor, opinions, editorials published in English language till June 30, 2020 were included. Duplicate articles and articles in language other than English were excluded. Several guidelines recommended by various international and national organizations such as World Health organization (WHO), Centers for disease control and prevention (CDC), Ministry of health and welfare, India and Indian Prosthodontic society (IPS) were also referred to. Certain opinions expressed in the review are on the basis of clinical and academic experience of the authors. Statistical analysis was not performed because of the heterogeneity of the data and lack of clinical trials published so far.

## 3. Observations and discussion

Distribution of types of publications and their country wise representation have been given in Graphs 1 and 2. Various reviews on guidelines and recommendations have been published in literature based on current scenario of pandemic in different countries. It is proposed to follow these guidelines to ensure a safe practice; which are hereby discussed as general (applicable to all dental professionals) and prosthodontic specific considerations.

### 3.1. General considerations

#### 3.1.1. Recommendations for designing of existent clinics and new clinic set up

As per the need of the hour, entire clinical setup has been recommended to have separate areas for donning/doffing, a separate sterilization room along with the segregation of areas into different zones (Fig. 2).<sup>14</sup> Its feasibility depends upon basic infrastructure, total area available, number of auxiliary health workers and number of patients reporting per day; all these vary substantially in Government hospitals and private set ups.

**3.1.1.1. ZONE A: reception and waiting area.** This area is dedicated to gaining basic information about the patient using individual clinic or institution-based protocol. Non-contact temperature recording, sensor taps, contactless sanitizer dispensers are essential additions in this zone. Here the patient is requested to remove accessories like jewellery, watch etc. and sanitize their hands thoroughly.<sup>15</sup> One attendant per needy patient is preferable owing to the norm of maintaining physical distancing.<sup>16</sup> Patient should be provided with triple layer facemask, disposable shoe-covers, head cap and gloves. A glass barrier can be installed at the reception counter to avoid transmission of droplets between patient and the staff.<sup>17</sup> A screening form (in local and national

Demographic details	
Name	
Age/ gender	
Phone number 1	
Phone number 2	
Email id	
Medical history (Covid specific)	
Fever	
Cough	
Breathing difficulty	
Diarrhea	
Altered sensation of smell or taste	
Other medical history	
Asthma	
Diabetes	
High blood pressure	
Pregnancy	
Allergy to any drug	
Current ongoing medications	
History of any long illness or hospitalization	
Travel history with duration	
National	
International	
Mode of journey	
Contact history	
History of contact with any Covid positive patient	
Attending any religious/ ceremonial/ professional gathering	
Dental history	
Chief complaint	
Previous treatment history	
Dental findings	
Knowledge of patient	
Hand hygiene/ coughing etiquettes	

Fig. 3. Suggested screening form.

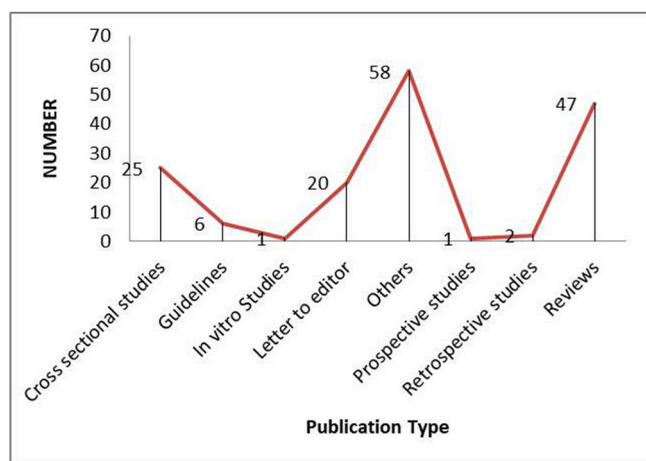


Fig. 4. Country wise distribution of the shortlisted articles.

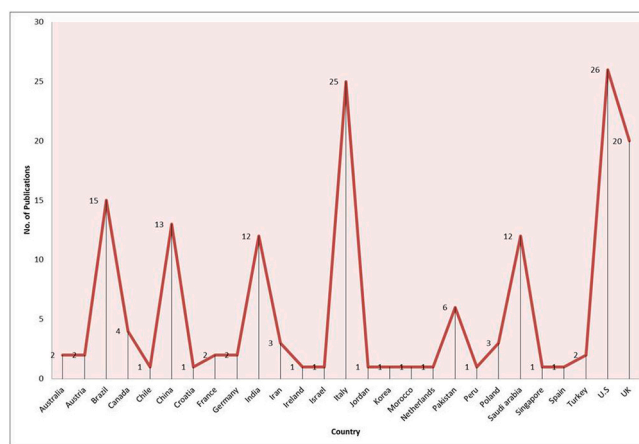


Fig. 5. Categorisation of the articles based on the publication types.

languages) (Fig. 3) and an informed consent should be duly filled by the patient in the language of his or her preference. Online consent before physical attendance of the patient is advisable, keeping the online signature on record. Posters can be designed and displayed to educate patients regarding hand hygiene, respiratory etiquettes etc using one's creativity. A pulse oximeter is a noninvasive, wireless finger tool recommended in screening area for monitoring of significant changes in arterial oxygen saturation in considerably less time, especially in

asymptomatic individuals.<sup>18</sup> If the oxygen saturation is less than 93%, referral to a physician for detailed screening is advisable.<sup>19</sup>

In India, the use of the indigenous “Aarogya setu application” facilitates COVID-19 contact tracing, and self-assessment.<sup>20,221</sup> “Namaste campaign” was also started to minimize the transmission of the virus.<sup>22</sup> Non-overlapping appointments with a gap of at least 15 min, physical distancing, digital payments are few other recommendations to be followed.<sup>14</sup> Levels of Personal Protective Equipment (PPE) which includes gloves, impervious body suit, mask, visor/hood and linen/

**Table 1**  
Level of PPE based on the type of procedure and zone classification.

LEVEL OF PERSONAL PROTECTION EQUIPMENT	RECOMMENDED CATEGORY	ITEMS INCLUDED
PRIMARY LEVEL	RECEPTION AREA AND SCREENING AREA (Zone A and B)	<ul style="list-style-type: none"> <li>● Disposable working cap and show cover</li> <li>● Disposable surgical mask</li> <li>● Cloth gowns or white coat</li> </ul>
SECONDARY LEVEL	NON- AEROSOL GENERATING PROCEDURE (Zone C)	<ul style="list-style-type: none"> <li>● Disposable latex or nitrile gloves</li> <li>● Disposable working cap and show cover</li> <li>● Disposable surgical mask</li> <li>● Disposable latex or nitrile gloves</li> <li>● Protective goggles or face shield</li> <li>● Disposable surgical gown</li> </ul>
TERTIARY LEVEL	AEROSOL GENERATING PROCEDURE (Zone D)	<ul style="list-style-type: none"> <li>● Disposable working cap and show cover</li> <li>● Disposable N95 or FFP2 mask</li> <li>● Disposable latex or nitrile gloves</li> <li>● Protective goggles or face shield</li> <li>● Disposable full body covered gown with hood and visor.</li> </ul>

**Table 2**  
Recommended Personal protection equipment for health care workers.

Health care worker	Gloves	Impervious body suit	Mask	Visor/Hood	Linen/Disposable gown
Security guard	✓	×	N-95	✓	×
Registration counter/(behind glass curtain)	✓	×	Surgical	×	×
Registration counter/(without glass curtain)	✓	×	Surgical	✓	×
Screening room/oral examination	✓	×	Surgical/N95	✓	✓
Dental procedures (non AGP)	✓	×	N-95	✓	✓
Dental procedures (AGP)/minor OT	✓	✓	N-95	✓	✓
Sanitation staff	✓	×	N-95	×	✓

(Thick boots)

disposable gown and their indications have been tabulated in [Tables 1 and 2](#).

**3.1.1.2. ZONE B: Screening area.** Initial screening and diagnosis, using sterilized instruments is to be done in this zone. Maximum viral load is present at disease onset, mainly in the upper respiratory tract.<sup>23</sup> According to Bidra et al., pre-procedural mouth rinse using oral preparation of Povidone-Iodine (PVP-I) in a concentration as low as 0.5% for at least 15 s can completely deactivate the virus.<sup>24</sup> The strong virucidal activity of povidone iodine can be effectively exploited by employing it as mouth gargle against COVID-19.<sup>25</sup> However lack of evidence-based research including randomized controlled trials warrants discretion before any final recommendation. Other chemical based mouth rinses advocated to disrupt the viral lipid membrane include ethanol, chlorhexidine, cetylperidinium chloride and hydrogen peroxide. However, their efficacy specifically against coronaviruses needs to be confirmed.<sup>26</sup>

During this phase, an Orthopantomogram (OPG) and cone-beam computed tomography (CBCT) are recommended rather than the intraoral radiographs to prevent salivary contamination.<sup>27,28</sup> But OPG lacks diagnostic precision and CBCT exposes the patient to a higher radiation dose as compared to an intraoral radiograph.<sup>29</sup> In house facility of taking digital radiographs is preferred rather than sending patients outside for this purpose.

**3.1.1.3. ZONE C: Non-aerosol generating area.** This section involves dentist performing those procedures where the use of airtor handpieces and ultrasonic scalers is not incorporated. Hence, priority is given to hand instruments such as spoon excavators and chemical-based caries removal agents. PPE is the sole effective method within the limit of administrative, environmental controls to prevent the spread of infection.<sup>30</sup> The donning and doffing should be done in the specified dedicated areas following sequential steps as lay down by CDC.<sup>31</sup> Four-hand dentistry with involvement of digital workflow is suggested.<sup>32</sup>

**3.1.1.4. ZONE D: aerosol generating area.** The use of high-speed hand pieces generates aerosols that are defined as particles which are less than 50 µm in diameter.<sup>33</sup> It has been postulated that aerosols have a tendency to remain suspended for at least 30 min even after the completion of the procedure and can reach up to 2 feet from the dental chair.<sup>34</sup> As the risk of transmission is high in this area and even the false negative rate of Covid Antigen test is around 30%, it becomes imperative to adopt universal precautions/OSHA guidelines.<sup>35,36</sup> Only essential items should be kept in open while maximum material and instruments should be kept in closed cabinets.

MoHFW has suggested avoiding switching on ceiling fans during such procedures; frequent servicing of air conditioners and; blocking the return air vents in centrally air conditioned operatories.<sup>9</sup> Use of carpets should be discontinued. However, in clinics that are already established and have a limitation due to lack of space and ventilation, it is advisable to filter the contaminated room-air using high volume evacuator and high efficiency particulate arrestor (HEPA) filters.<sup>37</sup> Although expensive option, the HEPA filters have been documented to remove 99% of particles measuring 0.3 µm in diameter.<sup>8</sup> According to the filtration efficiency, HEPA-13 or H-14 are recommended and the size depends on the total area of the clinic. However, it must be emphasized that these filters are an adjunct to the core strategies needed to combat the transmission. There is paucity in evidence-based research highlighting their role in COVID-19 era. Another recommendation, is the incorporation of the negative pressure rooms to treat the suspected or confirmed cases of COVID-19.<sup>38</sup> Sufficient ventilation, both mechanical and natural with the help of exhaust fans, is suggested to ensure dilution of viral load and expulsion of infected air.<sup>39</sup>

In addition to the above precautions, a prior COVID test for patients undergoing aerosol generating procedures is advisable depending upon the feasibility and resources available.<sup>40</sup> It is generally preferred to conduct such procedures during the latter part of the day or keeping a gap of 2 h before taking up the next patient. Eight o'clock chair position should be avoided completely to avoid direct contact with the splatter.<sup>6</sup> Rubber dams, low-speed anti-retraction hand piece and high-volume

suctions rather than chair side suction are highly recommended.<sup>39</sup> According to Peng et al., rubber dams are capable of reducing airborne particles by 70% within three feet wide operatory.<sup>32</sup>

### 3.1.2. Teleconsultation/teledentistry/videoconferencing

Teledentistry must be encouraged as the first mode of interaction between a dentist and a patient during the COVID era.<sup>41</sup> It serves as an effective means to evaluate the intensity of the patient's complaint, thereby categorizing the procedure into an emergency or urgent one.<sup>42</sup> Lending a patient ear to someone ensures ease in anxiety and fear amongst the distressed population.<sup>43</sup> It helps the practitioner to record a detailed case history without coming in actual contact with the patient. Education posters regarding hygiene or respiratory etiquettes, screenshots of updated Aarogya setu App can be shared between dentist and patient on the phone itself. Video call with the patient can also help to understand the situation better and guide them as required.<sup>44</sup> However, in view of difficult access and understanding in lower socioeconomic groups in India, this facility has limited significance. Other limitations include undue prescription of antibiotics and analgesics instead of treating etiology may sometime worsen the situation and expose the patient to a higher risk and side effects.

### 3.1.3. Guidelines for using facemasks and respirators

The selection of right mask in a “proper fit-checked” manner is an absolute necessity measure for the frontline workers while screening and treating the patient. The updated WHO guidelines (dated 6th June, 2020) calls for “targeted continuous medical mask use, which refers to the practice of wearing a medical mask by all health workers and caregivers working in clinical areas during all routine activities throughout the entire shift.”<sup>45</sup>

According to United States based National Institute for Occupational Safety and Health (NIOSH), the respirators are of three categories: R, P and N. According to the European standard, the respirators are divided into FFP1, FFP2, and FFP3 where FFP is an abbreviation for filtering face piece. The FFP2 is similar to N95 in its filtration capacity and it provides two-way protection.<sup>46</sup> Respirators with valves protect only the wearer while triple layer masks protect the people in surroundings not the wearer. Considering the high transmission rate of the virus, health workers should wear a respirator (N95 or FFP2 or FFP3 standard; or equivalent) especially during aerosol generating procedures.<sup>47</sup> Reuse of N95 and respirators with valve should be avoided as it has no evidence based recommendation.<sup>48</sup>

### 3.1.4. Disinfection protocols for dental clinics and laboratories

Prevention of cross infection and disinfection of the clinic and laboratory as well are essential steps to maintain a pristine environment by preventing the transmission. Chairside assistants, support staff and laboratory technicians should be trained and recruited on rotational basis with an aim to keep minimum workforce at a particular time.<sup>6</sup> Constant monitoring of staff involved in disinfection and waste disposal should be done to avoid any lapses in the protocol. COVID waste should be disposed in double layer bags, used PPEs should be disposed of in

yellow bin, biomedical waste management (BMW) should be done in accordance with latest guidelines given in the year 2016 and amended in 2018.<sup>49</sup> BMW generated during the screening, treatment, management and immunization from COVID-19 patients and healthcare staff working in wards should be segregated effectively.<sup>50</sup> Sodium hypochlorite solution in various concentrations (0.1%–1%), Ethanol (70–90%) and vaporized hydrogen are commonly recommended solutions for surface disinfection.<sup>51,52</sup> Additionally, the role of UV-C (wavelength = 200–280 nm) has been suggested as a method of terminal disinfection for dental clinics and laboratories.<sup>53</sup> The advantages of ultraviolet radiation is that it is safe, does not leave any residues, an effective alternative to dangerous carcinogenic chemical disinfectants, has a wide spectrum of germicidal activity and can be used in presence of human beings.<sup>54,55</sup> But still it has to be used on individual discretion as it lacks evidence for its specific action against corona virus.

### 3.1.5. Fumigation versus fogging

Fumigation and fogging are two methods used for disinfection of clinics and laboratory. In fumigation, formaldehyde solution is mixed with potassium permanganate in a fixed proportion. This combination gives rise to fumes, which are very effective in killing bacteria, fungus and their spores but formaldehyde is a known carcinogen, hence fumigation is obsolete now. Fogging can be done with the mixture of hydrogen peroxide and silver ion solution or third generation quaternary ammonium compounds (QACs).<sup>56</sup> It is a rapid, effective and residual-free method making it a more preferred protocol for clinic disinfection. This method of “no-touch surface disinfection” usually takes 45 min followed by contact time/dwell time of an hour. It is recommended to carry out these procedures where circulation of clean and natural air is possible post procedure.<sup>9</sup>

## 3.2. Prosthodontic considerations during covid 19 era

Dentists are bound by ethical obligation of treating patients even in times of emergency and personal obligation to keep their families and staff safe. MOHFW recommended postponing all elective procedures indefinitely and to manage only emergency procedures in red zones while urgent procedures can be done in orange and green zones (Table 3).<sup>9</sup> The implications of Covid in different sectors of dentistry have been depicted in Table 4.

### 3.2.1. Removable prosthodontics

This includes fabrication of complete and partial dentures. Age has been documented as primary risk factor for increasing COVID-19 mortality rate, compounded with the presence of co-morbidities.<sup>57</sup> Hence, a thorough medical case history is a must before starting any geriatric patient to evaluate risk versus need benefit. Completion of pending procedures must be given preference in comparison to starting of new cases to avoid unnecessary implications.

**3.2.1.1. Chair-side protocol.** Fractured prosthesis should be repaired by first disinfecting it thoroughly. Ulcerations or mucosal erosions can be

**Table 3**  
Management of Urgent Prosthodontic procedures.

Presentation/Condition	Consequences/risk	Intervention required
Mobile/Faulty prosthesis	Risk of aspiration	Removal with a crown remover
Fixed faulty prosthesis	Pain/Continued inflammation of underlying tissues/food impaction/source of infection	Removal with airtor/crown remover
Infection around prosthesis	Pain/Spread of infection	Removal of prosthesis
Perimplantitis	Pain/Spread of infection/Implant failure	Antibiotics/Curretage
Sensitivity/carries of abutment underneath fixed prosthesis	Pain/pulp exposure	Endodontic intervention
Fabrication of surgical and interim obturators	Problems in speech and deglutition	Impressions and delivery of prosthesis
Dislodged prosthesis needing recementation	Compromise in esthetics and function, pulpal sensitivity, Supraeruption of teeth	Recementation

**Table 4**  
The implications of COVID 19 on different sectors in dentistry.

<b>Clinical Implications</b>	<ul style="list-style-type: none"> <li>➤ Supra eruption of the opposing dentition if there was an ongoing tooth preparation and temporisation was not done.</li> <li>➤ Bone resorption around implants in case there is delayed prosthetic loading beyond 6 months</li> <li>➤ Continued resorption of the arches in cases where complete denture fabrication is delayed</li> <li>➤ Closing of partially edentulous span resulting in limited prosthetic space</li> <li>➤ Poor nutrition of geriatric patients due to missing teeth/fractured prosthesis/ulceration etc.</li> <li>➤ Unable to keep a track on follow-up cases resulting in attrition of data</li> </ul>
<b>Psychological implications</b>	<ul style="list-style-type: none"> <li>➤ Compromised aesthetics in patients with facial defects without prosthetic rehabilitation resulting in deep emotional impact</li> <li>➤ Delay in replacement of missing anterior teeth especially in young patients or children</li> <li>➤ Poor nutrition causing delayed repair and growth of tissues.</li> </ul>
<b>Financial implications</b>	<ul style="list-style-type: none"> <li>➤ Feeling of despair among the healthcare professionals and frontline workers<sup>65</sup></li> <li>➤ Less or no income while salaries have to be paid to the staff</li> <li>➤ Pending payments from the patients because of incomplete work</li> <li>➤ No timely payments to the laboratory</li> </ul>
<b>Academic implications<sup>66</sup></b>	<ul style="list-style-type: none"> <li>➤ No chair-side exposure and experience, clinical courses are being replaced by distance learning and online courses.<sup>67</sup></li> <li>➤ Research oriented studies and activities are at a compromise, as in-vivo studies are being replaced by in-vitro research<sup>68</sup></li> <li>➤ Lockdown, restriction on elective procedures, restrictions on taking radiographs etc has effected on going in-vivo studies<sup>69</sup></li> <li>➤ Lack of patient compliance and availability for follow up</li> </ul>

handled through tele consultation by advising some analgesic and antiseptic gels for local application and discontinuation of the prosthesis for the time being. Mild smoothing of sharp borders can be advised with sandpaper if patient can't come to the clinic. Patients should be recalled in the clinic on strict appointment schedule if any further adjustment of the prosthesis is mandatory to restore its function. Denture adjustment should be done using a low speed micro motor. New prosthesis should be fabricated if it is affecting the systemic health of the patient. Primary impressions should be made in well-fitting stock trays and secondary impressions should be made in custom trays which can be discarded after obtaining the master cast. One step border molding can be done to minimize chair side time.

**3.2.1.2. Laboratory protocol.** Record bases and wax rims should be adjusted on prior basis in order to avoid any modifications after insertion in the mouth. Care should be taken to minimize processing errors in lab and dentures should be remounted to adjust occlusion. This will ensure lesser follow up visits of the patient.

### 3.2.2. Fixed prosthodontics

The fixed prosthodontics includes fabrication of crowns and bridges, inlays, onlays, smile designing, veneers, full mouth rehabilitation, post and cores etc. These are elective and aerosol generating procedures. So, adherence to strict precautions and disinfection protocols is mandatory. Digital impressions using intraoral scanners is safe alternative but the cost-benefit ratio needs to be taken care of. Papi et al. have compared digital workflow with conventional workflow and concluded that digital method reduces human contact at multiple steps thereby decreasing risk of transmission of virus, saves time and improves efficacy.<sup>58</sup>

**3.2.2.1. Chair side protocol.** Use of rubber dam and high vacuum suction are recommended during tooth preparations where supragingival margins are planned.<sup>59</sup> This effectively wipes out most of the blood and saliva contaminants; also keeping the viral load to a minimum.<sup>60</sup> Clinicians should avoid any undercuts and under-reduction in their tooth preparations. Shade matching should be done by digital spectrophotometers and consent of patient should be taken. Intraoral photographs can be sent online to the laboratory to avoid any shade mismatch. Removal of fractured and faulty prosthesis using crown removers is advisable. Recementation of the dislodged prosthesis can be done, whereas adjustment of the temporary crowns should be done extra-orally using a micromotor. The dental tools such as air rotor and burs should be autoclaved as per manufacturer's instructions. Additional steps include working position of dentist at 11–12 o' clock, reduced air pressure in 3-way syringes, full protection PPE for both doctor and assistant, use of anti-retraction hand pieces and disposable

burs.<sup>6</sup> Frequent rinsing and spitting should be prohibited.

**3.2.2.2. Laboratory protocol.** Fomites can also lead to the spread of the virus.<sup>60</sup> Hence, impressions, which can act as route of spreading cross contamination between clinic and lab, should be disinfected (sodium hypochlorite 1% for ten minutes) and stored in disposable pouches.<sup>61</sup> If an external laboratory is involved, each work item must be separately stored in a sealed pouch and collected by the delivery boy. The delivery boy should also be provided with basic protective equipment. The prosthesis should be immersed in disinfectant before sending back to the clinic. Dentist can wash and store the prosthesis in a mouthwash before insertion in patient's mouth. Restorations should be fabricated on mounted models on an articulator. This will reduce the probability of repeating the procedure, time required for chairside adjustment, and use of micro motors or airtors. Consent for the final anterior restorations can be taken by sending the pictures to the patient before finalizing them.

Lab personnel and technician should practice physical distancing, hand hygiene and optimal disinfection. Computer aided designed and milled restorations should be preferred over conventional casting. Casting metal invariably involves generation of fumes and splatter. Also, digital workflow is proposed to minimize the salivary contact between different materials.<sup>58</sup>

### 3.2.3. Implant surgery & prosthodontics

**3.2.3.1. Chair side protocol.** Implant dentistry is the most fascinating and earning division for Prosthodontists these days. Deferring patients for placement of implants can lead to big financial and mental trauma to the dental and lab personnel. But implant treatment planning involves multiple dental visits which along with use of surgical aerosol generating hand pieces call for extreme precaution in regard to disinfection and infection control. Following recommendations are suggested by authors though personal discretion is a must. Healthy patients with no other co-morbidities can be taken up based on CBCT and virtual planning. During surgery, slow speed drilling with sharp drills is preferable. Intermittent external irrigation along with high volume suction should be done. Use of ultrasonic devices and piezoelectric surgery should be minimized; whereas use of osteotomes should be encouraged in order to reduce aerosol formation.<sup>62</sup> Immediate implants with immediate loading should be taken up wherever indicated as they require lesser time number of visits. It is advisable to avoid complex full mouth procedures. Digital impression with scan bodies is suggested as an alternative to conventional impression making.

**3.2.3.2. Laboratory protocol.** Implant impressions and components need to be carefully disinfected/autoclaved before reusing them.

**Table 5**  
Disinfection of various materials and equipment in a dental setting.

IMPRESSION MATERIAL	METHOD AND MATERIAL OF DISINFECTON
Alginate and Polyether (hydrophilic)	0.5–1% Sodium Hypochlorite (1:10 dilution) or 1:213 iodophors (Spray)
Zinc-oxide eugenol impression paste	2% Glutaraldehyde or 1:213 Iodophors (immersion) for 10 min
Impression Compound	Sodium hypochlorite (1:10 dilution) (immersion)
Rubber-base impression materials	2% Glutaraldehyde or Cidex
Wax rims	Iodophor disinfection sprays
Acrylic appliance	Povidone iodine/1% Sodium hypochlorite, store in mouthwash before use
Fixed prosthesis	Immersion in cidex, or 1% Sod. Hypochlorite
Gypsum casts	Microwave irradiation for 5 min at 100 W
Tips of intraoral scanners	Rubbing with alcohol based disinfectants

**Table 6**  
Summary.

<b>For the Clinician</b>
✓ Proper donning and doffing of the personal protective equipment
✓ Right selection and disposal of the facemasks
✓ Effective management of urgent and emergency procedures
✓ Strictly practice according to appointments (without overlapping)
<b>For the Patient</b>
✓ Hand hygiene, Follow respiratory etiquettes
✓ Updated and truthful information on Aarogya setu App
✓ Pre-procedural mouth rinse
<b>For the Clinic</b>
✓ A separate screening, donning and doffing room/area
✓ Work with minimal staff or rotation of existing staff
✓ Fumigation with a quaternary ammonium compound must be performed every day,
✓ Intraoral imaging should be restricted
✓ Biomedical waste management as per rules
<b>For the Laboratory</b>
✓ Proper disinfection of surfaces, floor, equipment, micromotors, burs
✓ High volume suction during trimming
✓ Delivery boy should take full precautions

Careful impression making using resin jig and precise pouring of the impressions are a must in order to prevent repetition of any chair-side step.

### 3.2.4. Intraoral and extra oral maxillofacial prostheses

Fabrication of surgical and interim obturators must be done at this time in order to restore the function of patients with intraoral defects. But owing to immune compromised status of post-operative carcinoma patients, they should be deferred for definitive obturator fabrication. Facial defects may act as esthetic urgencies for the patients who are going out of homes for their daily routines and have to interact with people. So, fabrication of extra oral prosthesis should be considered after assessing the risk benefit ratio. Additionally, psychological counseling and motivation for the maintenance of the prosthesis can be done through Teledentistry.<sup>63</sup>

### 3.2.5. Handling dental impressions

Dental impressions are a high risk source of infection transmission. Autoclaved stock trays should be used and material should be loaded carefully to avoid gag reflex. Impression should be kept under running water avoiding direct flow over tissue surface to avoid losing surface details. Spray disinfectant can be used for chair side disinfection followed by packing in zip lock bags before sending the impressions to laboratory for pouring. Recommendations given in Table 5 should be followed in the lab for disinfection as per the material.<sup>64</sup> Work authorization forms should be sent in separate zip lock bag.

## 4. Conclusion

The intent of this paper was to discuss the effect of COVID-19 on dental practice as it is a matter of global concern. Still dentists across the world are struggling with a plethora of questions, fear, dilemma and financial crisis. On one hand, it is affecting the mental health of the dentists while on the other hand; dental health and needs of the patients are at stake. Moreover, evidence-based recommendations are still lacking. Authors have attempted to consolidate the information available so far on this issue so that we can offer safe services to our patients and protect ourselves too from this deadly corona virus. The guidelines have been summarized in Table 6.

## Declaration of competing interest

None.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jobcr.2020.10.010>.

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