

## Prosthodontic procedural treatment consideration in pandemic situation: a review

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### ABSTRACT

The global spread of the coronavirus disease has put dentists, dental specialists, and staff, as well as patients, at danger of COVID-19 infection during dental procedures. The COVID-19 risk associated with prosthodontic dental treatment operations might range from low to very high. This article provides a helpful guide to prosthodontic treatment processes, including infection control and standards of care.

**Keywords:** prosthodontic, COVID-19, pandemic

### INTRODUCTION

The recently discovered coronavirus disease (COVID-19) that was first diagnosed in China has become pandemic as declared by World Health Organization due to its rampant spread throughout the world. This pandemic has affected every sector of human life worldwide and become international health crisis.<sup>1,2</sup> The symptoms of COVID-19 mostly include fever, myalgia, fatigue, coughing, and shortness of breath or dyspnoea along with abnormal chest x-ray diagnosed with lesions in multiple lung lobes.<sup>3</sup> Everyone is equally prone to this infection because of its transmission through air droplets that are transmitted by patients who cough and sneeze. People who are asymptomatic redundant could also be able to transmit the virus when in contact with other people.<sup>4</sup> Recently saliva of infected patients was found to contain COVID-19 virus. This can have a major role in the transmission of the virus.<sup>5</sup>

Due to the transmission of SARS-CoV-2 with long incubation period and possibilities of aerosol produced also oral fluids contact during dental procedures, both the dental healthcare professionals as well as the patients were put at high risk of cross infection.<sup>1,6</sup> Prosthodontist is going to face much more challenges because of high concentration of saliva contained in trays and dentures, also blood exposure during pre-prosthetic surgeries, implant placement and exposure to aerosols during tooth preparation for crown and bridge. Almost every prosthodontic treatment demands multiple visits by patients, which throws a unique challenge to ensure bilateral safety at every visit. As a result, the dental services were limited to the emergency and urgent cases during the early days of the pandemic.<sup>2,4,6</sup>

Dental laboratory service is an important feature of prosthodontic practice. Unlike other dental specialties, dental laboratory support is required in any type of prosthodontic care, from full dentures to partial dentures, crowns to bridges. It's critical to remember that dental laboratory work entails cooperation of the practitioner, assistant, laboratory supervisor, laboratory technician, and ending with the runner and doctor. The likelihood of contamination increases as the possibility of interaction between the team grows. Thus it is considerable for patients also practitioner to understand health protocols and personal prevention as we arrive in dental clinic.<sup>6</sup>

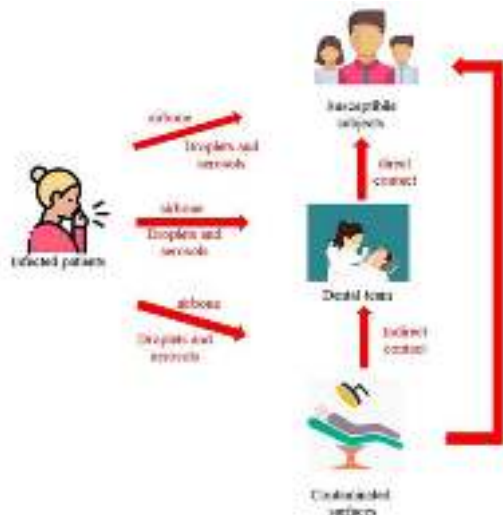
### Coronavirus

Coronavirus is an RNA virus with a diameter of 60-140 nm and spikes that give it a crown-like appearance, hence the name coronavirus. A few patients with serious pneumonia were presented to a hospital in Wuhan, China in December 2019.<sup>4</sup> This disease originated in Wuhan's wholesale seafood market, which also marketed wild animals. Coronavirus was described as having a 95% similarity to the bat coronavirus and a 70% similarity to the SARS-CoV. Human-to-human transmission began to occur later. Cases gradually increased, and it was discovered that this disease had a 1.8-day doubling period.<sup>4,6</sup>

### Pathogenesis of COVID-19

Adults and children of all ages are equally prone to this infection as the incubation period is generally from 0-24 days, hence person to person transmission may occur before any symptoms are seen in the patient. In the beginning of this virus outbreak, it was believed that coronavirus transmis-

sion may also be spread by touching surfaces and objects as in Fig. 1. Later on, WHO announced that transmission can occur more easily in the “Three C’s” which consist of crowded places with many people nearby; close-contact settings, especially where people have conversations very near each other; also confined and enclosed spaces with poor ventilation.<sup>2,7</sup>



**Figure 1** Three main routes for transmission of infectious agent (Source: Bizzoca ME, Campisi G, Muzio L Lo. Covid-19 pandemic: What changes for dentists and oral medicine experts? A narrative review and novel approaches to infection containment. *Int J Environ Res Public Health*. 2020;17(11))<sup>9</sup>.

Thus, disinfecting surfaces and regular washing hands are critical for preventing the spread of this disease. Several studies show people touch their faces regularly, on average 23 times per hour, and 44% of those include touching the mucous membranes of nose and mouth. As a result, hand washing with soap or hand rubbing with sanitizer should be done on a regular basis to prevent this transmission.<sup>4</sup>

Previous studies stated that angiotensin-converting enzyme-2 (ACE2) transmembrane receptors are found in the oral epithelium and salivary glands.<sup>8</sup> SARS-CoV-2 can penetrate saliva through three different routes: liquid droplets or drainage expectorate from the upper or lower respiratory tract that enter the oral cavity, serum containing the virus that leaks from inflamed gingival tissues into gingival crevicular fluid, and major and/or minor infections of the salivary gland(s).<sup>9,10</sup>

Aerosol-producing procedures in dental offices are a major source of concern. Fortunately, there is no evidence that the SARS-CoV-2 virus survives for long periods of time in the localized air flow. However, van Doremalen et al demonstrated that

the SARS-CoV-2 remained viable, within the aerosol, for 3 hours after being aerosolized.

To avoid the development of infectious saliva droplets, it's crucial to decontaminate indoor air, ensure proper air flow, and prevent cross-contamination through saliva droplets. These three acts, especially in the dental environment, can help to slow the spread of SARS-CoV-2.<sup>5,6</sup>

The protective measures that should be done in a dental context can be classified into the following categories, according to the COVID-19 recommended criteria 1) prior to dental therapy. Before entering dental office, dental team must provide patient triage. Identification of likely suspects, postponement of non-urgent dental care, appointment management, and active screening of dental staff are some safeguards that should be addressed before a patient enters the dental clinic.<sup>2</sup> Active patient screening, control of social distance in the dental office, providing sanitation steps to patients, use of facemasks by everyone in the dental office, patient education, use of personal protection equipment (PPE) by the dental team, and management of the dental operatory room are several procedures that are also necessary at dental offices during this pandemic situation;<sup>9</sup> 2) during dental therapy. During the treatments, clinicians must maintain hand hygiene, offer patients a preoperative antimicrobial mouth rinse, utilize rubber dams, high-volume saliva ejectors, and extraoral dental radiographs, implement 4-handed dentistry, avoid aerosol generating operations, one-visit therapy, and environmental cleaning and disinfection processes;<sup>2,11</sup> and 3) after dental therapy.<sup>2</sup> Following the treatment, cleaning and disinfecting reusable face protective equipment, as well as managing laundry and medical waste, should be considered.<sup>10</sup>

The complete clinical setup has been proposed to have distinct places for donning/doffing, a separate sterilizing room, and the segmentation of regions into distinct zones, as per the necessity of the hour. Its viability is contingent on basic infrastructure, total available space, number of auxiliary staff, and daily patient reporting.<sup>7</sup>

### **ZONE A: reception and waiting area**

This section is for gathering basic patient information utilizing particular clinic or institution-based protocols. This zone requires non-contact temperature recording, sensor taps, and contactless sanitizing dispensers.<sup>3</sup>

The patient is asked to take off any jewelry, watches, or other valuables and carefully sanitize their hands. Due to the standard of keeping physi-

cal distance, one attendant per needy patient is preferable. A triple layer facemask, disposable shoe covers, head cap and gloves should be provided to the patient. To prevent the passage of droplets between the patient and the staff, a glass barrier might be installed at the reception desk. The patient should complete a screening form as well as an informed consent form.<sup>6</sup>

Posters can be produced and exhibited to educate patients about hand hygiene, respiratory etiquette, and other topics. A pulse oximeter is a non-invasive, wireless finger tool used in the screening area to track substantial changes in arterial oxygen saturation in a fraction of the time, especially in asymptomatic people. If the oxygen saturation is less than 93%, a physician should be consulted for further examination. Other guidelines to follow include non-overlapping appointments with at least a 15-minute break, physical distancing, and digital payments.<sup>8</sup>

**ZONE B: Screening area**

In this zone, initial screening and diagnosis will be performed with sterilized devices. At the outset of the disease, the viral load is at its highest, mostly in the upper respiratory tract. According to Bidra et al, a pre-procedural mouth rinse utilizing a 0.5% concentration of oral Povidone-Iodine (PVP-I) for at least 15 seconds can totally deactivate the virus.<sup>4,7</sup>

Povidone iodine’s significant virucidal activity can be efficiently utilized by using it as a mouth gargle against COVID-19. To avoid salivary contamination, orthopantomogram and cone-beam computed tomography (CBCT) are advised instead of intraoral radiographs during this period. It is preferable to take digital radiographs in-house rather than sending patients outside.<sup>7</sup>

**ZONE C: Non-aerosol generating area**

This section features dentists doing operations that do not require the use of handpieces or

ultrasonic scalers. As a result, hand equipment such as spoon excavators and chemical-based carries removal solutions are prioritized. Within the limits of administrative and environmental constraints, PPE is the only effective strategy for preventing the transmission of infection. Donning and doffing should be performed in the designated regions in a systematic manner. As previously noted, four-handed dentistry with a digital workflow is recommended.<sup>1</sup>

**ZONE D: aerosol generating area**

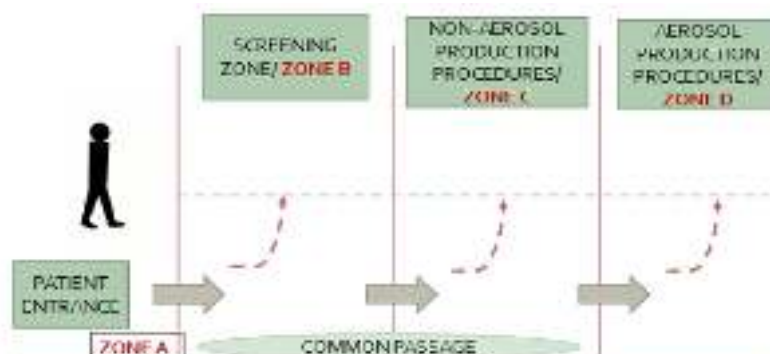
Aerosols are described as particles with a diameter of less than 50 µm created by the use of high-speed hand pieces. Aerosols are said to have a tendency to stay suspended for at least 30 minutes after the operation is over, and can travel up to 2 feet from the dental chair. Because the risk of transmission is considerable in this location, and the false negative rate of Covid Antigen tests is over 30%, universal precaution is required. Only the most essential items should be kept out in the open, with the majority of the material and instruments being maintained in closed cabinets.<sup>6,9</sup>

**DISCUSSION**

Dentists have an ethical commitment to treat patients even in emergency situations, as well as a personal commitment to keep their families and employees safe. This article will be concerning on prosthodontic treatment in pandemic situation. The prosthetic dental treatment procedures can be categorized as seen in Table I, from Rokaya<sup>3</sup> quoting Alharbi et al.

**Removable prosthodontics**

This comprises complete and partial denture creation. As a result, before initiating any geriatric patient, a detailed medical case history is required to assess risk against need benefit. To minimize unintended consequences, it is vital to prioritize



**Figure 2** Suggested operational clinic mechanism (Source: Pruthi G, Parkash H, Bharathi PV, Jain R, Gupta A, Rai S. Comprehensive review of guidelines to practice prosthodontic and implant procedures during COVID-19 pandemic. J Oral Biol Craniofacial Res [Internet]. 2020;10(4):768–75. Available from: <https://doi.org/10.1016/j.jobcr.2020.10.010>)<sup>1</sup>

**Table 1** Common urgencies in prosthodontic treatment<sup>3</sup>

Emergency Treatments	Urgent Treatments		Nonroutine Treatments	Routine Treatments
	Managed with Minimally Invasive Procedures and Without Aerosol Generation	Managed with Invasive and/or Aerosol-Generating Procedures		
<ul style="list-style-type: none"> <li>• Pain with diffuse infection-causing extraoral and/or intraoral swelling that can compromise the patient's airway</li> </ul>	<ul style="list-style-type: none"> <li>• Fractured prosthesis or soft tissue trauma from denture</li> <li>• Cementation of crown or bridge</li> <li>• Severe pain from tooth fracture from biting or trauma</li> <li>• Severe pain from pulpal infection or inflammation</li> <li>• Localized dental/periodontal abscess</li> </ul>	<ul style="list-style-type: none"> <li>• Fracture of removable or fixed prosthesis causing soft tissue injury</li> <li>• Debonded fixed prosthesis cleaning and cementation</li> <li>• Severe pain from tooth fracture that need to be managed by generating aerosol</li> <li>• Severe pain from pulpal inflammation that need to be managed by generating aerosol</li> <li>• Removable dentures adjustments for radiation therapy patients</li> </ul>	<ul style="list-style-type: none"> <li>• Removable dentures adjustments or repairs for normal patients</li> <li>• Asymptomatic fractured or defective restoration or prosthesis</li> <li>• Chronic periodontal disease</li> </ul>	<ul style="list-style-type: none"> <li>• Examination of the fully edentulous patient</li> <li>• Restorative treatments</li> <li>• Aesthetic dental procedures</li> <li>• Teeth bleaching</li> <li>• Dental implant surgery</li> </ul>

Sources: Alharbi, Alharbi, and Alqaide (2020).

the completion of ongoing proceedings over the start of new cases. Before repairing a fractured prosthesis, it should be thoroughly disinfected. Ulcerations or mucosal erosions can be treated via teleconsultation by prescribing analgesic and anti-septic gels for topical application and temporarily removing the prosthesis.<sup>8</sup> If the patient is unable to see the clinic, mild smoothing of sharp borders may be recommended. A low-speed micromotor should be used to adjust dentures. If the patient's systemic health is being harmed, a new prosthesis should be made. Primary impressions should be taken in well-fitting stock trays, while subsequent impressions should be taken in custom trays that may be discarded once the master cast has been obtained. To save chair side time, one-step border molding might be used.<sup>1,2,12</sup>

As for laboratory procedure, in order to avoid any changes following insertion into the mouth, record bases and wax rims should be adjusted beforehand. Dentures should be remounted to adjust occlusion and processing errors should be avoided in the lab. This will minimize patient follow-up visit.<sup>9</sup>

### Fixed prosthodontics

Crowns and bridges, inlays and onlays, smile design, veneers, complete mouth rehabilitation, post and cores, and other fixed prosthodontic procedures are all part of fixed prosthodontics. These are processes that produce aerosols. As a result, significant safety and disinfection measures must be followed. Digital intraoral scanner impressions are a safe option; however, the cost-benefit ratio must be considered.<sup>4</sup>

During dental preparations with supragingival margins, a rubber dam and strong vacuum suction are indicated. This successfully removes the majority of blood and saliva particles while also lowering the virus load. In their tooth preparations, dentists should avoid undercuts and underreduction.<sup>6</sup>

The patient's agreement should be obtained before using a digital gadget to match shades. To avoid any shade mismatch, intraoral pictures can be transferred to the laboratory via the internet. Crown removers should be used to remove a damaged prosthesis. Recementing the dislodged prosthesis is possible, but the temporary crowns should be adjusted extra-orally with a micromotor.<sup>11</sup>

Additional measures include the dentist's working position being 11–12 o'clock, lower air pressure in 3-way syringes, full PPE for both the doctor and the assistant, and the use of anti-retraction hand pieces and disposable burs. Rinsing and spitting on a regular basis should be discouraged. The propagation of the virus can also be aided by fomites. As a result, impressions, which can be used to transmit cross contamination, should be disinfected (sodium hypochlorite 1% for ten minutes) and stored in disposable pouches.<sup>4,9</sup>

### Implant surgery & prosthodontics

These days, implant dentistry is the most exciting and lucrative division for prosthodontists. However, implant treatment planning necessitates many dental visits, which, along with the use of surgical aerosol-generating handpieces, necessitates extraordinary caution in terms of infection control and disinfection. Authors encourage that

you follow their advice, but personal discretion is required.<sup>6</sup>

On the basis of CBCT, healthy patients with no other co-morbidities can be accepted. Slow speed drilling with sharp drills is preferred during surgery. External irrigation with high volume suction should be done on a regular basis. Ultrasonic instruments and piezoelectric surgery should be avoided, while the use of osteotomes should be encouraged to decrease the creation of aerosols.<sup>1</sup>

Immediate implants with immediate loading should be used wherever possible because they require fewer visits. Complex full mouth operations should be avoided wherever possible. As an alternative to traditional impression production, a digital impression with scanbodies is recommended. Before reusing implant impressions and com-

ponents, any implant component must be thoroughly disinfected or autoclaved,<sup>3,4</sup> and the prosthodontists must prevent repetition of any chair-side step.<sup>1</sup>

It was concluded that during prosthetic dental treatments, dentists, dental assistants, dental staff, and patients are all at risk for COVID-19 infection. The COVID-19 risk associated with prosthetic dental treatment operations might range from low to very high. As a result, prosthodontic/prosthetic dental treatment operations should be performed with high levels of care and infection control. Furthermore, there are still minimum evidence-based recommendations, but all of the relevant information on this topic have been compiled so that safe and update services to the patients have been provided while also protecting the clinicians from the virus.

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