

COVID-19 and Prosthodontic Practice: A Review

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ABSTRACT

Prosthodontists are more prone to various risk factors such as high concentration of copious amount of saliva in trays & dentures, exposure to blood during pre-prosthetic surgeries, implant placement and exposure to aerosols during tooth preparation for crown and bridge while practicing Prosthetic Dentistry. Due to various comorbidities, geriatric patients are highly prone to catch infections. Unlike other routine dental procedures prosthodontic treatment demands multiple patients' visits which throw a unique challenge to ensure bilateral safety and to avoid collateral damage at every visit.

Keywords: Prosthodontics, COVID-19, Aerosol, Impression, Cast, Prosthodontist

INTRODUCTION

A highly infectious pneumonia reported to spread in Wuhan, China from 12 December 2019.¹ In early January 2020, Chinese officials declared Novel coronavirus (COVID-19) as the causative pathogen of the disease.² The outbreak of the 2019 coronavirus strain (COVID-19) has led to increased stress and anxiety in the society; especially for head of the families due to increased responsibility of family care, future career, financial burden and crisis.^{3,4}

After the initial lockdowns imposed in most of the countries to curb the spread of infection; a series of unlock-down procedures were implemented in most of the countries to revive economy in a phased manner. During this period, most of the Prosthodontists started to reopen their dental practice rather than running out of income for expenditure, repayment of various loans, and payment of salaries to Para-dental staffs and to maintain desired social status. Since it is difficult to gauge how long this pandemic would last, it is important to be prepared for all scenarios. However, if the crisis continues indefinitely, Prosthodontists will have to reconfigure their clinical practice strategy to reduce capricious expenses, renegotiate unnecessary expenses and to focus only on the crucial essentials for survival.

Pathogenesis of SARS-CoV -2 Virus

SARS-CoV-2 is the seventh member of the family of corona viruses that infect humans.⁵ It is an enveloped positive-stranded RNA virus with a diameter of 60–140nm, spherical or elliptical in shape, and pleomorphic that shows a crown-like appearance under an electron microscope.⁶

Currently, the COVID-19 transmission routes are still to be determined, human-to-human transmission has been confirmed.⁷ The droplet mode of transmission while speaking, coughing, touching the virus contaminated surfaces and aerosols generated during clinical procedures are confirmed.⁸

COVID-19-related clinical symptoms can vary from case to case; the most common symptoms are fever, continuous dry cough, myalgia or fatigue. More severe cases have reported with abnormal chest computed tomography (CT) scan findings such as bilateral and peripheral ground-glass consolidative pulmonary opacities.⁹ Production of sputum, headache, diarrhea and hemoptysis are amongst the less common clinical symptoms.^{10,11,12}

Respiratory symptoms preponderate as they manifest after a mean incubation period of five days after virus inoculation. An increased risk of infection is found in patients with certain co-morbidities like hypertension, diabetes, and ischemic heart disease. In hypertensive and diabetic patients, circulating amounts of angiotensin converting enzyme-2 (ACE2) are increased. Moreover, some antihypertensive drugs act as ACE inhibitors which further increase ACE2 production and the virus binds to the host cell's membrane via ACE2 and there is an increased risk for infection.¹³ There is a wide variation between countries in the numbers of deaths and positive asymptomatic cases, with some reports indicating that approximately 80% of infected cases are asymptomatic.¹⁴ In approximately two thirds of the cases, the infection can progress to severe disease with respiratory failure; multi-organ damage like shock, arrhythmias, acute myocardial injury, acute liver injury, and sepsis.¹⁵ Considering the incubation period and to avoid transmission of virus from asymptomatic carriers various measures such as extended lockdown, social distancing, self-isolation and quarantine during COVID-19 pandemic may lead to an increase in the risk of mental health disorders, cardiovascular disease due to reduced mobility and increased risk of other medical conditions such as diabetes, which may subsequently influence patients' dental health and have significant implications for dentistry in terms of the role of patient's medical history, which will require further attention in the future.¹⁶

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Effects and Influence of COVID-19 on Prosthodontic Practice

While practicing Prosthodontics, in addition to droplets, procedures that mandate the use of high-speed hand piece or use of ultrasonic instruments for de-bonding various prostheses on patients may aerosolize the virus into the surroundings. Virus transmission can also occur through indirect contact by touching contaminated surfaces followed by self-delivery of virus to the eyes, nose, or mouth.¹⁷ After announcing COVID-19 as a pandemic by the WHO, The New York Times magazine published an article ranking the health professions at the highest risk of COVID-19 infection, amongst which dental professionals occupied the top of the ranking.¹⁸

In response to this challenging pandemic, the Center for Disease Control and Prevention (CDC), American Dental Association (ADA), the National Health Service (NHS), as well as other health regulatory bodies has provided advice to dentists to regulate dental services and to provide them with guidance in order to protect themselves, their co-workers, and their patients from this infection. The growing fear of cross infection, have obliged Prosthodontists to step aside and to confine themselves in home quarantine similar to other non-health care sectors of the population. In addition, there has been an increased demand for personal protective equipment (PPE), which consists of gloves, mask, face shield and gown. However, in case of COVID-19, additional equipment should be utilized including face protection, goggles, face shield, head cover, and rubber boots.¹⁹ An attempt should be made to triage all potential patients who require Prosthodontic care telephonically so as to reduce overcrowding of patients in the Prosthodontic clinics. Hence, exploring Tele-dentistry can be of a great assistance in this current pandemic situation.²⁰ Currently, various measures are being adopted to limit the spread of COVID-19. In Prosthodontic practice, apart from the universal precautions; following mandatory safeguards could be considered as extended treatment protocols [Guan et al].^{21,22}

Scheduling the appointment

Initial tele-screening all patients should be to identify suspected COVID-19 carriers. Before fixing an appointment, a detailed medical and travel history taking into account all symptoms of COVID-19 should be recorded and relevant associated questions should be asked via telephonic conversation. In case of a recent travel to any foreign nation, the appointment should be re-scheduled. Every patient should be considered as a potential asymptomatic COVID-19 carrier and also engaging recently recovered patients by considering them as potential virus carriers for at least 30 days after the recovery confirmation by a laboratory test. Any suspicion while tele- screening the patients warrants the maintenance of proper record, address, contacts details to defer their appointment to a minimum 2 weeks since the incubation period of this virus varies between 3-14 days. In case of doubt, the regional health care authorities should be immediately intimated without any delay. Additionally these

patients should be encouraged to self-quarantine at home and contact their primary care physician for necessary advice so that their viral load will be reduced so as to infect others.²¹

The incubation period of Sars-CoV-2 varies between 3 and 14 days; however, a 24-day incubation period has also been reported. Meticulous screening should be carried out on every patient by requesting them to fill out detailed standard questionnaire regarding COVID-19. Use of contactless thermal screening and use of pulse oxymeter devices to measure their O₂ concentration should be considered even if the patient answers no to the COVID related signs and symptoms during their appointments. Patients who seem fit for appointment after tele-screening should be advised to wear surgical face mask & gloves while visiting clinics and should be advised to come alone or with a single attendant at the time of their visit. Accompanying persons should only be allowed in case of emergency, major Prosthodontic procedure, pediatric patients and special cases like elderly and those who are medically or physically unfit. Patients should be instructed to arrive on time for their appointments. Appointments should be scheduled in such a way to minimize possible contact with other patients in the waiting room.

All Patients should be instructed for hand sanitization and proper hand washing as soon as he/she enters the clinic. Hand washing is one of the most frequently emphasized measures by World Health Organization (WHO) and other Health regulatory authorities to limit the spread of coronavirus. All personnel must be advised and encouraged to avoid touching their own eyes, nose and mouth every time. Use of alcohol-based hand rubs with at least 60% ethanol or isopropanol has also been documented as a simple and effective cross-infection control technique which can inactivate enveloped viruses, including coronaviruses.²³

Prosthodontic Clinics and the waiting area should be kept well ventilated at all times along with spaced out seating for the patients. Installation of enhanced air ventilation systems in the clinics can also help to facilitate removal of airborne pathogens from clinical environments and reduce the risk of infection.²⁴

Magazines, reading materials, and other items kept in the waiting areas which were used to occupy patient's time and mind while waiting for treatment in the clinics during pre-COVID -19 eras should be removed. Prosthodontists in his clinic should ensure that entire team is well versed with the universal precautions while instituting holistic care to their patients.²⁵

Scheduled appointments should be fixed in such a manner that there is enough time gap between two patients, making disinfection of clinic and sterilization of the instruments possible. Time overlap should be strictly avoided for proper implementation of the sanitization protocol. Whole of the Prosthodontic treatment instituting unit should be covered with disposable sheets that can be changed after every patient.

Protocols recommended during Treatment

While instituting Prosthodontic care to the patients the initial

step should be advising the patients to use the dispensed mouth wash to reduce the viral load in their mouth. The most commonly used mouth rinses in dental practices are chlorhexidine and essential oil-based products. It may not be as effective as 1% hydrogen peroxide or 0.2% povidone iodine as COVID-19 pathogen is more vulnerable to destruction by oxidation. Povidone iodine solution has demonstrated 99.99% activity when used against enveloped and non-enveloped viruses such as influenza, Ebola, MERS and SARS corona virus.²⁶

Intraoral X-ray examination is the most common radiographic technique in dental imaging; however, it can stimulate salivary secretion and coughing. Therefore, extra oral dental radiographies, such as panoramic radiography and Cone Beam Computed Tomography (CBCT), are appropriate alternatives during the outbreak of COVID-19. However if intraoral sensors are to be used, they should have double barriers to avoid cross contamination.²⁷

Healthcare professionals performing or assisting in aerosol generating procedures are at a very high risk of exposure.^{28,29} During the Prosthodontic procedures, isolation with rubber dam should be done. The use of Anti-Retraction hand pieces should be encouraged along with the use of high volume vacuum extra oral aspirating systems and high speed saliva ejectors so as to minimize aerosol dissemination.^{30,31,32} The use of disposable instruments for initial examination should be preferred to the most possible extent.³³ Working from 10 or 11 o'clock position is recommended. In order to avoid splatter, eight o'clock position should be avoided. Use of rubber dam during such procedures is recommended as it could significantly reduce airborne particles in approximately three-foot diameter of the operational field by 70%. Four-handed dentistry with high volume suction for aerosols should be implemented along with regular suction.^{35,36} Furthermore, air purification and sanitization before and after dental procedures should be done.

Properly autoclaved stock metal trays should be used for making oral impressions. Depending on the chemical composition of impression materials used different disinfection methods could be used to preserve the dimensional stability of the impression secured. Impressions made with Irreversible hydrocolloids should be disinfected with 2% Glutaraldehyde or 0.5% Sodium Hypochlorite or iodophors. Metallic paste impressions should be disinfected with Chlorine compounds or 2% Glutaraldehyde. Elastomeric impressions should be disinfected with Cidex or 2% Glutaraldehyde.³⁹ Dental casts and dies should be disinfected by immersing it in sodium hypochlorite solution for 10 minutes.

Dental Mechanics (Laboratory Technicians) should also follow stringent protocols while fabricating prostheses. Entry of laboratory personnel should be strictly monitored.³⁷ They should be permitted in the lab only after routine temperature checks.³⁸ Pulse oxymeter readings is also a good adjuvant in determining the present O₂ saturation and it is also considered as a good indicator on the existing respiratory condition of the personnel.³⁹ Functioning of Dental lab with

minimal working staff is also recommended along with other mandatory protocols like practicing social distancing, use of PPE kits with protective face shield and masks, frequent use of hand sanitizer, use of vinyl hand gloves and use of high vacuum suction during fabrication procedure of prostheses.³⁸

Protocols recommended after the completion of Treatment

Once the treatment is completed, again ask the patient to wash their hands before leaving. After which the whole dental surgery is disinfected along with replacing the protective coverings and tapes.

The clinical waste generated after treatment of COVID-19 positive patients must be regarded as infectious clinical waste and stored in clinical waste bags in closed containers within a designated area. Proper disposal of Dental waste and placement of instruments in the sterilization room should be done. Contaminated gowns, gloves and face shields should be properly disposed-off and replaced before calling any other patient for treatment.⁴⁰ The surface of the package bags should be marked and disposed according to the local regulations and requirement for the management of medical waste. It is crucial that Prosthodontic teams follow an effective and strict disinfection protocol for both clinical and communal areas frequently to minimize cross infection. The preferred use of PPE, N-95 Masks, frequent hand washing, disinfection of surfaces and social distancing though helpful cannot guarantee zero risk from COVID-19 but it can surely reduce the chances of contracting the disease. The Prosthodontists in comparison to other specialties faces less emergency cases in their field of specialization and specific treatment can be deferred based on priority.

Prosthodontic Emergencies

Although the word 'emergency' may not be applicable to prosthodontic treatment in the true medical sense, there are many situations in which a Prosthodontist's attention is urgently required as in the guidelines specified by American Dental Association (ADA). This urgent care is needed so that the patient without affecting his Quality of Life (QOL) could carry on with his usual activities without impairment in oral function or appearance.

Various Prosthodontic emergencies which warrants emergency appointment at Prosthodontic clinics include denture fracture which requires urgent repair of broken dentures, need for a temporary or immediate denture, repair and cementation of avulsed crown and bridges, adjustment of prostheses to avoid soft tissue trauma, various problems associated with implants and prostheses supported or retained on them. Commonly listed Prosthodontic procedures which require emergency care is tabulated in Table - 1.

The preventive methods which are routinely employed against COVID-19 virus, though helpful can't guarantee zero risk from infection but can surely reduce the chances. The prosthetic dental treatment procedures may range from low to very high risk for COVID-19. Hence, the prosthodontic/prosthetic dental treatment procedures should be done with standards of care and infection control following high

Common Treatment Procedures in Prosthodontic Clinical Practice				
Emergency Treatments	Urgent Treatments		Non-routine Treatments	Routine Treatments
Pain with diffuse infection-causing extra oral and/or intraoral swelling that can compromise the patient's airway	Fractured prosthesis or soft tissue trauma from denture	Fracture of removable or fixed prosthesis causing soft tissue injury	Removable dentures adjustments or repairs for normal patients	Examination of the fully edentulous patient
	Cementation of crown or bridge	Debonded fixed prosthesis cleaning and cementation	Asymptomatic fractured or defective restoration or prosthesis.	Restorative treatment
	Severe pain/extreme sensitivity from tooth fracture from biting or trauma	Severe pain from tooth fracture that need to be managed by generating aerosol		Aesthetic dental procedures
	Severe pain from pulpal infection or inflammation	Severe pain from pulpal inflammation that need to be managed by generating aerosol	Chronic periodontal disease or mild sensitivity of tooth	Teeth bleaching
	Localized dental/periodontal abscess	Removable dentures adjustments for radiation therapy patients		Dental implant surgery

Table modified from the Source: Alharbi A, Alharbi S, and Alqaidi S. Guidelines for dental care provision during the COVID-19 pandemic.⁴²

Table-1:

standard guidelines and recommendations for COVID-19.⁴¹ There is increased possibility that Dental clinicians and para dental staffs will be exposed to COVID-19 infected patients during COVID-19 pandemic. Therefore it has become all the more important for dental professionals to incorporate all precautions in their routine practice

CONCLUSION

In these extraordinary times, extraordinary measures need to be taken by all dental professionals. Prosthodontists, Para-Dental staff, other essential supporting staff, and patients are potentially higher risk of COVID-19 infection during Prosthodontic treatments. Dental team needs to update their knowledge and use of new approaches such as Tele-dentistry whenever possible to manage patients and to avoid the risk of cross infection. The chances of contracting COVID-19 are very low to very high while instituting holistic Prosthodontic care to the patients depending on the treatment protocols adopted in the clinics. Hence, the Prosthodontic procedures should be carried out following guidelines of care and infection control recommendations for COVID-19. Majority of the elective dental procedures can be postponed, however, by triaging and prioritizing treatment needs of the patients. Adequate treatment for acute patients who are in actual need of Prosthodontic treatment may be facilitated with utmost care so as to reduce the chances of propagation of COVID-19 in the community.

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