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Review Article

Implant Driven Prosthodontic Care in the Pandemic Era

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Abstract

The continuing pandemic has affected dental healthcare severely leading to clinical, psychological and financial repercussions worldwide with unforeseen consequences on dental professionals, patients and laboratory personnel's. Implant prosthodontics has been one of most predictable and fascinating division both for the patient as well as the prosthodontist. However most healthcare guidelines recommend only emergency and urgent prosthodontic procedures to be taken up. This scientific article focuses on the unique challenges associated with prosthodontic implant treatment with suggestions of successfully delivering the same to rightful recipients keeping a balanced approach so as to provide care in a way that minimizes harm to patients from delaying treatment as well as preventing any harm to personnel and patients from potential exposure to SARS-CoV-2 infection.

Keywords: Implant Prosthodontics; Treatment and Disinfection Protocols; Covid-19

Introduction

With the continuing covid 19 pandemic and variant strains attacking the population world over, it is of utmost importance that we continue to exert all possible preventive measures along with dedicated treatment protocols for delivering quality prosthodontic care to our clientele at large. This should be in consonance with the guidelines issued by the national and concerned state health departments for prevention and management of this disease. SARS-CoV-2, the virus that causes COVID-19, is thought to spread primarily between people who are in close contact with one another (within 6 feet) through respiratory droplets produced when an infected person coughs, sneezes, or talks. The newer variants make it challenging to completely understand the myriad clinical implications in varied population strata across the globe with relevant treatment efficacy.

All implant based prosthodontic procedures expose the dental surgeon and chairside assistants to the patient's oral cavity fluids i.e., saliva, blood, and respiratory tract secretions. Of these, saliva has a high viral load. Studies have shown the virus to persist in aerosols for many hours and on surfaces for days. SARS-CoV-2 can be spread by asymptomatic individuals. Many individuals despite having taken the double vaccination dosage as specified by the Ministry of Health and Family welfare, India (MOHFW)/WHO and having been infected once; have still acquired the infection again [1]. Also, with a lack of universal guidelines for dental care deliveries, there appears to be a new and different normal in every country.

Dental implants continue to remain the most promising method for replacement of missing teeth for improved quality of oral and overall life and elevated self-esteem. MOHFW India has been updating the guidelines with the changing dynamics of the disease. At present, only emergent and urgent dental procedures have been

recommended to be taken up. Also, no clear-cut procedures have been laid down for any dental speciality with respect to this viral disease.

Till date there have been no documented reports of transmission of COVID-19 from dental settings across the globe so far. With this scientific background it is suggested to practice patient centred and progressive dentistry following all laid down guidelines stringently; including the disinfection protocols; assessing the risk benefit ratio at all times thus safeguarding the health of all involved in any implant based prosthodontic procedure.

This scientific article highlights the WHO laid down guidelines with additional precautions to be taken while practicing implant prosthodontics during these challenging times.

Reasons for need of specific guidelines for practicing safe and effective implant prosthodontic care during covid-19

- Clinical implant prosthodontics involves the use of high speed hand pieces for implant placement that generates aerosol contaminated with the patient's oral fluids and other debris. Coupled with the above, the rare use of rubber dam or other isolation methods during surgery followed by other prosthodontic procedures warrants additional precautions.
- Various impression making procedures are fraught with contamination by oral fluids. The transfer of these impressions from the prosthodontists surgery to the dental lab involving multiple people in chain requires laid down protocols [2].
- In the dental lab, handling of these impressions, pouring of dental casts, wax up, casting, finishing, polishing, ceramic build up and other procedures must be followed with laid down sterilization and disinfection protocols to avoid spread of covid-19.
- Geriatric population form a large part of the prosthodontic speciality. Treating elderly patients with a compromised immune system calls for special consideration in these times [3].
- Every implant based prosthodontic treatment demands multiple visits by patients right from the diagnostic work up to the delivery of the final prostheses thereby posing a unique challenge to ensure safety for all involved during every visit.

Instructions to be followed prior to visit of patients seeking implant prosthodontic care at the dental centres

These are similar to the general dental health care instructions and should be disseminated widely to the dependant clientele via well displayed posters in the hospital settings/notices of local administrative authorities/television/telephonically etc. These include:

- The start of the OPD services of a dental hospital/surgery should be clearly mentioned. These in turn should be based on directions of the local administration so as to avoid a crowd and to ensure correct time spacing between the prosthodontic cases considering the time taken for the given procedure including time required for sterilisation/fumigation of the surgery.
- Implement Tele dentistry and Triage Protocols. Carry out a triage telephonically. If the patient reports symptoms of COVID-19, avoid non-emergent prosthodontic care and give suitable professional advice to tide over the dental problem the patient is seeking care for.

Instructions to be followed once patients enter the dental hospital

- Consider every patient as a potential asymptomatic COVID-19 carrier.
- Delay dental treatment for patients who have recently recovered from the infection by at least 30 days as they still pose the risk for transmission [4].
- Asymptomatic patients should also be carefully screened. Formulate a questionnaire pertaining to diagnostic relevance of COVID-19 and ask patients to fill them before the screening to avoid missing out on details. The questionnaire must include address, contact details of the concerned patient. Positive response towards presence of covid virus requires delay of appointment by two weeks to cater to the incubation period of SARS-CoV-2.
- For patients who report directly to the hospital, physically screen them at the screening cell placed at the reception of the hospital and follow the same procedure as mentioned for telephone triage above. Both the screening cell as well as the reception should have a glass/acrylic barrier to avoid transmission of droplets between patient and staff.
- Ensure that everyone entering the hospital wears a facemask to prevent spread of respiratory secretions when they are talking, sneezing, or coughing.
- Post a sign at the entrance of the dental hospital which instructs all individuals entering the hospital to self-assess for the presence of any of the varied symptoms of the ongoing covid-19 infection e.g. cough, sore throat, fever, sneezing, or

shortness of breath, myalgia, gastro intestinal symptoms, any form of skin rash etc for more than 24 hours to first consult their physician and get a relevant test done to rule out the viral infection. The number of accompanying attendants should be curtailed to only those who are necessary.

- Encourage Physical Distancing. Wherever possible, a minimum of 6 feet of distance between people should be maintained to prevent transmission of SARS-CoV-2. This can be done by opting for video-call applications between the patient and dental health care staff and limiting entry of visitors and patients to the hospital by giving appointments.
- Check for recent travel history of the patient to any region affected by the pandemic or if he/she cites history of having come in contact with a laboratory confirmed case of COVID-19. Reschedule appointments after the mandatory period of quarantine/test report.
- Keeping extra supplies for respiratory hygiene and cough etiquette that includes alcohol-based hand rub with at least 60% alcohol, tissues, and no-touch receptacles for disposal, at entrance, waiting rooms, washrooms etc will further assist in curtailing spread of the infection.
- Modify reception areas by having an enclosure with glass or clear acrylic as a barrier to limit close contact between the health care worker and potentially infectious patients.
- Remove objects that cannot be regularly cleaned and disinfected like toys, magazines etc from the waiting room.

Implement administrative controls and work practices while treating an Implant case to ensure safety for all

These would include the following:

- Patients keeping good health with no co-morbidities can be taken up for implant procedure based on CBCT and virtual planning.
- Create a process to respond to SARS-CoV-2 exposures among the dental health care staff and the visiting patients based on guidance from local and state health departments, testing availability and how rapidly results are available. Consider implementing pre-admission or pre-procedure diagnostic testing with authorized nucleic acid or antigen detection assays for SARS-CoV-2 which will help in scheduling the implant procedure or the need for additional transmission-based precautions while treating the patient.
- Drilling slowly with sharp drills aided with high volume suction is preferable during the surgery. The suction tip should be placed at the source of aerosol.
- Limit the use of ultrasonic devices and piezoelectric surgery to reduce aerosol formation. Prefer the usage of osteotomes.
- Immediate implants with immediate loading should be taken up whenever feasible to reduce the number of visits.
- Digital impression making with scan bodies is preferred as conventional dental impressions are a high-risk source of infection. Material specific disinfection and handling protocols for impression materials both in the surgery as well as the dental lab have been mentioned below in this paper.
- Only the essential clean or sterile supplies and instruments needed for the implant procedure should be kept outside. All other materials and instruments should be covered to avoid contamination by the aerosol generated during the surgical procedure. This is in accordance with the OSHA guidelines to reduce the risk of transmission which is high in the surgery during this procedure. The false negative rate of covid antigen test is around 30%.
- It is generally recommended to conduct this procedure either early morning or during the later part of the day keeping a gap of 2 hours before taking up the next patient.
- Avoid eight o'clock chair position to prevent coming in direct contact with the splatter. Rubber dams, low speed anti retraction hand piece and high volume suction are recommended to minimise the effect of aerosol produced.
- It is imperative to use a single patient treatment room/surgery with the door closed. To prevent cross infection immediate disinfection of the surgery is of paramount importance. Use fumigation or fogging for disinfection of the surgery. Formaldehyde used in fumigation is a known carcinogen, hence in many nations fumigation is becoming obsolete now. Circulation of clean and natural air in the surgery post the disinfection procedure is important.
- For surface disinfection, sodium hypochlorite solution in various concentrations (0.1%-1%), ethanol (70%-90%) and vaporized hydrogen are commonly recommended. Ultra violet wavelength; 280-300nm has also been employed.
- Placing the patient's head near the return air vents is another preventive measure. As suggested by the MoHFW, avoid switching on ceiling fans during such procedures. Frequent

servicing of air conditioners and blocking the return air vents in case of centrally airconditioned operatories too will be helpful.

- Prefer the use of the orthopantomogram (OPG) and cone beam computed tomography (CBCT) over the intra oral radiograph so as to prevent salivary contamination. Further it is better to use the in-house facilities for taking digital radiographs rather than sending patients outside.
- Limit the number of assistants to only those essential for the procedure giving preference to four-handed dentistry. The chair side assistants, support staff and lab technicians should be periodically rotated.
- Ask patients to rinse mouth with an antimicrobial product such as 1.5%-35 hydrogen peroxide, chlorhexidine gluconate, essential oils, 0.2% povidone-iodine or cetylpyridinium chloride before starting any procedure so as to reduce the level of oral microorganisms in the spatter generated during the clinical procedure [5].
- Select appropriate PPE in accordance with OSHA's PPE standards. During dental implant procedures, use of a N95 respirator or a respirator that offers an equivalent or higher level of protection such as the powered air-purifying respirators (PAPRs) or elastomeric respirators is recommended. Reuse of N95 and respirators with valve should be avoided.
- Equipment Considerations: These include:
- **Dental unit waterlines (DUWL):** The water circulating in the dental chair attachments should meet the standards for safety as laid down by the environmental Protection Agency (<500 CFU/mL) as well as be in consonance with the manufacturer's instructions. To minimise backflow of contaminated fluids from the oral cavity, anti-retraction valves should be fitted in the waterlines. Standard maintenance and monitoring of the waterlines is required by flushing for at least two minutes at the start and end of each day, and for 30 seconds between patients.
- Maintenance of autoclaves and other equipment's in the surgery or lab is to be performed as per manufacturer's instructions for use (IFU). Biological indicator with a matching control should be used for checking efficacy of sterilization. Optimize the Use of Engineering Controls in the dental hospital.
- Ventilation systems should provide air movement from a clean-to-less-clean flow direction since this reduces the distribution of contaminants. It is important to consult an HVAC (heating, ventilation, air conditioning) professional to assess the clinical air flow patterns for the hospital and accordingly determine air changes required per hour. An increase in the percentage of outdoor air supplied through the HVAC system and running bathroom exhaust fans continuously during busy hours will be helpful in curtailing the spread. A portable high-efficiency particulate air (HEPA) air filtration unit may be used as an adjunct during an aerosol generating procedure. Select a unit with a high clean air delivery rate. If the air conditioning is on a shared system, it must be switched off to reduce aerosol distribution to other areas. Whenever possible, open windows after the surgical procedure to help in aerosol dispersion. Position the HEPA unit near the patient's chair and make sure that the assisting staff is not positioned between the unit and the patient's mouth. Ultraviolet germicidal irradiation (UVGI) may also be employed for further disinfection [6].
- Environmental infection control measures should be adopted according to the Guidelines for Infection Control in Dental Health-Care Settings 2003. Manage laundry and biomedical waste in accordance with the latest policies and procedures given in year 2016 and amended in year 2018. It is important to monitor health of staff involved in disinfection and waste disposal.

Disinfection protocols for implant prosthodontic procedures

Several studies have shown that the dental impressions arriving in a dental laboratory are contaminated. Hence precise pouring of impressions is a must in order to prevent repetition. Professionals involved in handling them are extremely susceptible of cross contamination. SARS-CoV-2 virus has been reported to remain infectious in the surfaces from 2 hr up to 9 days at room temperature. The longest viability of this virus has been on stainless steel and plastic, with an estimated median half-life of approximately 5.6 hr on stainless steel and 6.8 hr on plastic [7]. Thus, adequate cleaning and disinfection of stock impression trays made of the above materials is a must to prevent contamination.

Methods of disinfecting impressions:

Liquid chemical disinfection either via spray or immersion is the most widely accepted method for eliminating potential patho-

gen microorganisms that are present on the dental impression surface. Care is taken that the chemical chosen does not affect either the dimensional accuracy or surface texture of the impressions and resulting gypsum cast. After spraying or immersing, the impression is kept in a sealed bag to create a charged atmosphere for the required contact time, then thoroughly rinsed with water followed by pouring of the cast.

- For impressions made with alginate material, ten-minute immersion time with 0.5 % Sodium Hypochlorite or iodophors or 2% Glutaraldehyde is recommended.
- For Elastomeric impressions, 2% Glutaraldehyde or Cidex is recommended with immersion time of 5 minutes.

Methods of disinfecting Trays and Cast Guidelines to be followed for this are

- Prefer usage of disposable trays
- Metal trays should be autoclaved
- Plastic trays/Bite rim should be immersed in 2% Glutaraldehyde solution for 10 mins
- Dental casts and die can be immersed in 0.5% Sodium Hypochlorite for 10 mins

Proposed guidelines for disinfection of implant prosthesis is as follows

It is of paramount importance that all implant supported dental prostheses should be thoroughly disinfected prior to handling both in the surgery as well as on acceptance in the dental lab and prior to insertion. The prostheses should be cleaned in an ultrasonic cleaner first followed by disinfecting with the undermentioned [8]:

- 1:10 dilution of sodium hypochlorite for 10-30 minutes
- 2% alkaline glutaraldehyde for 10 minutes
- 3% aqueous formaldehyde for 30 minutes.

The prosthesis should be rinsed and stored in diluted mouthwash before insertion.

Proposed guidelines for disinfection of the laboratory equipment/surfaces is as follows

Dental Labs need to use disinfectants containing virucidal agents that are effective against the coronaviruses including COVID-19. These generally include Hydrogen peroxide; Sodium hypochlorite; Isopropyl alcohol-based solution among others.

- Disinfect the laboratory surfaces using the disinfectant spray or surface wipes. Fumigation and fogging should also be done on a regular basis.
- Burs, polishing points, rag wheels, or laboratory knives can be heat-sterilized.
- Polishing attachments should be separate for all cases coming in the lab.
- Clean and disinfect the lathe machine daily.
- The use of pumice should be restricted to one case.
- Spray hospital-level disinfectant on articulators followed by rinsing.
- Non-sterilizable equipment's such as certain face bow components must be cleaned with soap

Employing digital prosthodontics while handling an implant patient

With a fully digital approach, the infection risk can be curtailed to direct contact of the patient in the dental surgery where the contamination can be ruled out by the use of PPE, surface disinfection and sterilization of the scanner tips [9].

Optical impression

The conventional impressions can be replaced by digital one's obtained using an intraoral scanner, saving time and reducing costs while ruling out the disinfection protocol. The other benefits include:

- It improves precision, consistency and accuracy of the impression.
- Enables visualization of coronal preparation in entirety which facilitates designing of the prosthesis.
- Allows for instant display and feedback for corrective procedures if necessary.

Computer-aided design/computer-aided manufacturing (CAD/CAM) technology

The benefits include reduced cost, decreased working time and lesser chances of error. Furthermore, in this the Standard Triangle Language Format (STL) file recorded by the intraoral scanner is received in real time by the dental technician, helping in designing the prosthesis which is then manufactured in closed automatic conditions using the CAD/CAM technology with limited human interven-

tion [10]. No physical impressions or materials/instruments need to be disinfected, no transportation is required, and the number of appointments is decreased. Hence whenever feasible, a fully digital approach should be preferred during the COVID-19 pandemic to limit infection risk in implant prosthodontics [11].

Digital Smile Designing through its state of the art videography and technology enables visualisation of existing aesthetic conditions and proposed changes allowing for better patient communication, education and management thus avoiding elaborate conventional protocols of studying articulated casts or wax mock ups.

Virtual articulators and digital facebows

Virtual facebow has substituted conventional facebow for relating the cast to an articulator with more accuracy thus minimizing possible errors for effective treatment planning and execution. The virtual articulator has replaced the manual articulator as regards the exhaustive analysis of static and dynamic occlusion of the patient.

Conclusion

SARS-CoV-2 disease has affected the entire world leading to widespread public health concerns. Prosthodontists may have to treat patients with suspected or confirmed SARS-CoV-2 infection and therefore need to be well equipped and informed for providing quality care as well as to prevent the further spread of this viral infection. Recommendations for practicing safe implant prosthodontic care has been suggested right from the time of patient screening to the varied infection control strategies, and patient management protocol in this scientific article.

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