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Short Communication

Innovative and cost-effective proposals for prosthodontist and dentist during covid-19 pandemic

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ABSTRACT

The COVID -19 virus has emerged as a threat to human existence. It has become the only trending topic on social media websites these days. To fight against this virus, we need armamentarium, which is in shortage in developing countries such as India. In this article, we shall discuss some innovative ideas that can be useful to a dentist and prosthodontist in fighting this deadly disease.

1. Introduction

Initial cases of COVID 19 pandemic were identified in Wuhan, the capital city of Huaei province, China, in December 2019. On 7th January 2020, the unknown etiological agent was identified as a novel enveloped RNA beta coronavirus, which is also called a severe intense respiratory system syndrome coronavirus 2 (SARS-CoV2). On January 30^{th}, the WHO declared it as a "public health emergency of international concern" (PHEIC), and on March 11 branded it as a pandemic.[1]

As of today, dated 7^{th} May, total number of corona cases reported worldwide is about 37,13,796, out of which 2,63,288 are said to be dead. On 30 January 2020, the first case of SARS CoV2 was identified in Kerala in India. Today, we have 52,952 reported cases, out of which 1,783 have lost their lives.[2] COVID-19 is likely to be zoonotic. However, several research studies are on to figure out the reservoir host and intermediate carrier that passed on the infection to humans. Originally, bats were thought to be a reservoir but human-to-human transmission is also well established through the close contact of positive or infected individuals as well as via droplet infection of the contaminated individual.[3] A fundamental principle is that the transmission of the virus is mostly with inhalation/ingestion/direct mucous contact with saliva droplets; it is likewise critical to keep in mind that the virus may survive on hands, objects or surfaces that were exposed to infected saliva of other surfaces. A recent study has proposed that this virus may survive on paper and copper for up to 4 hours to 48 hours, on steel they are viable up to 48 hours, and on plastic it is around 72 hours. Hence, oral health care workers appear to be at a greater risk as transmission may occur during dental procedures through inhalation of aerosol/droplets from infected individuals or direct contact with mucous membranes, oral fluids, contaminated instruments and surfaces.[4] The first case of a dentist being tested positive for COVID-19 was reported on 23 January 2020 at the Division of Preventive Dental Care in the Wuhan University Dental Hospital. Eventually, the transmission of illness was also noticed in other oral health

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care professionals.[5] If proper precautions are not taken, the dental offices/clinics can be a potential area of cross-contamination.

The screening of the patients by evaluating their travel history should be done at the pre- screening area. The suspected patients should be referred to the treatment centers for COVID-19. Keeping in view the risk being faced by prosthodontists due to COVID-19, this article shall discuss the precautionary and preventive measures to lower the risk to these oral health care professionals. It will also include valuable clues for the management of the patients through innovative techniques, in addition to discussing the standard recommendations available on various medical regulatory websites.[6–10]

2. Material and Methods

In this study, we have considered the material available on various medical regulatory sites. Around 25 online articles have been looked into various journals through the EBSCO, Scopus, Google scholar, Pubmed.etc search engines. In order to develop guidelines for prosthodontists during this pandemic, the following factors should be considered.

1. The incubation period of virus is believed to be up to 14 days; and transmission from asymptomatic COVID-19 carriers is possible (Bai et al., 2020; Guan et al., 2020; C.- C. Lai et al., 2020).
2. Aerosol and fomite transmission of SARS- CoV-2 is possible (Van Doremalen et al., 2020).
3. It is unclear yet, but COVID-19 recusancy might be possible and some virus strains can be present in saliva for as long as 29 days. (Barzon et al., 2016; D. Chen et al., 2020; Zuanazzi et al., 2017).
4. Some confirmed COVID-19 carriers might need urgent dental care at some point of time.
5. Appeal to non-emergency patients to postpone their treatment plans to avoid cross-infection caused by clustering in dental schools/colleges.
6. In case of a dental emergency; patients should wear masks for protection and minimize the number of accompanying persons as much as possible.
7. The body temperature of all employees must be taken before entering the workplace, and it should be forbidden to enter the workplace in case of illness.
8. Patient classified as emergency and non-emergency/elective procedures should be managed accordingly.
9. Maintain at least one meter (3 feet) distance between yourself and anyone who is coughing or sneezing. (Covid-19 Guidelines for Dental Colleges, Dental Students and Dental Professionals by Dental Council of India. By Dental Council of India.)[11]

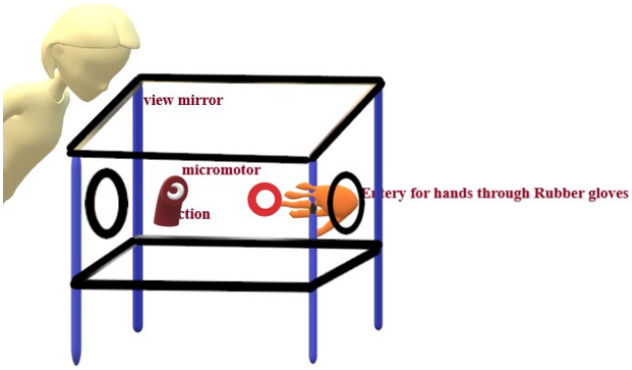

Fig. 1: Adjustment cabinet/unit

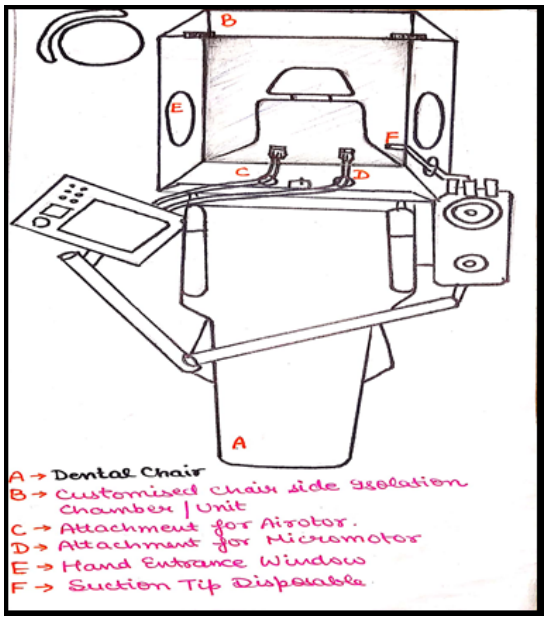

Fig. 2: Chair side trolley unit

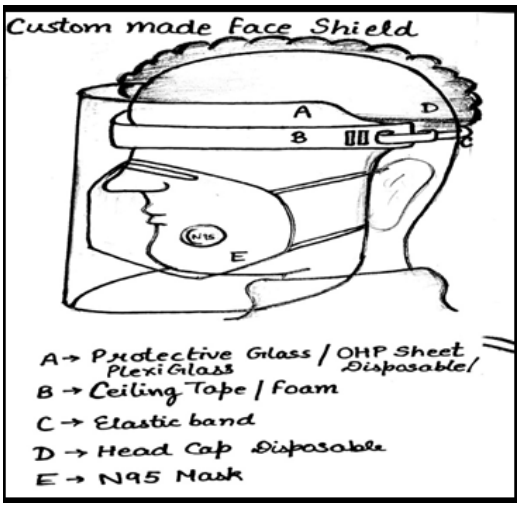

Fig. 3: Custom-made face shield.

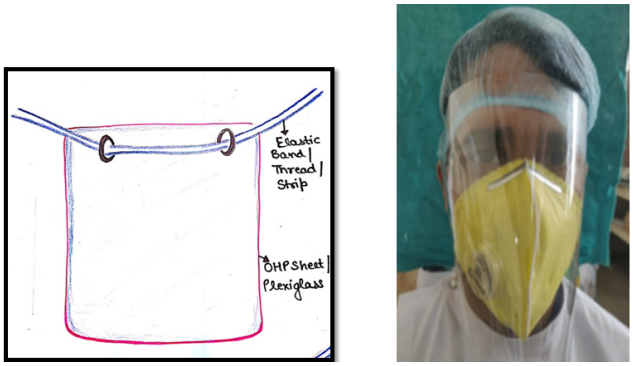

Fig. 4: Custom-made face shield with OHP sheet modification

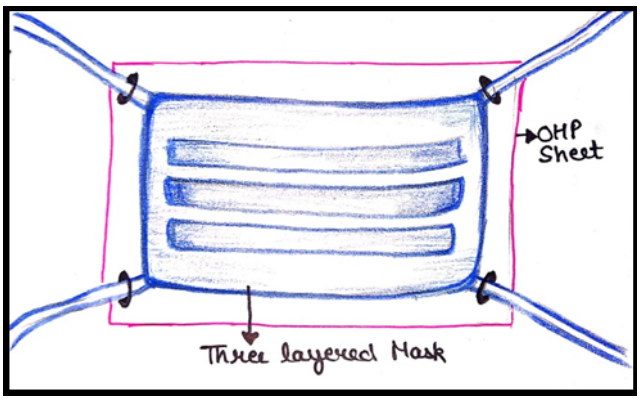

Fig. 5: Custom-made 3 layered masks with OHP sheet modification.

2.1. Suggestions for prosthodontic treatment environment

1. Old denture wearers visiting prosthodontic clinic can only be treated in case of emergency adjustments such as repair of fractured denture or a fixed bridge patient visiting the prosthodontic clinic for the adjustment of fixed prosthesis with the chief complaint of dislodge bridge, leading to difficulty in eating food. Maxillofacial patients visiting the clinic for emergency treatment, either of existing prosthesis or immediate interim prosthesis. These can be considered as emergency patients.
2. Every patient visiting the dental clinic should wear a minimal of two layered masks and maintain a minimum distance of one meter in the waiting area.
3. Before entering the operating area, the patient should be instructed for proper hand wash and use of sanitizer and mouthwash using chlorhexidine mouthwash.
4. The waiting area should be well ventilated and isolated.
5. The prescreening area should be disinfected by UV radiation and disinfectants.
6. The clinic area should be well wiped. Disinfect the surfaces, including floors with disinfectants, at least twice a day and immediately, if contamination is suspected.
7. After the treatment of a patient, the dental chair should be wiped with 75% ethanol/ disinfectants containing chlorine.
8. The operating prosthodontist should use precaution, including standard aerosol prevention protocol and use of personal protective equipment for procedures.
9. An operating prosthodontist should know how to wear personal protective equipment and how to remove them.
10. Correct disposal of generated waste into proper manner should be followed.
11. The denture to be adjusted should be stored in an EPA-registered hospital disinfectant for use against SARS-CoV-2 (Centers for Disease Control and Prevention) after removal from the patient mouth before proceeding for any adjustment.
12. Disinfect and sterilize aerosol producing equipment like airotor, burs, suction tips, tubes attached to the dental chair through the decontamination technique, which includes rinsing with water, washing with detergent and drying it, followed by autoclave sterilization in a Class B autoclave.[12] Burs should be discarded after use or can be autoclaved.[13]
13. Fumigation of clinic area and other nearby areas should be done at the end of the day as per manufacturer's instruction, based on the type and area of dental clinic room. Fumigation should be done on daily basis and in high contact area it should be done twice in a week.
14. Avoid use of air conditioner in public areas.
15. Use of UV chambers for storing the equipment.
16. Portable Adjustment trolley should be kept at a distance from the dental chair. To prevent the aerosol spillage of dust, the trolley is attached to high vacuum suction.

2.2. Innovative custom-made armamentarium to fight the covid-19 pandemic

In times of shortage of the essential protection equipment armamentarium due to current lockdown, it is wise to promote a custom made approach to fight against the pandemic. The self-protection of health care workers can be also act as an alternative. This way, any emergency situation can be handled without undue stress. For example, it could ease the treatment of elderly patients needing prosthodontic care in these tough times.

Following are the innovative and cost-effective proposals for safety of prosthodontists and dentists.

1. Custom -made disinfectants

2. Custom -made sanitizer
3. Custom- made Personal Protective Equipment (PPE) kit
4. Custom -made working trolley
5. Custom- made face shield.

2.3. Custom -made Disinfectants

Surface disinfectant can be used to clean soiled surfaces, medical equipment, bedding, and reusable protective clothing before it is given to laundry. It can also be used for disinfecting aprons, boots before leaving the clinical area.

Contaminated waste can also be rinsed with this custom made disinfectant before disposing off to protect other health care workers. To prepare 10 liters of custom made surface disinfectant (1%Hypochlorite solution), we have to add 1 tablespoon (16 grams of 30 % bleaching powder alongwith active chlorine) in 10 liters of distilled water cane.[14] This is more effective and less costly than commercially available disinfectants.

2.4. Custom-made Sanitizer

To make 1 liter sanitizer, you need 70% Isopropyl alcohol (blue sprit which is easily available at medical shops). Add 935 ml of this spirit to 50 ml of 3% Hydrogen peroxide along with 15 ml of glycerol. Adding glycerol has an additional benefit of keeping the hand moist. Another method to prepare 1 liter sanitizer is to add 833 ml 96 % ethanol in 42 ml of 3% hydrogen peroxide. In this solution, 145 ml of 98% glycerol is added for the same benefit as stated above.[14] This custom-made sanitizer can be made on a daily basis and is more cost effective than commercially available ones.

2.5. Custom- made Personal Protective Equipment (PPE) kit

Several fluid resistant and impermeable clothing options are available in the market for healthcare professionals.

Non-sterile, disposable patient isolation gowns, which are used for routine patient care in healthcare settings, are appropriate for use by healthcare professionals when caring for patients with suspected or confirmed COVID-19.

Reusable gowns can be made of polyester or polyester-cotton fabrics. Gowns made of this fabric can be safely reused after rinsing in customized disinfectants, followed by proper autoclaving. Routine inspection and maintenance of these customized gowns is needed.[15]

2.6. Custom-made working trolley

The emergency treatment of elderly denture-wearing patients or fixed prosthetics patients, who have trouble in eating food, can be carried out in the prosthodontic clinic, by following precautions and the guidelines mentioned above. The use of custom-made adjustment trolley and chair side working unit is an innovative idea to decrease the risk of transmission to the operating prosthodontist and cross contamination among other patients.

2.6.1. Adjustment cabinet/unit

Due to the sudden lockdown on account of COVID pandemic, we were not well prepared for the fight. With the alarming increase in cases, especially in the developing world that has a large population and limited resources, we have tried to make an adjustment cabinet that can be helpful in rearranging dentures and dislodged fixed/ removable prosthesis. Such tables can be designed by using plastic/wooden stands covered with aluminum foil/ transparent foil, which can be replaced after each patient. The unit is made of glass with inlets fixed with gloves and high-power suction. The unit comes with a micro-motor attachment to contain dust and keep cross contamination under check. The diagrammatic representation of this custom-made adjustment cabinet/unit has been explained in figure no-1.

2.7. Chair side trolley units

This is also an innovative technique to prevent aerosols during the procedure. The top unit on the trolley, as described above, can be made of glass, which can be disinfected after each patient as per guidelines. The suction, airotor and micro-motor attachments can be fitted inside so that during the aerosol procedure the dentist and their coworkers can be kept infection-free and the area can be kept sanitized. The units are provided with two inlets for gloved hands to work and hold the mouth mirror or intra-oral camera. These custom-made units can be disinfected after each use by a patient.

The chair side trolley is fabricated in such a way that it covers the till chest area of the patient and has inlets for air-rotor, micro-motor, suction for operator's hands. This will prevent the spread of aerosol and minimize exposure to operating prosthodontist and cross contamination of the patient.

The custom-made adjustment trolley is made with PVC pipes, covered with cling sheets/ aluminum foil which can be changed after each patient. There is an adjustment chamber with inlets for heavy suction, micro-motor attachment and rubber gloves with proper ambient lightening for carrying out treatment procedures during emergency. This can be moved away easily from the operating area.

After every patient, the working chamber can be disinfected and reused for the next patient. The diagrammatic representation of custom-made chair side trolley unit has been explained in figure no-2.

2.8. Custom-made face shield

2.8.1. Protection shield

In developing countries like India, the dentists are fighting against COVID 19 and the protection armamentarium is limited. So, we decided to provide protection by using an inexpensive custom-made shield to protect from aerosols and any other volatile or acrylic dust while carrying out an emergency procedure. The shield can be made using Over Head Projector sheet (OHP, A4 size, Oddy 175 micron interleaved clear transparent polyester film, Delhi, India) and plexiglass(Kapoor Plastics, Delhi, India). The stock helmets also being used as face shield are available in the market which are much costlier than our customized options. The OHP sheets/ plexi-glass can be tied with the help of an elastic band or can be fixed to the disposable head caps, using two-sided tapes as shown in the figure no-3, 4.

The OHP sheet can be punched with punch cutter and can be used with a three-layered mask, using the strips of mask to tie around face and use of elastic band to stabilize the custom-made protection shield as shown figure no-5.

3. Conclusion

The pandemic has been proosed an alarming danger to the human society. With limited resources and problems during the lockdown, oral health workers are only providing emergency treatment to the needy patients. In order to treat these special patients, including old patients who are under more stress and face greater risk, we have come up with the idea to treat such patients in the prosthodontics clinics by using such custom-made armamentarium. This way, one can protect the operators and patients, and also contain cross contamination from aerosols/ dust/ infections. This will be help the needy patients so that they can maintain their health by having good nutrition. More research is needed to improve and innovate the clinical areas. There are various limitations but one can deal with these through innovations.

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5. Conflict of Interest

The authors declare that they have no conflict of interest.

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