

INFECTION CONTROL MEASURES AGAINST COVID-19 PANDEMIC IN DENTAL RADIOLOGY UNIT: A REVIEWTahera Tarek Syed^{1*}, Nikhil diwan² and Vinod V. C.³¹Post Graduate Student, Department of Oral Medicine and Radiology, M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, India.²Professor, Department of Oral Medicine and Radiology, M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, India.³Professor and Head Department of Oral Medicine and Radiology, M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, India.***Corresponding Author: Dr. Tahera Tarek Syed**

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ABSTRACT

Dental health care professionals are at greater risk of cross-contamination during dental procedures. The risk of cross-contamination is high in Dental Radiology unit and which can be a source of COVID-19 transmission, if proper disinfection techniques are not applied. Dental health care professionals should follow standard guidelines to protect themselves from coronavirus.

This review provides all infection control measures which can be taken by dental health care professionals in Dental Radiology unit during COVID-19 pandemic.

KEYWORDS: Dental Radiology, COVID-19, Infection control.**I. INTRODUCTION**

Since the discovery of coronavirus disease (COVID-19) in the city of Wuhan, China, the whole world have been trying to deal with this serious pandemic conditions.

On 9 January, 2020 the World Health Organization declared the discovery of a new coronavirus, first called 2019-nCoV and then officially named SARS-CoV-2 and on 11 February, the respiratory disease deriving from SARS-CoV-2 infection was named coronavirus disease (COVID-19).^[1]

The incubation period of SARS-CoV-2 to be 1 to 14 days which is also the duration of medical observation and quarantine in exposed patients.^[1] The SARS-CoV-2 spreads predominantly through respiratory transmission of an infected person's aerosol and droplets during cough, sneeze, talk.^[1] Common symptoms may vary from the presence of fever, cough, fatigue shortness of breath or breathing difficulties, conjunctivitis, sore throat, diarrhea, vomiting, and muscular pain.^[2, 3] In patients who develop pneumonia ground glass opacity and patchy shadows can be detected on CT.^[4]

COVID-19 complications include respiratory distress syndrome, arrhythmia, and shock^[2, 5] and these complications are commonly seen in older age group and the presence of comorbidities.^[6,7,8]

'The New York Times' on 15th March 2020 published an article "The Workers Who Face the Greatest Coronavirus Risk" mention that dentists as the professionals are most susceptible to the risk of being infected by COVID-19. (Figure: 1)

Dental professionals face an especially greater risk of occupational exposure to COVID-19 due to saliva, blood and aerosol/droplet production during the majority of the dental procedures.^[1]

Dental radiographs are used as a part of routine examination in every field of Dentistry to rule out many dental diseases. Periapical, bitewing, occlusal and panoramic radiographs are the most common radiographs used in the dental radiography unit.

Several studies have confirmed that cross contamination occurs in dental radiology unit during the exposure and processing of films. According to Rahmatulla et al.^[9] mentioned that most high touched areas in dental radiology unit are dental chair headrest, chair adjustment buttons, X-ray cone, exposure control knob, timer switch, the radiographic film placement area in darkroom, the radiographic film feeding area in the automatic film processor and the revolving door to the darkroom are contaminated while taking radiographs and

concluded that the disinfection of high touch areas of the x-ray equipment is mandatory.^[9]

The Oral Radiology unit of dental colleges/ institutes can be a source of COVID-19 transmission due to cross contamination especially between dental health care

personnel and patients during radiographic procedures.^[10]

This paper describes specific infection control measures that are recommended to decrease the risk for cross contamination in Dental Radiology unit and reduces the COVID-19 transmission.

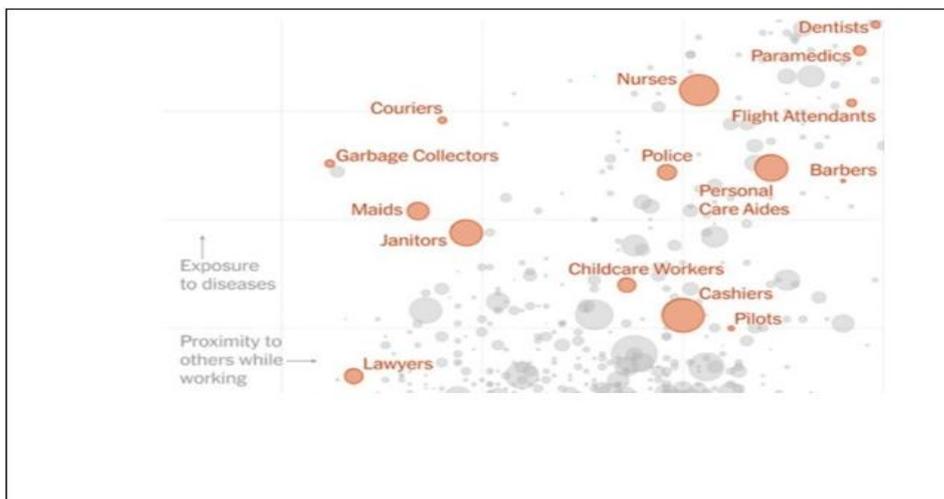


Fig. 1 Pic. courtesy: The New York Times.

I. Infection control measures for environmental surfaces

According to the research, SARS-CoV 2 virus can survive on inanimate surfaces for 4 hr to 7 days, depending on the temperature, humidity, type of surface and virus load.^[11]

Environmental surfaces can be divided into two groups

1. Minimal hand contact surfaces (e.g. floors and ceilings)
2. High touch surfaces, those with frequent hand-contact (e.g. Counter tops, tables, chairs, handrest, light switches, walls, sinks and computer peripherals etc). These surfaces are more likely to be contaminated and must be properly cleaned and disinfected. Surfaces that should be commonly disinfected in radiology unit are mentioned in table 1.

World Health Organization (WHO) recommended that outpatient/ambulatory care rooms and high touch

surfaces should be cleaned and disinfected after each patient visits and low touch surfaces should be cleaned daily. At least one terminal clean every day is recommended.^[12,13]

The recommended concentration of hypochlorite is 0.1% (1000 ppm) for general environmental surfaces and 0.5% (5000ppm) for blood and body fluids, 70-90% ethanol and greater than 0.5% hydrogen peroxide can be used for disinfection. A minimum of 1 minute contact time is recommended for these disinfectants or as recommended by the manufacturers.^[12]

Fumigation or misting is not recommended for disinfecting to environmental surfaces in COVID-19.^[12]

Cleaning equipment should be well maintained and disinfectant solutions must be discarded after each use. Fresh disinfectant solution must be prepared for each cleaning shift.^[12]

Table:1 Surfaces that should be disinfected in radiology unit.

Workarea/ tables top Dental chair’s headrest, handrest Chair adjustment buttons X-ray machines Tubehead X-ray cone Control panel Exposure button Darkroom equipment and surfaces, Processors/ solutions, and Any environmental surfaces contacted by gloved hands, contaminated film packets, or devices used in the mouth

II. Infection control measures for staff and patients

- During radiography procedures Dental radiology staff (radiologist, technician, interns, residence) should follow minimal personal protective equipment (PPE), which include disposable surgical mask, cap, gloves, long-sleeved gown, face shield.^[14]
- The staff must be trained for donning and doffing procedures of PPE and proper hand hygiene must be maintained before and after use of PPE.¹⁴
- Hand accessories, rings etc are strictly prohibited for health care professionals during procedures and it is also recognized that beards decreases efficacy of FFP2 mask.
- In Radiology unit, patient crowd in waiting areas should be avoided, appointments should be followed.
- To minimize staff exposure to the patients, shift work should be applied and the appointments must be spaced out (15-30 min) to leave adequate time for disinfection of equipment.

III. Infection control measures in dental radiology unit

1. General considerations:

- Prior to film exposure, dental radiology unit should be prepared using an aseptic technique, one which would break the chain of infection and prevents cross-contamination.
- To minimize cross contamination, staff must follow unit dosing before radiographic procedures.

What is unit dosing?

*All necessary equipments, instruments, supplies should be prepared before the start of the procedure, only the amount of necessary equipment required for each procedure should be dispensed. Unit dosing reduces both chairside time and dental health care personnel's contact with environmental surfaces.*¹⁵

- Most frequently in dental radiology unit, semi-critical (contact with mucous membrane) or non critical (contact with skin) instruments/equipments are used.
- Reusable semi-critical items e.g. bite guides, film positioning devices and reusable non-critical items such as chinrest, hand grasps must be sterilized with high- level disinfectants after each use and it must be covered with barriers like plastic wraps, sheets, adhesive edges etc during procedures, which must be discarded after each patient.^[15, 16, 17]
- Use low level disinfectant for lead apron, thyroid collars (e.g. quaternary ammonium compounds).^[11]
- During radiographic procedures, staff should be aware to minimize the positioning and exposure errors, in order to eliminate the need for repeated exposures which may additionally increase the risk of contamination.
- The patient should rinse with a pre-procedural mouthwash prior to any dental procedure, which has

been shown to reduce viral load.^[18] Considering the close contact of mucous membranes during panoramic, CBCT, and intraoral radiography, we recommend preprocedural oral rinsing.

- Dental radiology staff should follow proper hand hygiene prior to radiographic procedures. In this pandemic condition before radiographic procedures some precautious measures (table: 2) in dental radiology unit should be followed, which reduces the spread of the virus.

I. Extraoral radiography

- During this pandemic, in dental radiology unit extraoral imaging should be preferred and intraoral imaging is restricted. This help to reduce excess salivation and to avoid gag reflexes, both these factors are potential contributors to the spread of the virus.
- The quality of an extraoral digital panoramic radiography should be improved for better diagnosis of subtle caries, an estimation of the position of alveolar crest and periapical changes. For example, With the help of bitewing function on a dental panoramic machine is an orthogonal view, which improved separation of contact points better than a conventional panoramic radiograph by using improved interproximal angulation projection geometry.^[19] The extraoral bitewing was much clearer and these images have a better alternative to sectional panoramic radiographs for diagnosis.^[19]

a) Panoramic imaging

To minimize the exposure following measures should be followed^[15,16,17]

1. Registration of the patients should take place outside from procedure room, and the patient must remove all metal accessories (nose rings, earrings, neck chains, hair clips etc) and dentures before entering the procedure room.^[15,16, 17]
2. Before accepting the patient, the panoramic radiography room must be prepare, the machine should be turned on and the rotating component of the machine should be returned to the start point. If conventional films or storage phosphor plates are used, the cassette should be placed before accepting the patient.^[15,16]
3. All semi-critical and noncritical items (table: 3) should be barrier protected with plastic sheets or wraps and should be changed after each patient.^[15,16,17]
4. Bite- guide must be covered with disposable plastic sheet or wraps/disposable bite-guides must be employed and change after each patients.
5. Intermediate level disinfectants (70% ethyl alcohol, 70% isopropyl alcohol) can be used for disinfecting non-critical items.^[15,16,17]
6. For conventional films and storage phosphor plates, the cassettes should be held with clean gloves during transfer to the work station or darkroom. If in case of physical contact with the patient during

positioning, the gloves must be changed before taking the cassette out after exposure.

Table: 2 Precautionary measures.

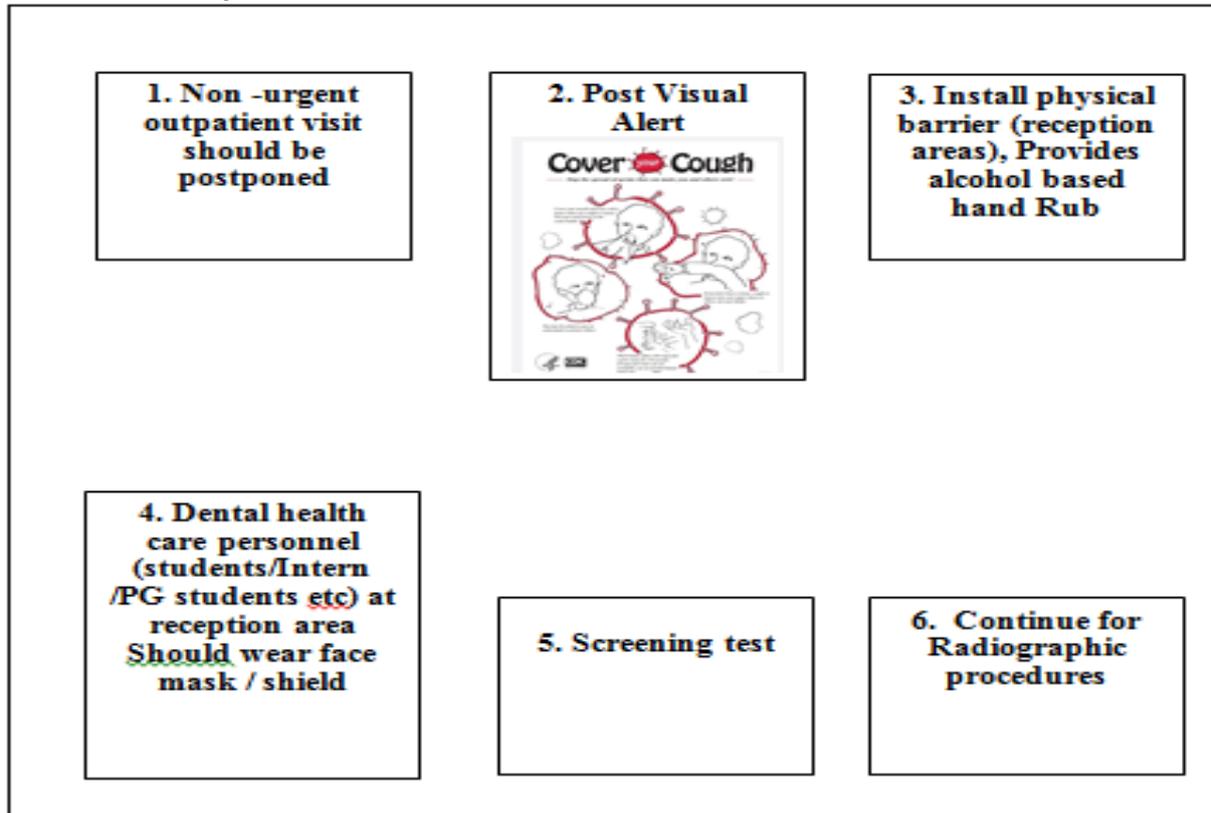


Table: 3 Semi-critical and Non-critical items that should be disinfected or barrier-protected in panoramic imaging/ CBCT imaging.

Bite- guide
Chin rest
Handgrips
Head positioning devices/ head stabilizers
Remote switch
Control panel
Chairs if patients need to be seated

b) CBCT imaging

- Same infection control measures also apply for CBCT imaging which we discuss in panoramic imaging.
- Semi-critical and non-critical items (table: 3) should be barrier protected as described above and disposable bite guides must be used if barrier-protection or sterilization is not possible.

the waste bin. If this procedure is performed by the staff, he or she should don gloves before removing the contaminated item and the gloves should be discarded and hands washed properly.

Protect Bite guides

- The main infection control concern when taking a panoramic/ CBCT radiograph is the bite guide protection.
- Bite guides should be barrier protected (figure: 1) or disposable and reusable heat-tolerant bite guides provide other options. If barriers are used, they should be placed before positioning the patient.
- After the procedure, ask the patient to dispose the barrier on the bite guide (figure: 2) and place it in

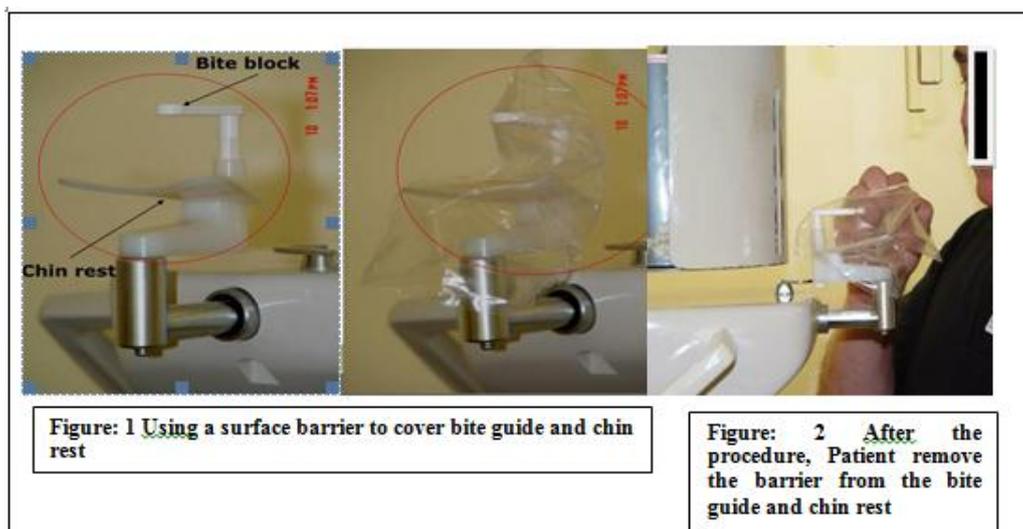


Figure: 1 Using a surface barrier to cover bite guide and chin rest

Figure: 2 After the procedure, Patient remove the barrier from the bite guide and chin rest

II. Intraoral radiography

If procedural periapical radiographs are unavoidable, in these circumstances following infection control measures should be followed

1. Preprocedural antimicrobial mouthrinse should be mandatory. Oral rinse with oxidative agents like 0.2% povidone or 0.1% hydrogen peroxide solution is recommended due to the vulnerability of virus to oxidation.^[18]
2. During intraoral radiographic procedures, measures to prevent gag reflex are advised as trigger of gag reflex may elicit coughing and increases the spread of the virus. A preventive approach can be psychological, pharmacological or even technical can be applied to prevent gag reflex.
3. The high touch and non critical items (table-1) should be barrier protected with plastic sheets or wraps and these barriers should be changed after each patient. Intermediate level disinfectants (70% ethyl alcohol, 70% isopropyl alcohol) can be used for disinfection of these items.^[15,16,17]
4. Use of autoclavable or disposable film/receptor holders is recommended to decrease radiographer's direct contact with saliva while placing the film/receptor.^[16]
5. Film/storage phosphor plates and film/receptor holders should be dispensed aseptically in a disposable container.
6. Protective barriers (plastic sheets and wraps) must be used for all kind of intraoral films/receptors (figure: 3) and integrity of sealed barrier must be recheck before film/receptor placement.^[20, 21]
7. After exposure, plastic sheet barriers over the films/receptors should be immersed in disinfectant solution and left to air dry. Protective barriers must be removed carefully, hand contact with the film/receptor and contact with saliva must be avoided. While opening the protective cover, the films should be allowed to drop out in a clean disposable cup (figure: 4) and the cup must be held with clean gloves. Then the film transferred to dark room.^[16, 20, 21]
8. In the dark room, the operator's must remove the film from vinyl package without touching the film and the lead foil, black paper, and the package should be discarded and film should be allowed to drop out on a clean disposable cup before manual/automated processing.^[16]
9. There are two basic type of intraoral digital receptors are used, first direct sensors which are attached to computer monitor via a cable and second storage phosphor plates, which resemble to intraoral films but are reusable and processed in a scanner.^[15]
10. Digital receptors cannot be autoclavable so it is important to follow manufacturer's recommendations. Digital system manufacturer's recommend protective barriers (plastic sheaths) and wiping with intermediate level disinfectants after each use (70% ethyl alcohol, 70% isopropyl alcohol) is recommended.^[15,16,20,21]
11. According to recent studies direct sensors cross-contamination rates can be reduced by augmenting the plastic sheath provided by the manufacturer with a latex finger cot (figure:5) should be used.^[14]
12. Hard copies of radiographs can be a major mode of spread of virus, since disinfection with solutions can affect the quality of the radiographs; therefore a Teleradiology system should be recommended to prevent contamination.^[10]



Figure: 3 Conventional radiographic films/ digital sensors placed in a plastic barrier



Figure: 4 Removing a radiographic film from its plastic barrier and allowing it to fall into a paper cup



Figure: 5 Digital sensor covered with a plastic sheath and a latex finger cot.

CONCLUSION

To conclude in the present scenario, it is extremely important that the professional be aware and follow efficient infection control measures in all steps of radiographic procedures, whether conventional or digital, care concerned intraoral, extraoral and specialized techniques too in order to avoid the transmission of the virus and possibility of COVID-19.

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