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Dental Radiology Practice during COVID-19

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Abstract

The COVID 19 pandemic is on the rise which has caused widespread public health concerns across the globe. The recently recognized SARS-CoV 2 virus is having devastating impacts on all aspects of life including economy, social life and health care, however the health care facilities are required to provide continuous service, treatment and relief for those in need and are rarely closed during any crisis . Dentist are one amongst these frontline health care providers who are at increased risk of infection owing to the droplet and aerosol mode of spread, the long and unpredictable incubation period of the virus and the high rates of asymptomatic carriers further challenges infection control measures during dental practice. Dental Radiography is one of the crucial components of diagnosis and treatment planning ,

however there is increased risk of infection from the asymptomatic patients as the amount of time involved in taking the radiographs is sufficient for a dental professional to contract the infection in addition to high chances of cross contamination with saliva. Hence, special emphasis on dental Radiological operatory infection control measures become essential. In this article we have discussed the precautions and guidelines in dental radiological operatory which will help practitioners as well as the patients and community in containing the spread of the pandemic .

Keywords: Dental radiology , COVID-19, Radiological operatory, Infection control.

Introduction

Outbreak of novel coronavirus (now called SARS-CoV-2) in the Chinese city of Wuhan began in December 2019, has infected millions of people world-wide. WHO raised the threat to the novel coronavirus epidemic to the "very high" level, on February 28, 2020.[(1)] On 11 March 2020, the Director-General of the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) outbreak a pandemic.[(2)] Since then the entire health care system has gone for a toss with approximately 20 billion infected patients till date. There are several challenges faced by health-care professionals with regard to the early recognition, providing treatment, and preventing transmission of this virus. Once in the human body, this coronavirus is abundantly present in nasopharyngeal and salivary secretions of affected patients, and its spread is predominantly thought to be respiratory droplet/contact in nature.[(1)] SARS-CoV-2 can bind to human angiotensin-converting enzyme receptors which are highly concentrated in salivary glands; this may be a possible explanation for the presence of SARSCoV-2 in secretory saliva which makes it more vulnerable to dental professionals. [(3)] Dental setups invariably carry the risk of COVID-19 infection due to the specificity of its procedures (aerosol production), proximity to the oropharyngeal region, and frequent exposure to saliva. Moreover, if adequate precautions are not taken, the dental office can potentially expose patients to cross-contamination.[(4)] However, dental treatments are deferred in symptomatic cases unless it is an emergency. In most of these emergencies the need for a dental radiograph can be inevitable be it intraoral or extraoral , however amongst them, the intraoral radiographs are the ones advised the first and the foremost for the preliminary diagnosis and treatment planning, although extra oral radiography can substitute for intraoral radiographs during these difficult times, OPG and CBCT are associated with lower resolution, artifacts from the patient movement and metallic restorations and much higher radiation doses and hence should not be used as an alternative to intraoral imaging. Intraoral radiography offers the best diagnostic efficacy however, a panoramic radiography would be reasonable in an emergency setting for the majority of conditions, especially in patients who may not tolerate intraoral films. Irrespective of the type of radiograph, careful infection control measures are to be followed while performing dental radiographs as there are concerns of aerosol generation through coughing induced from intraoral film holders which must be addressed by following strict COVID -19 infection control guidance.[(5)]

Dental Radiological operatory during covid-19

Emergency radiological procedures during covid-19 pandemic can be a potential source for disease transmission for both the radiologist as well as the patient. Apart from the conventional personal protective measures, adequate care must be ensured to prevent the spread of the disease. Some of the recommendations that can be adopted in a dental radiological operatory setting so as to complement the accuracy and efficiency of clinical cases

with the aid of radiographs during this time of pandemic includes -

Modification in techniques

- The main focus now while performing dental radiographs is to achieve ALARA(As low as reasonably achievable as possible), a radiograph must be performed only in cases were the benefits largely outweigh the risk involved
- Radiographs must be avoided as much as possible unless and until an extreme emergency arises. An intra-oral radiographs must be preferred wherever possible, an OPG radiograph should be considered for imaging only in cases such as craniofacial fractures where an intraoral radiograph fails to provide the adequate information
- CBCT must be considered for complex cases and where available, if panoramic radiography has failed to provide the diagnostic information required
- In case of intraoral radiographs, the patient must be asked to swish with an antimicrobial oral rinse before taking the image. Mouth rinse containing oxidative agents such as 0.2% povidone or 1% hydrogen peroxide is recommended due to the vulnerability of COVID-19 to oxidation. Measures to prevent gag reflex are also advised, as activation of the gag reflex may elicit coughing and coronavirus spread. A preventive approach can be psychological, pharmacological, or even technical.
- It is advisable to work as a pair, with one operator responsible for positioning of the patient and equipment, while the other operator taking responsibility for pressing the exposure button, operating the computer, and handling the imaging plates or film once unwrapped by the other operator
- Hard copies of images can be a major means of transmission of COVID-19 since disinfection with solutions can affect the quality of the radiographs and jeopardize the diagnostic information; therefore a Teleradiology system is recommended to prevent contamination. [6]

Recommendations for Intraoral radiography includes

- Use of autoclavable or disposable film holders to prevent the cross contamination with saliva while placing of the receptor /film in the mouth
- The high-touch and non-critical items such as tube head, X-ray cone, control panel, exposure button, head rest and adjustment control, chair and adjustment control and countertop/working area should be barrier-protected (plastic sheets, wraps) and the barriers should be changed after each patient.[7] Intermediate level disinfectants (70% ethyl alcohol, 70% isopropyl alcohol) can be used for disinfection of these items on a daily basis or when contaminated
- Use of plastic wraps for all films/receptors before placement in the mouth and their disposal aseptically in a sealed container
- If charged-coupled-device (CCD) sensors are used the cord must be wrapped with a plastic cover before placement and the cover must be changed after each patient
- Following exposure , the plastic sheath should be carefully disposed in disposable containers with without contacting the saliva, the films/receptors should be allowed to drop out in a clean disposable cup and the cup must be held with clean glove which can then be handed over for the processing
- For digital sensors (CCD and plates) wiping with intermediate level disinfectants after each use (70% ethyl alcohol, 70% isopropyl alcohol) is recommended.
- For conventional films, the operator in dark room must remove the film from the vinyl package without

touching the film. 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 processing

Panoramic imaging and CBCT

- Al l non critical items including chin rest, handgrips, head-positioning devices/head stabilizers, remote switch, control panel (chairs if patients need to be seated) should be barrier-protected with plastic sheets or wraps, and should be changed after each patient. They can be disinfected with intermediate level disinfectants (70% ethyl alcohol, 70% isopropyl alcohol) daily and when contaminated.
- The bite-guide (semi-critical item) must either be covered with a disposable sheath or sterilized following patient use. If both options are not possible, then disposable bite-guides must be employed
- In case of physical contact with the patient during positioning, the gloves must be changed after each exposure
- In order to minimize the spent time in the examination room, registration of the patients should take place outside and the patient must remove all metal accessories and dentures before entering the room

2) **Patient and Doctor preparation**

a) **Doctor and radiologist preparation**

- As of March 4, 2020, for health care providers, the World Health Organization recommends respiratory protection with use of a standard medical mask, unless aerosol-generating procedures are performed. Additional guidelines from The Centre for Disease Control and Prevention (CDCP) recommends airborne precautions and the use of a N 95 mask or higher when in close contact with patients who have COVID-19 or are under investigation for the virus.
- In addition, the droplet precaution instruction recommends appropriate **personal protective equipment (PPE)** , including a disposable isolation gown with fluid-resistant characteristics, a pair of disposable gloves with coverage over gown cuffs, eye protection with goggles, and if possible a face mask over goggles
- The dentist and the radiologist should follow standard, contact, and airborne precautions including the appropriate use of personal protective equipment and hand hygiene practices. The CDCP recommendations for the sequence of doning and doffing of PPE kits can be followed. Proper hand hygiene must be maintained before and after use of PPE.

b) **Patient Preparation**

Before arriving in the radiology room

- As soon as the patient enters the reception area, ask them to wash their hands using hand wash or alcohol-based hand rub. Include mandatory temperature and pulse oximetry recordings as part of the routine patient assessment before performing any dental procedure. A noncontact forehead thermometer can be used to measure the patient's body temperature so as to rule out any Covid like signs and symptoms.[4] It should be noted that patients presenting with fever or respiratory disease/symptoms should be registered and referred to designated hospitals.
- The patient is asked to minimise or eliminate wearing a wrist watch, hand and body jewellery and carrying of additional accessories bags etc
- Drape the patient preferably with single-use, disposable plastic apron
- Pre-procedural mouth rinse: Previous studies have shown that SARS-CoV and MERS-CoV were highly susceptible to povidone mouth rinse, therefore, the patient is asked to perform a pre-procedural mouth

rinse with 0.2% povidone-iodine.[7] Another alternative would be to use 0.5-1% hydrogen peroxide mouth rinse

In the radiological room

- During taking oral radiographs, either intraoral or extraoral, the patient is asked not to wear a face mask. Hence, it is of utmost importance that the distance from an x-ray room to the dental operatory (treatment room) should follow a standard guideline to prevent aerosol transmission. There is evidence that dental aerosol can reach 1–3 meters from its source and remain in the air for a considerable amount of time. Therefore, it is recommended that oral radiology section should be at least 3 meters away from the dental operatory.[6] Moreover, in the x-ray room, HEPA air filters and UV light chambers are strongly recommended to keep the possible viral load to a minimum by absorbing the aerosols containing SARS viruses into the system while clean air is filtered and recirculated into the air.

Patient discharge protocol

- The patient drape will be removed by the assistant, and the patient is asked to perform hand wash and is guided out towards the reception

Infection control of the Radiographic room

- The dental radiological operatory room must be well ventilated and the air quality management is mandatory using pereferably a indoor portable air cleaning system in which a negative pressure isolation mechanism can be achieved using HEPA filters (high-efficiency particulate air) and UV Light. HEPA filters are now the primary filtration media for electronic clean room assembly, hospital surgery rooms, bioengineering, pharmaceutical processes, and any applications where maximum reduction or removal of submicron particulates is required. [8] Air from HEPA filters is free of 99.99 percent of all particles larger than 0.3 microns
- Avoid the use of a ceiling fan while performing procedure.
- Place a table fan behind the operator and let the airflow towards the patient. A strong exhaust fan to be so located to create a unidirectional flow of air away from the patient.
- The window air condition system/ split AC should be frequently serviced, and filters cleaned
- In central AC buildings, on-recirculatory system: Blocking off the return air vents in the patient area will temporarily stop air circulation provided air handling units will have provision to receive adequate outdoor air supply and also allow fresh air into rooms by opening of windows or doors slightly
- The appointments must be spaced out (30 min) to leave adequate time for disinfection of equipment.
- A dedicated changing room must be maintained for the dentist and the radiographic personnel for donning and doffing of PPE

Disinfection of the radiographic area

- COVID-19 virus can potentially survive in the environment for several hours/days. Premises and areas potentially contaminated with the virus to be cleaned before their re-use. Remove the majority of bioburden, and disinfect equipment and environmental surfaces.
- Floors: 2 Step Cleaning Procedure (Detergent and freshly prepared 1% sodium hypochlorite with a contact time of 10 minutes. The floor has to be mopped starting at the far corner of the room and working towards the door.
- Frequency: after any patient/ major splash or two hourly.

- Rest of the surfaces: Freshly prepared 1% sodium hypochlorite (Contact Time: 10 minutes). Damp dusting should be done in straight lines that overlap one another. Frequency: before starting daily work, after every procedure and after finishing daily work
- Any other delicate electronic equipment used must be wiped with alcohol-based rub/spirit (60-90% alcohol) swab before each patient contact.
- Fogging-This method is called "No-touch surface disinfection." 20% (w/v) working solution of hydrogen peroxide (stabilized by 0.01% of silver nitrate) is prepared. [4] The amount of solution required is approximately 1000 mL per 1000 cubic feet.
- Immediately after the procedure, exit the room and close the operatory for half hour. This allows the aerosols/droplets to settle down.
- A 2-step surface cleaning is performed.
- Fogging is done for 45 min followed by a dwell time of 1 h.
- The room can then be opened and fans switched on for aeration.
- Wet surfaces can be dried/cleaned using a sterile cloth or clean cloth.

Waste disposal

All waste from confirmed patients are regarded as infectious medical waste, and should be managed strictly according to the following process-

- Put the infectious waste into the medical waste collection bag (ideally be no more than ¾ full); **spray the bag with 5000 mg/L disinfectant** containing chlorine (except for chlorhexidine); seal the inner layer and outer layer in a Goose-Neck-Type and spray the layers with 5000 mg/L disinfectant containing chlorine (except for chlorhexidine)
- Paste special identifications in the outer layer, and store it in the specialized site for medical wastes. [9]
- The cleaners should take the secondary level of protection and be responsible for handover registration, safe transportation, and proper storage of the infectious medical waste.
- The cleaners must wear appropriate PPE – heavy duty gloves, mask, eye protection (goggles/face shield), long-sleeved gown, apron (if gown is not fluid resistant), and boots or closed shoes and perform hand hygiene after saliva exposure and PPE removal

Other alternate radiographic techniques that can be employed during Covid 19

Extra-oral periapical radiography (EOPA)

- EOPA radiography is essentially a technique where the film/sensor is placed extra-orally overlying the tooth of interest. The X-ray beam is directed from the opposite side towards the film/sensor placed on the contralateral side
- The use of this novel extra oral film holding device can be dextrous during this pandemic as it prevents the chances of cross infection with saliva since there is no intra oral placement of film in this technique

Conclusion

Radiological examination is a mainstay in dentistry when it comes to diagnosis and treatment planning, however performing dental radiographs in this Covid-19 pandemic times can prove to be tortuous for the dentist performing it as well as the patient undergoing the procedure considering the contagious and infectious nature of the corona virus , Oral Radiologist and personnel must have a great command of the individual protection and disinfection procedures when working in the radiology department, especially in key areas.

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