

Dental Practice Infection Control Measurements: Coronavirus Disease (COVID-19) Outbreaks

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ABSTRACT

A new coronavirus disease called COVID-19 has been considered to be a public health emergency of international apprehension by the WHO. This new disease includes multiple symptoms such as fever, cough, sore throat, and rhinorrhea. The disease is mild in most people; however, in some patients, it may develop to pneumonia, acute respiratory distress syndrome (ARDS), and multiple dysfunctions in the organs which may lead to death. There are two routes of transmission for this virus, the first route is the direct transmission, through cough or droplet inhalation, while the second route is through contact, for example, contact with oral and nasal mucous membranes; consequently, extensive and intensive measures should be taken to decrease the transmission of COVID-19 from person to person. Due to the nature of dental work and its procedures, the dental professionals are in a high risk of transmission. Hence, in this article, we wanted to highlight the clinical features, trajectories of spread, and infection control considerations to prevent and control the spread of this fatal disease.

Keywords: Control, COVID-19, Dental field, Dentistry, Infection.

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INTRODUCTION

A sudden appearance of unidentified disease characterized by several symptoms such as pneumonia, dry cough, fatigue, and in addition occasional gastrointestinal symptoms. This is happened in the seafood market in Wuhan, China, certainly in December 2019. The elementary outbreak was notified and involved about 66% of the workers there. This infection has fast transmitted from Wuhan city to most other cities, provinces, and other countries. "On January 30, 2020, WHO declared an emergency of public health of global apprehension over this outbreak."^{1,2}

It reported that some of the clinical symptoms of this new virus were not the same symptoms that are caused by the severe acute respiratory syndrome (SARS) which is caused by SARS coronavirus (SARS-CoV), but it is just different, signaling that there is a new agent which is responsible for these infection and pneumonia from one person to others. The scientists in China rapidly started to make the separation for this new agent by extracting it from the infected patients and sequenced its genome. It revealed that the main reason for this viral infection was new coronavirus which is different than the previous one. This virus considered to be the seventh member of the family of coronaviruses that infect humans.²⁻⁵

Currently, coronaviruses contain four genera: (α), (β), (γ), and (δ). Most of the coronaviruses have the ability to rise diseases in both humans and animals (vertebrates). The usual target of both α -CoV and β -CoV is the systems of humans and mammals, as they infect central nervous, gastrointestinal, and respiratory systems. Multiple coronaviruses rise a mild respiratory disease for the human. However, other coronaviruses bring about death such as SARS-CoV and the Middle East respiratory syndrome coronavirus (MERS-CoV), according to the phylogenetic analysis of the genome of these viruses, they belong to β -CoV.^{2,6,7}

The rate of death of this disease seems to be increased especially in the epidemic region of China; in addition, the rate of separation of this virus seems to be faster than the two others coronaviruses. The routes of transmission of this new virus may involve direct and contact transmission routes, as the direct route

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involves cough, sneeze, and droplet inhalation while the contact route involves the oral, nasal, and mucous membranes of the eyes. During the treatment, health providers and patients both could be at risky situation as they may be exhibited to diseases through the direct or indirect contact with blood and oral secretions. COVID-19 could be one of those diseases that may rush the dental practice; consequently, the precautions must be on the highest level to prevent any chances that may leave it to spread.^{2,8-10}

SYMPTOMS

The average of the incubation period is 5.2 days. Fever, cough, and the general fatigue considered to be the first symptoms that will appear on the infected person. The symptoms also may appear on the respiratory system, such as cough, shortness of breath, rhinorrhea, inflammation of the throat, hemoptysis, and pain in the chest; other symptoms related to gastrointestinal and musculoskeletal, such as diarrhea, nausea, vomiting, and muscle ache, may appear too. Clinical features of this disease disclosed by a chest computed tomography scan and presented as pneumonia; however, there were abnormal features such as RNAemia, ARDS, acute injury of the cardiac, and incidence of ground-glass opacities that lead to fatal situation. While in other cases, the numerous peripheral ground-glass opacities were spotted in subpleural regions of both lungs. It is significant to recognize that there are

some similarities in the clinical manifestations between COVID-19 and previous diseases of betacoronavirus such as dyspnea, dry cough, fever, and bilateral ground-glass opacities on chest CT scan. But, COVID-19 owns some unusual behavior that it goes targeting the lower airways as evident by upper respiratory tract symptoms like rhinorrhea, sneezing, and sore throat.^{1,8}

RESERVOIRS AND TRANSMISSION

According to multiple studies, the bat might be the potential reservoir for the new coronavirus. However, there is no definite evidence and enough information to state that the origin of this virus is back to the seafood market as it thought. The genome of COVID-19 virus has been sequenced and then analyzed through the genome to bat-CoV RaTG13, and surprisingly, the identity value was 96.2%. This is giving the chances that the bat coronavirus and COVID-19 might share the ancestors. Also taking into consideration that the bats were not findable in that market.¹¹⁻¹⁴

ROUTE OF TRANSMISSION

This new virus contains two main routes of transmission. Well, both of those routes considered to be a common transmission route. The first route called the direct route of transmission includes the direct way of transmission through coughing, sneezing, or even droplet inhalation transmission, while the second route called the contact route of transmission considered to be different than the first routes, as it contains a contact with oral, nasal, and the mucous membrane of the eye. Although the eye is not included in the common clinical manifestations of novel coronavirus infection, the analysis showed another result. The collected conjunctival samples from both infected and suspected patients with COVID-19 showed that this virus is not only focusing on the respiratory tract as way of transmission but it may also consider the eye exposure as an efficient pathway for this virus to rush the human system. The studies showed that viruses that infect the respiratory system could spread from individual to other through direct or indirect contact, or even via small droplets also, this virus can spread directly or indirectly saliva. Uniquely, there is a report of one case in Germany showed that the spread of this virus may also take place via contact with asymptomatic individuals.^{2,14}

Route of Transmission in Dental Practice

Dental professionals and patients during their dental routine practice may be in risky situation, as they may be exhibited to different pathogenic microorganisms. The surrounding environment of dental practice invariably contains the risks of infection and transmission of COVID-19; this may back to the specificity and the nature of dental practice, which involves face-to-face communication with multiple patients every day. In addition to increase periodic contact and exposure to saliva and blood. Also, inside the dental practice the dental professional handling sharp instruments during their working routine.^{2,15}

The possible transmission windows:

- Inhalation of airborne, as it stated that the virus may stay in the air for extended period of time.
- The direct contact with body and oral fluids.
- The direct contact with blood.
- Patient materials may work as risk factor if the dentists get in contact with them.

- Risk of exposure to nasal or oral mucosa.
- The contact with non-sterilized instrumented (contaminated) indirectly.
- If the infected patients cough or sneeze inside the waiting room of the clinic.

Airborne Transmission

The scientific articles related to the dental practice showed that the dental operations could produce aerosols and droplets that contain viruses. Consequently, both the droplets and the aerosol considered to be the important factors in the process of transmission of these new viruses in the dental clinics and health centers, as avoiding the formation of the large amount of the aerosol that it mixed with the patient's saliva considered to be so difficult practically. The equipment and devices that are most usable inside the dental clinics include high-speed gas to drive the turbine, so it can rotate at high speed, and also, those devices use running water. Hence, during the dental procedure, a huge amount of droplets and aerosol were generated. The particles of that aerosol may remain airborne for a time. Wherefore, high precaution should be taken to offer a control this route of transmission.^{2,16}

Surface Contamination

In 2016, a study stated that viruses that have the potency to be pandemic, for example, SARS-Coronavirus, have the ability to stay alive for extended periods on dry surfaces presenting a contamination in the area of settings and may demand more enhancement in the procedures of disinfection and cleaning to assure effective infection prevention and control. Also, viral and bacterial surface contamination can be spread to hands, and serial transfer to a number of surfaces from contaminated hands may take place. Consequently, measurements should be taken to decrease the chances of transmission through this route.¹⁷

INFECTION CONTROL FOR DENTAL PRACTICE

The dentists should take multiple considerations to protect themselves and their patients from this disease:¹⁸

- Applying high measurements to provide a protection and avert or decrease the dental procedures and operation that it could create aerosols.
- Applying a special technique that it includes using four hands during the dental procedures, as this technique essential for controlling the infection.
- Using extraoral suction machine in addition to saliva ejectors with low or high volume could play an important role in decreasing the formation of aerosols.

It recommends that the dentist should follow the instructions and guidelines that are published by the WHO and government of the country that the dentist is practicing dentistry inside it.

The protocol to control the infection will be divided to the following:

Patient Evaluation

During the outbreak of COVID-19, all of the dental clinics and dental hospitals are preferable to obtain precheck triages to check the temperature of every patient as a routine procedure. Precheck team will ask the patients some questions about the general health status, and if there is a history of travel, they should ask whether the patient gets in contact with any suspected or confirmed cases. The patients

should be instructed to wear medical mask before entering the clinic or the hospital. Forehead thermometer (for no contact) is highly recommended for the screening procedure that it is done for patients, and a special sheet of questions called “checking questionnaire” should be used to screen patients who have the possibility to be infected by COVID-19 before they could move to the dental unit. The checking questionnaire should contain multiple questions to investigate whether the patients experienced any of the disease symptoms, in addition to provide a history whether those patients have visited any epidemic regions in the past 14 days. If the patients displayed a fever, they should be registered and referred to the specific hospitals or instructed to follow-up the rules and measurements that are presented by the ministry of health in the country. If a patient stated that he/she has been to town or regions that showed a history of positive COVID-19 case within the past 14 days, quarantine for at least 14 days is suggested. In areas where COVID-19 spreads, non-emergency dental practices should be postponed.^{2,18}

Oral Examination

The procedures that may own the chances to stimulate coughing should be averted (if possible) or performed with high caution. The procedures that contain aerosol should be reduced. In dental practice, different radiographs are used, the most common technique is the intraoral X-ray technique; unfortunately, this technique could initiate the secretion of saliva and also coughing. Consequently, using the other types of radiographs, such as orthopantomogram radiography and cone beam computed tomography, is the appropriate alternative during the outbreak of COVID-19.¹⁸

PERSONAL PROTECTIVE EQUIPMENT FOR THE DENTAL PROFESSIONALS

In the hospitals and dental clinics, the major route of spread is the airborne droplet. Hence, during the epidemic period of COVID-19, all the protection barrier equipment is highly recommended for all the dental teams in the clinic or hospital. The equipment includes protective eyewear, medical hand gloves, medical cap, face shield, medical face mask, and special medical protective suits. It stated that the correct use of a face shield is dependent upon the indications for use. Appropriately fitted, indirectly vented goggles provide the most reliable practical eye protection from splashes, but the face shields are considered an alternative to goggles for the prevention of eye contamination with infectious agents. A study recommended using N95 respirator masks or FFP3 respirator in addition to room ventilation to counteract airborne transmission. According to the chances of the spread of COVID-19 disease, the following protective measurements in three levels (according to the level of risk) are recommended.^{2,19,20}

Low-risk Level

This level is applied when the patient showed negative symptoms and pass the patient evaluation protocol. The personal protective equipment in this level includes the following:²

- Disposable medical cap
- Disposable medical mask
- Working clothes (white coat)
- Protective eye goggles
- Shield of the face
- Disposable medical gloves.

Moderate-risk Level

This level is applied when the patient has more chances to be infected, for example, the old and immunity-compromised patients. The personal protective equipment in this level includes the following:²

- Disposable medical cap
- Disposable medical mask
- Protective eye goggles
- Shield of the face
- Working clothes (white coat) with disposable isolation clothing or surgical clothes outside or using high protection suit
- Disposable medical gloves.

High-risk Level

This level is applied when the patient is suspected or confirmed COVID-19 infection. A patient with COVID-19 is not expected to get his/her treatment in a dental clinic; this event is not likely to take place, as the dental team cannot evade the close contact. Due to that it recommended to perform the dental treatment inside the hospital under the supervision of ministry of health. It recommended the following personal protective equipment:²

- Special protective outwear suit must be highly recommended; if the dentist could not find the protective wear, the working clothes (the white coat) with extra-disposable protective clothing outside should be worn.
- Disposable medical cap
- Protective eye goggles
- Shield of the face
- Disposable medical mask
- Disposable medical gloves
- Impermeable shoe cover.

In addition to those measurements, it recommends following the instructions issued by the government’s health care specialists as follows.

PREPROCEDURAL MOUTH RINSE

It is shown that both SARS and MERS were highly susceptible to povidone mouth rinse. Hence, before the dental procedure, rinsing the mouth of the patient with 0.2% povidone-iodine may decrease the load of coronaviruses in saliva.²¹

DENTAL DAM

The dental dam (DD) is considered to be an exemplary tool that is used for isolation in the dental field, especially during the procedure of root canal treatment. It helps to enhance a proper cross-infection control for both the dental team and the patients. Also, it plays an important role in the infection control measurements, as it aids in the prevention of the spread of the infection that appears in the cases that have contagious diseases, for example, acquired immune deficiency syndrome (AIDS) and viral hepatitis; due to that, the dentist and his/her team will be away from the risk of those diseases that may be spread by the saliva of the patient. A previous study stated that using the dental dam is considered to be an excellent barrier to the potential spread of the infectious disease in the dental office.^{22,23}

DISINFECTION AND STERILIZATION PROTOCOL

As part of the routine infection control measures, cleaning of the surfaces in the dental clinic is recommended before and after treating each patient. Consequently, both dental clinics and health centers should consider an effective and firm disinfection protocols in both inside the dental chair room and public area. The equipment and settings of the clinic should be disinfected and cleaned according to the special protocol which is accredited inside your country or according to the "Protocol for the management of surface cleaning and disinfection of medical environment (WS/T 512-2016) released by the National Health Commission of the People's Republic of China." All the appliances should be extremely cleaned and also disinfected, including chairs, the handles of the door, desks, walls, and every possible appliance that it may display the virus. People who are using the elevators should put their masks in a correct way and evade direct contact with buttons and other objects.^{2,23,24}

INSTRUMENT PROCESSING

To prevent the risk of the cross-contamination, the dentists should divide the processing area physically into the following areas:

- The area of cleaning: This area is responsible for receiving the reusable contaminated dental instruments. Those instruments will be cleaned, decontaminated, and sorted.¹⁰
- The area of packing: This area is responsible for the preparation of the cleaning instruments to the sterilization step, and also, the procedure of assembling, inspecting, and packing of the clean instruments took place in this area.¹⁰
- The area of sterilization: This area includes both the incubators and sterilizers for analyzing the spore tests.¹⁰

The concept of storage should be taken into consideration. The storage should be dust-resistant (dust-proof), have proper ventilation, and provide easy reach for frequent dental use. The sterile instruments should have at least eight inches between them and the floor, eighteen inches from the ceiling and two inches away from the walls. Attention should be taken for the items' position, as the position should be done in a way that prevents the packaged items from getting crushed, compressed, punctured, or bent.¹⁰

MEDICAL WASTE MANAGEMENT

Majority of the wastes that is formed in the dental clinic are considered to be non-infectious and can be thrown in regular trash. This also includes the gloves and masks, in addition to lightly bloody gauzes. The medical wastes such as needles, gauzes contain heavy blood, and extracted teeth may display a possible risk of infection. The special biohazard bag with a leak-resistant characteristic should be used to contain the non-sharp regulated medical wastes. While the sharp instruments such as unused sterile sharps, scalpel blades, and syringes should be contained in puncture-resistant containers with a biohazard label such as sharps containers. Medical wastes are stored and disposed of in accordance with state and local EPA regulations. The medical and domestic wastes generated by the treatment of patients with suspected or confirmed COVID-19 infection are regarded as infectious medical wastes. To dispose this category of wastes, double-layered yellow-colored package/bag specially designed for medical wastes and "gooseneck" ligation should be used. The surface of the package/bags should be marked

and disposed as per the requirement and SOP for the management of medical wastes.^{2,10}

DEDICATION

This work is dedicated to the ministries of health in Iraq and Egypt, and for all the dentists all around the world.

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