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The Urgency of Information Dissemination Regarding the Relationship between Airborne Transmission and COVID-19 inside Dental Health Facilities

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Abstract *- A pandemic outbreak of COVID-19 was caused by the spread of SARS-CoV-2. Containment and isolation of the virus lead to the study on how this virus spread. One of the possible transmission routes is airborne transmission, where aerosol droplets are involved. Healthcare facilities that use aerosol-related procedures are at risk of having infection inside the facility. The dental health facility is one of the facilities that use aerosol producing equipment. The virus can be combined with an aerosol particle inside the dental health facility because of the high viral load of the fluids or specimens that host SARS-CoV-2. This is possible through dental procedures that transmit aerosol in the operating area. Aerosol particles can be subjected to inhalation by any person inside the dental health facility. A respirable aerosol particle is assumed to be less than 5 µm. Most of the aerosol particle inside the dental health facility is less than 5 µm. The presence of aerosol inside the dental health facility relates to the rapid transmission of the virus. The members of the community, who do not know the relationship between airborne transmission and COVID-19, is presumably in danger. Information regarding airborne transmission inside the dental health facility can be distributed to members of the community through various information dissemination methods. In this review article, we summarized how it is possible to have a COVID-19 infection inside the dental health facility. We also showed the importance of the urgency of information dissemination regarding airborne transmission and COVID-19.*

Keywords *– COVID-19, Aerosol, Airborne Transmission, Oral Health, Dental Medicine*

INTRODUCTION

A spread of disease concerning pneumonia with unknown cause took place in a multinational level which originated from China. Global public health measures were implemented throughout the whole world, which also restricted international travel. Close monitoring of areas with a high number of cases of the disease is also implemented [1],[2]. Authorities from China implemented an investigation which led to the immediate control, isolation, and close monitoring of persons assumed to have contracted the disease of unknown cause. Chinese researchers eventually isolated and identified a virus related to the family of coronaviruses, which led to the rapid development of real-time reverse transcription polymerase chain reaction (RT-PCR) diagnostic tests for the virus that was isolated [3]. With the study of infected cases related to the outbreak in China, characteristic features of this virus were eventually identified and led to measures and protocols regarding the handling of confirmed infected patients. The studies also led to the comparison of this new virus to the previous outbreaks, which are also related to the family of coronavirus [2]. The World Health Organization (WHO) identified the disease as the Coronavirus Disease 2019 (COVID-19). With 3,267,184 confirmed cases of the coronavirus-19 (COVID-19) and 229,971 confirmed deaths (as of May 3, 2020) reported, there is a high chance that anyone from any healthcare facility can contract this disease [4]. Oral healthcare professionals, including dentists, are exposed to this disease because they provide healthcare to the public [5]. Dental health facilities can be a primary stage for transmission of COVID-19 because any patient with concerns on his or her oral health can come inside the clinic with no restriction on their movements. Dental patients may transmit potential infectious particles without the knowledge of the transmission of the virus to another person inside the dental health facility. One of the possible forms of transmission of COVID-19 is an airborne transmission. Aerosol droplets are present inside the dental health facility [6]. The rapid transmission of this disease shows that health organizations must act swiftly to counter the spread of the disease. The publication of guidelines for health facilities was enacted by major health organizations. The guidelines reflected a standard that is also enacted to non-medical facilities. The importance of a standard guideline reflects the urgency of information dissemination. The urgency of the distribution of the guidelines among members of the community is one of the important tasks being implemented by health organizations. The use of a guideline without proper information distribution is negligence toward health care. The rapid spread of the disease is one of the rationales that requires health organizations to implement an urgency of information distribution. This review article aims to analyze the urgency of information dissemination regarding the relationship between airborne transmission and coronavirus disease 2019 (COVID-19) inside the dental health facility.

Coronavirus Disease 2019 (COVID-19)

The COVID-19, previously known as 2019 novel coronavirus (2019-nCoV), was first reported in the Hubei province of China, particularly Wuhan China [7]. With the spread of the disease at an alarming rate, The World Health Organization characterized COVID-19 as a pandemic outbreak [8]. A person with a history of exposure to a possible host of the virus has a suspected case of COVID-19 that may have following symptomatic criteria: fever, cough, shortness of breath, and chest pain. Clinical diagnosis of pneumonia is also related to COVID-19. Patients with pneumonia may have radiographic evidence of pneumonia and laboratory results of low white cell count or lymphocyte count [9],[10] Asymptomatic patients may also carry COVID-19 and transmit through presumed asymptomatic carrier transmission [11]. The zoonotic agent that is causing COVID-19 is known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), formerly known as the 2019 novel coronavirus (2019-nCoV) [12]. It belongs to the β-CoV genera of coronaviruses [6],[12],[13],[14]. Isolation of this virus, which is related to the Coronavirus family, was done in China. Coronaviruses are enveloped RNA viruses that can be characterized by negative staining on electron microscopy [15],[16]. The isolated viral strain underwent phylogenetic analysis that resulted in the sequencing of genomes with 29,903 nucleotides [6],[17],[18].The characteristics of this virus as an RNA virus eventually identified as having a high mutation rate [19]. The pathological features of COVID-19 greatly resemble those seen in Severe Acute Respiratory Syndrome (SARS) and Middle Eastern Respiratory Syndrome (MERS) coronavirus infection [20],[21],[22]. SARS-CoV-2 is genetically related to Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), which caused a global epidemic with 8096 confirmed cases and 774 deaths in more than 25 countries in 2002–2003 [7],[23]. The phylogenetic analysis resulted in the existence of SARS-CoV in the sputum samples of confirmed SARS patients [19]. The epidemiologic analysis, experimental studies, and airflow simulations of SARS-CoV support the probability of airborne transmission [24]. SARS-CoV-2 is also genetically related to Middle East Respiratory Syndrome Coronavirus (MERS-CoV), which also caused a global outbreak with 1,360 confirmed cases and 527 deaths in 27 countries in 2015 [25],[26]. Aerosol generating treatment or procedures may cause the MERS-CoV to be airborne and cause infection to the healthcare workers that are within the approximation of a confirmed patient with MERS-CoV [27].

Possible Infection of COVID-19

The SARS-CoV is related to SARS-CoV-2 in terms of genetic concerns. During the

2004 outbreak of the Severe Acute Respiratory Syndrome (SARS), the SARS virus may spread more largely by airborne transmission than by liquid droplets, direct contact, or environmental surface transmission [28]. While another potential transmission is always considered, the prodromal phase of SARS may have prevented or decrease the spread of the disease in dental settings [29]. The airborne transmission of SARS-CoV through aerosol droplets raises the possibility of infection spread during dental procedures. Dental procedures that most likely generate aerosol droplets include restorative treatment, surgical treatment, and prophylactic treatment. The procedures use mechanical turbine burs, air-water spray, and ultrasonic scalers [30]. Dentists use mechanical equipment that expels a high volume of water and air for appropriate treatment, and this can lead to the contribution of airborne transmission of COVID-19.

Coronavirus 2019 (COVID-19) is definite with direct close contact human to human transmission [31]. Other possible forms of transmission of COVID-19 are believed to include environmental surface contact and aerosol droplets, which can be airborne under varying circumstances. These forms of transmission are based on historical experiences related to Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) outbreaks [24],[32],[33],[34],[35]. Diagnostic tools are also based on historical experiences related to SARS-CoV and MERS-CoV. The detection of respiratory viruses is high in saliva and nasopharyngeal specimen [36],[37]. The COVID-19 is reported to be present in the saliva of confirmed infected patients. The detection rate and viral loads in saliva samples from patients with COVID-19 admitted to the First Affiliated Hospital, School of Medicine, Zhejiang University were similarly high to those detected in sputum. The result explained that a large viral load accumulated in the lower respiratory tract were expelled with high air pressure. The detection of SARS-CoV-2 was also high in sputum and saliva when compared to a specimen collected from throat swabs and nasal swabs [31]. Transmission through saliva will be of great importance to the prevention, diagnosis, and treatment of confirmed COVID-19 patients. The current diagnostic test capable of confirmation involves a nasopharyngeal specimen, which is an uncomfortable procedure for most patients [36],[38]. Sputum production for diagnostic tests among confirmed COVID-19 is low [36],[39]. The basis for the time where a virus is detectable in the saliva is related to a study about the Zika virus (ZIKV), where persistent shedding of the ZIKV lasted for 29 days after clinical symptoms emerged [40],[41],[42],[43]. Possible saliva diagnostic test can be a comfortable non-invasive procedure which may benefit the safety of the healthcare provider and the patients. The saliva-related procedure has the potential of minimizing direct close contact between possible COVID-19 patients and the healthcare provider [5],[36],[44],[45]. There are still limited studies regarding the detection of COVID-19 in saliva, but it may be a safe diagnostic procedure for suspected persons with COVID-19 and health care providers.

Aerosol as a Source of Infection inside the Dental Health Facility

Aerosols must always be considered for infection control inside the facility. Infectious agents like bacteria, viruses, and fungal organisms may be transmitted through airborne transmission [46]. Infection in the health facility is possible through direct contact with body fluids from an infected patient, surfaces or dental instruments, and particularly airborne infectious particles [47]. Microorganism in aerosols is definite during treatments with high-speed handpiece with mechanical turbine burs, ultrasonic scalers, and air-water spray from the dental equipment. High-speed rotation of the high-speed handpiece with a mechanical turbine is used during restorative procedures and oral surgical procedures. This high-speed rotation is created with the use of water spray and compressed air [48],[49],[50],[51],[52],[53]. Another equipment that uses water spray and compressed air is the ultrasonic scaler. It is known that the water spray with compressed air can produce airborne particles for at least 18 inches from the operation area of dental procedures. Ultrasonic scalers are used in procedures for the removal of dental plaque, stains, and calcular deposits [54]. The air surrounding the patient and the oral healthcare professional is briefly contaminated, and depending on the microorganism, the air quality may increase if the microorganism settles quickly [55]. There are currently no universal or international standards regarding the maximum values of microorganisms in aerosols allowable for infection control in dental health facility. However, the ultra-clean operating room is strictly observed in hospitals. The ultra-clean condition may be a basis for infection control inside the clinic. The risk of infection during oral surgery procedures must also be considered due to the presence of infectious agents in aerosols [56]. Particles with a size of less than 50 µm are considered as aerosol particles [49],[54]. The size of most particles that can be found inside the dental health facility is less than 5 µm, and they are usually within the area of the operation of dental treatment. Respirable aerosol particles less than 5 µm can be a candidate for inhalation [57],[58],[59]. The measurement must always be considered for infection possibility so that infection protocols are not neglected. Airborne transmission is related to the cross-infection of patients within the dental health facility and the oral healthcare professionals [60].

With the basis of historical airborne transmission of SARS and MERS, COVID-19 is currently assumed to spread in any location through airborne transmission [61]. There are still limited studies regarding how long can SARS-CoV-2 can stay outside a host, but one study claims that SARS-CoV-2 can remain in aerosols for 3 hours and in different material surfaces from 2 hours to 9 days [62],[63],[64]. COVID-19 can also be directly deposited to the personal protective equipment (PPE) used by any healthcare provider caring for confirmed COVID-19 patients. The deposition is possible through airborne transmission and direct close contact with the healthcare provider [64]. The possible deposition means that oral healthcare providers are not exempted from obtaining infected airborne particles on their PPE. With their PPE infected, removal of the equipment from the oral healthcare provider may infect environmental surfaces in which the equipment has direct contact. Submicron aerosol may also come from resuspension of COVID-19 aerosol from PPE due to its higher mobility [64].

Information Dissemination

Health care providers must understand that the distribution of information regarding health concerns will always be the most effective way of preventing more harm [65]. Effective distribution means that the correct idea regarding a health care concern has reached the concerned members of the community in the most efficient way. The modern methods of information dissemination include radio broadcast, television, social media, website publication, and text message transfer [66],[67]. The methods are the most efficient way of distributing through modern communication. The modern concept signifies that a traditional method of dissemination is also available. The traditional methods include broadsheet newspaper publication, direct live announcements, and pamphlet print publications [68]. The traditional methods have always been a considered method in rural areas, especially in developing countries. Information dissemination has always been a priority in government agencies. The support of the government has a significant impact on the success of information dissemination.

COVID-19 occurred in the generation of information technology. The methods that are used today are capable of reaching rural areas that have no means of access. The communication capabilities of this generation are substantial. Health organizations may use this technology to distribute information regarding COVID-19. The mechanism of dissemination of this generation has always been considered by many organizations. The pandemic outbreak of COVID-19 requires health organizations to act within the scope of information technology. Rural areas are in danger because of the lack of modern technology. Urban centers are capable of modern technological health care concerns. The members of the urban community have a higher chance of surviving pandemic outbreaks because of health care access. Rural priority in information dissemination must be based on the fact that health care access is limited in the rural region.

Oral health care has always been less prioritized in the Philippines [69]. The danger of having symptomatic dental disorders and dental emergencies is significant in the pandemic outbreak. With the closure of most dental center, members of the community will have a difficult time experiencing symptomatic dental disorders and dental emergencies. The dental centers inside the hospitals that are capable of handling infection control are mostly the areas that accommodate dental emergencies. The danger of airborne transmission inside the accommodating dental center is still present. Cross-infection among individuals who are inside the dental health facility will have a negative impact on the fight against COVID-19. The dental centers tend to become a source of rapid transmission if aerosol-transmitting procedures are still being performed. The urgency of information dissemination regarding the relationship between airborne transmission and COVID-19 must be considered by health organizations to control transmission inside dental centers.

SUMMARY

Information dissemination is important in pandemic outbreaks. In the case of dental health care facilities, members of the community must understand the relationship between airborne transmission and COVID-19. Saliva is important in the relationship between COVID-19 and airborne transmission inside dental health facilities. Viral load volume is high in saliva. It can be a source of infection and a potential diagnostic tool. It may be one of the means that allows the infection to spread inside the health care facility, specifically the dental health facility. Respiratory droplets, together with particles from saliva, may become airborne due to the nature and circumstance of the dental equipment needed for treatment. Human-to-human transmission related to direct close contact must always be considered in patients infected with coronaviruses. Oral healthcare professionals should always consider the importance of using mechanical turbine burs and air-water spray from their respective dental equipment. The dental equipment may have a detrimental effect on the patient and the oral healthcare professional. Cross-infection may occur with aerosol-transmitting dental equipment. The dental health facility can be a source of rapid transmission of COVID-19. The distribution of the knowledge regarding this matter will help stop the dental center become a source of rapid transmission. The urgency of information dissemination is significant in the prevention of rapid transmission.

Conflict of Interest

The authors declare no conflict of interest.

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