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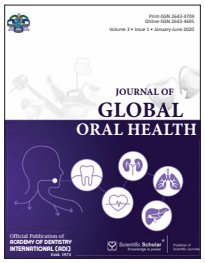

Review Article

Minimizing transmission of coronavirus disease 2019 at the clinical dental practice

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ABSTRACT

A brief introduction of unexpected occurrences of diseases that can become epidemic or pandemic such as what happened with COVID-19 is made. Current and anticipated global impact of the disease, characteristics and reported cases in China are described. Possible explanations and factors that may contribute or be responsible for possible transmission of diseases in the dental clinic are offered as well as emphasis on the need to exercise infection control strategies and special precautions to minimize Disease transmission are emphasized; additional precautions to implement for treating individuals that have been diagnosed of being infected with COVID-19 are given, as well as emphasis on the possibilities of treating asymptomatic patients; Advice on existence of protocols prepared by health organizations such as the US. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) are stressed and the lector is advised to visit websites that are available from CDC with detail information pertinent to protocols Health Care Providers can follow. Ideal recommendations as well as minimal recommendations to be followed by oral health care personnel and protection equipment are given. General facts related to survival of the COVID-19 virus that need to be taken into consideration are offered and precautions that health experts have recommended are also summarized.

Keywords: Coronavirus-19 disease, Infection control in dental practice settings, Oral health, Oral Health Care Personnel

INTRODUCTION

All living organisms are subject to disease!; a large number of diseases are readily preventable and public health officials have developed and implemented effective strategies in most countries of the world; most health prevention and promotion activities have also been designed and implemented effectively so that almost all individuals can maintain their health based on their local environment conditions and avoid many diseases; however, unexpected occurrences of disease can affect individuals in any country and if such are infectious can spread rapidly affecting small or large population groups to the point of becoming endemic or even worse pandemic in nature. Such has been the case of the coronavirus disease 2019 (COVID-19). There are various theories regarding how the disease started and its routes of contamination; health agencies have promptly directed efforts to disseminate symptoms, severity, prognosis, preventive measures for reducing spread of the disease, and lessen its impact; diverse protocols have been developed for the general public and health-care providers to interact and treat patients in a safe manner.

CURRENT GLOBAL COVID-19 PANDEMIC IN WIDE SPREADING

As of July 1, 2020, there have been 2,739,100 confirmed cases + 2680; recovered 808,134 + 9726, and death 130,162 + 1173 (confirmed numbers [e.g., cases, tests, and recoveries] are aggregated from official government sites and released records, such as the CDC and World Health Organization. Some numbers may be delayed). These numbers change daily and readers are suggested to verify local and global information as it is published by official sources. According to the New York Post, the WHO warned that the "worst is yet to come" and indicated that a WHO official had mentioned in a briefing that "more than 10 million people had been infected and over 500,000 had died over the past 6 months".[1] Unfortunately, the number of individuals infected, recovered and died changes daily; readers are encouraged to update such figures from local, regional or global information agencies.

The seriousness of the pandemic cannot be ignored and health-care providers must protect themselves and have the obligation to inform patients and relatives of special precautions that are indispensable to prevent the contamination and spread of the disease.

CHARACTERISTICS OF CORONAVIRUS AND ITS DESTRUCTION OF HUMAN HEALTH

Guan *et al*. described the clinical characteristics of COVID-19 in China[2] and noted that that during the first 2 months of the outbreak, the diagnosis of the disease was complicated by the diversity in symptoms and imaging findings and in the severity of disease at the time of presentation. These findings were part of a study conducted through January 2020 in which investigators extracted data from 1099 patients with laboratory-confirmed COVID-19 from 552 hospitals in 30 provinces, autonomous regions, and municipalities in mainland China.

About 43.8% of the patients had fever on presentation but developed in 88.7% after hospitalization. Severe illness occurred in 15.7% of the patients after admission to a hospital. Fever and cough were the dominant symptoms and gastrointestinal symptoms were uncommon, which suggest a difference in viral tropism as compared with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), MERS-CoV, and seasonal influenza.

In another report from Huang *et al*., common symptoms at onset of illness were "fever (40 [98%] of 41 patients), cough (31 [76%]), and myalgia or fatigue (18 [44%]); less common symptoms were sputum production (11 [28%] of 39), headache (3 [8%] of 38), hemoptysis (2 [5%] of 39), and diarrhea (1 [3%] of 38). Dyspnea developed in 22 (55%) of 40 patients (median time from illness onset to dyspnea 8.0 days [IQR 5.0–13.0]). Twenty-six (63%) of 41 patients had lymphopenia. All 41 patients had pneumonia with abnormal findings on chest CT. Complications included acute respiratory distress syndrome (12 [29%]), RNAaemia (6 [15%]), acute cardiac injury (5 [12%]), and secondary infection (4 [10%]). Thirteen (32%) patients were admitted to an ICU and 6 (15%) died."[3]

According to the U.S. Centers for Disease Control and Prevention (CDC), patients with COVID-19 have experienced mild-to-severe respiratory illness. Symptoms may appear 2–14 days after exposure to the virus. People needs to be aware of presence of fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea. CDC also recommends looking for "emergency warning signs" such as trouble breathing, persistent pain or pressure in the chest, new confusion, inability to wake or stay awake, or bluish lips or face. The recommendation concludes that if any of these signs are present to seek emergency medical care immediately. It is important to recognize that there are people infected with COVID-19 who do not have any symptoms with the consequent risk of transmitting the disease. National and international health organizations have disseminated information pertinent to practices that need to be exercised by the general community during regular daily activities, traveling, and also guidance for risk assessment and work restrictions for health-care personnel with potential exposure to COVID-19.[4] Readers are encouraged to visit the CDC website at this link https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-risk-assesment-hcp.html and become familiar with updates prepared and disseminated; the following paragraph was extracted from the CDC website: as updated May 29, 2020.

Updates include:

- Any duration of exposure should be considered prolonged if the exposure occurred during performance of an aerosol-generating procedure
- The time period that should be used for contact tracing after exposure to asymptomatic individuals who test positive for SARS-CoV-2 was shortened.
    - The time period was changed from 10 days before obtaining the specimen that tested positive for SARS-CoV-2 to 2 days to accommodate pragmatic and operational considerations for the implementation of case investigation and contact tracing programs
    - Recent data suggest that asymptomatic persons may have a lower burden at diagnosis than symptomatic persons. Thus, the longer contact elicitation window (10 days) may have limited impact in identifying new COVID-19 cases

- The recommendation for the shorter contact elicitation window (2 days) will help focus case investigation and contact tracing resources toward activities most likely to interrupt ongoing transmission
- The time period is also in alignment with recommendations from the World Health Organization
- This time period is also now in alignment with recommendations from the World Health Organization, European CDC, and Public Health Canada.

"Because of their often extensive and close contact with vulnerable individuals in health-care settings, a conservative approach to HCP monitoring and applying work restrictions is recommended to prevent transmission from potentially contagious HCP to patients, other HCP, and visitors. Occupational health programs should have a low threshold for evaluating symptoms and testing HCP."[5]

CLINICAL DENTAL PRACTICE

The profession of dentistry has been under constant change over the years; the practice of dentistry today is certainly different mainly as result of new discoveries and treatment modalities. In years past, although not in a unique form, teeth were the center of attention but this concept evolved to focus on other elements of the oral cavity and to give the deserved importance to the intimate relationship of the oral cavity with the entire human body systems. The concept of oral health science emerged and it involves several basic and clinical sciences that help focusing on how oral health may affect general health and how it may be affected by general health status and systemic diseases.[6,7]

The appearance of pandemics such as COVID-19 has evidently made a great impact on the "Modus Vivendi" at the community and individual level particularly as regard to how we interact with each other and how we act and proceed with certain circumstances in a more cautious way. Such approach has been evident in various work fields and on provision of health services including dentistry.

The practice of clinical dentistry has unique characteristics that require special infection control activities; it is important to prioritize service procedures according to their specific nature and urgency.

CLINICAL DENTAL PRACTICE AS A HIGH-RISK SETTING FOR TRANSMISSION OF DISEASES

Oral health-care providers are working together as a team mode. There are four major risk factors for causing potential transmissible diseases:[8]

a. The modern dental equipment, instruments, and dental products
   In the past centuries, all dental treatments were made by dentists using simple dental units, equipment, and instruments. However, as years passed and technology improved, dental industry developed very rapidly and made available modern dental equipment, instruments, and materials which would simplify operations with the consequent benefit to both, dental care providers, and patients. High-speed dental handpieces were part of such advancement; unfortunately, an undesirable effect is the production of harmful conditions such as spraying, airborne droplets, and aerosol which have been confirmed to carry viruses, bacteria, and other pathogen agents that favor cross-transmission of diseases between oral health personnel and patients and further may pollute surrounding surface of materials and clinic environment.
b. To provide dental treatment, every patient has to open his or her mouth for all clinical procedures from examination, performance of the procedure until its completion
c. Treatment arrangement: Usually, there are four hands operating together, those of the dentist and dental assistant, a modality which is known as a four hands technique operation or, four hands dentistry
d. The entire control process which may be executed by non-health care workers such as engineer, technician, and/or cleaning person.

There are five major issues related to transmissible risks at the dental clinic:

1. The most significant and key problem is the lack of recognition of practical transmissible risk and awareness of exact risk assessment
2. Many oral health-care providers have the erroneous thinking that it is very difficult to avoid cross-infection based on the fact that the mouth is dirty and has many microorganisms
3. The dental team working staffs usually lack awareness of the importance of the disinfection of surface equipment and the need to include other present elements, airflow, walls, and floor
4. Many dental care providers ignore or underestimate the basic theory and principles of infection control and risks of potential transmission of diseases
5. Some oral health-care providers may be highly concerned with various transmissible diseases such as HPV and HIV and believe that normal procedures for infection control are sufficient to prevent all diseases but such are not sufficient for performing treatment to an individual with coronavirus disease. Another problem is that in the case of COVID-19, all personnel involved on treatment procedure should be capable of controlling excessive aerosol production as well as spraying originated by handpieces and scalers instrument to diminish the risk of transmission. [Figure 1] depicts examples of aerosol spreading/splashing using a color dye on mask, gloves,

napkins and other elements commonly used during dental treatment.

UNITS OR ELEMENTS OF THE TRANSMISSION CHAIN

1. Infectious agent: Bacteria, fungi, virus, protozoa, rickettsia
2. Reservoirs: People, equipment, instruments, water (from tubing)
3. Susceptible host: Immunosuppression, medically compromised, elderly
4. Port of entry: Mucous membrane, GI tract, respiratory tract, broken skin, eyes
5. Port of exit: Secretions, saliva, blood, skin and mucosa membrane, droplets
6. Transmission: Direct contact, indirect contact, fomite vector, airborne.

INFECTION CONTROL IN THE DENTAL CLINIC

The basic routine for clinic infection control includes patient assessment, personal protection, and immunization; principles of sterilization and disinfection, and special protection for high-risk patients and health-care providers, etc.[9] However, in the current situation with COVID-19, this may not be sufficient. During the past 6 months in China, when the COVID-19 disease started in Wuhan, then spread to Hubei Province, and later to almost all provinces in China, all dental hospitals and clinics closed their services except for dental emergencies because coronavirus transmits directly from person to person. At that special time, we knew little about such a virus. Now, the following priorities have been established: First, is keeping social distancing everywhere for everyone, wearing a mask, washing hands, staying at home, blocking each community, checking body temperature, closing all high-risk areas and activities, etc. The second priority is checking high-risk people with some symptoms, such as high temperature and cough, confirms the COVID-19 positive patient, following and monitoring people who have been in close contact and making a barrier with others, to reduce the transmissible risk. The third priority as a most important strategy is making treatment immediately for all confirmed COVID-19 patients based on their seriousness level.[7,10-12]

At present, in the U.S., after a few months, dental practices that survived the first impact from COVID-19 have reopened adopting various requirements to ensure the safety of patients and working personnel at the clinics.

The American Dental Association and the U.S. CDC have issued several protocols to be used by health-care services facilities that include instructions on how to prepare a clinic to receive patients, how to treat the patient and the precautions and/or guidelines on what to do and what not to do on certain procedures.

SPECIAL AWARENESS, ATTENTION, AND EXTRA INFECTION CONTROL FOR COVID-19 TRANSMISSION AT THE DENTAL CLINICAL PRACTICE

There are sufficient evidence to demonstrate that the mouth as a pathway for transmission of COVID-19 disease is highly possible, even though we still do not know clearly the mechanism in detail of how, where, why, and when the COVID-19 virus is transmitted from one to another and it is evident that such a pandemic is still spreading in all populations worldwide, to the point that it may become a new normal status for everyone and every country, and continue for a long time.

1. The ordinary components of infection control
    a. Immunization
    b. Patient screening
    c. Hand hygiene
    d. Barrier technique – Personal protective equipment (PPE): Protecting clothing, masks, eyewear, and gloves (location of over gloves, latex allergy) [Figure 2] depicts ideal PPE to include face shield on the left and eyeglasses only on the right; Individual protective elements are shown on the far right: face shield, gloves, mask, and hairnet.
    e. Intraoral barrier technique
    f. Needles and sharp instrument safety
    g. Instrument sterilization and disinfection
    h. Surface disinfection and general operatory asepsis
    i. Radiographic asepsis
    j. Laboratory asepsis
    k. Disposal of contaminated wastes.[11-14]
2. Special awareness and attention for both oral health-care providers and patients
    a. Human health and disease in the 21st century – The universe space and earth natural environment changes influence the human safety and survival
    b. Civilized sickness in the 21st century – The human social environment changes, including lack of risk awareness, and working style, lifestyle, human behavior changes to disturb the natural bioecological balance between human being and the nature of earth, and then influence human body safety, health, and induce a lot of diseases and disorders, including transmission of virus diseases such as HIV, SARS, MERS, EBOLAR, and COVID-19
    c. Protect human health through oral health in the 21st century oral health or disease becomes the first priority of prevention and control for the human safety for the survival, protection, and maintenance of general health as a whole.
3. Extra infection control at the clinical practice
    a. The concept of social distancing as universal prevention should be recognized and accepted by all

oral health-care providers and administrators

b. Remodeling or setting up a new dental unit (operatory) should be based on the new concept of integrating each dental unit with stream of people contemplated to be present, informatics flow, material flow, airflow, water flow, and wastes flow; such dynamic management system should be implemented before reopening the dental clinic for provision of services to dental patients
c. The complete data recording, collecting, analysis, and evaluation from both patients and oral health-care providers are needed to set up a comprehensive data base for the purpose of protecting both safety and health of health-care personnel partners and others
d. The ordinary working style should be updated or changed for every patient based on their different disease level and different operational procedures needed for keeping time distancing during daily working time
e. Regular monitoring to assess the effectiveness of all procedures for infection control to be conducted every day or during a period of time to ensure that every step is being accomplished correctly without any uncertainty
f. Individualized dental operations provided for the emergency care to coronavirus-positive people with or without symptoms by a specialized dental team at a special equipped dental unit located in the special COVID-19 hospital. After finishing the emergency care service, the specialized dental team will be isolated and monitored for 14 days to assess their health status
g. All regular dental hospitals and private dental clinics should not be allowed to provide any dental service for the coronavirus-positive patients
h. All people in close contact with coronavirus-positive patient and/or in contact with high-risk areas should be monitored separately during 14 days. If there are emergency cases that may require dental intervention procedures, arrangements must be made to see these patients at a special dental emergency unit properly equipped to treat coronavirus patients.

MINIMAL RECOMMENDATIONS TO BE FOLLOWED BY ORAL HEALTH-CARE PERSONNEL

Encourage patients and relatives to stay home if at all possible particularly if they become sick. Be familiar of what steps to take if a patient with COVID-19 requests to be seen in the clinic.

When scheduling appointments for routine dental care instruct patients to call ahead and discuss the need to reschedule their appointment, if they have symptoms of COVID-19 on the day, they are scheduled to be seen. If they do not have symptoms of COVID-19, advise them that they should still put on their own cloth face covering before entering the facility.

Before a dental appointment, patient and workers must fill out a "pre-screening form" which includes information of traveling prior to the appointment within the past 2 weeks, any symptoms they may identify, contact to people who has been diagnosed positive to COVID-19.

Once this step has been fulfilled, the patient can proceed to make the appointment. On the day of the appointment, after arrival of to the clinic, the temperature should be taken to each person with a non-touch thermometer. Paper work and waiting time should take place in their personal vehicle. Only the patient can go to the dental chair unless he/she is an infant or someone who requires a guardian or chaperone.

Minimizing aerosol is the goal to prevent the spread of the disease. Also utilizing only a few dental chairs and cleaning each station in between patients for a period between 15 and 30 min depending on the nature of the procedure is also a strategy that requires to be followed with the "COVID-19 protocol." In addition, each surface of the clinic back and front should be wiped with a germicide solution each 15 min.

The entire armamentarium including low- and high-speed handpieces and ultrasonic scalers tips that can be removed from the waterlines must be heat sterilized after having been used in a patient. If such instruments cannot be sterilized, they cannot be used in another patient.

Daily routine elements required are mask, face shield, surgical cap, gloves, and isolation gown below the knee plus shoe protectors.[10]

*Courtesy of Dr. C. Diaz Guillory

IDEAL RECOMMENDATIONS

Detailed sections described within the recommendations from the U. S. CDC

- Risk
- Framework for health-care systems providing non-COVID-19 clinical care during the COVID-19 pandemic
- Patient management
- Facility considerations
- Equipment considerations
- Preprocedural mouth rinses
- Engineering controls
- Properly maintain ventilation systems
- Patient placement
- Patient volume
- Hygiene
- Universal source control
- Using PPE

- PPE supply optimization strategies
- Environmental infection control.

The U.S. CDC websites provide important information regarding the use of personal protective equipment, when to use it, what protective equipment is necessary, how to properly use it to prevent contamination, how to dispose it, and limitations: All oral health-care personnel including dentists, assistants, hygienists, and administrative office personnel need to become thoroughly familiar with the recommendations.

Recommended links from the U.S. Centers for Disease Control and Prevention (CDC)

- https://www.cdc.gov/oralhealth/infectioncontrol/statement-COVID.html
- https://www.cdc.gov/oralhealth/infectioncontrol/statement-on-reprocessing-dental-handpieces.htm
- Interim Infection Prevention and Control (IPC) Guidance for Dental Settings During the COVID-19 Response.[15]

USING PPE

The following information is described in detail on the website of CDC and readers are encouraged to become thoroughly familiar with each recommendation; major topics addressed are:

- Screen and triage everyone entering a health-care facility for signs and symptoms of COVID-19
- Reevaluate admitted patients for signs and symptoms of COVID-19
- Implement universal source control measures
- Encourage physical distancing
- Implement universal use of PPE
- Consider performing targeted SARS-CoV-2 testing of patients without signs or symptoms of COVID-19
- Consider if elective procedures, surgeries, and non-urgent outpatient visits should be postponed in certain circumstances
- Optimize the use of engineering controls and indoor air quality

Figure 1: Examples of contamination with saliva in various settings using a coloring dye pictures courtesy of Dr. Diaz Guillory.

Figure 2: Ideal PPE versus acceptable PPE*.

- Create a process to respond to SARS-CoV-2 exposures among HCP and others.

In addition become familiar with recommended IPC practices when caring for a patient with suspected or confirmed SARS-CoV-2 infection available on the CDC website at the following link: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html.[16]

GENERAL FACTS THAT NEED TO BE TAKEN INTO CONSIDERATION

The virus adheres on the surface of nonliving bodies, surviving more time in the wet and cold environment; it's very sensitive to sunshine, dry weather, and temperature between 33 and 34°C. It is still not clear where the virus comes from. Based on some reports from Singapore, CDC, US, and Japan indicated that the virus was positively identified from hands' surface, and bottom of shoes, except droplet, and aerosol. It has also been found that on the surface of oral mucosa, the new virus could be invaded, and much easily adhere on the smooth surfaces, and only survives for 15 min on a cotton role, and could stay active for 24 h on a mobile phone. The new virus could still be identified in the aerosol after 3 h; 4 h on the surface of copper, 24 h on the surface of hard paper; the maximum surviving time may reach 2–3 days on the surface of plastics or stainless steel.

There are more than 200 types of bacteria and virus identified on the surface of a mobile phone; so, the droplet with virus adheres on the surface of mobile phone and others and from the fingers touch will adhere to hands and then to the eyes; and when eating, it could enter the human body resulting in infection.

It has been demonstrated that the serious COVID-19 pneumonia like "ikemonia" results in the damage of lung function, body immunity system, and failure of body organs.

Based on the current pandemic situation in the US, and many countries in the world, the precautions are similar to those recommended for the duration of the influenza seasons and adding: Keeping social distances, washing hands, etc.

EXPERT RECOMMENDED

In March 2020, Dr. James Robb, MD, FCAP, disseminated information "on line" that contained advice on what people can do to prevent the spread of the coronavirus and encourage sharing such information to as many individuals as possible.[17]

CONSIDERATIONS

James Robb. MD. FCAP. March 2, 2020

Oral health science is a new concept of comprehensive oral health and view at the big data era that must cover the whole field of science and technology related to the nature and human society. Oral diseases and disorders are divided into three subdivisions: Chronic non-communicable diseases, communicable infectious diseases, and oral manifestations of general diseases. From prevention and control point of view, major contributions to improvement of oral health are closely related to environmental influences and behavioral changes which would reflect a "zero" point prevention; more specific preventive and therapeutic measures and a more operational definition of preventive dentistry than the conventional primary (1) secondary (2) and tertiary (3) prevention is recommended.[18]

The advancement and development of modern dental industry, technology, and materials are facing a new challenge that is to take into consideration advantages and disadvantages. It is certainly laudable to make efforts that will be beneficial to patients and oral care providers and at the same time to diminish and reduce many risks to both parties

as regards to security, safety, and potential transmission of different kinds of diseases and further the protection of human safety, health, and happiness. At this time, industry must pay more attention to this challenge taking into consideration public health, clinical practice, education and research, and its management and administration so that all block chains may be integrated into a common human life community and harmony with nature for our continuous survival on the earth.

EPITOME

As human beings, we know ourselves, our brain's conscience and awareness, but considering space and nature of earth we only know a little; as an iceberg over the waterline and there are so many bugs and weakness under the waterline that we conclude, we do not know anything. Hence, we have to continue on our efforts of exploring and discovering more, at the same time, we have to control our desire to reach an appropriate efficiency level so that we can maintain the balance between our humanity and nature.

That is our common responsibility for everyone, especially for the oral health-care providers.

CONCLUSION

While it is possible that contagious diseases may be transmitted in the dental office environment, oral health care personnel can protect themselves and others and strictly follow precautionary measures that would permit to provide oral health care needed in a safe manner.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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