

THE COVID-19 EFFECTS ON DENTISTRY

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Abstract

The rapid spread of the COVID-19 virus and related pneumonia has posed a major challenge for healthcare systems worldwide. The infection was discovered in the city of Wuhan, Central of China and swept across the world. The incubation period of the virus can range from 1–14 days, and the virus spread can happen in the absence of clinical symptoms as well. The most frequently reported symptoms are fever, cough, dyspnea, and myalgia or fatigue. Modes for transmission of virus include direct transmission through coughing, sneezing, and inhalation of droplets and contact transmission through contact with nasal, oral, and ocular mucosa. Droplet and aerosol transmission of the virus are the most common causes of COVID-19 infection in dental clinics and hospitals. COVID-19 virus has lately been detected in saliva of infected patients, thus posing an alert to health professionals to be customarily vigilant in protecting against the infectious disease spread. Because of the presence of virus in saliva, it may be helpful as a non-invasive tool in the rapid detection of the virus. During this pandemic dissemination of COVID-19, dental treatment must be confined to the procedures that cannot be deferred. All the precautions must be taken in terms of triaging, personal protective equipment, hand hygiene, pre-procedural mouthrinse, use of rubber dam, disinfection of the surfaces. Dental professionals are at the highest risk of COVID-19 infection; hence, dental practice has to be reorganized in order to ensure higher safety standards for both dentists and patients.

Keywords: COVID-19, aerosol, droplets, transmission, dentist, saliva, blood

Introduction

An infectious disease gaining popularity worldwide is Coronavirus, commonly referred to as SARS-CoV-2 or COVID-19 or 2019-nCoV.¹ The infection was discovered in the city of Wuhan, Central of China and swept across the world. Genomic analysis proposed that the virus is believed to have originated in bats and transmitted to humans through unknown hosts in the Wuhan seafood market, China, in December of 2019.² It was declared as a pandemic by WHO on 11 March 2020.³ The apparent ability of the virus to spread and its predisposition to cause severe

disease in immune-compromised and older adults makes it one of the most troublesome viruses in the world.³ It is widely renowned to mutate and recombine and the genomic sequence of coronavirus has changed since reported, hence the virulence of the virus has been enhanced.⁴ The virus belongs to a subfamily of Orthocoronavirinae from the family of Coronaviridae and is a single stranded RNA virus.⁵

The incubation period of the virus has been projected to be 1–14 days, and it is reported that virus spread can happen in the absence of clinical symptoms.⁶ The most frequently reported symptoms are fever, cough, dyspnea, and myalgia or fatigue. Although there might also be involvement of the gastrointestinal, cardiovascular, oto-laryngeal, nervous, system presenting with nausea and vomiting; acute coronary syndrome, arthralgia, headache; anosmia/ hyposmia; dizziness, encephalopathy, encephalitis, stroke, epileptic seizures; chilblains, erythematous exanthema, livedoreticularis, cutaneous vasculitis, acute urticaria; conjunctival hyperemia, chemosis, epiphora and increased secretions.⁷

Transmission subtleties

The two major means known for transmission of virus include direct transmission through coughing, sneezing, and inhalation of droplets and contact transmission through contact with nasal, oral, and ocular mucosa.⁸ COVID-19 being a respiratory virus infects the respiratory tract and is released through respiration. Droplets are produced on passage of air over a coating of fluid in the respiratory tract. Virus particles by virtue of those droplets are released on talking, coughing, sneezing or exhaling. Respiratory droplets are > 5-10 μm in diameter and transmission from the same occurs when an individual comes in contact with a contaminated surface or gets trapped in the spray zone of an infected patient. Aerosols are droplets are < 5 μm in diameter; remain suspended for prolonged periods of time and frequently hover long distances before evaporating, may serve as a potent contributor to transmission.⁹

Dental set up perpetually carries the risk of infection due to the nature of its procedures, entailing communication with patients by face to face contact; frequent exposure to saliva, blood, and other body fluids and the handling of sharp instruments.

Aerosol spread: Dentistry involves the use of rotary instruments, like handpieces which use high-speed gas to coerce the turbine to rotate at high speed and work with running water; airway syringes or ultrasonic scalers. These are known to produce an observable spray that comprise of droplets of water, saliva, blood, microorganisms, etc.¹⁰ Excessive heat is created with the use of high-speed dental hand pieces, which could damage dental tissue and lead to pathological changes to the dental pulp. Hence, to thwart the same, it is recommended to use a water coolant while performing all kind of dental procedures.¹¹ Droplet and aerosol transmission of the virus are the most common causes of COVID-19 infection in dental clinics and hospitals, as the generation of the same is unavoidable during various procedures. These particles are tiny enough to remain suspended in air for a prolonged period before settling on surfaces or entering the respiratory tract.¹² Inescapably, healthcare workers are in close contact with infected patients.

Contact spread: Close contact with fluids like water, saliva, blood; contaminated dental tools; patient equipment or surfaces makes a potential route for the spread of viruses. The aerosol

generated from an infected individual propels a short distance by talking and coughing and may come in contact with conjunctival, nasal, or oral mucosa of the dental personnel.¹³ Because of the presence of high number of asymptomatic carriers, all patients should be assumed to be infective. Spread via fomites: Fomites are objects/ surfaces that tend to get contaminated with pathogens and serve as a medium for the spread infection. These become contaminated by direct contact with body secretions or aerosols generated through dental procedures or during talking, coughing or sneezing.¹⁴ Droplets and aerosols derived from dental procedures tend to contaminate the whole surface in dental offices. The virus can remain infectious on surfaces like metal, stainless steel, plastic or glass from 2 hours to up to 9 days at room temperature.¹⁵ The most significant worry in dental clinics is the transmission of virus by way of droplets and aerosol as regardless of all of the safety measures, it is unattainable to trim down the droplet and aerosol generation to zero.

Diagnosis

The diagnosis of COVID infection can be entailed on the basis of history of stay or visit to an infected area within a time frame of 2 weeks; clinical features; laboratory investigations (real-time reverse transcription-PCR assays, nucleic acid amplification testing, serologic or rapid antibody tests); CT findings (representing bilateral pneumonia with ground-glass opacity and bilateral patchy shadows as the most distinctive patterns).¹⁶

Saliva as a potential COVID-19 reservoir

COVID-19 virus has lately been detected in saliva of infected patients, thus posing an alert to health professionals to be customarily vigilant in protecting against the infectious disease spread.¹⁷ The virus can exist in saliva due to the following reasons; entering the oral cavity from the respiratory tract by regular exchange of liquid droplets between these organs, virus present in the blood may enter the oral cavity through crevicular fluid, infection of the salivary glands with consequent release of particles into saliva through salivary ducts.¹⁸

It has been reported that ACE2 is the chief host cell receptor playing a vital role in the entry of virus into the cell to cause the final infection, the RBD on the spike protein binds to angiotensin-converting enzyme-2 receptor. This ACE 2 enzyme receptor a terminal carboxypeptidase, is present abundantly in the respiratory tract, epithelial cells present of the salivary glands along with heart, kidneys, and gastrointestinal tract.¹⁹

Because of the presence of virus in saliva, it may be helpful as a non-invasive tool in the rapid detection of the virus. Nasopharyngeal and oropharyngeal swabs are the suggested specimen types for detection of the virus, however, the collection by these methods requires close contact with infected patients and pretense a risk of transmission; causes discomfort. Saliva specimens can be obtained by instructing the patient to spit into a sterile bottle. Apart from being non-invasive, saliva has a sensitivity rate of greater than 90% and salivary diagnostics also significantly diminish the exposure of healthcare workers to the virus.²⁰

Patient Management and Infection Control

During this pandemic dissemination of COVID-19, dental treatment must be confined to the procedures that cannot be deferred. There should not be more than 1 patient in the waiting

room. The procedures involving the use of high speed hand-pieces and ultrasonic devices should be avoided as these are involved in intense production of aerosol and droplets, only emergency treatment should be rendered.²¹

Triaging

Preliminary screening by means of telephonic conversation with the patient can be performed before scheduling the appointments to identify the suspected or COVID-19 carriers and to define the real need for emergency treatment (excruciating or acute pain, pulpal/ periapical lesions, dental abscess, cellulitis or trauma). Patients should be enquired about history of any exposure to a person with known or suspected COVID-19 infection; any travel history in past one month to highly epidemic areas and presence of any symptoms such as fever or cough. Presence of any of the above mentioned, the elective dental treatment must be deferred for at least 2 weeks. Patient with a positive history of contact or symptoms should be reported to the sanitary authorities, to rapidly enforce quarantine or hospitalization depending on the severity.^{22,23}

During the visit to the clinic, data compilation on the telephonic history should be repeated, patients should be made to fill out a comprehensive medical history form along with COVID-19 screening questionnaire, and body temperature should be monitored with the help of a contactless infrared thermometer. If body temperature is >37.5 °C, treatment should be postponed. It is important to apply the same measures to people accompanying the patient. Limited staff should be present in the operating room and there should be adequate ventilation.

Mouth Rinse

A pre-procedural mouthrinse is one of the most proficient ways to reduce the microbial load of the oral cavity fluids. The efficacy of chlorhexidine as a pre-procedural mouthrinse in combating the virus is questionable. As per a meta-analytical study conducted by Marui, pre-procedural mouthrinse comprising of chlorhexidine, cetylpyridinium chloride, and essential oils can cause a mean reduction of 68.4% colony-forming units in dental aerosols. It has been reported that mouth rinses containing oxidative agents like 1% hydrogen peroxide or 0.2% povidone-iodine are recommended. Povidone iodine solution has demonstrated 99.99% activity against enveloped and non-enveloped viruses such as influenza, Ebola, MERS and SARS coronavirus, and it has strong bactericidal properties against pathogens, causing oral and respiratory tract infections.^{24,25}

Hand Hygiene

According to WHO, hand hygiene involves using an alcohol based hand rub or washing hands with water and soap at least for 20 seconds especially if the hands are soiled with dirt, blood or body fluids. Adequate hand hygiene should be practiced prior to and after touching the patient and after having contact with any body fluid or touching any of the tainted surfaces.²⁶ Frequent hand washing may result in skin damage; it has been reported that damage to the skin promotes the entry of virus as ACE2 receptors are also present in abundance in the basal layer of the epidermis, and hair follicles and eccrine glands. Hand washing must be accompanied by application of moisturizers on intact skin along with the use of gloves and alcoholic hand rubs to prevent skin drying.²⁷

Personal Protective Equipment

Dental Health Care Professionals must wear a surgical mask; protective glasses; face shields; a gown and gloves during the procedures as the spread of oral microorganisms mainly moves towards the face, especially in eyes and around the nose, especially when the procedure is liable to create spattering of blood or other body fluids.²⁸

Surgical Mask: Masks recommended by WHO for use during the dental procedures are respirators. These are well-fitted masks that guard one from inhalation of aerosol, commonly available as N95 or P2 respirators. N95 respirators have been projected to give enhanced safety against viruses in health care workers than the surgical masks especially in aerosol generating procedures and have a 95% particle filtering efficiency for a median particle size of 0.3 μm . The masks should not be touched once put on and hand hygiene must be followed after their removal.²⁹

Protective glasses: Dentists must wear eye protection when treating the patients as aerosol generating procedures tends to spatter the droplets near or into the eyes. Personal eye glasses/contact lenses do not provide sufficient protection to the eye from virus transmission. Reusable eye protectors should be cleaned and disinfected before reuse according to the producers' instructions.³⁰

Face shields: Face shields are used as a shelter for the facial area from airborne body fluids like blood, saliva, bronchial secretions, etc. expelled as a result of a wide array of dental procedures. For appropriate protection, the shield should extend underneath the chin inferiorly, to the ears laterally, and there should be no gap between the forehead and the shield's headpiece. Face shields are comfortable, protect the viral entry and prevent the health professional from touching their face, thereby reducing the probability of autoinoculation. These can be reused and can be cleaned with soap and water or disinfectants.³¹

Gowns: In healthcare settings, a cotton gown should be worn with a supplementary disposable plastic apron interchangeable between patients. It must fit snugly and should not be touched or worn outside the operatories. Gowns can be reusable or disposable; reusable gowns should be put in a plastic bag before being placed in the laundry container and can be washed and disinfected, in a washing machine with warm water (60–90°C) and laundry detergent. Disposable gowns should be discarded in to general or clinical waste according to usual practices.³²

Gloves: Medical gloves are disposable; patient examination gloves and surgeon's gloves. These provide broad barrier protection and are used by dental or medical personnel to prevent the spread of infection during examination or procedures. After performing adequate hand hygiene, clean non-sterile gloves should be donned upon entry into a healthcare setting. After the removal, the hand hygiene should be performed immediately.³³

Rubber dam isolation

Rubber dam is one of the most effective tools in attaining adequate moisture control and reducing contamination from the oral cavity. It effectively reduces the generation of droplets and aerosol contaminated with patient saliva and/or blood by 70% within 3-foot diameter of the field. The use of rubber dam must be advocated used during endodontic treatment, pediatric and

restorative dentistry or procedures that necessitate the use of high-speed handpieces and ultrasonic instruments. In addition to the use of rubber dam, high-volume suction is required for maximum prevention of aerosol and spatter from spreading and further minimizing the risk of contamination. When the use of rubber dam is not practicable, manual instruments such as excavators and hand scalars are preferred to keep aerosol generation at a negligible level.^{34, 35}

Anti-retraction handpiece

The high-speed dental handpiece without anti-retraction valves may push out the debris and fluids during the dental procedures and as a result, oral flora including bacteria and viruses may infect the air and water tubes within the dental unit become a potent cause of cross-infection. Anti-retraction dental handpiece with specially designed anti-retraction valves or other anti-reflux designs is robustly suggested as an extra preventive measure for cross-infection during COVID-19 outbreak.³⁶

Disinfection

Coronavirus is susceptible to disinfectants like sodium hypochlorite 0.1% (1 g/L), 0.5% hydrogen peroxide, 62–71% ethanol, and phenolic and quaternary ammonium compounds. It has been reported that biocidal agents such as 0.05–0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate have a lower efficiency. It is critical that the dental auxiliary staff follow a strict disinfection protocol; all surfaces must be sanitized to the highest standard including door handles, chairs, desks, touch screens and monitors.

Medical Waste Management

The clinical (dental or medical) waste should be transported to a safe temporary storage area. The reusable instruments and equipments must be pretreated, cleaned, sterilized, and properly stored in accordance with the modus operandi by the Disinfection and Sterilization of Dental Instrument released by the local authorities. The waste generated by the treatment of suspected or confirmed COVID-19 patients must be regarded as infectious, sealed in yellow color coded medical waste bag with “gooseneck” ligation with the surface to be marked.³⁷

Ramifications of COVID-19 on Dentistry

Dental professionals are at the highest risk of COVID-19 infection as the dental procedures involve the use of high pressure sprays of water and air that may possibly disperse virus-containing aerosols from a patient into the treatment room. Even in a well maintained dental office, practitioners are at a higher risk of infection than patients. Dental practice has to be reorganized in order to ensure higher safety standards for both dentists and patients. It has been suggested that the dental care should be limited to only emergency cases including patients with excruciating or acute pain, pulpal/ periapical lesions, dental abscess, cellulitis or trauma and all non-urgent dental treatments to be deferred. It is crucial that a thorough preliminary triaging is done before patient pays visit to the clinic; adequate hand hygiene to be followed; an appropriate Personal Protective Equipment must be utilized to minimize the risk of transmission during the treatment and a disinfection protocol to be practiced.³⁸

Implications on long term dental treatment: It is believed that the outlays of providing dental treatment in future may increase because of the need for additional resources such as PPE, dental

practice modifications; reduced number of patients in the waiting area in a given period of time and specialist service charge. It is also assumed that there may be a surge in the demands for e-consultations in the near future. People may have a fear of visiting a dentist for elective dental treatment after the settling down of this space. Due to the COVID pandemic, it is believed that the economic impact on the dental industry will be highly disruptive. It would be associated with ambiguity for the profession, reduced earnings and more unemployment in the future.³⁹ It is projected that the patients with infected gums/ periodontal disease, may remain untreated for a long period leading to periodontal complications; deferral of elective operative/ conservative dentistry procedures may result in extraction of more teeth, thereby, associated with an increased demand for a cost-effective prosthetic rehabilitation in near future and for a fixed tooth-retained and implant-retained prosthesis in the long run.⁴⁰

The COVID-19 pandemic creates distress in the healthcare system. Social distancing is one of the effective approaches to reduce the spread of infection and break the chain. In circumstances like these, there is a need for supervision, incessant adaptation of recommendations and guidelines. Healthcare workers need to be prompt in terms of exchange of knowledge/ ideas, new information on treatment modalities. One of the most advanced concepts of dissemination of knowledge or information is e-learning, which respects the integrity of social distancing. Webinars are the most relevant mode of e-learning and have been proved to be well accepted in health education.⁴¹ Dental professionals must have a copious knowledge of COVID infection spreading modalities; identification of suspects/ confirmed cases and self-protection protocols.

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