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Review Article

Management of COVID-19 Risk in Dental Office: A Review

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Abstract

Novel Coronavirus (COVID-19) is a new strain of coronavirus. WHO first identified this strain on December 2019 in a cluster with pneumonia symptoms in Wuhan city, Hubei province of China. There are several sources of transmission for the spread of COVID-19 but dental care procedures are under surveillance by health care authorities all over the world. Dental health care providers are the most exposed to aerosols transmissible infectious agent, and so at the vanguard of changes related to the pandemic on how to organize the efficient dental care to the providers. There are several reports, suggestions and guidelines set by health care authorities on how this infection could be transmitted through dental services and measures to be taken to protect the patients, staff and healthcare professionals providing dental service. The analysis was conducted to compare the guidelines which includes documents of OSHA and of CDC, an agency of the U.S. Secretary of Health and Human Services [1].

Contamination and disease control details and other risk relieving measures were reviewed under parameters of consistency, overlaps and similarities, then grouped together according to sectoral areas which covers all realm of managing a dental healthcare facilities [1]. This article reviews understanding about coronavirus and its transmission and the "Pandemic-5 Framework for COVID-19 Control in Dentistry" which can make a comprehensive decision-making simplified from a clinical view [1].

Keywords: *COVID-19; Dental Office; Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)*

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)

It is a single stranded RNA virus that is contagious in humans [2,3]. At present, there are four groups of coronaviruses [4,5]:

1. α-CoV
2. β-CoV
3. γ-CoV
4. δ-CoV.

This virus belongs to the β-COV variant, which along with α-CoV viruses, transmit infection to mammals and human beings [2,6,7]. Structurally, SARS-CoV-2 has a membrane envelope with multiple "spike glycoprotein" (S-protein) extensions (Figure 1) [8]. The capsule demonstrate other polyproteins, nucleoproteins, and membrane proteins, which includes specifically RNA polymerase, 3-chymotrypsin-like protease, papain-like protease, helicase, glycoprotein, and accessory proteins [8,9]. The viral entry into the target cells of the host is facilitated by the binding of the S-proteins from coronaviruses to the receptors on host cells. In case of SARS-CoV-2, human angiotensin-converting enzyme 2 receptor (ACE2) is the target receptor [10-13]. Increased viral loads in older individuals can be explained by harmony for the ACE2 receptor, since ACE2 expression increases with age [14].

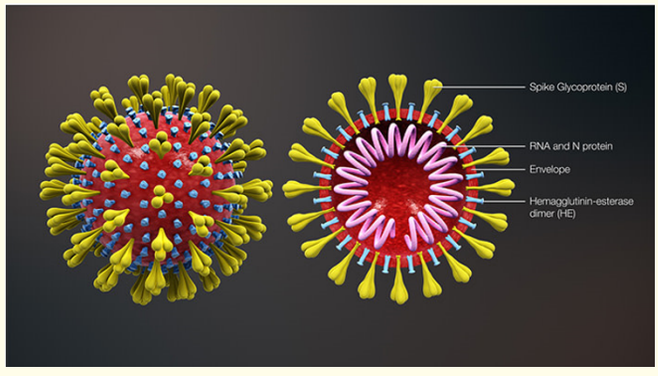

Figure 1: Diagram of the ultrastructure of the SARS-CoV-2 virus [31].

Prospective sources of spread for SARS-CoV-2 in the oral health care set ups

Reportedly, the channel for spread of SARS-CoV-2 can be directly and indirectly. Directly it can be from close encountered from person by respiratory droplets and indirectly can be communicated from fomites [15,16]. Asymptomatic person has the potential for viral shedding for a period of 14 days and the capability can extend up to 24 days [17]. Isolation of Live SARS-CoV-2 viruses from saliva of infected individuals is evident and in some cases its concentration in saliva has been shown to be considerably higher than that on nasopharyngeal culture [18]. As expected, $ACE2^{+}$ cells are copious in the upper respiratory tract and epithelium of the salivary gland duct [19]. During the SARS-CoV-1 epidemic, salivary duct epithelium cells were initial targets for viral infection [20].

SARS-CoV-2 spread is increased in the oral health care set up because of the near contact amidst persons working, poor ventilation and by the aerosol-generating procedures performed during the delivery of dental care [21-23]. The care provider and patients are at risk due to droplets containing microorganisms or if there is a close contact with the mucous membrane in upper or lower eyelids, nasal cavity or oral cavity [21-24]. Additionally, the virus may survive between 4 to 72 hours on inanimate objects which can lead to resulting disclosure after in touch with the surfaces [25]. The viral load of the infected person and the vulnerability of the host individual is considered to be the possibility for indirect spread of the infection [26]. Possible routes of SARS-CoV-2 transmission in the dental setting are indicated in figure 2.

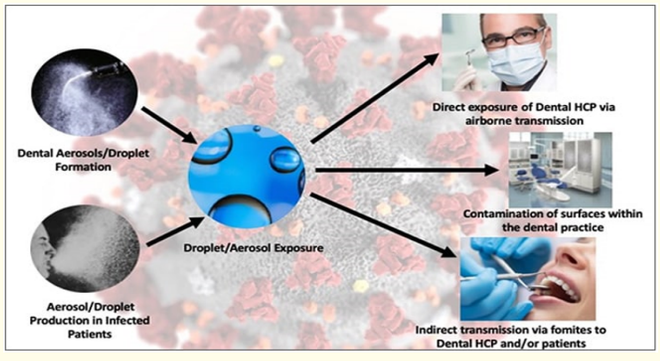

Figure 2: Possible routes of SARS-CoV-2 transmission in the dental setting [32].

The "pandemic-5 framework for COVID-19 control in dentistry"

The analysis of guidelines revealed five marked areas to control the widespread infection. It comprises of [1]:

1. Planning and protocols,
2. Patient screening,
3. Preparation of facilities,
4. PPE and infection control,
5. Procedures and aerosol control.

This framework covers all aspects requiring adaptation in a pandemic context in an organized manner. It amalgamates the components of OSHA's "Hierarchy of Controls" and CDC's "Standard and Transmission-based Precautions" into a latest, blended version (Figure 3). Roberts., *et al*. developed the health system reform which inspired the structure to control the pandemic [27]. It metaphorize "control knobs" to describe key areas of involvement or development to be done in the intricate healthcare system. The five areas which need intervention to control the spread of pandemic consist of:

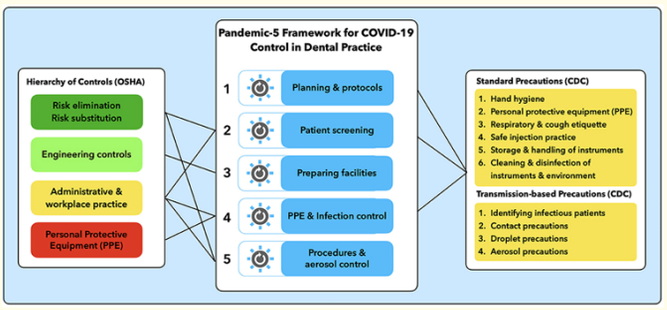

Figure 3: Pandemic-5 framework for COVID-19 control in dental practice [1].

1. **Planning and protocols:** Preparing for pandemic and response needs designing and anticipation, evaluation of risk, reasoning through different scenarios, and putting command and risk-reduction in place. Communication and participation of the dental team and interaction with patients also plays a significant role in designing the framework. Training of dental team, practice of protocols and monitoring compliance should be planned and authorized as well. Legal and licensing regulations also has some aspects of planning and documentation. A written plan which includes protocols, checklists and practical control measures are preferred to control the spread of infection [1].
2. **Patient screening:** It includes elementary evaluation of the patient's health condition and dental care requirements. Screening of the patient helps to limit access of the patients to the clinical setting. Pre-screening via phone or online questionnaires and/or software helps in determining the patient

who are at high-risk of getting infected or is presently sick. With tele-communication system patients for urgent care may receive palliative treatment while being scheduled procedure at the dental clinic, where additional screening for COVID-19 may be performed prior to dental care. Elective procedures may be either be reschedule or performed depending on the pandemic situation and risks involved [28].

3. **Preparation of facilities:** Preparing the dental settings includes a range of measures to ensure segregation in waiting and reception areas, partition of operatory, ventilation and air filtration, regular hand hygiene for patient and staff can be enabled through additional disinfection dispensers. **HEPA filters** (High Efficiency Particulate Air) are **mechanical filters** with a capacity for sifting small particles at higher rate can also be considered. Negative pressure rooms or infectious isolation facilities are designed for infection control.
4. **PPE and infection control:** Prevention of SARS-CoV-2 infections in oral healthcare workers requires a multi-pronged, integrated approach of infection prevention and control (IPC). Personal protective equipment (PPE) serve as effective barrier for dental teams as they works close to the patient's oral cavity. It refers to protective clothing, including gloves, face shields, eyewear, facemasks, and/or other equipment designed to protect the wearer from injury or the spread of infection. PPE should be used with other infection control practices like hand washing, using alcohol-based hand sanitizers, and the consistent enforcement of infection prevention practices.
5. **Dental Procedures and aerosol control:** Dental procedures must be selected and delivered carefully as the risk of spreading of SARS-CoV-2 through is still uncertain. Aerosols and spatter generating procedures should be performed with maximum suction methods and rubber dam should be used as much as possible. Otherwise, procedure with minimal or no aerosol potential may be chosen, such as the approach of the Safe, Aerosol-free, Emergent (SAFE) Dentistry concept [29]. Innovative suction technology is a new measure for aerosol control can also be considered once their efficiency and testament have been demonstrated.

Above all, it is crucial to follow the important principles such as follow the universal precautions, minimizing the droplet/aerosol transmission, and use effective PPE for protection of patients and staff [30]. All the five control areas mentioned are equally important and considered to provide the best possible safety and infection control in dental care settings [1].

Conclusion

In the future, we may find ourselves in a condition where lower levels of SARS-CoV-2 exist in the population which can demonstrates periodic or even seasonal spikes in infection. In the present situation, it may become essential that new strategies be developed to break the series of events that allow pathogens to cause infection. It is recommended that all dental care providers keep themselves updated as new scientific data expand regarding COVID-19.

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Volume 4 Issue 8 August 2021