

# Role of Droplets and Aerosols in Transmission of COVID-19 in Dental Practice: A Literature Review

Sanaz Helli <sup>1</sup>, Elnaz Shafiee <sup>2</sup>, Katayoun Mogharrab Alile <sup>3</sup>  

<sup>1</sup> Department of Oral Medicine, Faculty of Dentistry, Tabriz Medical Sciences, Islamic Azad University, Tabriz, Iran

<sup>2</sup> Department of Prosthodontics, Faculty of Dentistry, Tabriz Medical Sciences, Islamic Azad University, Tabriz, Iran

<sup>3</sup> Faculty of Dentistry, Tabriz Medical Sciences, Islamic Azad University, Tabriz, Iran

## Corresponding author:

Katayoun Mogharrab Alile, Faculty of Dentistry, Tabriz Medical Sciences, Islamic Azad University, Tabriz, Iran

Katayoun.m.98@gmail.com

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## Abstract

**Background and Aim:** This study sought to review the role of aerosols and droplets in transmission of coronavirus disease 2019 (COVID-19) in dental practice .

**Materials and Methods:** Published papers concerning the transmission routes of COVID-19 in dental environment were retrieved from the search engines, websites of related health organizations, and relevant electronic databases. Out of primarily retrieved 120 articles, 40 articles met the inclusion criteria.

**Results:** Many Studies reported that the main transmission routes of COVID-19 were direct contact, droplets and aerosols. Because of the adjacency to the patient's oral cavity and use of aerosol-generating headpieces, dental practitioners are at high risk of COVID-19. Adherence to clinical protocols and guidelines in the working environment was highly emphasized in all studies to minimize the risk of infection and prevent cross-contamination in dental office setting.

**Conclusion:** Dental healthcare providers should be well aware of the most recent guidelines and protocols to prevent COVID-19 transmission and constantly update their knowledge in this regard.

**Key Words:** Aerosols; COVID-19; Infection Control

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## Introduction

In December 31, 2019, an outbreak of pneumonia with unknown etiology was reported in Wuhan, China. The World Health Organization (WHO) named it coronavirus disease 2019 (COVID-19). It is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The WHO declared a pandemic state in March 2020 [1]. The primary reports suggested the transfer of the virus from animals to humans, which was later evolved to human to human transmission [2]. The novel coronavirus is a single, plus-stranded RNA virus. Procedures

generating aerosols are routinely performed in dental practice. COVID-19 can be transmitted through aerosolized saliva as long as SARS-CoV-2 is found in the saliva of patient [3]. Transmission through expelled respiratory droplets (> 5 µm) and aerosols (< 5 µm) is another established route of transmission [4]. COVID-19 infection may be transmitted in dental office setting through contact, aerosols, and droplets [5]. Dental care providers are among the most exposed healthcare workers to COVID-19 infection. Therefore, adherence to guidelines to prevent COVID-19 transmission in dental office environment is essential [6]. In

routine dental procedures, dental unit surfaces, saliva and material contamination can serve as sources of infection both for the dental staff and patients. Droplets of saliva and blood settled on surfaces or inspiration of aerosols generated by rotary instruments and ultrasound handpieces are hazardous for those working in dental offices [7].

This study sought to review the role of aerosols and droplets in COVID-19 transmission in dental practice to minimize the risks of this airborne infection in dental clinics and hospitals.

## Materials and Methods

A literature search was performed, and original articles, reviews, letters to editors, and international guidelines and protocols were searched. Also, relevant institutions, organizations, online resources for COVID-19, and American Dental Association (ADA) Coronavirus Center for Dentists were electronically searched. A relevant English literature search was also conducted in PubMed, Google Scholar, Elsevier, Wiley, Embase, Springer, Scopus, MDPI, and Center for Disease Control (CDC). The databases were searched for articles published from August 22, 2020 up to February 22, 2021 using the following search terms: “dentistry AND/ OR Coronavirus 2019”, “Infection control”, “Aerosol”, “Droplet” and “Dental care”. We included all papers that reported recommendations and practice guidelines for general dental practitioners during the COVID-19 pandemic. Out of the initially retrieved 120 articles, 40 articles met the inclusion criteria.

## Results

### COVID-19 Transmission Modes

Many studies reported different routes of transmission of COVID-19. The main routes of transmission of novel coronavirus include direct contact and high exposure to droplets and aerosols which are generated in daily dental procedures [8,9]. The main transmission

routes of COVID-19 include transmission through oral and nasal secretions (coughing and sneezing), through contact with virus-contaminated surfaces, and by inspiration of aerosols [10]. Respiratory droplets and contact transmission are the main interpersonal transmission routes [11]. Close contact and significant exposure to patient's blood and saliva also have potential risks for the office staff [12]. A recent study reported that respiratory secretions containing droplets can transmit novel coronavirus between individuals [12].

According to the reviewed literature, the most common transmission modes of COVID-19 in dental practice include direct exposure to respiratory secretions including droplets, saliva, sneezing or coughing, indirect transmission by touching the infected surfaces and tools and then touching the face, and nasal, oral, and conjunctival mucous membranes [12,13]. Conjunctival samples from infected and suspected patients show that eye exposure is another route of transmission for the COVID-19 [13]. COVID-19 transmission often takes place through direct and close contact with virus-laden respiratory droplets from infected patients when sneezing or indirect contact with contaminated surfaces [13,14].

### Risk of Transmission in Dental Practice

Transmission of COVID-19 in dentistry is through procedures that generate droplets and aerosols [15]. Aerosols and droplets are produced during different dental procedures either by patient, dental unit waterlines, or instrumentation [1]. Generated aerosols may contain microorganisms present in the patient's oral cavity and respiratory tract. The amount of oronasal secretions, presence/absence of periodontal infection, and dental plaque determine the risk of infection. Spread of infection in dental procedures can be due to the use of dental unit waterlines by shedding microorganisms into the oral cavity [16].

### **Aerosol Generating Medical Procedures in Dental Settings:**

High-speed dental handpieces generate droplets and aerosols combined with saliva or blood [5]. The statement by the United States CDC for dental healthcare providers is that any procedure that includes manipulation of teeth or oral mucosa with the use of mechanical instruments (e.g., rotary air driven, high speed dental handpieces, ultrasonic and sonic scalers, air water spray, air polishers, water jets and air abrasion units) is a potential aerosol generating medical procedure [7,17-21]. As stated in the literature, coronaviruses can settle on surfaces for several days. Thus, surfaces in dental offices can significantly aid in spread of infection [22]. Use of dental handpieces generates aerosols and droplets infected with microorganisms and blood. The water spray of dental handpiece is one of the primary sources of splatters and aerosols in surgery [18-20].

### **Discussion**

Dental healthcare workers are at high risk of exposure to coronavirus, because of their close contact with patients. Aerosols and droplets contaminated with virus are produced in many dental procedures [21]. Transmission of the novel coronavirus by droplets and aerosols is a serious concern in dentistry. Generation of aerosols and droplets in dental practice cannot be reached to zero despite all the precautions taken; thus, dental clinicians are at risk of infection [22,23].

Aerosols and droplets generated by the operation of dental handpieces are small enough to remain in the air for a prolonged period of time before they contaminate surfaces or enter the respiratory tract [16,24]. The recommendation of American Dental Association and CDC to dental healthcare providers is to defer all elective dental treatments and only provide

emergency care [25].

### **Dental Recommendations**

The CDC has presented an interim guidance for prevention of infection and reduction of transmission risk of COVID-19 in dental setting (Table 1)[26,27].

#### **1. Patient management and prevention of infection**

##### **•Triage of Patients**

Screening patients via phone and clinical triage by a questionnaire. Questions should include any symptoms of fever or experiencing respiratory symptoms such as sore throat, cough, or dyspnea, also recent contact with an infected or suspected patient.

##### **•Patient Considerations**

Patients must wear a surgical mask and have precise respiratory hygiene. They should cover their mouth and nose with a tissue when sneezing and coughing and then discard the tissue and ensure hand hygiene.

- Reduce number of patients in waiting room by certain appointment time. One room per patient to receive care.

- Social distancing by at least 2 meters between patients

#### **2.Engineering Controls**

- Provide sufficient air supply.

- Use of properly installed portable high efficiency particulate air filtration units.

- Negative-pressure or airborne infection isolation/treatment rooms

#### **3.Dental Treatment Guidelines**

##### *3.1. Preprocedural considerations*

##### **•Hand Hygiene**

Hand hygiene with water and soap for a minimum of 20 seconds.

In situations with no access to water and soap, alcohol-based hand sanitizers containing 80% v/v ethanol or 75% v/v isopropanol may be used.

##### **•Personal Protective Equipment**

The WHO and the Public Health Agency of

**Table1.** Dental recommendations for COVID-19 management

Patient management and prevention of infection	Engineering Controls	Dental Treatment Guidelines		
		Pre-procedural considerations	Procedural considerations	Post-procedural considerations
Triage of Patients	Increase outdoor air supply	Hand Hygiene	Single Use Tools	Equipment and Surface Cleaning / Disinfection
Patient Placement Considerations	Use of high efficiency particulate air filtration units	Personal Protective Equipment	Radiographs	
		Mouthwash	Reduce Aerosol Production	
	Negative-pressure treatment rooms		Dental Rubber Dams	
			High Volume Suction/ Evacuation	

Canada recommend using medical gowns, face masks, respirators (N95), gloves, and goggles or face shields.

- Preprocedural Mouthwash

Use of preprocedural mouthwashes may re-duce the level of oral microorganisms during aerosol-generating procedures, but there is no evidence to reduce the risk of transmission. Evidence shows sensitivity of similar viruses to povidone mouthwash [28].

### 3.2. Procedural considerations

- Single Use Tools

It is encouraged to use disposable dental mirrors, blood pressure cuffs, and syringes to minimize cross contamination.

- Radiography

Extraoral imaging modalities e.g. cone-beam computed tomography and panoramic radiography must be requested to avoid cough or gag reflex that may occur in intraoral radiography. If intraoral imaging is necessarily required, sensors with double covers should be used to prevent perforation and subsequent cross contamination.

- Reduce Aerosol Production

Limit the aerosol-generating procedures

including high-speed hand pieces, ultrasonic instruments, and 3-way syringes.

- Dental Rubber Dams

Rubber dams should be used for pediatric, endodontic, and restorative treatments that require rotary instrumentation to reduce aerosol production. Also, it can cover the nose to minimize the risk of transmission.

- High Volume Excavator / Suction

Use of high volume suction to minimize droplets, spatters and aerosols.

### 3.3. Post-procedural considerations

- Equipment and Surface Disinfection

The WHO recommendations for cleaning and disinfecting of healthcare settings surfaces, the use of disinfectants against virus envelope i.e. 70% ethyl alcohol for disinfection of reusable equipment and 0.5% sodium hypochlorite

Dental clinicians have a fundamental role in prevention of COVID-19 transmission. The human-human transmission routes are droplet inhalation transmission, direct transmission, and contact transmission. Dental clinicians and office staff are at high risk of infection due to close communication

with patients and exposure to blood, saliva, body fluids, and sharp instruments. Also, protective measures with respect to patient screening, mouthwashes, personal protective measures, use of antiretraction handpieces, rubber dam isolation, disinfection and waste management should be considered [29,30].

## Conclusion

Most dental procedures generate droplets and aerosols. Since droplets and aerosols are the main route of COVID-19 transmission, as discussed in this review, the most appropriate suggestion in all clinical protocols and guidelines is to reduce the risk of infection and prevent virus spread through dental procedures. Therefore, dental care providers should be well aware of the most recent guidelines and protocols about transmission routes of COVID-19 and measures of infection control in dental clinics and hospitals [29,30].

## Conflict of Interest

None declared

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