



## Original Research Article

## Aerosol phobia and SARS-CoV-2 spread amongst dentists: Hype vs reality!

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## ABSTRACT

The definite mechanism of SARS-CoV-2 transmission remains unclear, but it is certain that basically it is through aerosols produced by coughing or other sources. Besides, these aerosolized droplets can remain suspended in an area, even after the person responsible for the transmission has left and thus may result in the surface contamination and infection of the health-care professionals. Most of the dentists worldwide are anxious and have chief concerns about aerosols. Aerosols containing the virus can be a risk. So far, no clear evidence in the literature exists that aerosols containing the virus have affected people and of course, no proof to reject that, either. Most of the dentists have profound fear and anxiety of getting infected while working during the current viral outbreak that has usually been due to the overwhelming reports on the COVID-19 pandemic. Most dental professionals get exposed to infections, and older generations have lived through various health scares in the past, including HIV and SARS. Indeed, there is so much we still don't know about COVID-19, but we can't live with this fear for eternity; we have to find a way to live with this pandemic. Since the aerosols increase during and after the dental procedures, therefore, the Dental offices should adhere to CDC and OSHA guidelines to reduce the risk of transmission of infections. In consideration of the current situation, it will be a wise decision to decrease patient contact, restrict the generation of aerosols and use the best PPE.

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## 1. Introduction

Severe Acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been declared a pandemic by the World Health Organization, thereby making an entry into the list of the deadliest illnesses of the past including cholera, bubonic plague, smallpox and influenza. This severe flulike sickness also termed as COVID-19 seems to be caused by a new type of coronavirus; a family of viruses usually linked with the common cold. Although there is no confirmed source of COVID-19 origin, the role of bats and pangolins are suspected. Since the coronavirus is novel, the information gathered by several researchers keeps on changing as scientists and the medical community continue to learn how the virus behaves.<sup>1,2</sup> The definite mechanisms by which

SARS is transmitted remains unclear, but it is certain that the main means is through aerosol produced by coughing or other sources. The saliva of the patients infected with COVID-19 plays a pivotal role in the human-to-human transmission.<sup>1,3</sup>

So far, the scientific consensus is that transmission of COVID -19 mostly occurs via respiratory secretions in the form of large respiratory droplets and not by small aerosols. Droplets are usually heavy and do not wander considerably; rather, they fall from the air after transported up to six feet but may become a worrisome situation when the viral particles get converted into fine spray of aerosols via coughing, sneezing or oro-dental procedures. In these instances, particles can potentially be transported to a greater distance, approximately up to 20 feet, from an infected person and then spur secondary infections in another place. Even after the person responsible for

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the transmission has left these aerosolized droplets can remain suspended in an area and thus may result in the surface contamination and infection of the health-care professionals.<sup>4</sup>

While researchers all over the world are busy working on a definite therapy (vaccine) for COVID-19, rigorous enforcement of efforts implemented to prevent or reduce transmission have been put forth by several states and countries. Healthcare professionals are facing unprecedented circumstances related to patient care and growing concern about this deadly disease. Dentistry is facing its darkest hour yet, with the growth and spread of the Coronavirus pandemic as most of the dentists involved in aerosol-generating procedures may be unknowingly treating infected but not diagnosed yet COVID-19 patients, or those considered to be suspected cases for surveillance. Before the World Health Organization (WHO) declared a pandemic, and while the disease was contained in China only, 29% of patients treated at a hospital in Wuhan were the medical staff. Most of these subjects (75%) had worked in the general wards, while the rest were stationed in the intensive care unit (ICU) and handling the emergency services.<sup>5</sup> Till date medical professionals who have tested positive for COVID-19 had exposure in the health centres and long-duration care facilities, yet there are no reports in dental settings or among dental professionals, even though dentistry is considered a very-high-risk profession involving aerosol production. Early infections and deaths amongst the healthcare workers could have been due to several possible reasons such as inadequate availability or use of PPE, lack of knowledge about its spread, considerable exposure to infected patients, and lacking training in infection control, as proposed by Wang et al. (2020).<sup>5</sup> Ng et al. (2020)<sup>6</sup> in a Singapore based study reported that none of the 41 healthcare workers (HCWs) exposed to a SARS-Cov-2 positive patient amidst AGPs (including high-risk AGP procedures like non-invasive ventilation, emergency intubation and subsequent extubation) developed COVID-19. These findings were contrary to the arguments that there may be a high risk of airborne transmission. Besides, eighty-five per cent of them wore only surgical masks. In a different study from Hong Kong, 71 hospital staff and 49 patients were exposed to a COVID-19 positive patient who had received 8L/min oxygen but no other AGPs. 52 subjects with respiratory symptoms and fever when screened were found to be negative for SARS-CoV-2.<sup>7</sup>

## 2. Role of Aerosols in Dentistry

What does dentistry have to do with COVID-19? Most of the dentists worldwide are anxious and have chief concerns about aerosols. Aerosols are defined as particles less than 50 micrometres in diameter. Because of their small size, these particles remain airborne for a long time before they come to rest on physical surfaces or invade the respiratory tract.

Besides, aerosol (0.5 to 10  $\mu\text{m}$  in diameter) are also capable of penetration and inhabit within the smaller passages of the lungs and thereby increase the possibility of disease spread. There is a general agreement that aerosols particles (less than 50  $\mu\text{m}$  in size) have a considerable threat of airborne infection in dentistry because of their ability to stay airborne and ability to invade respiratory passages.<sup>3,8</sup>

Aerosols containing the virus can be a risk. So far, no clear documentation in the literature exists stating that aerosols containing the virus have infected people and of course, no proof to reject that, either. So, this makes it very complicated. Zemouri et al. (2017)<sup>9</sup> reported insignificant findings related to the existence or non-existence of direct threats or health risks for patients or HCWs involving bio-aerosols.

Micik et al. (1969)<sup>10</sup> studied the characteristics of bacterial aerosols generated from the oral cavity during dental procedures and by naso-oral activities in a controlled environment operatory and specially designed human aerosol test chamber. It was confirmed during this experiment that the bacterial load in the aerosols produced during a few dental procedures was significantly more than generated during coughing or sneezing and were considered potentially hazardous. Moreover, there are also the risks of inhalation of aerosols by everyone in the dental operatory due to the transmission of the splatter and droplet<sup>11</sup> and the chances of transmission is more during the periodontal procedure than a prosthodontic procedure.<sup>12</sup> It is presumed that there is greater risk of particle transmission during non-surgical procedures involving Ultrasonic and sonic transmission, followed by dental procedures related to air/water syringe, air polishing, and high-speed micro motors.<sup>3</sup> As per available literature ultrasonic instruments can generate up to 100,000 microbes per cubic foot with the transmission of aerosols as far as six feet, and, these microbes can survive in any place from 35 minutes to 17 hours.<sup>13</sup>

It is yet not established whether there are any risks of aerosol transmission of pathogenic agents during dental treatment. Since dentists' work with high-energy instruments, such as air rotor, and ultra-sonic scalers, which in combination with the bodily fluids like blood and saliva, and dental plaque results in the production of aerosols of oral micro-organisms and blood.<sup>13</sup> Generally, the aerosol containing (c108. ml-1) of ACDP (Advisory Committee on Dangerous Pathogens) hazard group 2 micro-organisms<sup>14,15</sup> is not a health hazard. Nonetheless, in situations where patients are carrying viruses, either blood-borne or respiratory bacterial pathogens such as *Mycobacterium tuberculosis*, aerosol generation may prove a significant health risk to dentists and their dental attendants.<sup>16</sup>

Although the existence of dental and microbiological aerosols has been there for a long time, the scientific analysis of the role they have in dentistry has been

recent. Furthermore, statistics evidence concerning bacterial contamination of air in settings involving multiple dental units, like seen in dental hospitals, hardly exists.<sup>14</sup> In 1995 Grenier<sup>14</sup> studied the quantity of bacterial contamination of the dental environment during dental procedures undertaken in a closed dental operator as well a multiple dental chairs setting. The study concluded there was a significant increase in the levels of bacterial air contamination in the closed dental operator and the multiple chair settings following the dental procedures. Whether such a degree of air contamination has any influence on infection rates is not known.

### 3. Dental Aerosols in COVID Conditions

As per the prevailing circumstances and evidence, predominately COVID-19 virus spreads amidst the general population via respiratory droplets and direct contact.<sup>17–20</sup> An analysis of 75,465 COVID-19 cases in China, did not report of any airborne transmission.<sup>21</sup>

However, according to a recent publication in a newspaper, the World Health Organization has agreed to assess the emerging evidence of the airborne and aerosol spread of COVID-19. This action is following the observations of 239 scientists in 32 countries published in the *Clinical Infectious Diseases* journal; indicating that the virus is freely available in the air and when inhaled by humans can infect them. However, they are still taking the stand that though there is evidence emerging of airborne transmission of the coronavirus, it is not definitive. This finding could result in apprehension that if WHO accepts this as airborne transmission, the health workers might refuse to go to the hospital.<sup>22,23</sup>

Since COVID-19 have behavioural pattern quite identical to severe acute respiratory syndrome (SARS-CoV-1), Middle East respiratory syndrome (MERS) and the influenza viruses, there exists a strong possibility of its airborne transmission via aerosols.<sup>24,25</sup>

Most of the dentists have profound fear and anxiety of getting infected while working during the current viral outbreak that has usually been due to the overwhelming reports on the COVID-19 pandemic by various types of circulating media reports. Besides, there are apprehensions of carrying infections from the dental clinics to the home environment. Since COVID-19 has rapidly spread to almost every country, the fear of getting infected by a patient is legitimate. In anticipation of this elevated anxiety, a large proportion of dentists have shut down their practices which are causing them significant financial losses and frustrations.<sup>26</sup>

Most dental professionals get exposed to infections, and older generations have lived through various health scares in the past, including HIV and SARS. Indeed, there is so much we still don't know about COVID-19, but we can't live with this fear for eternity; we have to find a way to

live with this pandemic. That is why dental offices should adhere to CDC<sup>27</sup> and OSHA guidelines<sup>28</sup> when it comes to providing safety in the workplace since the coronavirus can last for a few hours to a few days on various surfaces.<sup>26</sup>

### 4. Dental Considerations in Managing Aerosol Phobia

Usually, the aerosols increase during and after the dental procedures and, the risk of transmitting these virulent agents can be reduced or intercepted with proper preventive measures. Regular surgical face masks used in dentistry when correctly worn and frequently changed offer around 80% filtration rate. It is a good option for elective dentistry in normal circumstances, knowing that the majority of our patients are healthy. The SARS-CoV-2 measures approximately 120 nm (0.12  $\mu$ m) and aerosol particle sizes range from 3-100 nm and hence working with an FFP3 respirator can provide effective filtration of 99% of all particles measuring up to 0.6  $\mu$ m.<sup>29</sup>

In their recent algorithm for treating emergency patients during the COVID-19 pandemic, the ADA's interim guidance,<sup>30</sup> released in April, builds upon the already strong infection control protocols in place in dental offices and calls for the rubber dam use along with a high-volume saliva ejector to reduce the spread of the highly contagious virus.<sup>31</sup>

Pre-procedural mouth rinsing by patients, vacuum and electrostatic removal of aerosols during dental treatments and appropriate use of personal protective measures (PPE) can result in a significant reduction of the contact with bacterial aerosols and splatters in any dental setting.<sup>32</sup> Techniques like ART and SDF can prove to be beneficial in this time.<sup>30</sup> SDF (Silver Diamine Fluoride) is a colourless solution with a pH of 10, that can be applied on a tooth surface with a tiny applicator tip or brush without the need for complicated instruments and dental equipment's. The main ingredients of SDF are, Silver in 24.4-28.8% (w/v) and Fluoride in 5.0-5.9%. It is an acceptable topical fluoride therapy, and its application is possible by an experienced or any non-dental faculty, nurses or primary health care providers under supervision. Various brands of SDF are commercially available like Advantage Arrest, (Elevate Oral Care; USA.) Fagamin (Tedequim SRL Argentina) Bioride (DENTSPLY Industria e Comercio Ltda Brazil).<sup>30,33</sup> ART (Atraumatic restorative technique) is a part of minimal intervention dentistry based on minimal invasion and minimal cavity preparation. It involves removing carious tooth parts using hand instruments and restoring the cavity with adhesive dental filling materials. Both SDF and ART procedures can thus result in minimising the aerosols, minimising the risks of transmissions of COVID-19 virus, and maximising the protection of the dentists and associates.

Along with the use of these proper safety and procedural measures, it is equally important to take support from the mental health professionals, to handle all the stress associated. Many times it is not COVID, but the stress of

getting COVID through aerosol, that can adversely affect the general and mental health of the dental surgeon.

## 5. Conclusion

There is a lack of clarity about how the actual spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) occurs. Most acceptable is that it is transmitted predominantly by aerosolized droplets and direct contact although there is a little possibility of opportunistic airborne transmission too. The significance of airborne transmission or spread of SARS-CoV-2 with the aerosol-generating procedures (AGPs) is not clear. The clinicians lack knowledge and are unsure whether dental procedures are safe to undertake. No reviews or trials are investigating whether AGPs are associated with the transmission of SARS-CoV-2. Since there has been a rapid spread of COVID -19 globally, hence all HCWs may be at increased risk of infection.

Till date, no guidelines are available specifically based on the evidence of infectivity of SARS-CoV-2 during AGPs. Since the transmission behaviour of both SARS-CoV-2 and SARS are very much alike, there occurs a significant risk of airborne transmission of COVID-19 with AGPs until and unless newer data testify otherwise. And considering the current state, it will be a wise decision to reduce patient contact, restrict the generation of aerosols and use the best PPE. We also need to look out for our mental health and wellbeing, and that of each other.

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None.

## 7. Conflict of Interest

None.

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