

# Ventilation in the Dental Clinic: An Effective Measure to Control Droplets and Aerosols during the Coronavirus Pandemic and Beyond

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*Clinical and epidemiological studies suggest that human-to-human transmission of coronavirus disease 2019 (COVID-19) most frequently occurs through virus-laden respiratory droplets discharged from infected individuals while coughing and sneezing. Aerosols can act as another potential transmission route. The World Health Organisation (WHO) has advised medical personnel to consider taking 'airborne precautions'. It is important to protect dentists and patients and reduce the amount of spatter produced during dental procedures. In order to prevent airborne transmission, dental offices should be sufficiently ventilated, with great emphasis placed upon removing bioaerosols.*

**Key words:** aerosol, airborne transmission, disease prevention during dental care, SARS-CoV-2, ventilation

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Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a worldwide pandemic. The transmission of COVID-19 occurs mainly through close direct contact with virus-laden respiratory droplets discharged from infected individuals while coughing and sneezing, and indirect contact with contaminated surfaces<sup>1,2</sup>. Although the possibility of airborne transmission of SARS-CoV-2 remains a topic of debate, some recent studies have shown that SARS-CoV-2 remains viable in aerosols for several hours<sup>3,4</sup>. Therefore, aerosols may act as another potential transmission route. The World Health Organisation (WHO) has stated that there is no sufficient evidence of aerosol transmission of SARS-CoV-2, but they have also advised medical personnel to consider taking 'airborne precautions'<sup>5</sup>.

A large amount of spatter and spray containing microorganisms is generated from dental spillages and procedures and results in contamination in dental clinics<sup>6,7</sup>. In response to the rapid spread of COVID-19 across the country, expert guidelines and recommendations from the Chinese Stomatological Association (CSA) for protection and infection prevention measures during dental procedures have been introduced<sup>8,9</sup>. The American Dental Association (ADA) has also developed "Interim guidance for management of emergency and urgent dental care"<sup>10</sup>. Four types of measures were put forth in the above documents from the CSA and ADA, along with protection and infection prevention measures deemed appropriate for the safety of the patients and staff during dental treatment:

- Patients should go through triage, screening and risk assessment.
- Dental staff should be provided with adequate personal protective equipment (PPE), including surgical facemasks, N95 respirators, gloves, full-face shields, goggles, isolation gowns, head covers and shoe covers.
- Measures should be taken to reduce spatter, such as instructing patients to rinse their mouth with bacteriostat before a dental procedure, placing rubber dam, using high-volume saliva ejectors and limiting use of high-speed handpieces.
- Strict sterilisation and disinfection should be carried out following dental procedures.

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In addition, great emphasis was placed on the need for sufficient ventilation in the dental office in the CSA guidelines<sup>8</sup>, as the WHO stated that ventilation efforts should be reinforced in hospitals<sup>11</sup>. Among the measures mentioned above, PPE could protect against spatter produced during dental procedures carried out in close proximity to the patient<sup>12</sup>. Measures taken to reduce spatter could help to prevent or decrease droplets and aerosols containing a mixture of oral microorganisms<sup>13</sup>. It is worth noting that the size of droplets produced during dental procedures that create spatter varies from a few micrometres to a hundred<sup>13-15</sup>. Particles larger than 50 microns can deposit on surfaces near the patient's mouth within seconds of the spatter being produced, including the dentist's and assistant's hands, arms, face and chest<sup>13,16</sup>. PPE would provide protection against these larger particles. Particles smaller than 5 microns and droplet nuclei may float in the air as aerosols for an extended period and travel for a distance from a few feet to several metres<sup>13,14</sup>. Bioaerosols are droplet nuclei that contain microorganisms<sup>17</sup>. If bioaerosols are present in the dental clinic, there could be a higher risk of airborne transmission<sup>13</sup>.

A recent study found that the viral RNA of SARS-CoV-2 was detected in air samples from isolation wards in Wuhan hospitals where patients with COVID-19 were treated<sup>18</sup>. These reports indicated that aerosol transmission of SARS-CoV-2 was possible when three conditions, "closed space, prolonged exposure, high concentration of virus in the air", were met<sup>19</sup>. Therefore, providing that one of these links is severed, aerosol transmission can be contained.

Indoor ventilation is essential in dental clinics, especially during a respiratory pandemic so severe as COVID-19. Natural ventilation or a mechanical system is necessary to achieve sufficient airflow. Continuously introducing fresh air into operating rooms by opening windows may dilute indoor air contaminated with virus-laden aerosols. In the meantime, indoor air purifiers are an effective supplementary measure to improve air quality and significantly reduce exposure to aerosols for personnel in dental clinics<sup>20</sup>.

Effective ventilation in dental clinics during the pandemic and beyond must be treated with paramount importance. Negative-pressure rooms are effective in reducing the risk of transmission for infectious respiratory diseases<sup>21</sup>. Can we envisage the existence of negative-pressure dental operatories, or at least while respiratory disease pandemics are a frequent occurrence<sup>22</sup>? We hope that the COVID-19 pandemic will soon be over and that normal life will be able to resume.

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