

The development of safety protocols with Covid-19

A safe clinical protocol regarding Covid-19 can only occur after a thorough understanding of the transmission and the pathogenesis of this disease. The purpose of this paper is to review basic disease principles based on an understanding of the “particle size concept.” This information can be applied to your experience in the dental office as well as other public areas or at home.

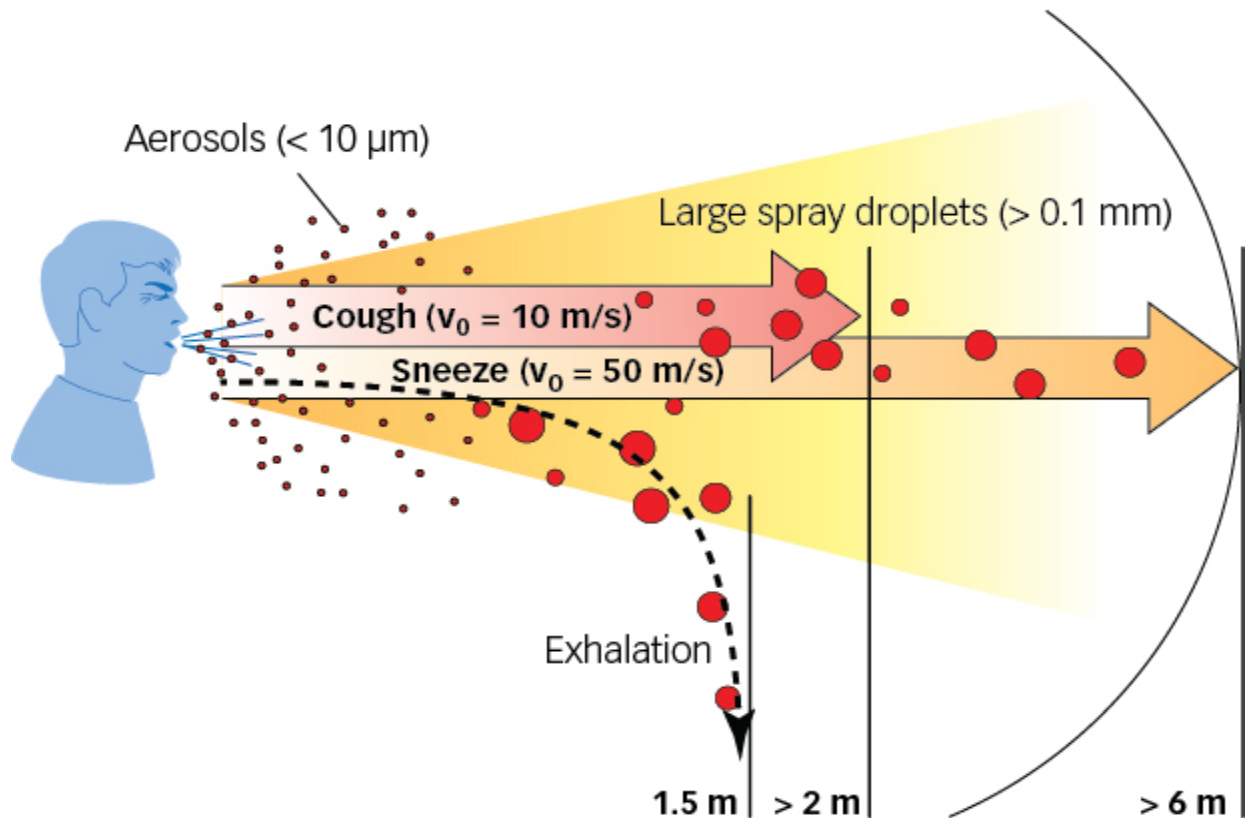
Aerosol is defined as less than 10 μ in diameter and small enough to stay in the air for an extended period of time before they settle on a surface. These small particles have the potential to penetrate and lodge into the smaller passages of the lungs and carry the greatest potential to transmit disease. There is a long history of many infections that have been transmitted by an airborne route and this is especially true for Covid-19.

We know that the Covid-19 virus averages 0.125 μ in size. The nose typically filters air particles above 10 μ , and if a particle is less than 10 μ then it can enter the respiratory system. If it is less than 2.5 μ , it can enter the alveoli. This mismatch of our “filtering system” and virus size is among the many reasons for its high infectivity.

Splatter (or droplet) is defined as an airborne particle that is larger than 50 μ and behaves in a ballistic manner until they contact a surface. They do not stay suspended in the air for a long period of time but can travel up to 6 meters. These droplets can result from a simple conversation, a sneeze or a cough. The NYS mandate of wearing a mask addresses these factors.

In dental and non-dental settings, the consensus has been that the greatest airborne infection threat comes from aerosols due to their ability to stay airborne and potentially enter the respiratory passages.

Figure 3: How COVID-19 is transmitted through aerosol particles



At this time, it is impossible to determine the infection risk by aerosolized material with Covid-19 but we are learning more and more each day. **So the challenge in the dental office becomes how to integrate a series of meticulous protocols to optimize the safety of patients and dental health care providers.** The basic tenet and the most practical approach to minimize transmission is to remove as much airborne contamination as possible **before** it escapes the immediate treatment site to create an aerosol.

As demonstrated by S. Harrel, J. Molinari in a paper published in JADA 2004, the use of high volume evacuators (high speed suction which has been used in dentistry for decades) or HVE will reduce the operative aerosol by more than **90 percent** that is produced by our dental instrumentation. This requires at least an 8mm tip, an evacuation system that will remove large volumes of air (100 cubic feet of air per minute), and the hard work of excellent chairside dental assistants.

Overall, there are four layers of defense to reduce dental aerosols which include:

- 1) Routine use of hydrogen peroxide 1.5% as a pre-operative rinse
- 2) Second layer of defense: PPE (masks, gloves, gowns, face shields)
- 3) Third layer is HVE and excellent dental assisting skills
- 4) Fourth layer may be use of a device to reduce aerosol contamination that escapes the operating area such as a HEPA filter

Please note a single step will reduce the risk of infection by a certain percentage, another step added to the first will reduce the remaining risk, until such time as the risk is minimal. The key is to control the operating field.

More specifically, who are the stakeholders in disease transmission? This includes patient to health care provider, health care provider to patient, and patient to patient. In reality, all of these vectors matter but the center of attention is focused on patient to patient transmission in a health care setting (meaning hypothetically, one could become infected by an unknowingly previous person who presents to a doctor's office or a patient previously seen in a treatment room). Please note that an important aspect of the infection control protocol supported by the CDC, OSHA and the ADA is that all patients seeking dental treatment are treated as if they have been infected and this is part of the universal barrier mindset. In addition, we have long utilized sterilization procedures that surpass university-based standards so any risk of transmission from this "touch point" would be considered negligible.

Splatter has also been implicated in transmission of TB, SARS, measles and herpes but what do we know about Covid-19? This question was addressed in an important paper by N van Doremalen et al published in the New England Journal of Medicine in April 2020, he demonstrated the following:

The virus is viable up to 72 hours after application to plastic and stainless steel surfaces

The virus is viable up to 24 hours on cardboard surfaces

The virus is viable up to 9 hours on copper surfaces

The virus is viable in suspended aerosol for up to 3 hours

So the virus may be viable over these time periods but what is the correlation for disease transmission? According to data that was supported by the CDC on May, 21, 2020 as they stated "Covid-19 does not easily spread via contaminated surfaces. The agency now believes it is primarily spread through the respiratory droplets of people in close contact."

With regards to safety considerations regarding your visit to the office the following guidelines have been implemented:

1) Universal precautions will be applied to all patients and regardless of conflicting information regarding transmission from surfaces, we will proceed as though this is still a mode of transmission. Additional time has been appropriated to achieve proper surface disinfection.

2) Considerable focus will be placed on minimizing dental aerosols through mitigation techniques but this may not be “good enough”. Accordingly, all treatment rooms have been equipped with medical grade air cleaning systems (ACS) to address the viability of the virus in the aerosol or to eliminate what is called the “biohazard cloud”. The following questions further examine the effectiveness of these devices.

Will an ACS be effective to eliminate the biohazard cloud?

The answer is yes and no as it depends on the system.

According to the CDC, “If a portable unit is used, they should recirculate all the room air within a certain time period or what is called CFM (cubic feet per minute) and more specifically it needs to turn over the indoor air at least once every 30 minutes through medical grade filters.”

The science suggests most of the ACS may not be helpful

Most HEPA filters will be ineffective because the pore size is wrong (0.3mm too big, they do not have medical grade filters) and the CFM will be too little. In addition, after about 6 months or less their efficacy becomes even worse.

Numbers we need to know

As mentioned, Covid-19 or SARS-CoV-2 has an average diameter of 0.125u. Most HEPA filters are effective with 0.3u diameter for many things but the pore size may be too big to catch the virus! However, the virus is most commonly attached to a droplet which is 0.5-10u so the droplet issue may be more helpful to catch the virus but this is unknown.

What devices without question meet this criteria and have been tested on a high level?

There may be others, but the following are the industry leaders and are hospital grade type units:

a) IQAir Health Pro Plus - This has the smallest HEPA type filter with a pore size of 0.003u so the virus will easily be trapped unrelated to droplet size. For this reason, this device was the filtration device of choice in Chinese hospitals where the virus originated. It is a Swiss product and they have been in business for 50 years. This may be considered the gold standard with regards to Covid-19 testing. All treatment rooms have been equipped with these devices. Why? In 5 minutes or less, the treatment room is completely “clean”, meaning there is no residual aerosol. Major hospitals, biotech companies and other institutions use these devices to obtain “clean rooms.”

b) Surgically Clean Air- Has a larger HEPA filter plus UV to kill the virus. For different reasons, this unit has been placed in the “front desk” or non-treatment area so the entire office is under the umbrella of a “clean air concept”. Overall, this will provide considerable piece of mind and a healthier air environment for our patients and staff long after this pandemic has passed.

3) Masks will be utilized at all time (before and after completion of treatment).

Again, the purpose of this correspondence was to demonstrate my desire to learn as much as possible about Covid-19 and then apply this information to develop our own set of unique protocols that exceed present mandates recommended by the CDC, OSHA, the ADA and others. The goal is to provide a health care environment that is extremely safe for our patients and staff. Please contact me if you have any additional questions.

Sincerely

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