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Mini Review

Aerosols in Dentistry: The Coveted Invivible Enemy

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Abstract

COVID-19 has brought the world to its knees, with dental specialty has been the worst hit due to the proximity of the patient to the dentist as well as the need for the removal of the mask for the work to be performed. Aerosols are defined as particles of size less than 50 micrometers in diameter, capable of staying airborne for a comprehensive period in air before they settle down on stable surfaces with the capability to infiltrate and lodge in the smaller tracks of the respiratory tract. These have the greatest potential for transmitting infections. The physical, chemical and the environmental barrier form the three sides of the triangle and help in damage control. These precautionary measures are mandatory in any practice but are rarely followed completely and require reinforcement measures to make it compliant with all the practicing dentists. Further, an awareness program included in the study period as well as in the continuing dental education may play a pivotal role in reminding the dentist of its importance and its implementation at their practice..

Keywords: Aerosols; Dentistry; COVID-19

Introduction

The impact of COVID-19 has brought the world to its knees and now all the countries stand united to eradicate and minimize the damage caused by it mentally, socially as well as economically. Dental specialty has been the worst hit due to the proximity of the patient to the dentist as well as the need for the removal of the mask for the work to be performed.

The most common pathways for the spread of infection in dental office are by direct body contact or with the contaminated surfaces/instruments. Airborne route by aerosols are also a potential routes for the spread of infection in a dental office [1]. The bubonic plague also famously known as the "black plague" is characterized by unembellished coughing which spreads from patients to those surrounded by the patient, but not necessarily in direct contact [2,3].

The Centers for Disease Control and Prevention, World Health Organization and the American Dental Association have recommended avoidance of aerosol events in patients with active SARS CoV-2. The ADA has further pointed out that it is improbable to treat any such patients who are extremely ill and should not undergo any elective procedures [4,5].

Sources of aerosol

Aerosols were defined as particles of size less than 50 micrometers in diameter, whereas splatter was defined as airborne particles of size larger than 50 µm in diameter. Aerosols are capable of staying airborne for a comprehensive period in air before they settle down on stable surfaces with the capability to infiltrate and lodge in the smaller tracks of the respiratory tract. These have the greatest potential for transmitting infections [6-10].

Micik and his colleagues have specified that these particles acted in a ballistic fashion, wherein the particles are emitted robustly from the operating site after which they arc in a trajectory path and become incompetent and large after collision with another particle [11,12]. Qualitative and quantitative analysis of the makeup of dental aerosols would be extremely difficult, and the composition of aerosols probably varies with each patient and operative site [13,14]. The most serious potential microorganism in in the field of dentistry was M. tuberculosis, detected in aerosols, responsible for tuberculosis [15].

Various studies have shown that, ultrasonic scaler produced the greatest amount of airborne contamination, followed by the air-driven high-speed hand piece, the air polisher and various other instruments such as the air water syringe and prophylaxis angles [10,16,17].

The operatory

Dental procedures use mechanical instrumentation which works with an air-water mixture to provide efficiency as well as better visibility with a good outcome. Dental hand pieces, ultrasonic scalers, air polishers and air abrasion units act by rotary action, the ultrasonic vibrations or the combined action of water sprays and compressed air, produce the most visible aerosols [18].

A study done by Harrel SK., *et al.* showed that the use of ultrasonic scaler *in vitro*, without coolant water, produced a large amount of aerosol blown-out up to 18 inches from the workplace [19]. Occupational Safety and Health Administration regulations state that "all procedures involving blood or other potentially infectious materials shall be performed in such a manner as to minimize splashing, spraying, spattering, and generation action of droplets" [20].

Kobza J., *et al.* from his study (2018) showed that 33 bio-aerosol samples had significant increase in airborne concentration of bacteria and fungi including Staphylococcus epidermidis and Micrococcus spp., Cladosporium and Penicillium. They concluded that exposure to the microorganisms identified is not a significant occupational hazard for dental care professionals [21].

Methods of reducing airborne contamination

The generation of aerosols in the field of dentistry is almost inevitable. The aerosols generated from the oral cavity contain bacteria, virus and supra/subgingival plaque organisms admixed with blood. So, it becomes very important to minimize the spread of infection into the surrounding environment and eliminate the same with the help of specialized equipment.

It can be achieved in three steps

- Personal protection equipment/barriers such as masks, gloves and safety glasses.
- Routine use of antiseptic pre-procedural rinse with a mouthwash such as chlorhexidine.
- Use of an HVE either by an assistant or attached to the instrument being used.

We should make use of personal protective equipment which includes masks, gloves, face shields and eye protective goggles, all of which will be the first line of defense for the treating dentist [22].

A pre- procedural rinse containing .01 percent chlorhexidine or essential oil-containing mouthwash for 60 seconds in before the start of a dental procedure has exhibited a significant reduction of the bacterial count in the dental operatory [23,24]. Chlorhexidine is an antiseptic which has proven its efficiency in the removal of free floating oral bacteria in the oral cavity.

Rubber dam use is advocated for cavity preparation, root canal treatment, supra-gingival tooth preparation and minor procedures involving the tooth above the cervical line. Periodontal and hygiene procedures including root planing, periodontal surgery and routine prophylaxis cannot be done under the application of rubber dam.

Many studies have shown the use of a High-volume evacuator, or HVE, decrease the contamination arising from the operative site by more than 90 percent [6,16]. A High-Volume Evacuator is capable of removing a large volume of air within a short period of time and not the hospital evacuator that pulls a high vacuum. The use of HVE has been seen to be more efficient when the assistant

controls the HVE as they aim at the spray and remove the spray immediately; preventing the airborne spread of the aerosols as well as increased visibility and reduced working time and the number of CFUs produced.

High efficiency particulate air, or HEPA, filter and the use of ultraviolet, or UV, chambers in the ventilation system work by air filtration. The biggest drawback of these techniques is being expensive and time-consuming.

It is important that all the three stages of protection be followed to maximize the benefits of the protective equipment to the dentist. It would be spot-on to describe each step to reduce the risk of infection by a certain percentage; another step added to the first step will reduce the remaining risk, until such time as the risk is minimal.

Conclusion

Dentistry involves the generation of aerosols and splatter which can blowout impurities which may not only be limited to debris but also contain pathogenic microorganisms which are harmful to the dental personnel and other people in the operatory. The physical, chemical and the environmental barrier form the three sides of the triangle and help in damage control. An awareness program included in the study period as well as in the continuing dental education may play a pivotal role in reminding the dentist of its importance and its implementation at their practice.

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