Managing Dental Aerosols with Regards to COVID-19

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Current situation

In more and more countries, dental practices that had been stopped or limited to urgent or emergency procedures due to the COVID-19 pandemic have resumed operations. Even in the normal course, strong dental practices follow strict guidelines in terms of hygiene and preventive measures to ensure the best possible safety for their patients and dental staff. The current situation, however, puts a special focus on hygiene and preventive measures in dental offices and on aerosol generating procedures (AGPs).

AGPs are a major component of modern dentistry. The use of high-speed handpieces, ultrasonic scaling devices, and 3-way syringes are routinely used for operative and preventive dental procedures. Most restorative and prophylaxis procedures cannot be performed without these devices. Compliance with local, state, and federal infection control guidelines including hand hygiene, personal protective equipment (PPE), and environmental surface disinfection and other Standard Precautions are effective, in most cases, at preventing infections in the dental setting. In addition, the use of high-volume evacuation (HVE) better allows aerosols to be managed by the dental team.

Although there is currently little evidence of transmission of SARS-CoV-2 (the virus that causes COVID-19) via aerosols, public health agencies and dental associations globally recommend minimal use of aerosol-producing dental procedures at this time.

By way of illustration, included below are several agency statements regarding aerosols:

American Dental Association (ADA):

- “Use professional judgment to employ the lowest aerosol-generating armamentarium when delivering any type of restorative or hygiene care. As an example, use hand scaling rather than ultrasonic scaling when appropriate. High velocity evacuation should be employed whenever possible.” (8mm large bore devices with 100 cubic ft/min capacity)

National Health Service (UK)

- “Aerosols should be avoided wherever possible. If an aerosol generating procedure is necessary, the use of high-power suction and rubber dam is recommended where possible.”

Robert Koch Institute (Germany)

- “There is no evidence for a transmission via aerosols. However, the generation and spreading of aerosols should prophylactically be avoided. This should be done primarily using an efficient high-volume evacuation.” ["Für eine Übertragung durch Aerosole gibt es keine Evidenz. Aus Gründen des vorbeugenden Gesundheitsschutzes sollte dennoch die Entstehung und Verbreitung von Aerosolen wirksam vermieden werden. Dies sollte zuallererst durch eine effiziente, hochvolumige Absaugung geschehen. …"]
Possible Transmission Routes of COVID-19 in a dental office

Dental patients and dental health care professionals (DHCP) can be exposed to pathogenic microorganisms, including viruses such as SARS-CoV-2. The transmission routes in a dental setting include direct transmission via droplets (cough, sneeze) or indirect transmission when an infectious material, such as saliva, contaminates surfaces of dental equipment and instruments and is then transmitted either to the DHCP or other patients (cross-contamination) (Figure 1) (Peng 2020).

The current scientific consensus is that most transmission via respiratory secretions occurs in the form of large respiratory droplets. Therefore, all dental procedures including periodontal treatment carried out with hand-instruments should be undertaken with caution as hand-instrumentation produces considerable amounts of potentially infectious droplets and spatter (Watanabe et al. 2018). Droplets are often heavy enough that they do not travel very far; instead, they fall from the air after traveling about six feet (~1.5m).

Some studies have suggested that SARS-CoV-2 may be airborne through aerosols formed during dental procedures using high speed handpieces, air water syringes or ultrasonic scaling devices (Figure 1) (Peng et al. 2020). Potentially, these aerosols can also contaminate surfaces and may lead to an indirect transmission of pathogens (Figure 1). Aerosols are much smaller and can travel longer distances (~6m). An analogy from daily life might be that droplets are more like rain, whereas aerosols are more like fog (Figure 1).

Figure 1: Possible Transmission routes of COVID-19 in a dental office.
Mitigation of Infection transmission in the dental setting

In order to mitigate the risk of infection transmission in a dental setting, a variety of infection prevention measures should be considered, and likely implemented, by DHCP. Please note that guidelines, recommendations, and regulations vary in each country and may even be state or locality specific. Due to the current pandemic, these guidelines are frequently updated and should be monitored carefully.

For example, in the US, reliable sources of infection prevention information include the Centers of Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA), and the American Dental Association (ADA). Recommendations from these agencies generally follow the same basic infection prevention principles (Figure 2):

1. Patient screening
2. Hand hygiene and personal protection equipment (PPE)
3. Disinfection and re-processing of equipment & instruments, single use items and environmental surfaces (and barrier sleeves)
4. Managing aerosols

- Figure 2: Principles of Mitigation infection Transmission routes in a dental office (overview)

Managing dental aerosols

High-speed handpieces, ultrasonic scalers and air-water syringes may produce potentially infectious droplets, splatter and aerosol. In order to minimize the risk of contamination, three principal measures are generally recommended to be undertaken in a dental setting (Figure 3).

1. The DHCPs should **protect themselves** by using proper PPE and infection prevention measures in compliance with the applicable local, state, or country specific guidelines as described above. An isolation of the operation field using a rubber dam has also been recommended as this measure provides a barrier for the teeth from the soft tissue and saliva (Peng 2020, ADA).
2. It has also been suggested to ask the patient to use a pre-procedural mouth rinse with viricidal capability in order to sanitize the aerosol. 1% hydrogen peroxide or 0.2% povidone as well as Listerine® have proven to be viricidal whereas Chlorhexidine (commonly used against bacteria) has shown a very limited effect against viruses. More research is needed to give clear guidance as to the appropriateness of this suggestion (Slots 2002, Peng 2020).

3. Using High Volume Evacuation (HVE) instead of saliva ejectors is also another way to reduce the amount of aerosol. Studies published by the ADA show that proper HVE can reduce the amount of aerosol by 90%-98% (Jacks 2002, Harrel 2003).

**Managing Aerosols**

Do the right thing: evidence-based protocols and education

Figure 3: Managing dental aerosols

To manage dental aerosols and implement a strong infection control protocol, DHCPs and their teams should:

- follow recommendations for donning and doffing PPE;
- use environmental surface disinfectants according to the manufacturer’s instructions; and
- use HVE in accordance with all manufacturer instructions for use.

Because Dental Hygienists (DH) often work alone and are not in a position to perform “four-handed dentistry” (Figure 4 – left picture), standard saliva ejectors are often used instead of HVE, as two hands are required to operate both the mirror and the aerosol generating device. Engineered HVE devices such as the Purevac® HVE enable the DH to use HVE and an intraoral mirror simultaneously and as needed. This provides the benefit of evacuating fluid and debris while facilitating retraction, visibility, and illumination (Figure 4).
Conclusion

In more or more geographies, dental practices that had been stopped or limited to critical or emergency procedures due to the COVID-19 pandemic have resumed operation. Dental practices should follow strict guidelines in terms of hygiene and preventive measures to ensure the best possible safety for their patients and dental staff. The current situation, however, puts a special focus on hygiene and preventive measures in dental offices and during dental procedures.

Most restorative and prophylaxis procedures cannot be performed without using rotating handpieces that create the potentially infectious spatter, droplets, and aerosols. Minimizing potential risk for dental health care professionals and their patients is essential. Thus, reducing and managing the amount of aerosol generated is a key focus of dental teams and Dentsply Sirona.

Aerosols can be managed by proper personal protective equipment, sanitization measures, and compliance with the infection prevention measures according to the local, state, and country-specific guidelines. The amount of generated aerosols can be further reduced by using high-volume evacuation (HVE) instead of saliva ejectors for procedures. The Dentsply Sirona Purevac® High Volume Evacuation Mirror Tip is an example of a true HVE, enabling evacuation of fluid and debris with 90% less aerosols during ultrasonic scaling compared to low-volume saliva ejectors.

Figure 4: High Volume Evacuation (HVE); ADA recommendation: HVE = 100 cubic ft/min (Molinari 2004)
References


