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Back-to-Work Treatment Recommendations: Aerosol Containment, Dental Hygiene Procedures, and Personal Safety Practices

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ABSTRACT

In light of the COVID-19 pandemic, it is essential that protocols be developed that enable ultrasonic therapy to be implemented with minimal risk to dental healthcare providers. Aerosol reduction strategies combined with rigorous infection control procedures, including the use of effective personal protective equipment, are needed to reduce the risk of pathogen transference from patient to dental provider so that ultrasonic instrumentation can be utilized when necessary.

Recommendations on how to navigate a return to routine dental care in the current climate of the COVID-19 pandemic have varied widely. With this in mind, suggestions should emerge from a combination of a review of the available science, clinical judgment, practicability of implementation, and risk versus benefit analyses. This article is aimed at providing evidence-based information to assist regulatory bodies in their decision making as they consider recommendations for the provision of effective dental therapy in a way that maximizes the safety of everyone who enters the dental treatment space.

The Need for Periodontal Debridement

Adequate debridement is essential for periodontal inflammation to resolve. Persistence of inflammation in periodontal tissues contributes to the systemic burden of inflammation.[1] Low-grade systemic inflammation has the potential to increase the risk for subsequent infections.[2] Patients at high risk for severe illness from COVID-19 have included those with underlying conditions that deactivate mechanisms of the body's immune system.[3] Up to 94% of hospitalized patients diagnosed with COVID-19 have had one or more underlying conditions.[4] The most common comorbidities have been hypertension, obesity, and diabetes, all of which can be affected by chronic inflammatory periodontal disease (CIPD).[5-7] It is conceivable that CIPD may be an underlying condition that can affect the severity of the COVID-19 illness.[8]

Effective periodontal debridement involves removal of clinically detectible debris and interruption of pathogenic microscopic biofilm. While mechanical treatment (ie, hand instrumentation) is still commonly used during debridement, evidence has long suggested that even the most intensive mechanical treatment on its own cannot consistently yield adequate control of the bacterial etiology.[9,10] In the case of the COVID-19 pandemic, many interim recommendations for the provision of dental care suggest the use of hand instrumentation solely and to avoid the use of ultrasonic instrumentation.[11] This may be an ill-advised strategy.

Rather than employ protocols that suggest avoidance of evidence-based procedures that are essential to patient health (ie, ultrasonic instrumentation), it may be prudent to develop protocols in which ultrasonic therapy can be implemented with minimal risk to the dental healthcare provider, especially in times of pandemic. By combining aerosol reduction strategies with updated infection control procedures, including the use of effective personal protective equipment (PPE), dental practitioners can reduce the risk of pathogen transference from patient to provider even when using ultrasonic instrumentation.

The Extent of the Problem

Ultrasonic, compressed-air-driven high-speed handpieces, three-way water/air syringes, prophy cups/paste, and air-polishing devices all have the potential to generate aerosols, which can spread and persist if not adequately captured. When measured via colony-forming units and collected onto non-specific growth media placed at locations distant from the device being used, ultrasonic instrumentation, when inadequately controlled, is suggested to have the greatest potential to create possible aerosol contamination.[12] However, it is important to note that studies documenting the spread or persistence of ultrasonic-generated aerosols have all been performed when the device was used without any attempt at

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bore capture device (≥8 mm diameter) on a properly functioning dental vacuum system removes 90% to 98% of any generated aerosol, preventing it from leaving the operative site.[13-18]

The amount of aerosol capture via high-volume evacuation (HVE) is subject to the basic laws of air flow dynamics. Air flow rate depends on the suction force at the point of capture and the diameter of the opening to the HVE suction line. Just because a device attaches to an HVE line does not necessarily mean it can be expected to capture all or even 90% of aerosols. The actual diameter of the capture device attached to the HVE is what determines its effectiveness. Devices designed with numerous holes, even if the total surface area of the holes equals that of an 8 mm orifice, will not remove as much aerosol due to the basic laws of air flow dynamics.

A Reasonable Approach Going Forward

For safe use of ultrasonic instrumentation, a layering of protections has long been suggested.[12] Currently, no data is available for determining and ranking the impact of each of the potential protective steps on transmission reduction, and studies concerning aerosol generation and capture in dentistry have focused on bacteria with little having been published on virus and fungus. Availability of resources can also affect the implementation of and adherence to the steps involved in an overall aerosol contamination reduction strategy. Any strategy developed to improve the safety of the dental treatment environment should include steps that can be reasonably implemented and have data supporting the benefit of implementation.

Many factors affect the generation, composition, and spread of aerosols in the dental treatment room. Although it is impossible to determine the exact infection risk to a clinical dental professional when using an ultrasonic device, a prudent goal is to reduce or eliminate as many factors as possible.

Three basic strategies to reduce the impact of ultrasonic-generated aerosols are as follows: (1) Reduce the likelihood that carriers of SARS-CoV-2 are seen the office. (2) Affect the generation, spread, and duration of potentially infectious aerosols. (3) Protect against any potential contaminants in the room.

A number of recommendations may be adopted that could allow patients to receive the level of dental care necessary to affect their oral and overall health in a manner that reduces risk to dental providers beyond that afforded by previous dental hygiene visit protocols. These recommendations include the following:

1. Screen potential patients prior to their visit to identify those who may be asymptomatic carriers of SARS-CoV-2 and reschedule them.

2. Temperature-screen patients on arrival to the office and reschedule those with a temperature ≥100.4 degrees.[19]

3. Have patients pre-rinse with 1.5% hydrogen peroxide.[19]

4. Follow standard precautions for infection control as per the Centers for Disease Control and Prevention (CDC) October 2016 publication, "Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care."[20]

5. Always use a large-bore capture device (≥8 mm diameter) on a properly functioning dental vacuum system.

6. Consider alternatives to the use of a three-way syringe.

7. The operator, assistant, and anyone who enters the active treatment room must wear appropriate PPE,including a disposable full-coverage gown, head cover, face shield, and surgical N-95 mask. If such a mask is not readily available, a level 3 mask with face shield may be considered but only if the other recommended steps are followed. (See next section on N-95 respirator usage.)

8. Follow manufacturer instructions for use to operate and clean ultrasonic devices and vacuum lines.

N-95 Respirators

Certainly, the use of a surgical N-95 respirator is preferable. However, data is sorely lacking regarding the effectiveness of these respirators, level 3 masks, and face shields used either alone or in combination during procedures and their potential to protect against viral-laden aerosols. These knowledge gaps must be filled in as dentistry moves forward. In the absence of available data, the current need for periodontal debridement (especially considering the adverse effect chronic oral inflammation can have on the immune response) mandates that risk versus need versus availability analyses be considered to develop realistically implementable protocols for providing dental healthcare safely and effectively.

The CDC recommends to hospitals and other ambulatory medical settings that a second tier of infection prevention called transmission-based precautions be followed when aerosol-generating procedures are being performed.[21] Transmission-based precautions include the use of surgical N-95 respirators and environmental controls such as negative pressure room with minimum rates of air exchanges per hour.

While it may seem logical to try to apply CDC regulations designed for medicine to dental procedures, there are distinct differences between the two entities. The location of any generated aerosol is not as predictable in medicine as it is in dentistry. For example, when a breathing tube is removed from a patient, potential pathogens will be spread based on the highly variable path that the tube takes upon removal and continue onto any surface on which the tube makes contact. In dentistry, the operative site where aerosols may be created is easily identified and, more importantly, able to be effectively controlled because air flow rates of suction devices used in dentistry are typically much higher than those used in medical treatment rooms.

need to dedicate considerable time and resources to adhering to published guidelines (OSHA guideline 1910.134 - Respiratory Protection). Additionally, medical clearance, verified fitting, regular fit testing, and required written respiratory control protocol and training programs are not easily attainable for dental personnel.

Realizing that a multi-tiered approach to aerosol control in the dental setting, including use of a large-bore capture device attached to an adequately functioning vacuum system along with pre-procedural rinse and avoidance of use of a three-way syringe, greatly reduces aerosol generation and pathogenic potential, one of the first states to endorse reopening recommendations for dental offices, Kentucky, noted that substitution of a facemask/level 3 surgical mask for a surgical N-95 respirator is acceptable assuming that other steps for aerosol control are followed.[22]

Conclusion

It is important for dental professionals to perform risk assessments to determine what is safe and effective for themselves and their patients before proceeding with treatment. Dental hygiene therapy is an essential component of oral and overall wellness, and guidelines for the delivery of patient care must be able to be implemented in a reasonable manner.

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