

**Rationale for recognition of the diode laser as non-aerosol-generating
and beneficial for adjunctive dental hygiene management:**

Overview: Devices utilized in dental operator can create aerosols, with ultrasonics and high-speed hand pieces producing more airborne contamination than other commonly utilized devices. Because of this, CDC guidelines for prevention of transmission of the novel Coronavirus SARS –CoV-2 includes recommendations to decrease high speed handpiece activity with particular attention to limiting the use of ultrasonic devices in the dental hygiene operator. This has led some dentists and hygienists to believe that all non-mechanical, adjunctive cleaning devices are prohibited, including the diode laser which does not produce aerosol when used correctly. Public health benefits associated with adjunctive use of the diode laser for bacterial reduction (LBR) in the sulcular epithelium are well documented. Similarly, co-morbidities associated with oral bacteria load become greater risk factors during public health emergencies, including the current pandemic. Consequently, clarity by public health experts about the safety and efficacy of the diode laser in the hygiene operator may be key to keeping dental offices open and optimizing the public health benefits of good oral health during the present, and possibly future pandemics.

Background: Dental hygienists now resort to manual instrumentation and are challenged by the physical stress, ergonomic issues and the added time required to perform prophylactic and periodontal procedures. CDC Guidelines also include a stringent recommendation for the use of PPE in aerosol-producing environments, which increases cost and reduces time efficiency.

Studies demonstrate that clinicians prefer biofilm control with ultrasonic instrumentation versus manual instrumentation. (1) However, the dental hygienist appreciates that aerosol-generating ultrasonics may put them and their patients at greater risk for infection and transmission of SARS-CoV 2 (CoVID 19). (2) Additionally, the fear of returning to work has resulted in a shortage of dental hygienists.

No Aerosol: Unlike high-speed handpieces, ultrasonic devices, and some lasers requiring water, dental diode lasers do not utilize water spray and therefore do not generate the typical aerosol, splatter or droplets associated with these other devices. This is because the temperature for plume production via vaporization must reach a minimum temperature of 100 degrees centigrade. (3) The quantity and composition of the plume is totally dependent on the wavelength, power setting, pulse mode, delivery device, tissue type and location. Consequently, if used properly by a hygienist who is trained in its operation, the diode laser cannot produce plume or aerosol.

Those that assert the contrary, i.e., that diode lasers can produce a plume, conflate laser use at *high* power settings requiring a photo-thermal destruction process to ablate, cut or coagulate tissue. At these settings, dental diode lasers can generate a plume. However, standard LBR settings on dental diode lasers are in a default mode and pre-prescribed. The procedures require an un-initiated tip (no heat generated) with low settings.

Some have also conflated the use of lasers in procedures performed by dermatologists, plastic surgeons and gynecologists. Specifically, a laser plume may be generated in medical or cosmetic settings when treating hair, skin and other lesions on the body with *high* powered ablative lasers, primarily the CO₂ laser, but not in dental hygiene settings (4). Photodynamic therapy does not rely on thermal but photo-chemical reactions to decrease the microflora. Data measuring diode LBR settings considering thermal changes with Infrared cameras demonstrate a temperature less than 35 degrees centigrade and far below vaporization and plume generation. (5) Moreover, the activity is contained within a closed For further information contact:

Academy of Laser Dentistry 9900 W. Sample Road Suite 315, Coral Springs, FL 33065 Telephone 954-346-3776
www.laserdentistry.org Email office of the Executive Director: laserexec@laserdentistry.org

environment of the periodontal pocket since the LBR technique requires that the tip be placed 1-2 mm into the gum pocket so that there is also a physical tissue barrier that results in minimal to no escape of any matter. (6)

Public Health Benefits: Bacteria in oral biofilm can be aspirated into the lungs and potentiate respiratory diseases. We can surmise that bacterial reduction via oral hygiene and professional debridement could decrease the predisposition to novel Coronavirus SARS –CoV-2 infection. The co-morbidities between periodontal inflammation and novel Coronavirus SARS –CoV-2 infections are very similar including chronic inflammatory pathways. (7) Studies demonstrate utilizing a diode laser in a non-thermal setting is antimicrobial and as effective as utilizing biofilm control with an ultrasonic device in a dental hygiene operatory. (8) Publications describing laser bacterial reduction in managing periodontal conditions indicate settings that are low level and below the vaporization threshold from a thermal perspective. (9)

Conclusion: One can conclude the following:

- 1) The dental hygiene operatory is shifting toward increased use of non-aerosol-producing manual instrumentation in lieu of ultrasonic instrumentation.
- 2) The diode laser with appropriate settings is a non-aerosol delivery device that can be adjunctive in prevention and management of periodontal disease.
- 3) The addition of a diode laser can supplement manual instrumentation resulting in decreased procedure time, potential decrease in cost, and less stringent PPE recommendations.

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