LED imaging visually confirms oral suction device efficacy in droplet and aerosol reduction

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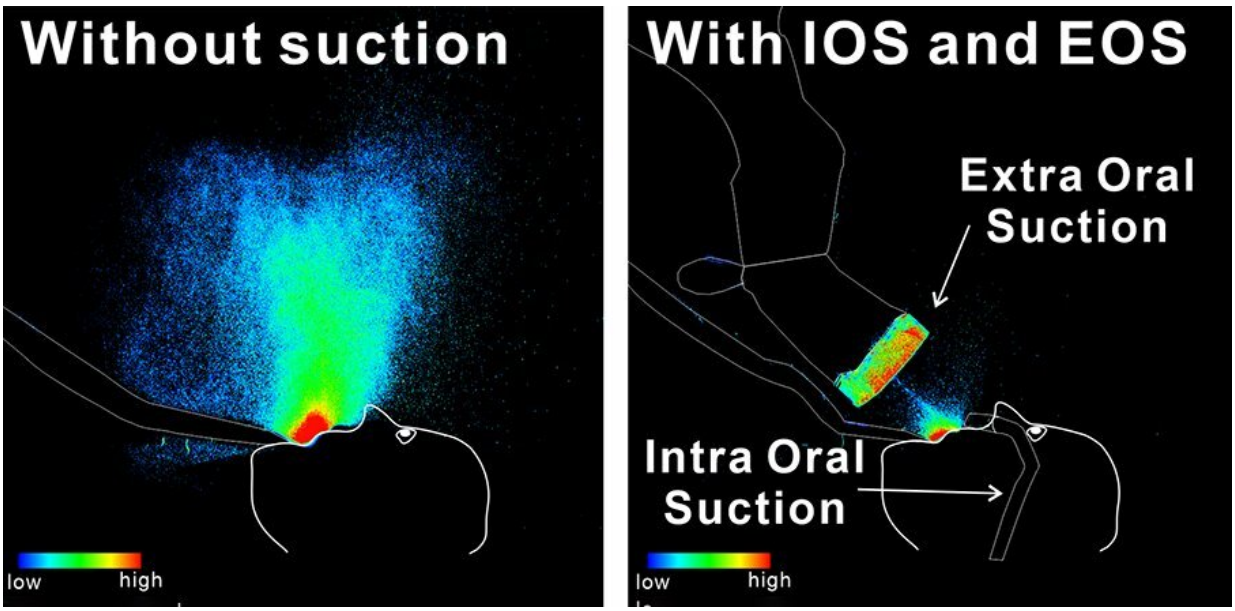

Credit: Japan Prosthodontic Society

Many infectious diseases, such as COVID-19, are known to spread through aerosols and droplets suspended in the air. Therefore, it is necessary to fully understand the hazards of aerosols and droplets presented during dental treatment.

Using a dental air turbine and a mannequin, researchers at Tohoku

University recreated the droplets and aerosols that occur during dental procedures. The key is the high-sensitivity camera and high-intensity LED light source, which allowed for high-quality images of the droplet spreading during the simulated procedure, which was previously difficult to do in real-time without dye.

Then, extra-oral suction (EOS) and intra-oral suction (IOS) were used to determine how well these oral suction devices work. Using these techniques, the researchers reduced droplet and aerosol spread within the air by 97.8% when both EOS and IOS were used, and a 92.1% reduction using IOS alone. The researchers published their results in the *Journal of Prosthodontic Research*.

"Since the droplets and aerosols ('spray' and 'mist') generated during dental treatment contain bacteria and viruses derived from saliva and blood, elucidation of their spreading and diffusion dynamics is required from the perspective of COVID-19 prevention," said Jun Watanabe, author and researcher at Tohoku University. And saliva is not the only component that can aerosolize and cause issues either. Different materials can produce different aerosols; silicon, calcium, potassium, and zinc have been recorded in air samples from dental clinics.

Inhalation of fine dust, mainly silica, can lead to respiratory issues in frequently exposed individuals. Understanding the spread and diffusion of such particles in the air is a key step in successfully protecting individuals from potentially harmful diseases that can be spread through airborne droplets.

It's also worth noting that the work being done on the patient can alter the directionality or spread of the droplets. For example, researchers found that treatments for cavities on the anterior teeth are the most likely to be associated with droplet spreading. Furthermore, the correct placement of the oral suction devices is important, with the most

effective positioning of the EOS device found to be about 10 centimeters away from the patient's mouth at a 0º angle.

"Analysis in various clinical situations is expected to elucidate the dynamics of dental treatment-derived droplets and aerosols and lead to the establishment of new dental treatment protocols, the development of air purification equipment, and the development of a cleaner and safer dental care environment," said Hiroyasu Kanetaka, author and researcher at the Liaison Center for Innovative Dentistry at Tohoku University.

While this study confirmed the effectiveness of IOS and EOS at reducing droplets in the air during dental treatment, some limitations will require future testing. The mannequin could not simulate breathing or exhalation, which may produce differing results. Moreover, the mannequin's lack of accurate lip and tongue morphology could also have impacted some results. Further investigations using a patient model will be required to clarify the efficacy of these oral suction devices.

More information: Jun Watanabe et al, Visualization of droplets and aerosols in simulated dental treatments to clarify the effectiveness of oral suction devices, *Journal of Prosthodontic Research* (2023). DOI: 10.2186/jpr.JPR_D_23_00013

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