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SYNOPSIS

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Review of "Sources of SARS-CoV-2 and Other Microorganisms in Dental Aerosols"

Article citation: Meethil AP, Saraswat S, Chaudhary PP, Dabdoub SM, Kumar PS. Sources of SARS-CoV-2 and other microorganisms in dental aerosols. J Dent Res. 2021 May 12 [cited 2021 May 18]. Available from: https://doi.org/10.1177/00220345211015948

One-minute summary

- The purpose of the study was to determine if microbial contamination in the dental operatory from aerosol-generating dental procedures (AGDPs) is of non-salivary or salivary origin.
- Surface sampling was conducted on the patient's chest, the face shield of the operator and assistant, and surfaces at a six-foot (1.8 metre [m]) distance 30 minutes after AGDPs in two enclosed, six-exchanges-per-minute ventilation dental operatories (Ohio, United States).
- Preventative measures to reduce salivary contamination of tested surfaces included a pre-procedural mouth rinse (30 mL, 1% hydrogen peroxide [H_2O_2]) for one minute (n=23 out of 28 total participants) and the use of high-volume intraoral evacuators (n=28).
- Nineteen out of twenty-eight of the participants had detectable severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) ribonucleic acid (RNA) in saliva prior to their dental procedure at low levels (high cycle threshold values, viral loads ranging from 27–912 copies/millilitre [mL]); however, no SARS-CoV-2 was detected in surface samples following the AGDPs.
- Authors identified the source of microorganisms as predominantly originating from irrigant fluids passing through handpieces (median: 78%; range: 2.5–100%), rather than patient's saliva (median: 0%; range: 0–82%) regardless of procedure type (P<0.001).
    - Source-tracking analysis revealed that, irrespective of the AGDP, on average, 20% of the microbiota could not be attributed to either irrigant or saliva (range: 0–90%).
    - Salivary bacteria were only detectable in 8 of 28 procedures, of which 5 had not used a pre-procedural mouth rinse; most often the salivary bacteria was detected on the chest of patients (P<0.05).
- The authors conclude that in their study the risk of transmission of SARS-CoV-2 and other respiratory pathogens is moderately low during AGDPs owing to nonsalivary microorganisms being the prevailing source of contamination, and that high volume intraoral evacuation and pre-procedural mouth rinses reduce contamination of the surrounding environment during AGDPs.

Additional information

- AGDP (N=28): dental implant (n=11) and drilling (restorative) procedures (n=3) with high-speed handpieces, and ultrasonic scaling (n=14).
- Flow rates for irrigants were as follows: implant osteotomies, 30 mL/minute (min) (sterile saline); restorative procedures, 23 mL/ min (dental unit water line); ultrasonic scaling, 19.3 mL/min (dental unit water line).
    - Irrigant flow dilutes the saliva by 20- to 200-fold (assuming a salivary flow rate of 0.1 to 1.0 mL/min).
- Intraoral evacuators had a mean suction capacity of 7.1 L/min (range: 6.6–7.4 L/min).
- SARS-CoV-2 RNA was detected in some saliva samples despite participant selection and recruitment criteria excluding any individuals with Coronavirus Disease 2019 (COVID-19) symptoms or COVID-19 history since January 2020 and up to the time of the study (May 4 to July 10, 2020).
- 16S rRNA next generation sequencing was used to characterize the microbiome from saliva and condensate for source tracking. Primers to two hypervariable regions (V1 to V3 and V4 to V5) were used to reduce taxonomic bias. Amplicon sequence variants (ASVs) were used for finer sequence resolution. Clustering was determined using linear discriminant analysis (LDA) of Bray-Curtis dissimilarity distances.
- Petri dishes in the clinic environment before patient or staff arrived were used to control for environmental bacterial normally found and rarefy (i.e., normalize) sequencing datasets.
- Microbial analysis included 4,500,063 classifiable sequences representing 22,013 ASVs.
- Authors highlight that their study has characterized and identified the source of contamination, whereas previously few studies characterized the types of microorganisms, and none identified their source.
- Authors explain that the sterile saline (implant irrigant) was not likely not contaminated, but that the autoclaved reusable handpieces likely contained diverse, non-viable microorganisms.

PHO reviewer's comments

- The sampling method does not include assessment of aerosols small enough to have remained in the air and not settled or impacted on any surfaces tested prior to removal from air by ventilation. If the ventilation rate was indeed six-exchanges-per-minute, then the experimental conditions may not be representative of most dental settings, reducing generalizability.
- The duration of procedures was not described, but longer procedures may result in more dilution of microorganisms from salivary origins which could limit their detection or identification amidst the abundance of microorganisms from irrigants.
    - Lack of detection of SARS-CoV-2 may be in part due to high cycle threshold counts of saliva and the impact of dilution.
- 16S rRNA sequencing detects microbial DNA, which may or may not reflect live microorganisms.
- The SARS-CoV-2 polymerase chain reaction (PCR) results only detects RNA, which may or may not reflect viable virus.
- The saliva SARS-CoV-2 PCR protocol was used to test condensate; however, it is not optimized and validated for environmental testing.
- It is not stated if the patient's chest being sampled refers to the dental bib or the patient's clothing.

- It is not clear if the face shield and the dental bib (assuming this is the patient's chest sample) were sampled immediately following the procedure or were doffed and left in the operatory during the 30 minute period between the procedure completing and when the surface samples were taken. Further, the method of sample collection and size of area sampled was not included.
- Figure 2 indicates that 10 procedures resulted in detection of salivary origin microbes, but authors have stated 8 procedures in the text.
- The authors conclude that high-volume intraoral evacuators reduce contamination of the surrounding environment, but the authors have not provided sufficient data to make this conclusion (e.g., a control group without suction).
- The authors conclude that H_2O_2 pre-procedural mouth rinse reduced salivary microbial bioloads, but the authors have not provided sufficient data to make this conclusion (e.g., a comparison to post-mouth rinse).
- The authors conclude that risk of transmission of SARS-CoV-2 and other respiratory pathogens is moderately low, yet:
    - Whether or not transmission from patients with detectable SARS-CoV-2 in saliva to dental staff occurred was not assessed (i.e., sequencing of SARS-CoV-2 samples from patient saliva and follow-up of dental staff for SARS-CoV-2 testing and sequencing was not reported).
    - These findings likely do not apply to all patients (no symptomatic patients included) and may not apply to all asymptomatic patients (e.g., patients at 1 day before symptom-onset where viral load is highest and most infectious).
    - Sampling the N95 respirators worn by dental staff was not conducted but would help to address important risks related to aerosols.

Citation

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