COVID-19: Is it possible to define the aerosol clearance time after dental health care?

Adriane Batista Pires Maia,1 Vanessa Paiva Reis,2 Adriana Raymundo Bezerra,2 Danielle Castex Conde4
1Oral Maxillofacial Surgery and Traumatology Service, Military Police Central Hospital (Hospital Central da Polícia Militar), Rio de Janeiro State Military Police, Rio de Janeiro, RJ, Brazil
2Oral Maxillofacial Surgery and Traumatology Service, Military Police Polyclinic of Cascadura (Policlínica da Polícia Militar de Cascadura), Rio de Janeiro State Military Police, Rio de Janeiro, RJ, Brazil
3Oral Maxillofacial Surgery and Traumatology Service, Military Police Central Dental Clinic (Odontoclínica Central da Polícia Militar), Rio de Janeiro State Military Police, Rio de Janeiro, RJ, Brazil
4Oral Maxillofacial Surgery and Traumatology Service and Anatomical Pathology Service, Military Police Central Hospital (Hospital Central da Polícia Militar), Rio de Janeiro State Military Police, Rio de Janeiro, RJ, Brazil

• Conflicts of interest: none declared.

Dear Editor,

The World Health Organization (WHO) recognizes that aerosol-generating procedures represent an increased hazard of transmitting the new coronavirus to healthcare professionals.1 In dentistry, the frequent use of aerosol-generating devices such as three-way syringe, high-speed dental drill, and ultrasound associated with close contact with the patient, represent a potential risk to occupational health.2 As a result, several publications have recommended the postponement of elective dental procedures during the outbreak of COVID-19 in order to reduce the chance of contamination.3,4 In several locations, the epidemic has reached a level of greater control of contamination, which has enabled the gradual return of elective dental care.

Because of this, we have seen an effort by the academic community to orient dental surgeons on the new biosafety guidelines during care, however, a gap remains to be filled about the care for handling the aerosol produced.5 Considering that the time for the purification of aerosols, its impact on the risk of cross-infection and the organization of dental appointments, we intend to analyze some aspects that directly interfere in the definition of the time necessary for the aerosol clearance.

van Doremalen et al. (2020)6 in experimental conditions found the presence of SARS-CoV-2 in aerosols for up to 2.64 hours and on surfaces for up to 72 hours, which raised a series of questions about the respiratory protection of the health team, the care in disinfecting surfaces and the safe time interval between dental care. As for respiratory protection during the performance of aerosol-generating procedures and cleaning of surfaces, there was a consensus among publications on the indication of use of N95, FFP2 or equivalent respirators and the sanitation of work area surfaces with soap and water followed by disinfection with 70% ethanol (hydrus ethyl alcohol [70% w/w] or 77° G.L. [77% v/v]) and 0.1% sodium hypochlorite or quaternary ammonium.2-5,7,9,10-13 However, the time interval required for the clearance of aerosols produced in dental care remains one of the most polemic topics in dentistry in the days of COVID-19.

The first controversial aspect of this discussion rests on the particie diameter of the aerosol produced in the experiment by van Doremalen et al. (2020).6 One of the objectives of the study was to investigate the permanence of SARS-CoV-2 in aerosols mechanically produced using a nebulizer. Nebulizers produce dispersion particles with a very small diameter, between 1.0 to 5.0 micrometers (µm), so that they have the ability to penetrate more deeply into the respiratory tract as desired.14 The aerosols produced in dental procedures are composed by saliva, body fluids and organic debris and are made up of droplets and droplet nuclei with a diameter of 50 µm or less, concentrating between 0.6 to 1.5 meters away from the patient’s mouth.15,16,17 Baron (2001)18 demonstrated that the smaller the diameter of the droplets, the longer they will remain in the ambient air and attested that aerosol particles with 1 µm, 3 µm, 10 µm and 100 µm can remain in the air for 12 hours, 1.5 hours, 8.2 minutes and 5.8 seconds respectively. Thus, when we know the dynamics of aerosol dispersion and its direct relationship with particle size, we understand that the period of permanence of aerosols in the environment in the experiments by van Doremalen et al.6 cannot be compared with the reality of the expected permanence of aerosols produced in dental care.

In addition to the particle size, in order to accurately define the time for aerosol clearance after dental care, the environment would need to be equipped with exhaust systems, preferably with negative pressure, and high efficiency...
particle filtering as suggested by WHO, the Brazilian Public Health Regulatory Agency, Agência Nacional de Vigilância Sanitária, (ANVISA), the US Centers for Disease Control and Prevention (CDC) and the United Kingdom’s National Health Service (NHS). This is because this type of controlled environment, in addition to prevent the spread of aerosol and contamination of areas adjacent to the treatment room, allows the monitoring of air changes per hour, which, together with other environmental variables, allows calculations by hospital engineering to define the correct time for the exchange of air ambient air.

However, the adaptation of dental offices to rooms with negative pressure and controlled exhaust systems is not a feasible task in most cases. In view of this, different recommendations have been prescribed to enable service in rooms without differential pressure use (neutral rooms). The NHS recommends that neutral rooms should remain with closed doors and windows open for an hour after treatment before cleaning and disinfecting the environment; the American Dental Association based on the CDC study conducted by Baron, which measured the settling speed of the aerosol particles by virtue of their density, recommended that they wait fifteen minutes before cleaning the office.

Finally, care has been widely recommended in environments that could remain naturally ventilated. However, it is important to note that the natural ventilation of the care room compromises the correct maintenance of room temperature, which generates discomfort additional to professionals and patients, allows the entry of vectors and increases the risk of infection by other microorganisms.

### Conclusion

In view of the lack of experimental studies that simulate the type of aerosol produced during visits to dentistry in neutral rooms and the permanence time of SARS-CoV-2 viable for contamination in this aerosol, it is not possible to define exactly, what is the minimum time between appointments. However, it seems reasonable, considering the size of the aerosol particles produced in dental care and the behavior of the dynamics of its fluids, the recommendation to wait between fifteen minutes to an hour for cleaning and disinfection of the service room. This time should be adjusted due to the extension of aerosol production during the procedure, the use of aerosol mitigation techniques, the possibility of natural ventilation and the size of the service room.

### References

1. Organização Mundial da Saúde. OMS. Prevenção e controle de infecção durante os cuidados de saúde quando houver suspeita de infecção pelo novo coronavírus (nCoV). Available at: https://www.paho.org/br/index.php?option=com_docman&view=download&slug=prevencao-e-controle-de-infeccao-durante-os-cuidados-de-saude-quando-houver-suspeita-de-infeccao-pelo-novo-coronavirus-ncov&Itemid=965. Accessed May 20, 2020.

2. Judson SD, Munster VJ. Nosocomial transmission of emerging viruses via aerosol-generating medical procedures. Viruses. 2019;11(10):940.

3. Maia ABP, Reis VP, Bezerra AR, Conde DC. Odontologia em Tempos de COVID-19: Revisão Integrativa e Proposta de Protocolo para Atendimento nas Unidades de Saúde Bucal da Polícia Militar do Estado do Rio de Janeiro-PMERJ. Rev Bras Odontol. 2020;77:e1812.

4. Lo Giudice R. The Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) in Dentistry. Management of Biological Risk in Dental Practice. Int J Environ Res Public Health. 2020;17(9):3067.

5. Martins-Filho PR, de Gois-Santos VT, Tavares CSS, de Melo EGM, do Nascimento-Júnior EM, Santos VS. Recommendations for a safety dental care management during SARS-CoV-2 pandemic. Rev Panam Salud Publica. 2020;10:44–51.

6. Li Y, Ren B, Peng X, Hu T, Li J, Gong T, et al. Saliva is a non-negligible factor in the spread of COVID-19. Mol Oral Microbiol. 2020;4.

7. Izzetti R, Nisi M, Gabriele M, Graziani F. COVID-19 transmission in dental health care providers: a review. Int J Endod J. doi: 10.1111/iej.13313.

8. Van Doremalen N, Bushmaker T, Holbrook MG, Gamble A, et al. Aerosol and surface stability of SARS-CoV-2 as compared to SARS-CoV and流感病毒. Aerosol measurement: principles, techniques, and applications. New York: John Wiley and Sons, Inc. 2001;2:387–415.

9. Agência Nacional de Vigilância Sanitária. Prevenção e controle de infecção durante os cuidados de saúde quando houver suspeita de infecção pelo novo coronavírus (nCoV)/Nota Técnica GVIMS/GGTES/ANVISA nº 04/2020 [published online May 1, 2020] Int Endod J. doi: 10.1111/iej.13408.

10. Umer F, Haji Z, Zafar K. Role of respirators in controlling the spread of novel coronavirus (COVID-19) among dental health care providers: a review. Oral Dis. 2020;5:11. doi: 10.1111/odi.13408.

11. Zemouri C, Volgenant CMC, Bujs MI, Crielwaard W, Rosema NAM, Brandt BW, de Soet JJ. Dental aerosols: microbial composition and spatial distribution. Journal of Oral Microbiology. 2020. doi:https://doi.org/10.1008/20002297.2020.1762040.

12. Umer F, Haji Z, Zafar K. Role of respirators in controlling the spread of novel coronavirus (COVID-19) among dental health care providers: a review. Int J Environ Res Public Health. 2020;17(9):3067.

13. Zemouri C, de Soet H, Crielwaard W, Laheij A. A scoping review on bio-aerosols in healthcare and the dental environment. PloS one. 2017;12(5).

14. Jain M, Mathur A, Mathur M, Mukhi PU, Ahire M, Pingal C. Qualitative and quantitative analysis of bacterial aerosols in dental clinical settings: Risk exposure towards dentist, auxiliary staff, and patients. Journal of Family Medicine and Primary Care. 2020;9(2):1003.

15. Baron PA, Willeke K. Dynamic Mass and Surface Area Measurements. Aerosol measurement: principles, techniques, and applications. New York: John Wiley and Sons, Inc. 2001;2:387–415.

16. Martins-Filho PR, de Gois-Santos VT, Tavares CSS, de Melo EGM, do Nascimento-Júnior EM, Santos VS. Recommendations for a safety dental care management during SARS-CoV-2 pandemic. Rev Panam Salud Publica. 2020;10:44–51.

17. Li Y, Ren B, Peng X, Hu T, Li J, Gong T, et al. Saliva is a non-negligible factor in the spread of COVID-19. Mol Oral Microbiol. 2020;4.

18. Li Y, Ren B, Peng X, Hu T, Li J, Gong T, et al. Saliva is a non-negligible factor in the spread of COVID-19. Mol Oral Microbiol. 2020;4.

19. Li Y, Ren B, Peng X, Hu T, Li J, Gong T, et al. Saliva is a non-negligible factor in the spread of COVID-19. Mol Oral Microbiol. 2020;4.

20. Centers for Disease Control and Prevention. CDC. Interim infection prevention and control recommendations for patients with suspected or confirmed coronavirus disease 2019 (COVID-19) in healthcare settings. [actualizada em 13/05/2020]. Disponível em: https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1/2020. Accessed May 26, 2020.

21. Centers for Disease Control and Prevention. CDC. Interim infection prevention and control recommendations for patients with suspected or confirmed coronavirus disease 2019 (COVID-19) in healthcare settings. [actualizada em 13/05/2020]. Disponível em: https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1/2020. Accessed May 26, 2020.

22. ADA. https://www.ada.org/en/news-releases/2020/archives/
COVID-19: Is it possible to define the aerosol clearance time after dental health care?

Submitted: 06/22/2020 / Accepted for publication: 06/29/2020

Corresponding author:
Adriane Batista Pires Maia
E-mail: adrianepmaia@gmail.com

Mini Curriculum and Author’s Contribution

1. Adriane Batista Pires Maia - DDS; PhD student. Contribution: literature review, preparation, writing, and review of the manuscript. ORCID: 0000-0001-6081-707X
2. Vanessa Paiva Reis - DDS. Contribution: preparation, writing, and review of the manuscript. ORCID: 0000-0001-7682-547X
3. Adriana Raymundo Bezerra - DDS; MsC. Contribution: preparation, writing, and review of the manuscript. ORCID: 0000-0001-9487-1904
4. Danielle Castex Conde - DDS; PhD. Contribution: preparation, writing, and review of the manuscript. ORCID: 0000-0002-8492-9145

may/cdc-guidance-for-dental-settings-echoes-ada-guidance?utm_source=cpсорg&utm_medium=cpasalertbar&utm_content=ada-cdcstatement&utm_campaign=covid19

23. aron PA. Generation and Behavior of Airborne Particles (Aerosol). Presentation published at CDC/NIOSH Topic Page: Aerosols, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Public Health Service, U.S Department of Health and Human Services, Cincinnati, OH. www.cdc.gov/niosh/topics/aerosols/pdfs/Aerosol_101.pdf

24. Associação Brasileira de Normas Técnicas (ABNT). NBR 7256: 2005, de 30 de março de 2005. 2005. Dispõe sobre o Tratamento de ar em estabelecimentos assistenciais de saúde (EAS) - Requisitos para projeto e execução das instalações. [Internet]. [citado 2019 Set 12]. Disponível em http://www.ductbusters.com.br/normas/NBR_7256.pdf.