AEROSOLS IN DENTISTRY

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Content

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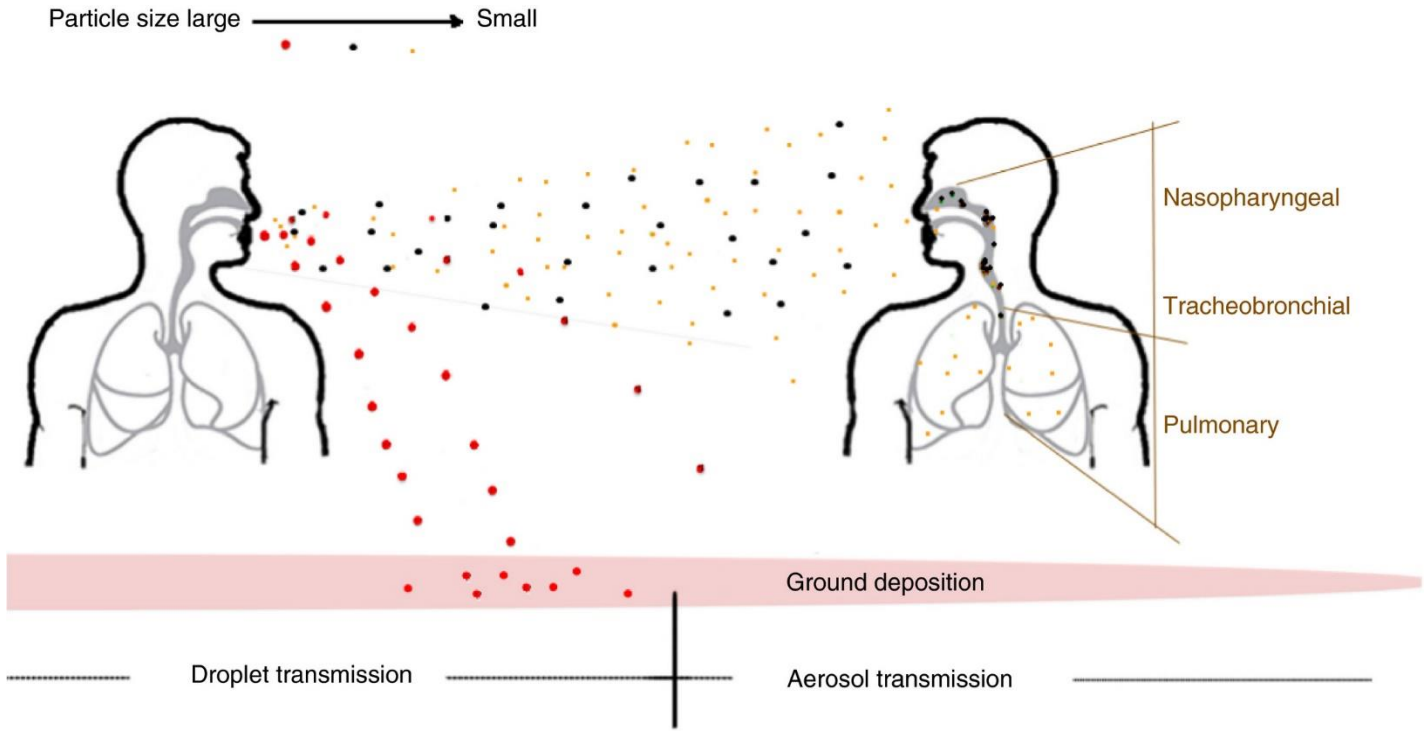
DEFINITION

Aerosols = liquid or solid particles suspended in the air by humans, animals, instruments, or machines.

Bio-aerosols = aerosols containing particles of any kind of organism.

Picture reference: https://www.todaysrdh.com/

DEFINITION



- Aerosol - particles less than 5 μm in diameter
- Splatter - particles larger than 5 μm in diameter

Picture reference: **Collection, particle sizing and detection of airborne viruses (2019)**

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SIZE COMPARISON

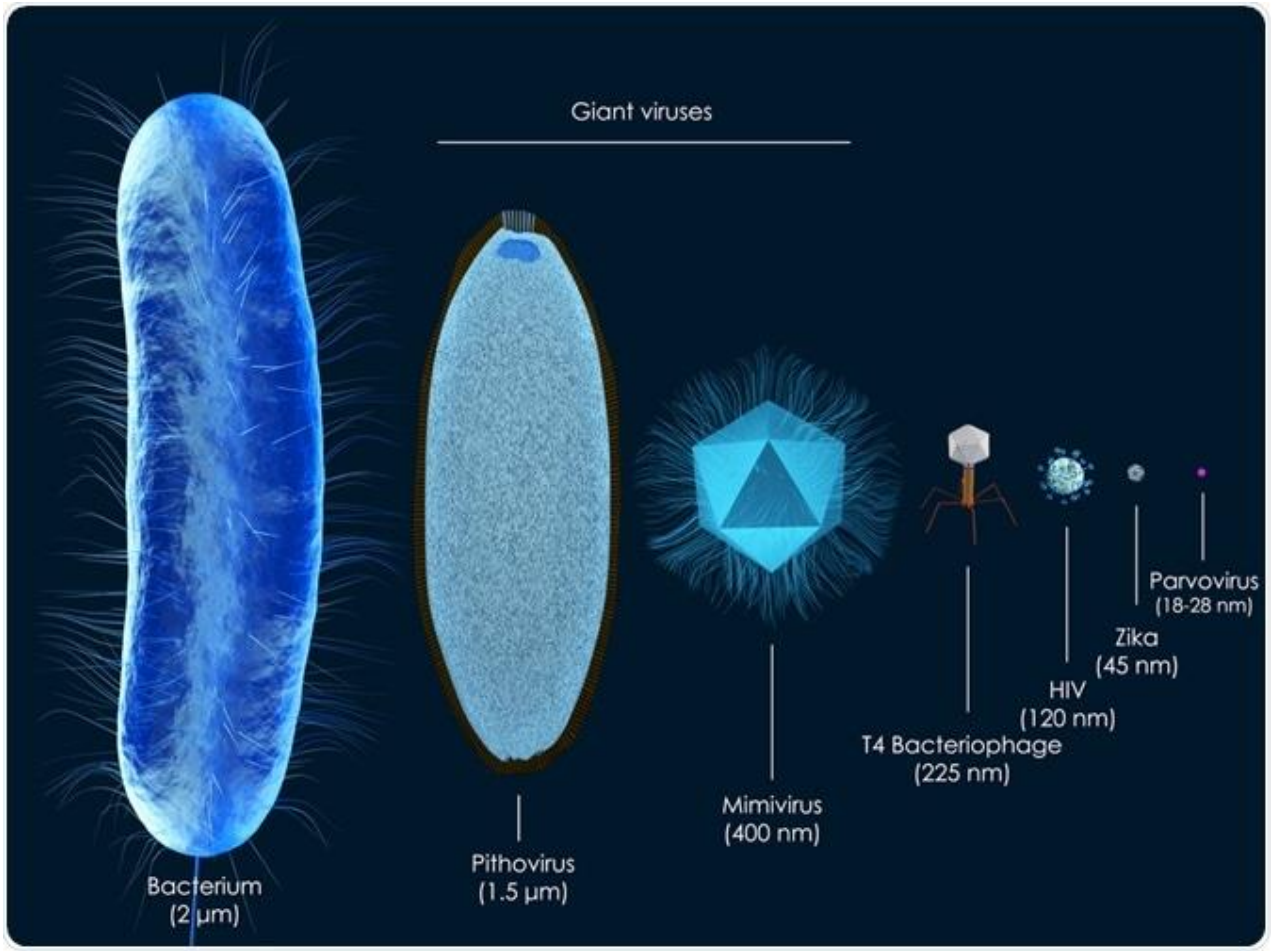
Aerosol particles: < 5 µm

Mycobacterium tuberculosis: 2 µm

Staphylococcus epidermidis: 1,5 µm

Coronaviridae: 90-150 nm

Influenza viruses: 80-120 nm



Picture reference: https://www.news-medical.net/health/The-Size-of-SARS-CoV-2-Compared-to-Other-Things.aspx

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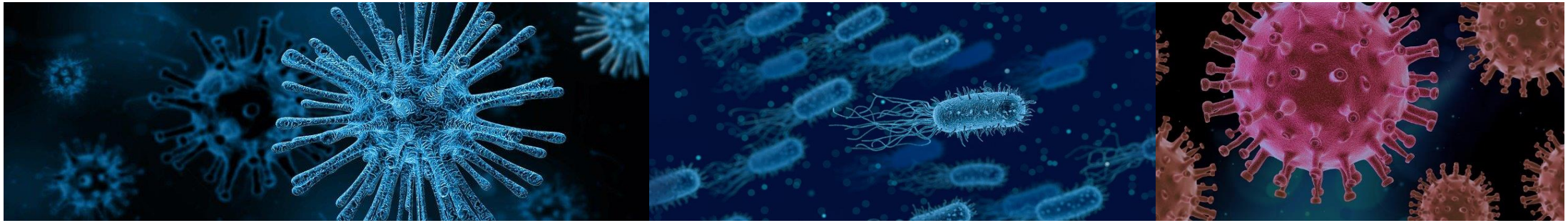
DISEASES KNOWN TO BE SPREAD BY DROPLETS OR AEROSOLS

Tuberculosis, Influenza, Legionnaires' Disease, Severe Acute Respiratory Syndrome, Measles, Pneumonic Plague,

diseases caused by herpetic viruses (Varicella Zoster Virus), rhinoviruses



Reference: **Aerosols and splatter in dentistry (2004)** https://jada.ada.org/article/S0002-8177(14)61227-7/fulltext#cesec60
Particle sizes of infectious aerosols: implications for infection control (2020)

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INFECTIOUS AEROSOLS IN DENTAL ENVIROMENT

What is the composition of contaminated droplets or aerosols?

Complete overview micro-organisms identified in the dental setting.

Bacteria N = 19					
Gram negative		**Gram positive**			
Acinetobacter wolffii		*Staphylococcus capitis*	*Staphylococcus chromogenes*	*Micrococcus luteus*	*Diphteroids*
Legionella spp.		*Staphylococcus lentus*	*Staphylococcus haemolyticus*	*Micrococcus* spp.	*Corynebacteria*
Pseudomonas aureus		*Staphylococcus xylosus*	*Staphylococcus epidermidis*	*Micrococcus lylae*	*Bacillus* spp.
Staphylococcus aureus			*Staphylococcus fominis*	*Bacillus pumilus*	*Actinomycetes*
Viruses N = 0					
None reported					
Parasites N = 0					
None reported					
Fungi N = 23					
Alternaria alternata	*Aspergillus flavus*	*Cladosporium cucumerinum*	*Geotrichum* spp	*Stemphylium* spp	
Alternaria brassicicola	*Aspergillus fumigatus*	*Cladosporium ramotenellum*	*Monocillim indicum*	*Stemphylium* spp	
Alternaria citri	*Aspergillus niger*	*Cladosporium sphaerospermum*	*Monodictys glauca*	*Ulocladium alternariae*	
Arthrinium phaesospermum	*Botrytis* spp	*Cladosporium* spp	*Pencillium* spp		
Aspergillus	*Cladosporium cladosporiodias*	*Cladosporium spongiosum*	*Penicillium chrysogenum*		

Reference: **A scoping review on bio-aerosols in healthcare and the dental environment (2017)**

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AEROSOL SAMPLING METHODOLOGY

Passive air sampling

Active air sampling (air sampler)

Note: viral particles such as influenza, rhinoviruses, SARS coronavirus and bacteria such as Mycobacteria tuberculi and strict anaerobic bacteria could not be measured if common culture medium and cultivation conditions were used.

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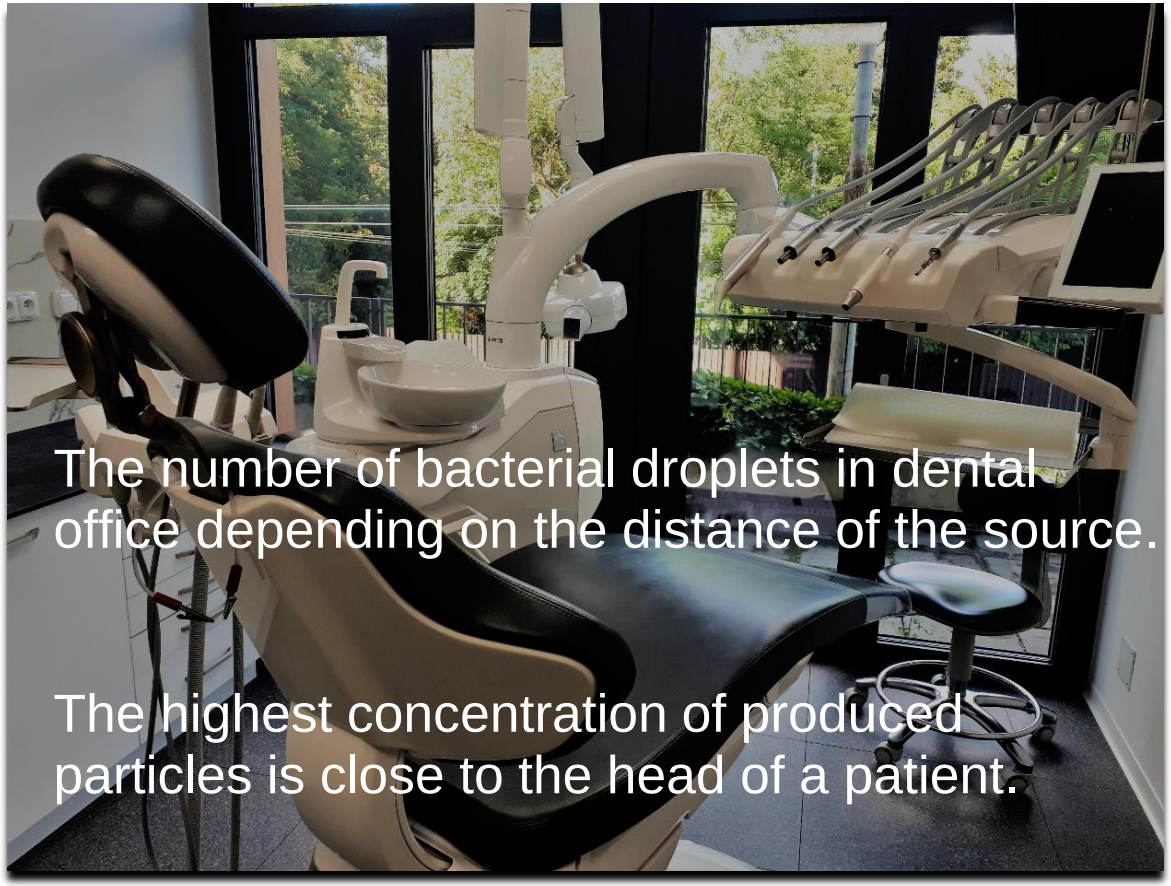
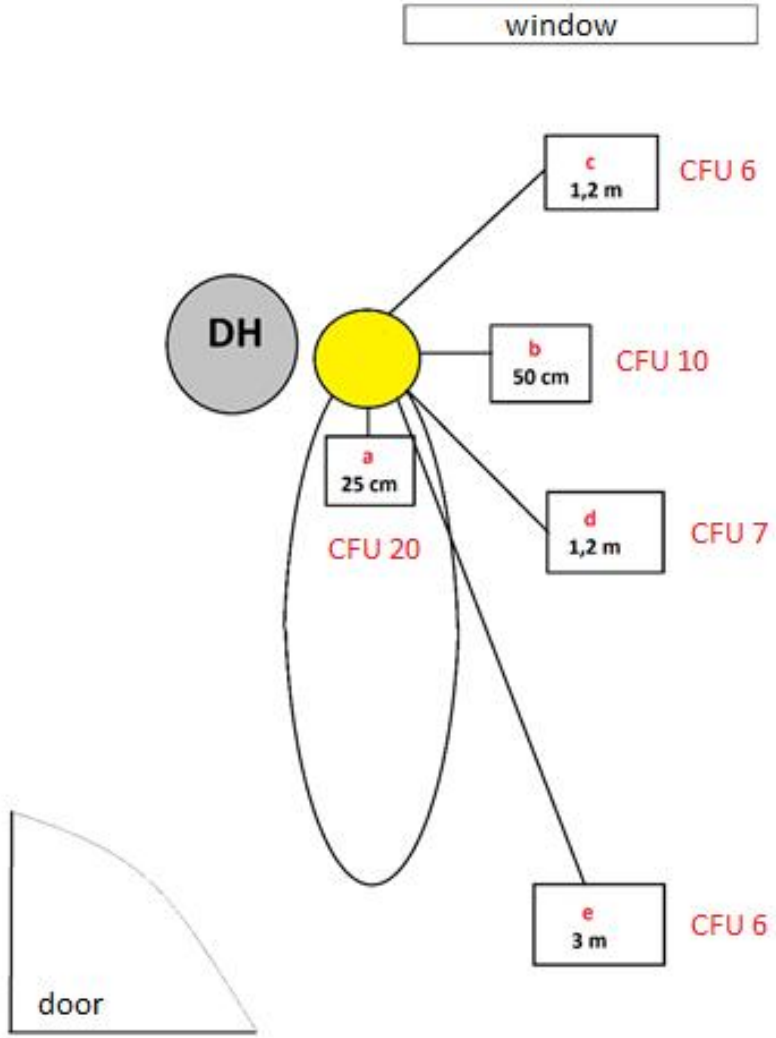
PILOT MEASUREMENT OF BACTERIAL AEROSOL IN THE ENVIRONMENT OF A DENTAL CLINIC (JUNE 2021)



- The number of bacterial droplets in dental office depending on the distance of the source.
- The highest concentration of produced particles is close to the head of a patient.



CFU = colony forming unit
Source: Measurements for the pilot study, passive air sampling (Department of Public Health, MUNI)

WRONG

RIGHT

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KEY INFECTION CONTROL FOR DENTAL OFFICE

- 1) Adoption of contact precautions (Thorough hand washing, Personal protective equipment)
- 2) Use of pre-procedure mouthwash (0.12% chlorhexidine mouth rinse, povidone iodine…)
- 3) Use of rubber dam isolation
- 4) Removal of contaminated ambient air (High volume evacuation)
- 5) Reduce concentration of aerosols in dental office (ventilation, HEPA filters)
- 6) Decontaminate aerosols in the air (UV light, etc)

Reference: Severe Acute Respiratory Syndrome (SARS) and the GDP. Part II: Implications for GDPs (2004)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7091810/

CDC: COVID-19: Guidance for Dental Settings

- The current guidelines are extrapolated from influenza and previous outbreaks of SARS-1 and are based on expert opinion
- **For DHCP working in facilities located in areas with moderate to substantial community transmission:**
  - **During aerosol generating procedures DHCP should use an N95 respirator or a respirator that offers an equivalent or higher level of protection**
  - If aerosol generating procedures are necessary for dental care, use four-handed dentistry, high evacuation suction and dental dams to minimize droplet spatter and aerosols.
  - Preprocedural mouth rinses (PPMR)
    - There is no published evidence regarding the clinical effectiveness of PPMRs to reduce SARS-CoV-2 viral loads or to prevent transmission. Although SARS-CoV-2 was not studied, PPMRs with an antimicrobial product (chlorhexidine gluconate, essential oils, povidone-iodine or cetylpyridinium chloride) may reduce the level of oral microorganisms in aerosols and spatter generated during dental procedures.

DHCP = dental healthcare personnel

Reference: https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html

Reference: https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html#section-2

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COVID-19: RELEVANT INFORMATION

WHO

https://www.who.int

CDC

https://www.cdc.gov/coronavirus/2019-ncov/index.html

Science

https://www.sciencemag.org/collections/coronavirus?intcmp=sci_cov

Actual information from Ministry of Health of the Czech Republic

https://onemocneni-aktualne.mzcr.cz/covid-19?utm_source=general&utm_medium=widget&utm_campaign=covid-19

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It is good to know…

…humans produce infectious aerosols in a wide range of particle sizes, but pathogens predominate in small particles (< 5 μm) that are immediately respirable by exposed individuals.

…surgical masks might offer some respiratory protection in comparison to not wearing mask at all. Respirators offer more respiratory protection than surgical masks.

…proper hand hygiene is still one of the most important factors in preventing the spread of infectious diseases. Remember, all surfaces in your dental office are covered with aerosol and droplets.

Particle sizes of infectious aerosols: implications for infection control (2020)

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Articles for extra knowledge

- **Interventions to reduce contaminated aerosols produced during dental procedures for preventing infectious diseases (Cochrane Library, Review, 2020)**
- Particle sizes of infectious aerosols: implications for infection control (Lancet, 2020)
- A systematic review of droplet and aerosol generation in dentistry (Elsevier,2021)
- Severe Acute Respiratory Syndrome (SARS) and the GDP. Part II: Implications for GDPs (Br Dent J, 2004)

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