#2453

Handpiece Design and Coolant Delivery Affect Aerosol and Droplet Production

Allison JR, Edwards D, Bowes C, Pickering K, Dowson C, Durham J, Jakubovics N, Holliday R

INTRODUCTION

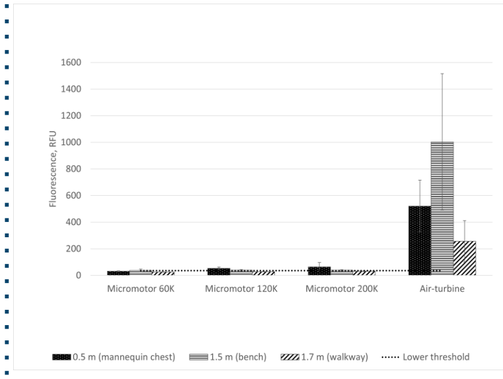
- Dental procedures produce aerosols and droplets contaminated with microorganisms. This may disrupt service provision during infectious disease outbreaks like COVID-19.
- This study aimed to evaluate aerosol and droplet production from an electric micromotor handpiece with water-jet coolant compared to an air-turbine handpiece.

METHODS

- 10-minute anterior crown preparations conducted in a dental mannequin. Fluorescein tracer (2.65 mmol L^{-1}) added to irrigant.
- Experiments in a 603 m^3 open-plan clinic, 3.45 air-changes/h mechanical ventilation.
- 1:5 micromotor handpiece used at 60-, 120-, and 200,000 rpm (Ti-Max Z95L, NSK; Tochigi, Japan). Air-turbine as positive control. All experiments in triplicate.
- Aerosols and droplets captured by:
  - Optical particle counters (at 0.5/ 1.5/ 1.7m)
  - Cyclone air-samplers (at 0.5/ 1.5/ 1.7m)
  - Passive settling onto filter papers placed across the clinic.
- Fluorescein quantified by spectrofluorometry.

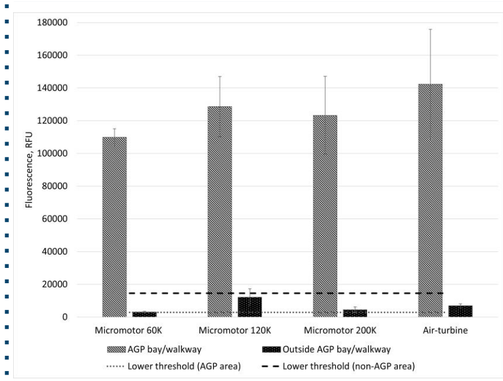
RESULTS

Aerosols by air-sampler



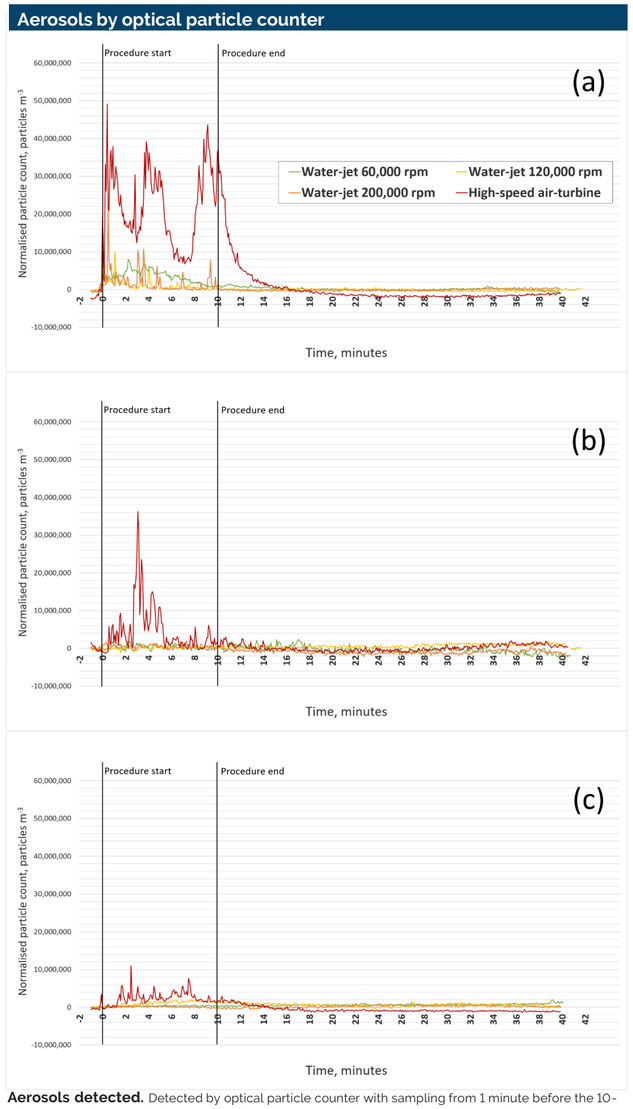
Aerosolised fluorescein tracer. Detected with a liquid-cyclone air sampler (BioSampler) using the micromotor at different bur speeds, or air-turbine. Sampling at three locations (0.5m, 1.5m, 1.7m). Error bars show 2 SEM. RFU: Relative Fluorescence Units.

Droplets by settling

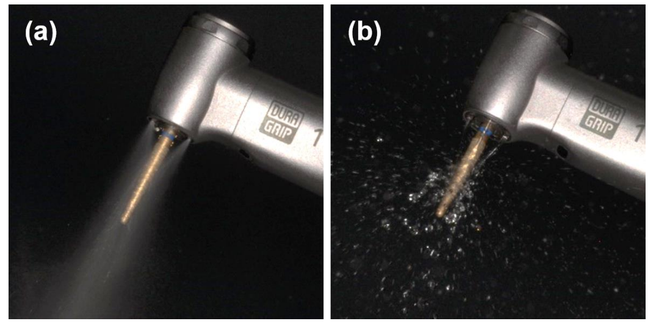


Settled fluorescein droplets. Detected by analysis of filter papers placed across an open plan clinic. The clinic was divided into the bay where the procedure was conducted (AGP bay) and it's associated walkway, and other areas. Error bars show 2 SEM. RFU: Relative Fluorescence Units.

Aerosols by optical particle counter



Aerosols detected. Detected by optical particle counter with sampling from 1 minute before the 10-minute procedure, to 30 minutes after it (41 minutes total). (a) 0.5m, (b) 1.5m, (c) 1.7m. Single repetition shown for clarity, but other repetitions were similar.



Micromotor handpiece irrigation. (a) Standard air/water mist irrigation. (b) water-jet irrigation (no air)

CONCLUSION

- Electric micromotor water-jet handpieces produce less contamination than air-turbine handpieces.
- Localised droplet contamination is similar with both handpieces, the micromotor produces much less aerosol contamination.
- No aerosol is seen with the micromotor handpiece beyond the immediate treatment area (1.5 m)
- At higher bur speeds (>120k), aerosols are produced in the vicinity of the procedure (<1.5 m), and respiratory protection may be required in infectious disease outbreaks.

Newcastle University
School of Dental Sciences

British Endodontic Society

THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH

Declaration: NSK UK Ltd. loaned equipment but were not involved in the design, conduct, or reporting of the study, and did not have advance sight of the data or this poster.

James.allison@ncl.ac.uk
@JamesR_Allison

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