

NPL Studies into dental surgery airborne particulates for COVID-19 mitigation

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The National Physical Laboratory (NPL) has conducted two studies into the measurement of aerosols produced by dental Aerosol Generating Procedures (AGPs) at a MyDentist dental surgery. The first study was a feasibility study in July 2020 using an Optical Particle Counter (OPC) in a surgery where AGPs were performed on real patients. This attempted to recreate the conditions found in a dental surgery (including both high speed and 3-in-1 AGPs), in line with the UK's Covid-19 guidance at the time. This included the mitigations in use in dental surgeries across the UK: pumped ventilation, an open window, high-bore suction in the mouth and four handed dentistry.

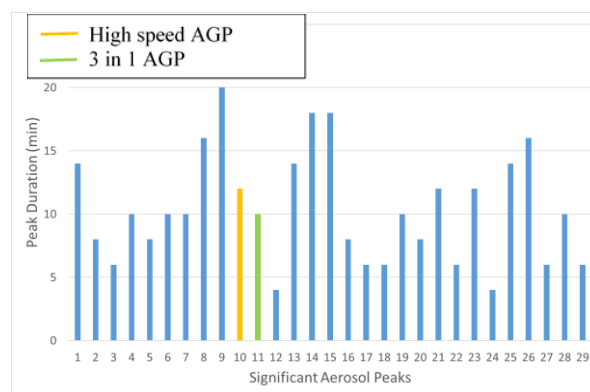


Figure 1. Significant aerosol peaks from AGPs in the first study

The first study suggested that in this specific mitigated clinical environment:

- OPC particle number concentrations in the size range 0.2-10 μm were driven by non-AGP background effects.
- The impact from the range of 41 AGPs on particle number concentrations was limited (Figure 1).
- The duration of significant increased particle number concentration events measured by the OPC did not exceed 20 minutes (Figure 1). The mean event duration time was approximately 10 minutes.

A follow-on study was conducted in February 2021. This study was much larger, with five different OPC instruments in two differently sized rooms with AGPs performed on both dental patients and a surgical manikin. The second study observations supported the first:

- Manikin tests showed a significant increase in OPC-measured particle mass concentrations when the surgery was unventilated (air filtration off, window closed).
- The real patient study found little impact on in-surgery particle concentrations from the range of 19 AGPs where listed mitigations were used. This was true for both particle mass concentrations and particle number concentrations.

- The study highlighted the difference between OPC-measured particle number concentration and particle mass concentration measurements, in relation to aerosol concentrations in the room.

We present the results from both studies and examine the effectiveness of using OPCs in dental studies. We also highlight the importance of the OPC calibration standardisation work in projects such as the AEROMET II EMPIR project.