



A WORLD LEADER IN FUME
EXTRACTION TECHNOLOGY

METHODS OF AEROSOL EXTRACTION IN THE DENTAL CLINIC: A COMPARISON

How to control infective aerosols created during examination and treatment processes is a challenge dental staff have always faced. Dental personnel and patients are exposed to tens of thousands of aerosols containing bacteria and viruses per cubic metre, and the potential to breathe contaminated air is high¹. COVID-19 has heightened the concern about aerosols in the dental office.

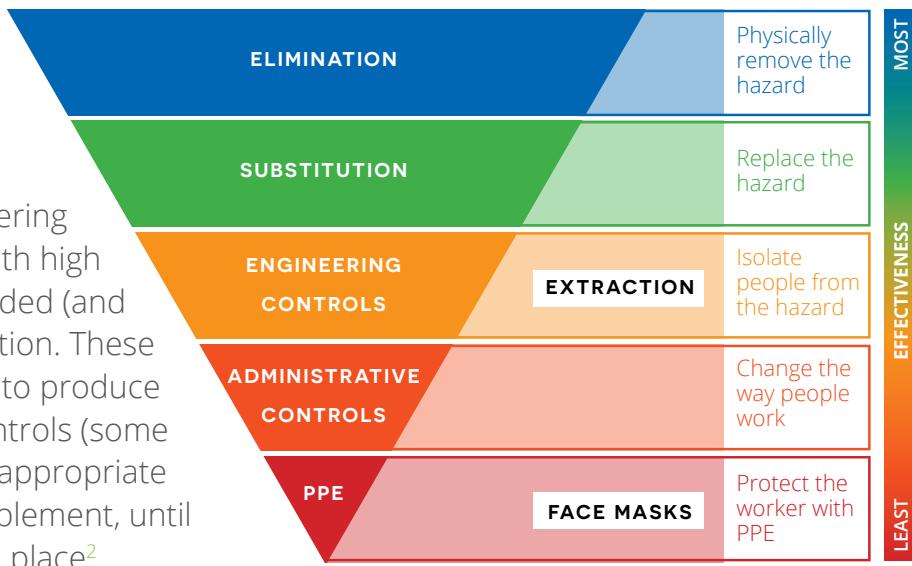
While it is common practice for staff to wear PPE, this only mitigates some of the risk of transmission and it is known that this does not provide total protection to its wearer. More can be done to stop aerosols reaching surfaces, equipment and the breathing zone of the dental staff and it is recommended that the risk could be further reduced by diverting, capturing and containing it within a suitable extraction and filtration device where it can become no longer viable and then disposed of in a safe manner.

Good extraction can have a very definite positive impact on the spread of infection, reducing the amount of aerosol transmitted during dental procedures. The marketplace is full of systems that state they offer adequate protection and claims of effectiveness can be grossly misleading. Knowing what to purchase for a proper infection control regime can be confusing, and costly if the right choices aren't made – financial and to the health of dental staff. This document considers the options available.

What additional interventions are best?

The hierarchy of control tool is used widely across industries to minimize exposure to hazards.

Use of an extractor is an example of protection through use of an engineering control. Use of extraction systems with high grade HEPA filters can provide an added (and in some cases higher) level of protection. These types of controls generally take time to produce and implement so administrative controls (some may be temporary) and PPE may be appropriate supplements as they are quick to implement, until more effective controls can be put in place².



1. <https://decisionsdentistry.com/article/transmission-precautions-for-dental-aerosols/>
2. <https://www.assp.org/news-and-articles/2020/03/31/how-to-apply-the-hierarchy-of-controls-in-a-pandemic>

A comparison of options

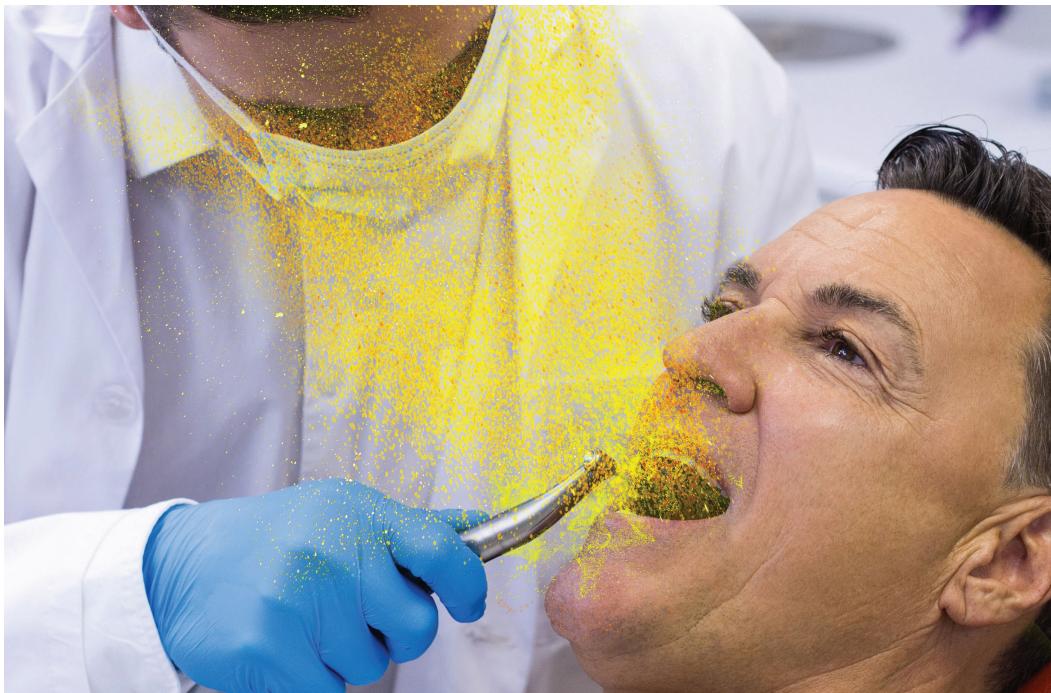
Viruses such as COVID-19 spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, or via the aerosols created during examination and procedure³. Within a dental clinic, aerosols can remain in the air for a long time, may be transported for long distances in airflows and can contaminate areas beyond the patient's immediate vicinity⁴. Furthermore, risk is present when airborne droplets settle on surfaces. There is also evidence that some microorganisms live within splash or spatter and even when the surface dries, they may become airborne as dust particles⁵.

An effective system needs to remove air pollutants created in the dental surgery. Extraction in place **direct at the patient's mouth** gives the best chance of capturing the contaminant at source.

Direct extraction, also known as local exhaust ventilation (LEV), is a method of hazard control where a nozzle generating an airflow is placed at the source of a contaminant in order to capture it and then pass it through filters.

In the context of a dental surgery, where the patient's mouth is the potential source of bacteria or virus, a nozzle would be placed next to their mouth to capture aerosol generated by dental procedures. When used in conjunction with other protective measures, such as PPE, this can act as the first line of defence and even overcome some of the shortcomings of PPE.

Direct extraction is the only method that ensures the maximum possible level of aerosol capture.



1. <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>
2. <https://www.dentalcare.com/en-us/professional-education/ce-courses/ce619/airborne-droplets>
3. <https://www.dentalcare.com/en-us/professional-education/ce-courses/ce619/airborne-droplets>

All other methods listed below have greater risk of virus or bacteria landing on the clinical team.

METHOD	DESCRIPTION	LIMITATIONS
PPE/masks	Personal protective equipment. This is normally in the form of an N95 or surgical mask, nitrile gloves and eye protection (though these are usually not face fitting).	<ul style="list-style-type: none"> Many variants in the market of varying standard. Virus held on mask filter therefore if it fails, it fails completely. Offers personal protection but does not mitigate further afield. Only protects one person. Must be fitted correctly to be effective. <ul style="list-style-type: none"> Surgical masks do not fit the face so air (and potentially viruses) can enter around the sides. Does not protect the wearer from inhaling small particles that remain airborne for long periods of time, once they remove their mask. Single use. Doesn't protect the eyes (vulnerable mucus membrane). Provides a layer of protection but should not be regarded in isolation. N95 masks filter 95% @ 0.3 microns. Handling of used mask, gloves, eye protection is a hazard.
Room scrubber/ air purifiers	Either in the form of a unit that sits in the room or ventilation that extracts from the room. Likely to contain a filter.	<ul style="list-style-type: none"> By the time the contaminants reach the filter they have likely already come into contact with the patient, staff, equipment and surfaces. Typically have very low flow rates. If too low, then contaminants will be able to diffuse away from the scrubber/ purifier faster than the air is being pulled towards it. As dental surgeries are not designed to be aerodynamic it is likely that there will be airflow dead spots, back eddies, etc. that mean not all of the air is processed. These are usually at the edge of the room (in a corner, on a wall) where the contaminant concentration is lowest while the patient and staff are where the concentration is highest.
Air conditioning / HVAC	Heating, ventilation, and air conditioning (HVAC) is designed to maintain thermal comfort and adequate indoor air quality.	<ul style="list-style-type: none"> These remove large quantities of air from the room and so have a very large heating/energy cost. By the time the contaminants reach the filter they have likely already come into contact with the patient, staff, equipment and surfaces. Typically have very low flow rates. If too low, then contaminants will be able to diffuse away from the HVAC faster than the air is being pulled towards it. As dental surgeries are not designed to be aerodynamic it is likely that there will be airflow dead spots, back eddies, etc. that mean not all of the air is processed. These are usually at the edge of the room where the contaminant concentration is lowest while the patient and staff are where the concentration is highest.
Push/pull airblade barrier	A filtration system that pushes air from one side and pulls air from the other to create a 'wall of air' between the dental staff and patient.	<ul style="list-style-type: none"> Pushed air is a lot more directional and forceful than pulled air (this is why you blow a candle out rather than suck it out). This leads to an imbalance between the push and pull systems that can push the contaminants further. Only creates a barrier between the push and pull devices and therefore doesn't prevent contaminants spreading in other directions or around the push/pull system.
Local extraction	Where an extraction point is placed close to (usually within 2m) the patient but not at the source of the hazard.	<ul style="list-style-type: none"> Typically, too far away and not a high enough flow rate to effectively capture the contaminant. The dental staff and patient are closer to the source than the extraction point.

Although providing a level of protection, none offer the level of protection necessary to the immediate clinical team that direct extraction provides:

Direct extraction	BOFA extraction system	<ul style="list-style-type: none"> Captures aerosols direct at source Easy to manoeuvre for optimum capture and minimal interference Low noise level Virus held in filters away from operator Three stage filtration, removes 99.997% of particles @ 0.3 microns Returns clean air back into the environment Can be adjusted to cater for heavier aerosol generation Developed using over 30 years' expertise in dental aerosol extraction
-------------------	------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

DIRECT aerosol extraction is the only effective method

BOFA HAS THE ANSWER

DentalPRO Aerosol

- maximum protection, minimal interference

The DentalPRO Aerosol helps to reduce risk of cross contamination between dental staff and the patient during examination.

With a market leading airflow to ensure optimum capture, it is designed to work alongside appropriate PPE guidelines. The DentalPRO Aerosol works by extracting contaminated air away from dental staff breathing zones and passing through a series of filters.

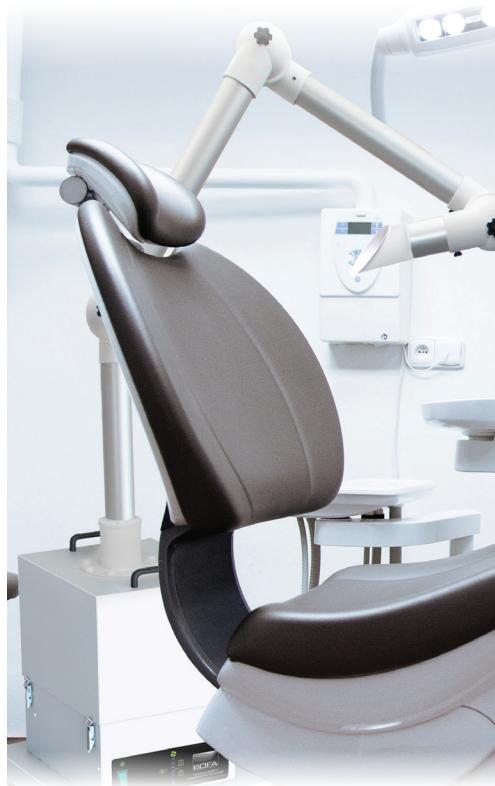
The unit works on three set points: idle mode, AGP mode, and room scrubber mode.

It is simple to use and maintain, and there's no need to vent outside as the filtered air is sent back into the room. Its three-stage filtration includes a HEPA filter which removes 99.997% of particles at 0.3 microns.

Due to the large adjustable flow rate, the DentalPRO Aerosol may be used for a variety of procedures between dental staff and patient and can be turned to maximum capacity for applications that involve heavier aerosol generation.



CAPTURE – CONTROL – FILTER



- ✓ Fully portable and easy to move into position
- ✓ Supplied with multi-joint arm and funnel capture device making this a versatile unit
- ✓ Low noise level, so won't interrupt clinician-patient interaction
- ✓ Movable arms allow the inlet nozzles to be positioned in multiple locations to suit the requirement
- ✓ Detachable nozzles and inlets for easy change and cleaning
- ✓ Three-stage filtration
 - ✓ DeepPleat pre-filter to remove larger particulate including dust associated with solidified paste in many dental processes
 - ✓ HEPA filter to remove 99.997% of particles at 0.3 microns
 - ✓ Odour/gas filter
- ✓ Ergonomically designed
- ✓ High airflow and high vacuum for maximum aerosol capture
- ✓ Variable speed – adjust as required
- ✓ Easy to operate
- ✓ Filter condition indicator
- ✓ Multi-voltage sensor automatically adjusts to local voltage (90-257V)
- ✓ Powerful pump, serviceable for 20,000+ hours
- ✓ Three set points: idle mode, AGP mode, and room scrubber mode
- ✓ British made and CE marked

BOFA International Ltd. - UK. Tel. +44 (0) 1202 699 444 Email. sales@bofa.co.uk

- Germany. Tel. +49 (0) 40 739 3735-15 Email. vertrieb@bofa.co.uk

BOFA Americas, Inc Tel. +1 (618) 205 5007 Email. sales@bofaamericas.com

Web. bofainternational.com