

## Environmental Mitigation

Air ventilation is an important factor in providing a safe and comfortable workplace, and this is widely recognised within healthcare guidance and building control regulations. Adequate air ventilation is considered important in terms of general health and wellbeing and current guidance recommends 10 air changes per hour for new buildings which include health treatment rooms.

Until very recently, air ventilation within dental surgeries has perhaps not had the focus which it deserved, but this is likely to change with the impending publication of a revised version of HTM 03-01 in late 2020. In addition to the benefits of an adequately ventilated work place, air ventilation has been identified as an important factor in eliminating aerosols within a dental surgery following an AGE / AGP, and is considered a key mitigation in reducing the risk of contamination via bioaerosol.

PHE, NSS SBAR and SDCEP have all highlighted the importance of increasing air changes per hour (ACH) in a dental surgery as a means of reducing fallow-time, and this is now being considered as a critical element in reducing risk.

Particulate aerosols of <5um, can potentially contain viable SarsCo-V2 virus. Particles of <5um can suspend in the air for a significant period of time and can theoretically be inhaled by patients or dental staff, settle in the lower respiratory system and cause infection. It should be noted that there is little evidence to indicate the risk of transmission from a dental aerosol and the minimum infective dose is currently unknown.

The use of air ventilation as an environmental mitigation is based on the process of dilution of the aerosol by either introducing 'fresh air from outside' or by cleaning the existing air. Ventilation can be provided by natural or mechanical means and there are a variety of methods which can be considered to achieve dilution of the bioaerosol.:

### 1. Natural ventilation – windows, doors, vents

### 2. Mechanical ventilation

- a. **Negative pressure** - mechanical ventilation where air is actively extracted from the room which creates a negative pressure allowing fresh air to enter from outside via additional air vents.
- b. **Positive pressure** – mechanical ventilation where air is actively pushed into the room. Used in operating theatres where provision of clean air is via wall/ceiling diffusers and escape vents are located above floor level.
- c. **Supply and extract system** – mechanical ventilation where air is both actively pushed into the room and actively removed with the inlet / outlet strategically positioned to optimise clean air flow within the dental surgery.

- 3. Air cleaners / “scrubbers”** – mechanical process of ‘cleaning the air’ through HEPA or UV filters. These devices are typically recirculating units which enhance the effective air change rate by removing or inactivating airborne virus.

**Natural ventilation**, i.e. opening a window, may allow for fresh air to mix with room air and dilute any aerosols, but has the greatest variation in effectiveness and it is not possible to quantify the level of dilution or the number of ACH. The nominal value of 1 ACH is assigned to a room with windows, irrespective of the size of the room, the number of windows, size of opening, height of the building or climactic conditions outside. In practical terms it is not possible to calculate the ACH from natural ventilation in a dental surgery. This will undoubtedly impact on the ability to use this form of environmental mitigation to reduce fallow time, although it will invariably improve air ventilation and air quality within the room.

**Mechanical ventilation** – any of the methods described previously will increase ACH, the value of which will be dependent on the size of the room and the output of the mechanical ventilation. The number of air changes per hour can be easily calculated if the air flow rate of the mechanical ventilation and the volume of the room are known. This information can either be obtained from the manufacturer, the installation engineer or ideally an independent report obtained from a ventilation expert.

The use of window or wall mounted extraction fans may be considered to be an effective method of increasing ACH, but consideration needs to be given to the impact on the air temperature within the room. There are likely to be significant financial and environmental costs to maintaining an optimal room temperature, when there is a significant temperature gradient to the outside. A heat exchange system may mitigate to a certain extent, but installation costs are likely to be higher. It is recommended that practice owners seek expert advice on the system which is most effective for their own premises. It is important to recognise that many factors can impact on the performance and efficiency of any mechanical ventilation system, and the effectiveness may vary from that stated by the manufacturer. The performance and efficiency of one-way extractor fans can be affected by the air pressure within the room and will be related to the availability and position of passive inlet / outlet vents.

**Air cleaners (air scrubbers)** – recirculating air cleaners do not provide fresh air from outside, but may be effective in improving the quality of air within the surgery by removing or diluting contaminated aerosol and thus reducing the risk of contamination. The air particles, including bioaerosol, is filtered by the use of High Efficiency Particulate Air (HEPA) filtration or UV irradiation. The efficiency of such units has been questioned in view of the risk of recirculation of the same air when located in one position. It is recommended that the units be positioned close to the source of the aerosol production (i.e. head or the foot of the dental chair) to mitigate against this risk. Positioning of the unit behind the operator or nurse should be avoided. The effectiveness of air cleaning devices will depend on the air flow rate of the device, the

efficiency of air cleaning and the size of the room. Any introduction of such devices must consider these elements as well as cleaning, maintenance and safety.

In view of concerns over the efficiency of recirculation units, NSS SBAR recommended that their effectiveness should be “downgraded” to 50% of their manufacturers output when calculating ACH. The value of air cleaners was recognised within the SDCEP Report although it did not go as far as recommending them, in view of the lack of evidence to support their use. PHE would appear to be supportive of the use of air cleaners through their involvement and endorsement of the SBAR document.

The FGDP (UK) / CGDent would support the use of air cleaners especially in dental surgeries where alternative means of environmental mitigation may not be feasible or practical. In view of the concerns raised within the NSS SBAR Report, a 50% reduction in efficiency is seen as pragmatic, unless evidence to the contrary can be provided by an independent expert. The type, design and manufacture of recirculating air cleaners is highly important, as not all models are equally effective. Care should be taken in selecting the appropriate machine and practitioners have a responsibility to ensure that it is fit for purpose and regularly maintained.

**In summary:**

- Aerosol generated procedures should not be conducted in a windowless room without mechanical ventilation or an air cleaner.
- Natural ventilation cannot be calculated reliably and needs to be discounted in relation to achieving a “reduced fallow time” by use of environmental mitigation. This translates into 30 minutes fallow time for all procedures in a room which is solely reliant on natural ventilation with no procedural mitigation employed.
- FGDP / CGDent supports the application of the SDCEP recommendations on mitigation-based reductions for fallow time.
- FGDP / CGDent support the use of mechanical ventilation to achieve at least 6 ACH to improve air quality and reduce fallow time.
- This guidance supports the use of air cleaners / scrubbers as an acceptable recirculation method of removing bioaerosol, and should therefore be considered an effective method of environmental mitigation, although their relative efficiency in terms of ACH must be taken into consideration.