

COVID-19: Continuing education on Open Plan Clinics - guiding principles to mitigate risk

This document has been jointly developed by the Dental Schools Council and the Association of Dental Hospitals and represents the consensus view of all dental schools and dental hospitals.

Executive summary

The two key COVID-19 related risks within open plan clinics that are specific to the practice of dentistry/dental therapy are aerosols and droplets. Aerosols are likely to be highly diluted given recent data and the mitigating factors that can be introduced both at the operative site and within the clinical environment. In dentistry, a combination of aerosols and larger droplets are generated by a range of operative dental procedures such as the use of high-speed air-turbine handpieces. Aerosols are made up of tiny droplets which can remain suspended in the air, and larger droplets are likely to have greater viral loads than aerosols and may be of concern both in terms of direct cross-contamination and fomite formation. However, this too can be mitigated by appropriate operative site and clinical environmental measures. The guiding principles in this document are based on the best available knowledge in the professional and scientific literature at the time of writing, and expert opinion where the evidence base is lacking. It must, however, be noted that due to substantial variation in local infrastructure and environment in UK and Irish dental hospitals and schools, the information within this document would need to be used and interpreted within the context of the relevant school/hospital's local clinical environment and Infection Prevention Control guidance. All the guidance is within the context of a level 3 COVID-19 risk in the UK where SARS CoV-2 is in general circulation. Above this level, bespoke local solutions will be required and below this level pre-COVID-19 standard infection prevention controls will likely return.

The working group are aware at the time of writing of an ongoing consultation on the appendix to the COVID-19 infection prevention and control recommendations *COVID-19: infection prevention and control dental appendix*.¹ Once this guidance is

released, this principles document will be updated.

Major changes summary in this version:

- Updated evidence on level of risk to dental professionals from COVID-19
- Updated information on household and non-household contact tracing
- Updated aerosol generating procedure principles with most contemporaneous evidence

Purpose

The purpose of this document is to outline a set of guiding principles to support all UK/Irish dental hospitals/schools and their key stakeholders towards the provision of dental educational placements within open plan clinics.

Terms of reference

To draw upon existing and emerging research evidence and guidance in order to provide a consensus view on:

1. The principal steps institutes should undertake to assess the open clinic environment (air change, ventilation and clinic configuration).
2. The underpinning fallow times in open plan clinics for non-aerosol generating procedures (non-AGPs) and aerosol generating procedures (AGPs).
3. Mitigating steps to reduce risks arising from AGPs (dental suction with wide bore aspirator, rubber dam, no working without a chairside assistant).
4. Safe distances between chairs where AGPs are undertaken using mitigating steps.
5. The potential role of structural changes to clinic designs, under different air replacement rates and chair configurations.
6. The patient journey through the hospital, and procedures for the safe entry of patients into and out of AGP zones.
7. Future measures to improve confidence in safe AGP provision and facilitate a ramping up of student placement activity (eg testing).

The group respects the primacy of national policies and guidance from national governments and regulatory authorities eg UK Health Security Agency (UKHSA), Health Protection Scotland / National Services Scotland, Public Health Wales, Public Health Agency (PHA) Northern Ireland and the Health Protection Surveillance Centre in the Republic of Ireland.

Overview

The SARS CoV-2 (COVID-19) pandemic brought with it specific challenges to the dental profession, not least related to the provision of oral care using procedures that involved the generation of dental aerosols. The use of dental handpieces and powered scalers generates droplets and aerosols. The World Health Organisation (WHO) defines procedures that generate aerosol (aerosol generating procedures or AGPs) as any medical, dental and patient care procedure that results in the production of airborne particles $<5 \mu\text{m}$ in size (aerosols), which can remain suspended in the air, travel over a distance and may cause infection if they are inhaled (WHO, 2014).² Some authors have criticised this $5 \mu\text{m}$ cut-off, and there is evidence larger droplets may remain suspended for some time.³ The term “aerosol” is used in this document to refer to droplets which remain airborne for a significant time and may be transported some distance from the source with a risk of inhalation.

Due to the perceived risks associated with the provision of dental care, where dental clinicians operate within 1 metre of a patient’s respiratory tract and carry out frequent AGPs, routine dental care services in the UK were suspended on 15 March 2020. However, aerosols generated during dental treatment procedures differ substantially from respiratory aerosols generated during medical interventions. The dental aerosol is largely produced from a device with clean water, whereas medical aerosols are often generated directly from secretions in the respiratory tract. Risks associated with dental aerosols arise from mixing clean water from dental devices with saliva or blood. Despite being highly diluted by water from dental instruments,⁴ dental aerosols may still carry pathogens from patients’ saliva in suspension. Median salivary SARS-CoV-2 viral load appears to be around 1.1×10^6 virions per mL, with significant variation between individuals, and similar rates in symptomatic and asymptomatic individuals (range: 8×10^1 – 6.1×10^{12} virions per mL).^{5,6} Data from before the emergence of SAR-CoV-2 suggests that the majority of the pathogen load from dental handpiece emissions is likely to be contained within the larger droplet fraction rather than in aerosols, nevertheless, there remains a paucity of evidence addressing dental aerosols and associated viral transmission.⁷

Government focus has been upon the specific challenges of the lack of access to, and provision of oral and dental care services following cessation of routine care on 25 March 2020. The gradual realisation that there were significant harms associated with service closure led to the development of urgent dental care services across the UK and Ireland and the recognition that dental care should be designated as an essential healthcare service. This was followed by the gradual restoration and recovery of dental services in the UK from 8 June 2020 (still ongoing), out with the clinical education setting.

Dental education and assessment moved online, but clinical placements were suspended in line with national guidance, resulting in the loss of over four months of clinical experience for undergraduate dental and hygiene/therapy students.

Clinical training of the future dental workforce creates specific challenges, in particular due to the nature of large open plan teaching clinics and the challenges of providing AGPs within an environment that must be safe for patients, students and staff. The risks posed by COVID-19 to workforce development were outlined by Dental Schools Council (DSC) and the Association of Dental Hospitals (ADH) and published on 29 July 2020.⁸

Since then, new data has emerged in dental care professionals that demonstrates seroprevalence levels more than two-fold higher in dental teams than the general population prior to implementation of UKHSA (then PHE) guidance on Infection Prevention and Control (IPC) and enhanced PPE.⁹ Reassuringly, post-introduction of UKHSA (previously PHE) guidance, the incidence of new exposures in dental teams was no higher than the general population.

Context

While there is no current evidence for specific proven risks from dental AGP provision within multi-chair clinical teaching areas, by extrapolation from other data, there are presumed tangible risks specific to open plan clinics that need addressing.

The consensus view of the Scottish short life-working group was that the safe zone between chairs to contain droplets is 2 metres and larger droplets which are destined to settle out onto surfaces are likely to do so within 10 minutes.¹⁰

The environment in which current planning is being undertaken is highly dynamic. This document is therefore a live document based upon pragmatic expert opinion and provides the guiding principles for reducing risks to patients, students, and staff to the lowest possible levels, while providing AGP provision in open plan teaching

clinics. We recognise that dental hospital/school estates vary across the UK and Ireland in terms of age, condition, architecture, and environmental management systems. Ultimately, decisions on clinic configurations to enable the safest possible care to student patients will lie with the local IPC teams, placement providers, and academic partners.

Overarching guiding principles

There are several overarching guiding principles for this document:

1. Patient, student and staff safety and well-being is a priority.
2. Appropriate social distancing and associated risk mitigation measures should be in place. These should include movements of patients, staff and students.
3. To mitigate the spread of droplets and aerosols, students must not work without a chairside assistant when undertaking AGPs or without high volume, wide bore suction.
4. No vulnerable patients will be exposed to AGPs on an open plan clinic.
5. There should be adherence to government guidelines at all times.
6. This document should be considered a “live” document and will be updated as new evidence becomes available.

This document considers the risk mitigation for working on open plan clinics as follows:

1. Before entering the clinical environment
 - a) Staff and Students
 - b) Patients
2. The open plan clinical environment
 - a) Non-aerosol generating procedures
 - b) Aerosol generating procedures
3. Clinical Supervision in the open plan clinical environment

Before entering the clinical environment

Staff and students

- Risk assessment of staff and students returning to clinical and non-clinical environments to safeguard health and minimise the risk of infection and complications associated with COVID-19.
- Staff and students with symptoms of COVID-19, or living in a household where somebody has symptoms, should self-isolate, obtain an appropriate COVID-19 test and follow relevant government guidelines following this.
- Positive contact tracing of staff and students may result in different outcomes with respect to the individual's need to isolate. The outcome is dependent on several factors: vaccination status, household versus non-household contact etc. Staff and students should therefore follow local guidance which will be based on governmental guidance.
- Maintain social distancing and use of fluid resistant surgical masks in staff/student areas and facilities according to local guidelines. Consider staggering lunch breaks and limiting use of changing facilities.
- All staff and students should be familiar with local guidance to keep them safe, including use of PPE and infection prevention and control measures.
- Staff and students should be encouraged to undertake regular asymptomatic testing using a lateral flow device according to government guidelines.
- As new evidence emerges, consider introduction of point of care testing.
- Ensure staff and students have knowledge of, and access to, mental health and wellbeing resources.

Patients

- Patients should be provided with clear information about their dental appointment in advance including advice not to attend if they have symptoms of COVID-19 or suspect they have come into contact with someone with COVID-19 prior to their appointment.
- Patient information should include advice about parking, arrival times at clinic, entrances, infection prevention and control precautions and COVID-19 screening.

- Patients should be encouraged to attend their appointment alone where appropriate.
- Upon arrival, patients and escorts must sanitise their hands and be asked to wear their face covering or be provided with a surgical facemask. Patients may be exempted from the requirement to wear a face covering for medical reasons on an individual basis.
- Upon arrival patients and escorts will be screened for COVID-19 symptoms and assessed for exposure to contacts.
- Waiting times within the building should be reduced as much as possible.
- Immediately prior to entering an AGP restricted open plan clinic, patients must be provided with a fluid resistant surgical face mask (type IIR) and single use or reusable eye protection. The eye protection must be worn for the duration of the visit and the mask worn for the duration of the visit other than during the operative procedure.
- Patients must leave the AGP open plan clinic upon completion of their clinical care and their PPE removed upon exit into designated clinical waste containers.
- Patients who are known or suspected to have COVID-19 infection should not be treated by an undergraduate student.
- Patients who are at extremely high risk of severe COVID-19 illness should not be treated by an undergraduate student on an open plan clinic.

The Open Plan Clinical Environment

This section will consider two categories of open plan clinics, those on which only non-AGP procedures are conducted, and those on which AGP procedures are conducted.

Non-AGP open plan clinics

The main risks to mitigate in non-AGPs clinics/procedures are contamination by large droplets (i.e., those which fall onto surfaces quickly). Risk from these procedures is mitigated:

- for staff and students by: Level 2 PPE - fluid resistant surgical mask (Type IIR), eye protection (with side protection or visors) and apron for staff and students; reducing footfall and increasing physical distancing; exemplary cross-infection

control post procedure.

- for patients and the public by: mandatory face coverings in hospitals; reduced footfall (no unnecessary accompanying person for majority of procedures); physical distancing; use of face-coverings when not undergoing dental procedure, particularly during consultations (but physically distanced when undergoing procedure); exemplary cross-infection control by staff and students.

Other considerations for droplet mitigation can include the following dependent on design and ventilation of the clinic: physical distancing of approximately 2m between the heads of dental chairs and physical barriers as appropriate eg dividing screens or cubicle partition walls and use of wide bore high volume suction.

Patients, the public, staff and students should all adopt exemplary hand hygiene (to elbow in case of staff and student) for 20 seconds using soap and water and good respiratory hygiene for coughs or sneezes. The use of alcohol gel may also be substituted if hands (to elbow in the case of staff and students) are visibly clean.

In summary, for an open plan clinic zoned for non-AGPs:

- AGP procedures cannot be conducted.
- Patients should be approximately 2m apart and preferably with some form of physical barrier between them (although this may not always be appropriate or desirable dependent on ventilation or design parameters of clinic design)
- Appropriate PPE should be adopted for patient, staff and student.¹¹

AGPs

Most institutions are now providing at least some AGP treatment within their clinical settings. A range of different risk mitigation approaches have been used to suit the different environments and requirements of each dental hospital/school. There is not one correct approach but rather a range of mitigation approaches that can be utilised. No approach is 100% effective and several mitigation steps are therefore often taken to reduce risk to acceptable levels. Table 1 summarises the approaches used, the advantages and disadvantages, and any supporting evidence.

Table 1

<i>Mitigation factor</i>	<i>Advantages/ Disadvantages</i>	<i>Supporting evidence (example sources, not exhaustive)</i>
Ventilation	<p>Advantages: removes aerosols from the air, prevents dispersion into the wider clinical environment</p> <p>Disadvantage: cost, may not be possible to change ventilation parameters in most settings, does not capture potentially contaminated aerosol at the source</p>	<p>Ventilation is a critically important factor in providing a safe environment for students, staff, and patients both in terms of comfort and removal of contaminants such as airborne particulates, volatile organic compounds and, CO₂. Providing clean air by natural or mechanical ventilation removes potentially contaminated aerosols produced during dental procedures. Guidance on ventilation requirements is provided by SDCEP¹² and PHE.</p>
Physical barriers (eg partition walls to make individual bays or pods)	<p>Advantages: maximum protection as eliminates 'open clinic' risk</p> <p>Disadvantages: expensive, not physically possible in some settings, can reduce the number of chairs available. Ventilation provision may need to be assessed to ensure newly partitioned spaces are appropriately ventilated.</p>	<p>Discussed in a review by NHS National Services Scotland, and allows the conversion of an open clinic to individual enclosed bays, thus eliminating risk of dispersion across the clinic. Individual bays produced by partitioning open plan clinics may not be adequately ventilated, as the ventilation configuration designed for a single open space may not be appropriate for the newly partitioned spaces (ie vents may be in the wrong place). This should be locally assessed. There is also a risk that simply increasing inter-surgery partition heights may disrupt the airflow patterns within an open plan clinic and paradoxically worsen or concentrate contamination in unexpected areas.</p>

Spacing

For AGPs $\geq 2\text{m}$ distancing (between heads of chairs) for risk of contamination from larger droplets.

5m spacing to reduce risk of aerosol contamination when no other mitigation factors are used.

Advantages: quick to implement as no building work required

Disadvantages: reduces the number of chairs available, not practical in some settings

As discussed in the review by NHS National Services Scotland and subsequently guidance from Public Health England (PHE; due to be updated). Larger droplets are unlikely to travel further than 2 metres. This is consistent with experimental evidence and 2 meters is a pragmatic distance to ensure between the head rests of dental chairs to reduce the risk of droplet contamination where other measures are not used.

Experimental evidence from an open plan clinical setting demonstrates that when dental suction is used as the only mitigation measure, dispersion of aerosols at 5 metres is unlikely¹³, which suggests that this is a safe distance to prevent aerosol dispersion where other measures are not used. It is important to note that where other mitigation measures are use, closer spacing is likely to be appropriate.

Electric micromotor handpieces

Advantages: large reductions in the production of aerosol compared to a conventional air-turbine handpiece, and therefore likely reduced risk of cross-infection.

Disadvantages: operators may need some further training, particularly students, the benefit is likely to be mainly from instruments that cool the bur with water only and do not use compressed air (water-jet, not mist coolant), some chairs will need an external electric motor if not already present, cost

Although recent microbiological evidence suggests that any potential pathogens from the oral cavity are likely to be highly diluted in dental instrument aerosols, the use of dental instruments which produce less aerosol provides an opportunity to reduce any risk of pathogen transmission.

A recent study using laser light scattering to measure droplets produced by dental handpieces demonstrated that significantly less energetic droplets were produced by electric micromotor handpieces which use only water and no compressed air to cool the bur (water-jet coolant), compared to air-turbine handpieces. This suggests that these droplets are able to travel shorter distances from the source and pose a lower risk of pathogen dispersion.¹⁴ Additionally, the speed of these devices can be carefully controlled and the authors suggested that a bur speed of below 80,000 – 100,000 rpm produces much less aerosol than higher speeds. This finding was conservatively adopted by the Scottish Dental Clinical Effectiveness Programme (SDCEP) in recommending that speeds below 60,000 should not be classified as AGPs,¹⁵ and this was subsequently adopted into guidance from PHE.

Data from a study using a viral tracer to demonstrate where viruses from dental procedures are likely to be distributed to demonstrated that dispersion of viral particles is very unlikely during procedures using a micromotor handpiece with water-jet irrigation pattern (ie no compressed air) at 60,000 rpm.¹⁶

There is evidence from a study using a fluorescent tracer that electric micromotor handpieces with water-jet irrigation are unlikely to produce aerosols at 1.5 m at speeds of 200,000 rpm,¹⁷ and further unpublished data from this group confirms that this is also the case at 1.2 m.

It is important to note that the irrigation delivery mechanism is critically important to the aerosol produced, and therefore the risk of pathogen dispersion. It must be possible to turn off the compressed air delivered to the handpiece, so that only a jet of water cools the bur and not the typical mist pattern seen with an air-turbine or other handpiece.

<p>Dental suction</p>	<p>Advantages: already part of usual care, acceptable to patients</p> <p>Disadvantages: may be technique sensitive, effect is dependent on the performance of the dental vacuum system in each setting</p>	<p>Data using a fluorescent tracer in an open plan clinic demonstrated that medium volume, wide bore suction reduces dispersion of aerosols and droplets within the bay where an AGP is occurring by approximately 50%. There was a more substantial reduction in the contamination reaching distant bays of over 80%. Little difference was seen between low and medium volume suction suggesting that there is a low threshold for suction having a substantial benefit.</p> <p>A study using a viral tracer also demonstrated a modest effect of high volume suction on the contamination within the treatment bay.</p> <p>Note: High volume suction is defined as 250 L/min of air, medium volume suction as 90 – 250 L/min and low volume as less than 90 L/min at the largest bore operating hose.¹⁸</p>
<p>Rubber Dam</p>	<p>Advantages: already part of usual care, economical</p> <p>Disadvantages: not possible to place in some clinical situations eg periodontal scaling</p>	<p>Data from a simulation study using a viral tracer showed no detectable virus when rubber dam was used, suggesting a substantial beneficial effect. This is supported by clinical data measuring the dispersion of oral bacteria.¹⁹</p>
<p>Local Exhaust Ventilation (LEV) / Extra-oral suction</p>	<p>Advantages: relatively straightforward to implement, removes contamination at source (less reliance on ventilation and air cleaners)</p> <p>Disadvantages: capital and maintenance costs. space requirements, increased noise</p>	<p>Studies of Local Exhaust Ventilation (LEV) devices (often describes as extra-oral suction/ scavenging) demonstrate substantial reductions in the dispersion of droplets²⁰ and aerosols²¹ when these devices are used during dental AGPs.</p> <p>Recent data using a fluorescent tracer suggest that LEV reduces aerosol dispersion in the breathing zone of the operator by 90% when using an air-turbine handpiece, but that this reduction is more significant with ultrasonic devices (> 99% reduction), most likely because the particles produced are less energetic than from the air-turbine handpiece.²² This suggests that the use of ultrasonic scalers in open plan clinics may be appropriate without spacing where LEV is used.</p>

HEPA air cleaners/ air scrubbers	Advantages: relatively straightforward to implement Disadvantages: capital and maintenance costs, space requirements, increased noise	Standalone air cleaning devices have been shown to reduce the persistence of aerosols from dental procedures in open plan clinics ²³ however they are not able to capture aerosols at the source, but may provide additional capacity to remove aerosols from the environment. These devices are not a substitute for ventilation and expert advice is required if they are to be added to a pre-existing mechanical ventilation scheme.
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In addition to the mitigation approaches detailed in Table 1, there are a range of other techniques which have not yet been used widely in dental hospitals/schools but are worthy of mention. These have been appraised by other authors²⁴ and include:

- Irrigation additives
- Isolation tents
- Water line disinfectants

Clinical Supervision in the Open Plan Clinic Environment

The open plan clinic environment differs from the single surgery environment due to the requirement for supervisors to move from chairside to chairside, and IPC protocols need to ensure that the level of PPE is appropriate for the procedure being supervised and that the risk of cross-contamination is reduced as far as possible.

Hand hygiene

Washing hands thoroughly with soap and water for at least 20 seconds, is essential to reduce the transmission of infection. All clinical staff, students and patients/carers should wash their hands or decontaminate their hands with alcohol-based hand rub (70% ethyl alcohol) when entering and leaving the dental facility.

All clinical staff must have performed handwashing (washing from elbow down to hand) immediately before every episode of direct patient care and after any activity or contact that potentially results in hands becoming contaminated, including donning and doffing PPE.

If arms are bare below the elbows and not covered by a fluid resistant long-sleeved gown, hand washing should be extended to include both forearms (washing from elbow down to hand). Wash the forearms first and then the hands.

Uniforms and Work Wear

It is best practice to change into and out of uniforms at work and not wear them when travelling; this is based on public perception rather than evidence of an infection risk.

Uniforms and work wear should be transported home in a disposable plastic bag or washable laundry bag. The plastic bag should be disposed of in household waste or the laundry bag simply placed into the washing machine with the uniform inside. Uniforms and work wear should be laundered: separately from other household linen, in a load not more than half the machine capacity and at the maximum temperature the fabric can tolerate, then ironed or tumble-dried.

PPE

The appropriate level of PPE required is dependent on the activity being carried out and whether the treatment includes aerosol generating procedures (AGPs) or not. Sessional use of certain single use PPE items should be determined only following significant disruption to local level supply chains.

Gloves must be:

- Worn during every patient contact or procedure
- Changed immediately after each patient and/or after completing a procedure/task
- Never decontaminated with Alcohol Based Hand Rub or soap between use

Plastic aprons must be:

- Worn during every patient contact
- Changed immediately after each patient and/or after completing a procedure/task
- Forearms should be washed prior to handwashing if apron does not have sleeves

Fluid resistant full-length gowns, or sleeved aprons, or coveralls must be:

- Worn when undertaking aerosol generating procedures
- Worn when a disposable apron provides inadequate cover for the procedure or task being performed
- Changed between patients/individuals and immediately after completing a procedure or task unless sessional use is advised due to local/national guidance.

Eye or face protection (full-face visors) must:

- Be worn during all dental procedures including AGPs and during direct supervision or intervention if blood and/or body fluid contamination to the eyes or face is anticipated or likely
- Not be substituted by regular corrective spectacles, which are not considered eye protection
- Not be impeded by accessories such as piercings or false eyelashes
- Not be touched when being worn

A fluid resistant surgical face mask (FRSM Type IIR) must:

- Be worn during all non-AGP dental procedures, direct supervision or intervention
- Be worn when social distancing is not possible, for example during clinical patient-based or simulation-based teaching
- Be well-fitting and fit for purpose, fully cover the mouth and nose (manufacturers' instructions must be followed to ensure effective fit and protection)
- Not touched once put on or allowed to dangle around the neck
- Be replaced if damaged, visibly soiled, damp, uncomfortable or difficult to breathe through

FFP3 respirator masks are used to prevent inhalation of small airborne particles arising from AGPs and must:

- Be worn when undertaking, assisting with or directly intervening in any AGP
- Not be allowed to dangle around the neck of the wearer after or between each use
- Not be touched once put on
- Be removed outside the AGP area
- Be either single use or single session use (disposable or reusable) and fluid-resistant
- Be covered by a full-face shield if undertaking or directly supervising an AGP
- Be fit tested for the relevant model (according to the manufacturer's guidance). Fit checking (according to the manufacturer's guidance) is necessary every time a respirator is put on (donned) to ensure an adequate seal has been achieved
- Be compatible with other facial protection used (protective eyewear) so that this does not interfere with the seal of the respiratory protection
- Be discarded and replaced and NOT be subject to continued use if the facial seal is compromised, it is uncomfortable, or it is difficult to breathe through

Where fit testing of a particular type of FFP3 respirator mask fails, suitable alternative equipment must be provided e.g., powered air purifying hoods.

Reusable respirators can be utilised by individuals if they comply with HSE recommendations. Reusable respirators should be decontaminated according to the manufacturer's instructions.

Summary

With appropriate and planned mitigations in place it is possible to deliver dental education in the open plan clinical environment and undertake both non-aerosol and aerosol generating procedures.

Investment will be required to allow the required mitigations to be implemented across all UK and Irish Schools.

This is a live document and will be updated as evidence emerges.

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