Dental Surgery Design

A quick guide illustrating the impact of circulation, layout and design on the user experience.
It is estimated that for one in four adults a visit to the dentist can cause some degree of anxiety and fear.

In this short design study we look at how the design of a dental practice can affect the quality of the patient and staff experience as well as the staff and clinical environments. By analysing several layout models and investigating some of the approaches to light, colour and texture, we aim to assist clients, practitioners and designers who are intending to undertake a dental surgery design project whether a small scale refurbishment or a larger scale new build project.

We would like to note that this study is by no means a review of the technical guidance or a definitive guide on dental surgery design, but a quick reference guide to what is achievable.
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A dental surgery can be designed to suit a number of different locations ranging from a refurbished residential dwelling or within a community hospital to a stand alone purpose built facility. The layout of these surgeries will vary depending on their setting and this can have a fundamental effect on a) the patient experience and b) effective hygiene practices. Early consideration of how these adjacencies and circulation routes can affect each other, is key to a successful, efficient and pleasant environment for both patients and staff.

A dental practice must also successfully link two circulation flows: patient flow and staff flow as illustrated in Diagram A below and discussed further in chapter 2.1. Understanding how these two flow patterns can be successfully integrated into the circulation model can improve the patient and staff experience and help the overall efficiency of a facility.

There are two basic circulation models within dental surgery design: a single corridor (chapter 2.2) and a dual corridor (chapter 2.3) model. Within these two models there are also a number of smaller variations. The choice of model will be determined by a number of functional, spatial and organisational requirements, such as the type and number of surgeries, local decontamination procedures, clinician working practices, facility type, etc.
2.1 Patient + Staff Flow

**Patient Flow**

Patients who are well-informed, relaxed and comfortable are more likely to have a positive experience of going to the dentist. As such, the environment should be designed to help foster a more calming and relaxed atmosphere.

Arrival is one of the most important elements on the patient journey and will provide a flavour of how patients will perceive the overall environment.

Any reception point should be obvious and welcoming with markers for onward wayfinding. Waiting spaces should be organised to ensure a mixture of seating is offered, catering for people of different characters or dispositions and allowing people to sit alone or in a group. Opportunities should be taken to provide welcome distractions that allow patients to take their mind off the procedure, for example through the introduction of artwork, a view to outside or possibly access to a courtyard.

The proximity of the surgery to the waiting area will determine the nature and experience of the patient journey. Shorter journeys can aid wayfinding and be beneficial for efficiency. However, longer journeys can provide opportunities for informal discussion between clinician and patient, promoting reassurance. Consideration of rest points along the route are helpful for those less able. The need to allow space for patients to recover discreetly after their treatment is considered essential.

**Staff Flow**

The design of the staff workflow generally focuses on increasing efficiency and helping to foster good infection control procedures. The design of the overall environment is likely to be more clinical in nature, however, this needs to strike a balance between generating a sense of professionalism and pride in the workplace, whilst expressing the value placed on staff.

The surgery, located at the heart of the staff workflow, is where the staff and patient routes meet. This space is likely to be where clinicians spend most of their day and should therefore be designed to create a positive environment for staff. Further analysis and considerations of this are discussed in sections 3.5 and 4 of this study.

The location and interdependency of the local decontamination unit (LDU) is an important factor in the design of the staff workflow. A number of solutions have been examined in this section, however, further guidance is referred to in Appendix A of this study.
An example of a single corridor model in practice

The single corridor model is the most commonly used approach. It offers a number of potential considerations for those designing a dental practice.

The basic arrangement of this model has a single run of surgeries accessed off a corridor with support spaces located opposite. Alternatively, opposite facing surgeries (fig. 2.2a) with support spaces located elsewhere within the facility or offsite are also used. Both arrangements offer the potential for natural ventilation and daylight to the surgeries; however, consideration should also be given to this within the main corridor space.

In this model (fig. 2.2b) the waiting area tends to be remote from the surgery benefitting from acoustic separation and allowing clinicians to collect and greet patients. This model allows a single waiting area to act as a hub serving a number of different surgery wings.

One drawback is the requirement for both patients and staff to use the same corridor. With the cross-flow of dirty and clean processes the infection control risk is increased. The nature of this route also reduces staff privacy.
2.3 A Dual Corridor Approach

Dual corridor approach

The dual corridor approach is less common but is increasingly being used and has a number of potential benefits for practices. Figure 2.3a, 2.3c explore two variations of the dual corridor approach looking at using a sterile and non-sterile corridor. This approach separates patient and staff flows, minimising cross flow and reducing the potential infection control risk.

In both examples the surgery is internalised meaning that to provide natural daylight a rooflight will be required. This can be beneficial to the patient by offering a view out during a procedure.

The sterile corridor

Figure 2.3b illustrates a dual corridor arrangement utilising a sterile corridor to the rear of the surgery. This variation provides a degree of flexibility within the staff spaces whilst maintaining high levels of infection control. This is achieved by separating the two flows and allowing servicing to be undertaken discretely through the service wall via a series of pass-through cupboards, while the surgery is in use.
The inhabited staff corridor

Figure 2.3c illustrates a dual corridor arrangement with an adjacent waiting area at the front of the surgery and an inhabited staff corridor to the rear. This variation of the model minimises circulation and connects key spaces better, providing an overall efficiency to the process.

The proximity and the arrangement of the waiting area allows patients to sit in clusters adjacent to their surgery aiding an increased turnaround. However, consideration should be given to noise transfer between these spaces.

Smaller surgery rooms are supported by separate work and storage areas, which need to be carefully designed and maintained to meet infection control requirements.

Both dual corridor approaches can be used in a training situation, but due to the linear nature and the use of separate staff spaces this layout is less convenient for situations where supervision is required.

(fig. 2.3c)
(fig. 2.3d)
The surgery is at the heart of any dental practice. The design of this environment should be positive and welcoming to reduce anxiety for patients undergoing treatment. The space must also be highly practical for clinicians and nursing staff as well as providing a pleasant working environment.

There is a common perception that a surgery should look clinical in order to feel clean and professional. This can often lead to environments being created that feel more sterile than welcoming. A well-designed surgery should be an environment that is positive for patients and staff, can be cleaned effectively and helps improve efficiency for clinical working practices. Balancing all of these requirements is challenging but can ultimately influence how successfully the practice performs for both staff and patients.

The complexity of dental surgeries needs means the design must address a number of functional and technical considerations. In Scotland there is currently no standard surgery layout. A number of different layouts have been designed and built and these are generally based around four basic approaches:

- Single Corridor – Rectangular layout, with at least one external wall
- Single Corridor – Ambidextrous layout – Suitable for Right/Left hand use
- Dual Corridor – Internalised layout, top lit, with staff corridor to the rear and waiting area adjacent
- Dual Corridor – Simplified internalised layout, top lit, with sterile corridor to the rear and remote waiting

The four layouts studied have a variety of pros and cons that suit different conditions. These are discussed further in chapters 3.1 - 3.4 of this study.
This is the most commonly used of the dental surgery models and generally incorporates an L-shaped storage/worktop formation (although single runs have also been used). This layout works well with the head of the chair pointing toward the internal corner of the units and the toe of the chair pointing away from the door, increasing modesty to the patient. This layout includes a single access point dealing with both clean and dirty flows, raising issues of waste management and infection control. More rigorous infection control procedures need to be employed to reduce the risk of cross contamination.

This surgery type has been used well in both new-build and refurbishment situations and can easily be adapted to suit an existing building where sizes may be more restricted. In a new build situation this surgery type can provide some efficiency in the plan when used in a double-loaded corridor situation allowing both surgeries to have a view to outside.

In a teaching or training situation this type of layout works well in arrangements of four, with two surgeries adjacent and back to back (refer fig. 3.1a), or a cluster formation, with two large/two small surgeries linked by a corridor (refer fig. 3.1b). Depending on the situation the rear wall to the surgery may incorporate a glazed screen or be half height to allowing efficiencies in monitoring of a number of students/trainees.
The ambidextrous setup (to suit either a left or right handed clinician) is a variation of the basic rectangular layout, allowing clinicians to work in either a left or right-handed orientation, countering the general approach of most surgeries, which are designed to suit right-handed use only.

As with the basic rectangular model, this layout includes a single access point dealing with both clean and dirty flows, raising issues around waste management and infection control.

This arrangement works better if a number of additional features/aspects are included within the design including the following:

• Space on both sides of the chair to allow adequate transfer room for patients.

• Flexible storage and equipment to allow the orientation of the layout to flip – for example; provision of mobile storage units at the head of the chair, ceiling mounted equipment such as lamps and trays.

• Positioning of sinks either side of the chair, one hand wash and one clinical sink, but both sized to function as either.

One benefit of this layout is that it works well within a teaching facility, as illustrated at Dumfries Dental Centre. The inclusion of glazed screens or low-level walls behind the head of the chair allows monitoring to be undertaken discreetly by a clinician.
The compact layout is based on a dual corridor arrangement. The surgery has two access points with patients entering from a waiting area through a patient corridor at the front and staff accessing through an ‘inhabited’ corridor at the rear. (fig. 3.3b)

The dual corridor approach reduces opportunities to locate the surgery on an external wall therefore natural ventilation and daylight is usually provided from a rooflight located over the dental chair. This has the benefit of giving patients a view out while inclined in the chair.

If the patient waiting area is located immediately outside the surgery additional consideration should be given to the provision of adequate soundproofing between the two spaces to avoid the possibility of noise transfer.

The inhabited staff corridor to the rear forms an integral part of the working environment and houses much of the storage needs of the surgery. Consumables, clean equipment and patient records can be stored here to free up the surgery leaving just necessary items which reduce the room size and overall cleaning times. This area also doubles as working space for nursing staff and clinicians for writing up of notes, checking patient records, etc. As the inhabited corridor is used by staff it is more difficult for this to be a sterile environment.
The pass-through model is based on a dual corridor arrangement. Patients access through a corridor at the front of the surgery and staff access through the rear of the surgery by way of a sterile corridor. One of the aims of this model is to improve efficiency and increase productivity by reducing the cleaning times required within the surgery by stripping back the layout and operational constraints.

The layout works best where the staff corridor is sterile and pass-through units are installed within each surgery in the form of an ‘active wall’ allowing sterile activities to be undertaken while the surgery is still in use, facilitating restocking of both equipment and consumables.

The dual corridor approach reduces opportunities to locate the surgery on an external wall therefore the primary source of natural daylight is often provided by rooflight located directly over the dental chair, giving patients a view out while inclined in the chair. Additional borrowed light can be provided through the introduction of glazing the front wall of the surgery.
3.5 Considerations In Surgery Design

Chair position and orientation

In most instances the chair should be positioned to allow easy transfer for patients, particularly catering for those who are less able.

Good orientation of the chair is where it aids privacy and dignity ensuring that modesty is maintained when the patient is in a vulnerable state. The foot of the chair should therefore face away from the surgery door, offering patients, particularly women wearing skirts, a level of modesty. This also means that, should a dentist need assistance, help can be provided discreetly and quickly, however, this is not possible in all layouts.

The chair position in an instructive or teaching situation may differ from a normal patient situation. In this circumstance the instructor would monitor the student at the head of the patient to oversee a procedure, but would not necessarily be visible by the patient.

Handing

In the recent past most dental surgeries have been designed to be right-handed meaning that dentists who are left-handed would normally adjust to work right-handed. In this instance consideration should be given to the position of the chair to allow for flexibility for right/left hand dentists, however due to space requirements, this may not always be possible.

Equipment and Storage

For most surgeries storage is provided by a single or double run of cupboards either ‘U’ shaped or ‘L’ shaped situated behind the head of the chair. In recent years there has been a move to reduce the amount of fixed storage provided, partly driven by the need to tighten up infection control requirements. This can work well where centralised storage zones are offered in back-of-house areas. Additionally, items such as computers, filing and dispensers can be integrated into wall-mounted units providing scope to reduce cleaning times therefore increasing efficiency by streamlining work surfaces.
The drive for a paperless office is difficult to achieve within a practice. Patient records are often held on hard copy format and there is the need to retain these records for a number of years post treatment. Adequate storage at close proximity should be considered within the design to accommodate this requirement until the digitisation of patient records replaces the need for physical copies. A cost analysis undertaken by the Scottish Futures Trust in ‘Quality and Efficiency’ publication indicates that it is much more economical to digitise records over the life of the building. Initial costs can be absorbed over the lifetime of the building by the savings made from a) not renting paper record storage or b) reducing the build area needed to store records for new build projects.

**Decontamination**

The decontamination requirements for a dental surgery are extensive and will develop over time as new measures are introduced and adopted. This study did not look in detail at the technical aspects surrounding decontamination however, areas for further reading and current guidance are noted in Appendix A.

The introduction of a staff corridor (dual corridor arrangement) to the rear of the surgery, linking to an LDU (Local Decontamination Unit), has been indicated to reduce instances of cross contamination between patient and staff. Further, the introduction of pass-through cupboards to separate dirty and clean utensils means that there are clear channels for this, which again can reduce the potential for cross infection.

The use of colour to distinguish one surgery from another has also been shown to be successful both from a wayfinding point of view and for decontamination. In one example the colour coding of equipment to match a surgery was indicated as a way of helping pin point infection quicker by identifying where an outbreak may have started.

**X-ray**

In all examples being able to maintain a visual connection with the patient during an x-ray is considered to be good practice as it can help to put a patient at ease. This was not possible in all surgery models due to size. However, when designing the surgery layout consideration should be given to the location of activation switches to ensure, where possible, that dentists have a view of the patient.
With the vision for health in Scotland changing significantly over the last few years there has been a shift in focus to create healthcare environments that are significantly better for both patients and staff. This shift has brought with it a need to provide environments that are more homely in nature. One of the ways in which this can be achieved is through the use of colour, light and texture.

Historically this has been undertaken by a simple approach to design predicated on a need to achieve cleanliness levels and a desire to convey this perception. There are various approaches to how this can be incorporated with good effect.

**Natural light**

Most clinicians agree that natural daylight is a necessity within a dental surgery; some even consider this to be more important than a view. As dentists and nurses are likely to spend a large portion of their day within the surgery, there is a physical and mental health benefit of providing natural daylight.

**Windows**

An external window is the simplest and most common form of providing both natural daylight and a view. However, there are situations where this may not always be possible, for example, when refurbishing an existing building such as a high street retail unit with a narrow shop frontage. There are some recent examples where a window has been used as a way of framing the view out from the surgery. This appears to work best where there is a landscape buffer, such as grass or planting, between the surgery and public domain. Where there are opportunities for good views but a buffer is not possible there will be a requirement to introduce blinds, curtains and/or screening to provide some level of privacy.

In general, the use of full height glazing, both internally and externally, can provide good levels of light. However, care should be taken to ensure the privacy and dignity of patients is maintained, particularly when undergoing treatment where low-level glazing has the potential to reduce the modesty of some patients.
Rooflights

Where the dual corridor system is in operation natural light can be provided through a rooflight, often centred over the chair. This can benefit the patient by providing a view out when inclined in the chair offering a distraction while undergoing longer treatment sessions. A rooflight can also be helpful for the dentist by providing a good level of light directly over the working plane. Due to the changing nature of light over the course of the day good quality artificial lighting will be required to supplement this.

At night or when it is dark outside the nature of the rooflight changes becoming more reflective offering patients a view of themselves. This can elicit a positive or negative response from the patient depending on their specific disposition.

Rooflights were installed in two out of the four models studied and were generally considered to be a positive addition to the overall environment. One commentator highlighted the importance of getting the internal thermal environment correct to prevent condensation forming, particularly on rooflights that could drip onto patients.

Borrowed light

Where there is less opportunity to provide natural daylight, the use of transparency between the surgery and corridor space can create opportunities for borrowing light. This trend is becoming increasingly more common within dental surgery design and is often used where there is little or no natural daylight, such as in a dual corridor arrangement. There is mixed reaction to the success of this with some people nervous about the reduction in privacy for patients, both visually and acoustically. Some commentators feel this can help to open up the facility giving a clean and stripped back feel.
Artificial lighting

To supplement the use of natural daylight a well-balanced and focused artificial lighting scheme will also be required. Artificial lighting is needed in two areas: task lighting to allow clinicians and nursing staff to undertake their duties, and general lighting to lift the overall ambience and quality of the space.

One of the main areas for task lighting within a surgery is the examination lamp as part of the chair setup. These can be chair mounted, floor mounted or ceiling mounted to suit the surgery layout and size. Smaller surgeries may mount these units on the ceiling to free up floor space and allow a better flow. This also helps to reduce the weight of the chair and can help make patient transfer easier from either side of the chair.

It is common around a rooflight to install perimeter track lighting to provide some direct/indirect light. This can lift the general ambience of the space and provide increased lighting levels around the dentist’s working plane. This has also been achieved by illuminating the recess where the rooflight is providing a halo effect over the working area.

Task lighting will also be required over the worktop area, which is regularly provided by ceiling downlights. Depending on their location and design these have a tendency to cause shadows at the work plane level. To alleviate this issue some designers have sought to integrate wall lights.

Whatever lighting solution is used it should take into account the need to reduce glare, particularly over the chair.

Colour and texture

The introduction of colour and texture to a dental surgery can be done for a number of practical or aesthetic reasons. It can help create a less clinical atmosphere and may even help to reduce anxiety by making a more inviting environment. Although there have been countless studies on the psychological effect colour has on people, there has been no conclusive evidence on the matter. Colours appear to have different meanings for different people depending on personal experience and cultural background.

A few practices have opted to individually colour code each surgery differently, creating individual identities. This can improve patient wayfinding but it also means that equipment can be matched to a particular surgery, speeding up detection of infections should any arise.

There is the potential to introduce warmer colours and textures creating an ambiance similar to a coffee shop. This can lessen the clinical aesthetic by incorporating softer acoustics, interesting lighting and a more comfortable place in general. The introduction of graphics or art can be helpful in creating environments that children can engage with and respond to positively.
The following is a list of the current technical publications and guidance available for the design of dental surgeries. Further information can be sought from Health Facilities Scotland (www.hfs.org.uk)

- Compliant Dental Local Decontamination Units in Scotland (Primary Care), May 2013
- Project Management, Advice on the Provision of Local Decontamination Units (LDUs), January 2010
- Scottish Health Planning Note (SHPN) 13, Part 2, Decontamination Facilities: Local Decontamination Units, June 2008
- Scottish Health Technical Memorandum (SHTM) 2022: Supplement 1, Dental compressed air and vacuum systems published, March 2004
- Health Building Note (HBN) 12, Sup 2 - Oral Surgery, Orthodontics and Restorative Dentistry. Old NHS Estates, 1992
- Infection Control in Dentistry - BDA advice sheets, February 2003
- Conscious Sedation in Dentistry - Scottish Dental Clinical Effectiveness Programme published May 2006
- Medical Electrical Installation Guidance Notes ‘MEiGaN’ Version 2.0, September 2007
- Scottish Health Technical Memorandum 2030 (Part 1 of 3) Design considerations washer-disinfectors, October 2001
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