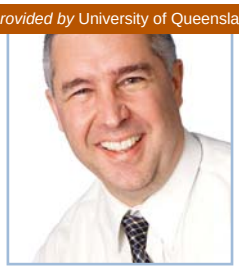

Designing the dental practice environment for optimal infection control

By Professor Laurence J. Walsh

When considering renovations to or construction of a dental practice, the design process should consider contemporary requirements for infection control, as well as function (efficiency), ergonomics, and aesthetics (ambience). The requirements for occupational health and safety and for infection control do not necessarily conflict with the overall aesthetics of the practice, in fact a strengthening trend internationally has been to use design features to focus attention of patients onto the instrument reprocessing area (IRA) (sterilizing room), rather than to relegate this to the "back room".

The IRA can be divided into a number of logical areas:

- A receiving area;
- A cleaning area, which includes the ultrasonic cleaner, thermal disinfector, handpiece lubricating system, and the deep sinks used for rinsing. These sinks should be used only for cleaning equipment and instruments (NOT handwashing);
- A sorting area, where items can be assembled and packaged as necessary;
- A sterilizing area, where the autoclaves are located;
- A sterile storage area where items in pouches and packs are kept. This area needs to be completely free from contamination and splatter; and
- An area for storing items that are required to be kept aseptically, but not in a sterile fashion.

Space

Consideration should be given to the movement of staff in and out of the IRA. The entrance or passageway into the IRA should be sufficiently wide that 2 people can pass in opposite directions without their arms colliding. A suggested minimum (based on current construction standards for doorways) is greater than 810mm wide. Note that the main passageways in the practice (i.e. those from which 2 or more passageways arise) will normally be wider and are typically at least 1200mm in width.

Benchtops

The horizontal dimensions of the benchtops in the IRA need to be adequate for instrument reception, holding, sorting, cleaning, inspection, and packaging. At the same time, the benches need to be sufficiently deep in parts to locate autoclaves without these "hanging over" the front of the bench. Modern benchtop materials made from temperature and chemical-resistant polymers provide a smooth, easily-cleaned surface which will not retain moisture or debris.

Sufficient benchtop space in the IRA needs to be allowed for specialized items such as handpiece cleaning/lubricating systems (such as the W&H Assistina), as well as for a heat sealer if this is used for instrument pouches. The location of sharps containers, scalpel blade removers, and clinical waste containers should be planned so that these are conveniently positioned in the receiving area.

The autoclave log book which records data from each cycle needs to be readily accessible in the IRA, since data will be entered into this before and after each autoclave cycle during the day. There also needs to be space for storing printouts from autoclaves, and for items that will be used during the day for quality assurance, such as air-removal tests for pre-vacuum autoclaves, and chemical indicator strips.

Figure 1. Various cassette designs can fit into a modern instrument washer such as this Miele thermal disinfector.

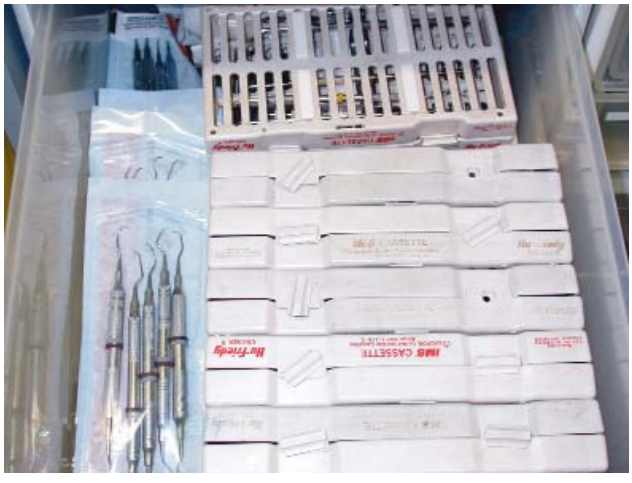

Figure 2. Hu-Friedy cassettes and instrument pouches stored in plastic sliding bins keeps them away from aerosols generated by patient care.

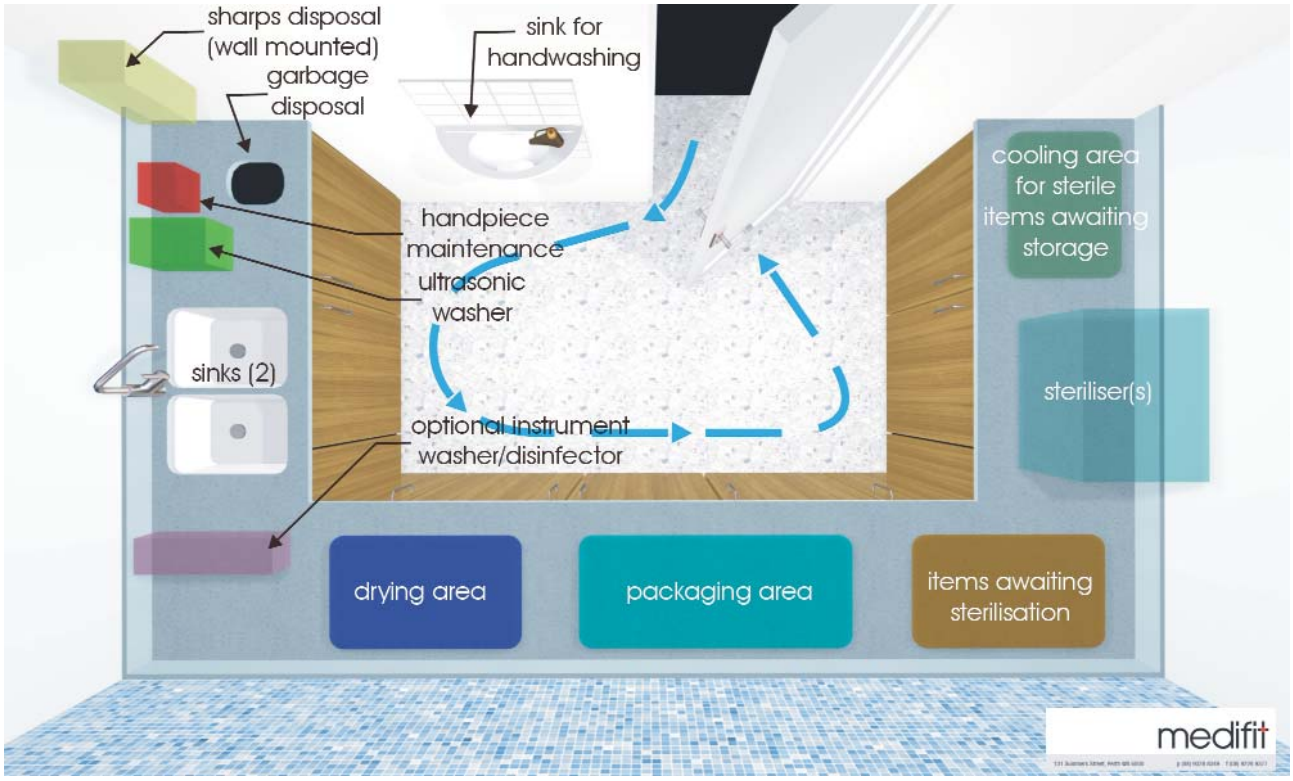

Figure 3. Suggested layout for a reprocessing area:
1. Arrow indicates the flow of instruments and equipment from dirty to clean to sterile.
2. Personnel working in the processing area should wash their hands:
(a) After handling soiled items and removal of gloves;
(b) Before handling clean items; and
(c) Before handling sterile items.

Image courtesy of Medifit based on AS/NZS 4815:2006 recommendations. Originally published in ADP Nov/Dec 2006.

Lighting

Appropriate lighting in the IRA is essential for proper visual inspection of instruments for cleanliness before they are sterilized. Conventional ceiling lighting combined with the location of eye-height cupboards and the standing position of staff members creates shadows which makes proper visual checking of instruments impossible. The general requirements for environmental lighting (described in Australian Standard 1680) are that for high tolerance work, that is requiring the worker to detect dimensions of 25 microns, a minimum light intensity of 1600 lux is required. In comparison, for computer data entry, the minimum illumination intensity is 600 lux. Correct positioning of under-bench lights (with pelmets to prevent glare from these) will ensure that staff in the IRA have sufficient light to inspect instruments prior to packaging/sterilizing.

Ventilation

Ventilation in the IRA must be sufficient to prevent the build up of aerosols (from hand cleaning of specialized items in the sink), water vapours (from instrument washers and autoclaves) and vapours of other materials. Air conditioning will often be adequate for this purpose, however if problems with vapour build up are anticipated or experienced, the addition of negative pressure ventilation (e.g. through an exhaust fan) may be very useful. Because of the large amount of heat generated in the IRA from instrument washers and autoclaves, it is important to ensure adequate airflow through this area. A normal air conditioning specification provides air movement at body level at a rate of 6-12 metres/minute. The temperature in the IRA should be between 20-22 degrees Celsius (the limits of comfort are 18 and 25 degrees (unless the outside shade temperature is more than 32 degrees). Using a "peak tracking" digital thermometer (available from electronic stores for ~ $80), the temperature variations in the area of the IRA where staff normally work can be assessed. One needs to consider that the "human comfort" factor in the IRA will be influenced by the additional personal protective wear that staff may be wearing (e.g. hair net, plastic apron), since these reduce the normal cooling effect of the movement of dehumidified air from the air conditioning system.

Floors

Welded vinyl materials are the most commonly used materials for floors in the IRA as these are leak-proof in the event of splashes of water or other fluids. Lapping this material 75mm up the walls is recommended to contain fluid spills and to simplify cleaning. If welded vinyl is not used, the alternative flooring material should provide a smooth, impermeable and seamless covering of the underlying floor. These physical requirements exclude carpeting as well as ceramic floor tiles from being used in the IRA.

Instrument flow

In the IRA, the flow of instruments from the contaminated receiving area through to the clean storage areas should be a straightforward linear progression through the various parts of the IRA (Holding area, Instrument cleaning, Inspection and drying, Instrument packaging, Autoclaving, Storage). Using instrument cassettes can simplify this and at the same time reduce risks of sustaining a sharps injury during instrument reprocessing. Contemporary instrument cassettes are designed to fit into ultrasonic cleaners, thermal disinfectors, and autoclaves, which again improves efficiency.

Figure 4 (above). One side of the A-dec ICC which shows instrument reception, a holding area in the upper cupboard (illuminated in red), an instrument washer and handpiece lubricator, and to the far left the instrument washing and inspection area. Note the excellent under-bench lighting in the instrument inspection area.

Figure 5 (left). The other side of the ICC showing the autoclave and a sterile instrument storage area above the autoclave (with blue lighting). This is a sealed section which does not get exposed to vapours or heat from the autoclave, and is opened in a touch-free manner using compressed air pistons activated by foot controls built into the kickboard. The autoclave (in this case, a Lisa pre-vacuum autoclave) is on a sliding platform.

Autoclaving

Because packaged items can only be processed in a steam sterilizer that has a built-in drying cycle, dental practices that previously used bench-top sterilizers without a built-in drying cycle are now acquiring pre-vacuum units since these are optimised for sterilization of instruments in pouches (e.g. those required for surgical or endodontic procedures). These autoclaves tend to be larger in the depth dimension because of the vacuum pump and thus require a sufficiently deep bench.

If possible, each autoclave should be on a separate electrical circuit from the main distribution box in the dental practice. This will reduce interference from other electrical devices in the practice, and prevent circuits being overloaded. Sufficient electrical outlets should be provided nearby to supply autoclaves as well as their ancillary devices such as printers. If a distiller or deionizer is not used, sufficient storage must be provided for water for the autoclave, ideally at waist height to minimize the possible adverse effects of mechanical handling of water containers on a regular basis. Several on-demand water deionizer units are available and these provide an excellent means of providing high quality deionized water for autoclaves, at modest cost and with greatly increased efficiency in terms of staff time. Many modern autoclave systems use water once and then dump it to prevent build-up of lubricants and other residues.

Storage for sterilized packaged instruments for critical (surgical) procedures

Instruments and equipment used in critical sites, i.e. those that come into contact with sterile tissue, must be sterile at the point of use. To achieve this, they must be packaged (e.g. in a pouch) and the autoclave parameters used in the cycle linked using batch numbers to the eventual use of the individual instrument sets in patient care. In other words, requirements for instrument tracking apply to instruments used to intentionally enter or penetrate into a sterile tissue environment.

Dry, sterile, packaged instruments and equipment must be stored in a clean, dry environment which protects them from environmental contamination (from splashes of water, aerosols or splatter), and at the same time protects the packages from being pierced from sharp objects within or without.

Aseptic storage for sterilized routine (non-surgical, semi-critical) instruments

Determining the appropriate areas for keeping sterilized packs and pouches away from aerosols and splashes of water and body fluids is an essential step when planning the flow of these instruments from the IRA back to the operatory. Often such storage includes pass-through cabinets, cupboards and drawers. The key factor is the isolation of these instruments from the contamination which occurs during clinical procedures. Many tray systems are well-suited for storage in large clear plastic bins and other systems which can be adopted from normal business supply/storage systems.

The unitized IRA

A recent trend has been the development of components which suit the needs of the individual practice and can be assembled into a "pre-assembled" IRA. These systems provide a logical instrument flow, have sufficient space for all the activities of the IRA, and have purpose built lighting, ventilation and storage. The Infection Control Centre (ICC) concept from A-DEC is an excellent example of a modern system which can be customised to the needs of the individual practice through selecting various modules. These systems have a number of design features for containing splashes of water from the instrument cleaning operations, and preventing vapour and heat build-up from equipment, thus ensuring that a long life is obtained for the equipment and the cabinetry. The finish of bench-tops and cabinetry which is achieved can make such areas an aesthetic highlight of the practice.

Professor Laurence J. Walsh is the technology editor of Australasian Dental Practice magazine. He is also a noted commentator on and user of new technologies and is the Head of The University of Queensland School of Dentistry.