

ADA Guidelines for Infection Control

Second Edition



AUSTRALIAN DENTAL
ASSOCIATION INC.

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Disclaimer: The routine work practices outlined in these guidelines are designed to reduce the number of infectious agents in the dental practice environment; prevent or reduce the likelihood of transmission of these infectious agents from one person or item / location to another; and make items and areas as free as possible from infectious agents. Professional judgement is essential in determining the necessary application of these guidelines to the particular circumstances of each individual dental practice.

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Foreword

This second edition of the *ADA Guidelines for Infection Control* incorporates a number of changes that have arisen since the publication of the first edition in 2008, including the release in October 2010 of the National Health and Medical Research Council (NHMRC) *Australian Guidelines for the Prevention and Control of Infection in Healthcare*. It is the intention of the Australian Dental Association Inc. (ADA) that these infection control guidelines will be updated every three years to ensure that they remain aligned to the evidence base of infection control.

The current edition of the *ADA Guidelines* is the result of over 20 years of dedicated work by the members of the ADA's Infection Control Committee. During that time the Committee has assisted external expert bodies such as the NHMRC and the Communicable Diseases Network of Australia (CDNA) help define safe practice. Quite fittingly, the *ADA Guidelines* are now recognised as a key source of information for the *NHMRC Guidelines*, and have been identified by the Dental Board of Australia as a major resource for dental practitioners.

The production of this document has required a considerable effort over a long period. Special thanks and acknowledgment are due to the current members of the ADA's Infection Control Committee (chaired by Professor Laurence Walsh) for their generous donation of time and their technical advice and expertise in preparing this document.

The ADA declares that no conflict of interest existed in the development of these guidelines, and that they have been developed independently without any corporate interest or sponsorship.

F Shane Fryer
President
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Introduction

This document describes the infection control procedures that dental practitioners and their clinical support staff are expected to follow in a dental practice. It outlines the primary responsibilities of dental practitioners in relation to infection control, and provides the rationale for those obligations.

These guidelines are mainly evidence-based or otherwise based on current international best practice, and have been drawn from current expert knowledge and advice in infection control. These guidelines will be regularly reviewed and updated in light of changes in the knowledge base. References used to prepare these guidelines are listed at the end of the document and can be sourced for further information.

This second edition of the *ADA Guidelines* incorporates a number of key areas drawn from the NHMRC *Australian Guidelines for the Prevention and Control of Infection in Healthcare* (published in October 2010). The *NHMRC Guidelines* should be regarded as a companion document to the ADA document as it addresses the foundations of infection control across all healthcare settings, including dental practice, and provides specific advice on situations where additional risk-based precautions are warranted. This revision of the *ADA Guidelines* also incorporates information from the CDNA *Australian National Guidelines for the Management of Health Care Workers known to be infected with Blood-Borne Viruses* (published in September 2011).

The routine work practices outlined in these guidelines are designed to reduce the number of infectious agents in the dental practice environment; prevent or reduce the likelihood of transmission of these infectious agents from one person or item/ location to another; and make items and areas as free as possible from infectious agents. It is important to acknowledge that professional judgement is essential in determining the necessary application of these guidelines to the situation of the individual dental practice environment. Individual dental practices must have their own infection control procedures in place, which are tailored to their particular daily routines. Professional judgement is critical when applying these guidelines to the particular circumstances of each individual dental practice.

Each dental practitioner is responsible for implementing these guidelines in their clinical practice and for ensuring their clinical support staff are familiar with and able to apply them. All clinical support staff require appropriate training in the infection control measures that they are expected to undertake on an everyday basis. Compliance with procedures is more likely if those involved in carrying them out understand the rationale behind the requirements. This includes knowing how infections are transmitted, what personal protection is needed and when and how to use it correctly, what vaccinations are needed and why, as well as the details of how to keep the practice clean and hygienic, and what to do in the event of an exposure incident such as a skin penetrating injury with a sharp instrument. Effective infection control involves not only maintaining documentation about the various procedures and processes in a specific manual, but reviewing protocols, training and documentation on a regular basis, and ensuring that staff members undertake the procedures in a consistent and uniform manner.

Practitioners should also be aware of the development of systems for accreditation of healthcare facilities as a national initiative from the Australian Commission on Quality and Safety in Health Care (ACQSHC). This body has developed a set of uniform standards to apply across all health services that set the minimum expected level of safe and quality care to be provided to patients. One of the 10 standards developed by ACQSHC is a standard on Healthcare-Associated Infection, which aims to prevent infection of patients within the healthcare system and to manage infections effectively when they occur to minimise their consequences. This standard was written in concert with the NHMRC *Australian Guidelines for the Prevention and Control of Infection in Healthcare*.

Definitions

Bloodborne viruses (BBVs) include hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency (HIV). These viruses are transmitted primarily by blood-to-blood contact.

Clinical support staff are those staff other than registered dental practitioners who assist in the provision of dental services – namely dental chairside assistants (dental nurses), dental laboratory assistants and dental technicians.

Contaminated zone is that area of work in which contamination by patient fluids (blood and saliva) may occur by transfer, splashing or splatter of material. It includes the operating field in the dental operator, as well as the instrument cleaning area within the sterilising room. Contamination must be confined and contained to this area.

Dental Board refers to the Dental Board of Australia.

Dental practitioners is an inclusive term that refers to those registered by the Dental Board to provide clinical dental care to patients, and comprises dentists, dental specialists, dental prosthetists, dental therapists, dental hygienists, and oral health therapists.

Dental staff is an inclusive term for all those employed in a dental practice setting – namely dental practitioners, clinical support staff and clerical or administrative staff.

Disinfection is the destruction of pathogenic and other kinds of microorganisms by physical or chemical means.

Exposure incident is any incident where a contaminated object or substance breaches the integrity of the skin or mucous membranes or comes into contact with the eyes.

Exposure prone procedures (EPPs) are procedures where there is a risk of injury to dental staff resulting in exposure of the patient's open tissues to the blood of the staff member. These procedures include those where the dental staff's hands (whether gloved or not) may be in contact with sharp instruments, needle tips or sharp tissues (spicules of bone or teeth) inside a patient's open body cavity, wound or confined anatomical space where the hands or fingertips may not be completely visible at all times. Three different types of EPPs are described in the CDNA *Australian National Guidelines for the Management of Health Care Workers known to be infected with Blood-Borne Viruses* (2011).

The majority of procedures in dentistry are Category 1 EPPs because they are undertaken with the hands and fingertips of the dental practitioner visible and outside the mouth most of the time. The possibility of injury to the practitioner's gloved hands from sharp instruments and/or tissues is slight, and the risk of the practitioner bleeding into a patient's open tissues is remote.

In a smaller group of procedures, designated as Category 2 EPPs, the fingertips may not be visible at all times; however, injury to the practitioner's gloved hands from sharp instruments and/or tissues is unlikely. If injury occurs it is likely to be noticed and acted upon quickly to avoid the dental practitioner's blood contaminating a patient's open tissues.

Category 3 EPPs in dentistry are those surgical procedures where the fingertips are out of sight for a significant part of the procedure, or during certain critical stages, and in which there is a distinct risk of injury to the dental practitioner's gloved hands from sharp instruments and/or tissues. In such circumstances it is possible that exposure of the patient's open tissues to the practitioner's blood may go unnoticed or would not be noticed immediately. Such procedures include: maxillofacial surgery; oral surgical procedures including surgical removal of teeth and dento-alveolar surgery; periodontal surgical procedures; endodontic surgical procedures; and implant surgical procedures (such as implant placement and recovery). The definition of Category 3 EPPs excludes forceps extraction of highly mobile or exfoliating teeth.

Invasive procedure is any procedure that pierces skin or mucous membrane or enters a body cavity or organ. This includes surgical entry into tissues, cavities or organs, or repair of traumatic injuries to the soft tissues.

A surgical procedure is one where there is a planned breach of a patient's skin or mucosa and penetration into deeper layers of tissue which have a different immune response.¹

¹ From section B5.3 of the NHMRC *2010 Australian Guidelines for the Prevention and Control of Infection in Healthcare* and Appendix 1 of the CDNA *Australian National Guidelines for the Management of Health Care Workers known to be infected with Blood-Borne Viruses*.

A. Infection control

1. What is infection control?

The purpose of infection control in dental practice is to prevent the transmission of disease-producing agents such as bacteria, viruses and fungi from one patient to another patient, from dental practitioner and dental staff to patients, and from patients to dental practitioner or other dental staff. In addition, it is necessary that endogenous spread of infection also be prevented by limiting the spread of infectious agents.

Successful infection control involves:

- understanding the basic principles of infection control;
- creating systems that allow infection control procedures to be implemented effectively and make compliance with them easy (this includes having clear procedural documentation, and comprehensive training of dental staff together with a process of regular monitoring of the application of these systems and procedures);
- keeping up-to-date regarding specific infectious diseases, particularly newly-evolving infection challenges such as avian flu, H1N1 influenza, and multiple resistant organisms, and how to take precautions against them; and
- identifying the settings that need modified procedures (e.g. nursing homes).

In dental practice, microorganisms may be inhaled, implanted, ingested, injected, or splashed onto the skin or mucosa. They can spread by **direct** contact from one person to another, or through **indirect** contact via instruments and equipment, when the dental staff member's hands or clothing become contaminated, where patient-care devices are shared between patients, when infectious patients have contact with other patients, or where environmental surfaces are not regularly decontaminated.

In the dental practice setting, microorganisms can also spread by **airborne** transmission – when dental staff or others inhale small particles that contain infectious agents. A number of infectious agents, including viral influenza, can be transmitted through respiratory droplets (i.e. large-particle droplets >5 microns in size) that are generated by a patient who is coughing, sneezing or talking. Transmission via large droplets (splash and splatter) requires close contact, as large droplets do not remain suspended in the air. Droplet transmission can occur when a staff member's hands become contaminated with respiratory droplets and are transferred to susceptible mucosal surfaces such as the eyes, when infectious respiratory droplets are expelled by coughing, sneezing or talking, and come into contact with another's mucosa (eyes, nose or mouth), either directly into or via contaminated hands.

Whether or not the spread of microorganisms results in clinical infection depends in part on the virulence (power to infect) of a particular microorganism and on the susceptibility of the host. For instance, hepatitis B virus (HBV) is highly infectious and the chance that this disease will be transmitted by a contaminated penetrating injury² to a non-immune person is approximately one in three (depending on the infective status of the source of injury). In comparison, the chance of transmission of the hepatitis C virus (HCV) by similar means is one in 30; and for HIV/AIDS, one in 300. Patients and dental staff have varying susceptibilities to infection depending on their age, state of health, underlying illnesses, and immune status (which may be impaired by medication, disease, cancer therapy and other factors such as malnutrition and hormone deficiency).

Infection control focuses on limiting or controlling factors that influence the transmission of infection or that contribute to the spread of microorganisms. The spread of microorganisms can be reduced by:

- limiting surface contamination by microorganisms;
- adhering to good personal hygiene practices, particularly efficient hand hygiene;
- using personal protective equipment;
- using disposable products where appropriate (e.g. paper towels); and
- following risk minimisation techniques such as using rubber dam and pre-procedural mouthrinsing.

² A penetrating injury is any injury from a sharp object such as an injection needle, scalpel blade, dental bur or denture clasp contaminated with a patient's blood or saliva.

Standard precautions are the basic processes of infection control that will minimise the risk of transmission of infection, and include:

- undertaking regular hand hygiene before gloving and after glove removal;
- using personal protective barriers such as gloves, masks, eye protection and gowns;
- wearing appropriate protective equipment during clinical procedures and when cleaning and reprocessing instruments;
- correctly handling contaminated waste;
- appropriately handling sharps;
- appropriately reprocessing reusable instruments;
- effectively undertaking environmental cleaning;
- respiratory hygiene and cough etiquette;
- using aseptic non-touch techniques where indicated;
- appropriately handling used linen and clinical gowns; and
- using, where appropriate, environmental barriers such as plastic coverings on surfaces and items that may become contaminated and that are difficult to clean.

These standard precautions minimise the risk of transmission of infection from person to person, and are required for the treatment of all dental patients regardless of whether a particular patient is infected with or is a carrier of an infectious disease. They apply to all situations whenever dental practitioners or their clinical support staff touch the mucous membranes or non-intact skin of a dental patient. Standard precautions are also essential when cleaning the dental surgery environment, when handling items contaminated with saliva (e.g. radiographs, dentures, orthodontic appliances, wax rims and other prosthetic work that have been in a patient's mouth), when handling blood (including dried blood), saliva and other body fluids (excluding sweat) whether containing visible blood or not, and when cleaning and processing instruments.

There are a number of situations where patients have a specific highly infectious condition that necessitates the use of transmission-based precautions **in addition to** standard precautions, to address the increased risk of transmission.

Transmission-based precautions are applied to patients suspected or confirmed to be infected with agents transmitted by the contact, droplet or airborne routes. The agents of most concern to dental practise are respiratory viruses. The range of measures used in transmission-based precautions depends on the route(s) of transmission of the infectious agent involved. The application of transmission-based precautions is particularly important in containing multi-resistant organisms (MROs) in hospital environments and in the management of outbreaks of norovirus gastroenteritis in institutions such as hospitals and nursing homes.

The requirements for transmission-based precautions are listed in Section B5.2 of the 2010 NHMRC *Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010 NHMRC Guidelines)*. In brief, contact precautions are used when there is a risk of direct or indirect contact transmission of infectious agents (e.g. MRSA, *Clostridium difficile*, or highly contagious skin infections/infestations) that are not effectively contained by standard precautions alone.

Droplet precautions are intended to prevent transmission of infectious agents spread through respiratory or mucous membrane contact with respiratory secretions. Because these microorganisms do not travel over long distances in droplets or aerosols, positive pressure ventilation is not required.

Airborne precautions, such as wearing P2 (N95) surgical respirators, are designed to reduce the likelihood of transmission of microorganisms that remain infectious over time and distance when suspended in the air. These agents may be inhaled by susceptible individuals who have not had face-to-face contact with (or been in the same room as) the infectious individual. Infectious agents for which airborne precautions are indicated include measles, chickenpox (varicella) and *Mycobacterium tuberculosis*. At the present time there is a lack of evidence from clinical trials regarding the additional benefit of P2 (N95) respirators over conventional surgical masks for reducing the risk of transmission of viral influenza.

Because the majority of procedures undertaken in dentistry generate aerosols, it is important to recognise that patients with active tuberculosis, measles, chickenpox or viral influenza pose a considerable risk to dental staff and patients if they undergo dental treatment. For patients whom airborne precautions are indicated, formal risk assessment should be undertaken so that the need for dental treatment is determined. Non-urgent treatment should be delayed or postponed.

If such patients need urgent care, transmission-based precautions must be followed. The additional measures would include these patients being seen as the last patient of the day. Use of pre-procedural mouthrinses and rubber dam would be essential, together with minimising the use of aerosol-generating techniques, and two cycles of cleaning for environmental surfaces. In general, there will be few situations where the use of analgesics and appropriate antimicrobial agents will not allow a delay until the patient is no longer infectious.

2. Duty of care

Dental practitioners have a common law legal duty of care to their patients, and must ensure that effective infection control measures are in place and are complied with in the practice. The Dental Board stipulates that dental practitioners must practise in a way that maintains and enhances public health and safety by ensuring that the risk of the spread of infectious diseases is prevented or minimised. Dental practitioners must ensure the premises in which they practise are kept in a clean and hygienic state to prevent or minimise the spread of infectious diseases; and ensure that, in attending a patient, they take such steps as are practicable to prevent or minimise the spread of infectious diseases.³ Consequently, all dental practitioners and clinical support staff have a responsibility to follow the specific infection control policies in their place of work.

Dental practitioners must:

- develop and implement work practices to ensure compliance with infection control standards;
- document their infection control protocols in a practice manual;
- ensure that all dental staff have read the practice manual and have been trained in the infection control protocols used in the practice;
- provide their dental staff with access to key resources such as these *ADA Guidelines*, the *2010 NHMRC Guidelines*, and the relevant Australian Standards (AS/NZS 4815, Office-based health care facilities – Reprocessing of reusable medical and surgical instruments and equipment, and maintenance of the associated environment; or AS4187 for hospitals);
- have in place a system of reporting, monitoring and rectifying breaches of infection control protocols (which would involve addressing this topic in staff meetings and recording the outcomes from such discussions);
- ensure an immunisation program for dental staff is in place and is in accordance with the current edition of the *Australian Immunisation Handbook*;
- maintain a vaccination record for each member of the dental staff (see Section 3 of this document for a list of recommended immunisations);
- maintain a record of workplace incidents and accidents (including sharps injuries) as required by national OHS legislation;
- maintain an allergy record for each member of the dental staff;
- implement specific training and education on personal protective equipment;
- implement a hand hygiene program consistent with the national hand hygiene initiative from Hand Hygiene Australia (HHA) which promotes the use of alcohol-based hand rubs in situations where hands are not visibly contaminated;
- implement systems for the safe handling and disposal of sharps;
- implement systems to prevent and manage occupational exposure to bloodborne viruses;
- implement systems for environmental cleaning;
- implement systems for processing of reusable instruments and devices;
- be aware of their immune status. The Dental Board stipulates that all dental practitioners must be aware of their infectious status for the bloodborne viruses HBV, HCV and HIV, seek expert medical advice from an infectious diseases specialist familiar with the requirements of dental practice or from an expert advisory panel if diagnosed with a bloodborne virus. Such advice could include a prohibition on undertaking exposure prone procedures (EPPs) if viraemic;
- follow through after potential exposures to bloodborne viruses, including reporting the incident if it was an occupational exposure, undergoing testing, and if necessary, seek specialist medical management. Note that it is not necessary for practitioners to stop performing EPPs after the exposure, unless they are found to have become infected with the bloodborne virus.

³ See the Dental Board of Australia *Guidelines on Infection Control*, July 2010 <http://www.dentalboard.gov.au/Codes-and-Guidelines.aspx>

In addition, under workplace health and safety legislation, practice owners have an obligation to provide and maintain a safe working environment for employees and for members of the public. This means that practice owners must provide their employed dental practitioners and dental staff with the required materials and equipment to allow these employees to fulfil their legal obligations for implementing effective infection control in their workplace.

The law demands that dental practitioners take reasonable steps to accommodate a patient's disability. It is a breach of anti-discrimination laws for dental practitioners to refuse to treat or impose extra conditions on a patient who has a disability such as being infected with or being a carrier of a bloodborne virus.⁴

Infected dental practitioners

Dental practitioners who are infected with, or who are carriers of, bloodborne viruses should seek the advice of infectious disease specialists familiar with the requirements of dental practice and an advisory panel regarding their fitness to practice. They may need to modify their clinical practice, and this includes not undertaking EPPs, in accordance with the relevant policies of the Dental Board and the current CDNA *Australian National Guidelines for the Management of Health Care Workers known to be infected with Blood-Borne Viruses* (CDNA *Australian National Guidelines*).

While the protection of the public's health is paramount, employers of dental practitioners should also consider, and comply with, relevant anti-discrimination, privacy, industrial relations and equal employment opportunity legislation. Employers must ensure that the status and rights of infected staff members as employees are safeguarded.

If a dental practitioner knows or suspects that they have been infected with a bloodborne virus, they should consult an appropriately experienced medical practitioner for their management. This includes seeking treatment, which may modify their illness to the extent that restrictions on practice can be lifted. It is not appropriate for a practitioner to rely on their own assessment of the risk that they pose to patients.

Under the current Dental Board policy (July 2010), practitioners diagnosed with a bloodborne viral infection must cease performing EPPs if viraemic. This policy also applies to students. Upon entry into university dental training programs, students are required to undergo testing for BBVs. If found to be positive for one or more BBVs, they must not proceed with their dental studies. As a result of limitation of practice, intending students with a bloodborne viral infection must be advised that they will not be able to complete their clinical course requirements or be allowed to practice as a dental practitioner. Advice on alternative careers and counselling should be made available.

Risks of transmission from clinician-to-patient or from patient-to-clinician are dependent on a range of factors including the infectivity of the individual (for example viral load and effect of viral treatments), the clinical treatment type, and operator skill and experience. The CDNA *Australian National Guidelines* stipulate that HIV antibody positive practitioners must not perform EPPs, and impose limits on practitioners infected with HBV or HCV according to their infectivity as assessed by viral load and antibody levels.

Effective anti-viral drug treatment protocols reduce the infectivity of individuals, and persistent negative results for PCR may result in a review of the infectious status of the practitioner. Dental practitioners must not perform EPPs while they are HCV RNA positive, but may be permitted to return to normal working arrangements and perform EPPs after successful treatment or following spontaneous clearing of HCV RNA. Likewise, dental practitioners must not perform EPPs while they are HBV DNA positive, but may be permitted to return to normal clinical work following spontaneous clearing of HBV DNA or clearing of HBV DNA in response to anti-viral treatment. However, further HCV RNA and HBV DNA testing will be required in such cases for an extended period. The CDNA *Australian National Guidelines* recommend that testing for HBV and HCV should be performed three-monthly and yearly, respectively, for the duration of the practitioner's career, to ensure that virus levels remain undetectable.

⁴ Anti-discrimination, privacy, industrial relations and equal opportunity laws apply. Relevant State, Territory and Commonwealth legislation is listed in the References and Additional Reading.

B. Standard precautions of infection control

The following standard precautions form the basis of infection control and must be carried out routinely for all patients.

1. Hand hygiene

Hand hygiene is a general term applying to processes aiming to reduce the number of microorganisms on hands. This includes either the application of a waterless antimicrobial agent, e.g. alcohol-based hand rub (ABHR), to the surface of the hands, or the use of soap/solution (plain or antimicrobial) and water, followed by patting dry with single use towels. Comprehensive information on contemporary hand hygiene measures is found on the Hand Hygiene Australia (HHA) website <http://www.hha.org.au/>.

Simply put, the HHA protocol is to use an ABHR for **all clinical situations where hands are visibly clean**. The normal routine in dental practice should be for dental staff to use ABHR between patient appointments and during interruptions within the one appointment. The hand rub is applied onto dry hands and rubbed on for 15-20 seconds, after which time the hands will be dry. ABHR can be used as often as is required; however, a compatible moisturiser should be applied up to four times per day. ABHR must only be used on dry skin, because having wet hands dilutes the product thus decreasing its effectiveness. Unlike detergents, ABHR do not remove skin lipids and they do not require paper towel for drying.

A range of ABHR products are registered with TGA and these contain a sufficiently high level of alcohol (ethanol or isopropanol) to achieve the desired level of decontamination. Practitioners must not use ABHR products that do not carry TGA approval. Suitable ABHR will typically contain a skin emollient to minimise the risk of skin irritation and drying, have minimal colour and fragrances, and will leave the hands in a dry state after being rubbed on for 15-20 seconds. It is not permitted to 'top up' bottles of ABHR because the outside of the dispenser may become contaminated. Thus, the empty dispenser should be discarded and not re-used. Attempts to recycle/re-use ABHR dispensers have not proven to be cost effective in Australia to date.

The initial use of ABHR by staff with existing skin irritation often results in a stinging sensation; this usually declines over several weeks with the ongoing use of an emollient-containing ABHR. However, if symptoms persist, medical opinion should be sought.

Both alcohol-based gels and solutions with proven efficacy that have been designed for use in healthcare settings are available. ABHR products designed for domestic use lack TGA registration. As a result, such domestic products must not be used in clinical settings. There is insufficient evidence at present to recommend the use of alcohol-containing foams for hand hygiene.

Dental staff must be educated regarding the correct use of ABHR and handwashing products, and on caring for their hands. Regular use of skin moisturisers both at work and at home should be promoted, bearing in mind that any moisturising skin care products used in the dental practice must be compatible with the ABHR used.

For further information on hand decontamination with ABHR, see <http://www.hha.org.au>. This site also has posters on 'How to Hand Rub' and 'How to Handwash' which can be downloaded for use in dental practice.

Hands must always be washed at the start of a working session, after toilet breaks, and on leaving the surgery at the end of the day. They must be washed with soap and water when visibly dirty or contaminated with proteinaceous material, or visibly soiled with blood or other body fluids. The rationale is that washing hands with soap and water is preferred in these situations because it guarantees a mechanical removal effect.

Washing hands with soap and water immediately before or after using an ABHR is not only unnecessary, but may lead to dermatitis. For this reason, it is both desirable and convenient to position ABHR dispensers close to the clinical working area (but away from contamination by splash and aerosols), rather than at an existing handwashing sink.

Handwashing should be undertaken in dedicated (clean) sinks preferably fitted with non-touch taps (or carried out using a non-touch technique) and not in the (contaminated) sinks used for instrument cleaning. If touch taps are used the taps may be turned on and off with a paper towel.

Hand hygiene must be undertaken before and after every patient contact, before gloves are put on, and after they are taken off. If hands are washed, wet hands must be dried with single use linen or disposable paper towels.

Hand care

Hands must be well cared for, because intact skin is a first line defence mechanism against infection. Damaged skin can not only lead to infection in the host, but can also harbour higher numbers of microorganisms than intact skin and hence increase the risk of transmission to others. Damaged skin in dental practitioners and clinical support staff is an important issue because of the high frequency of dry, itchy skin from irritant contact dermatitis, which is primarily caused by frequent and repeated use of handwashing products – especially soaps, other detergents, and paper towel use, that result in skin drying. Other factors that may contribute to dermatitis include fragrances and preservatives in hand care products (which can cause contact allergies), donning gloves while hands are still wet, using hot water for handwashing, failing to use moisturisers, and using poor quality paper towels,

Because lacerated, chafed or cracked skin can allow entry of microorganisms, any cuts or open wounds need to be covered with a waterproof dressing. All hand, wrist or nail jewellery should be removed prior to putting on gloves as its presence compromises the fit and integrity of gloves and also promotes significant growth of skin microorganisms. (A plain band ring such as a wedding ring may be left on for non-surgical procedures but may cause irritation of the underlying skin, in which case it must not be worn).

Artificial fingernails can harbour microorganisms and must not be worn. Any nail polish should be clear, and preferably no nail polish should be worn by dental staff. All fingernails must be kept short to prevent glove tears and to allow thorough cleaning of the hands. The hands of dental staff should be free of jewellery and false nails, and any cuts or abrasions covered with waterproof dressings.

2. Personal protective equipment

The wearing of protective personal clothing and equipment where aerosols are likely to be generated is an important way to reduce the risk of transmission of infectious agents. Not only must dental practitioners and clinical support staff be provided with all appropriate necessary protective clothing and equipment for the procedure being undertaken, they also need to be educated about how to use these items correctly.

Barrier protection, including gloves, mask, eyewear and gown must be removed before leaving the work area (e.g. dental surgery, instrument processing or laboratory areas).

Gloves

Dental practitioners and clinical support staff must wear gloves whenever there is risk of exposure to blood, saliva or other body secretions or when hands will come in contact with mucous membranes. This means gloves must be worn for all clinical procedures. The Practice Manual should list the protocols for glove wearing and for hand hygiene before gloving and after de-gloving.

Wearing gloves does not replace the need for hand hygiene because hands may still become contaminated as a result of manufacturing defects in new gloves that were not obvious to the user, or because of damage (such as tears and pinpricks) that occurs to the gloves during use.

Gloves used in patient care must not be washed or reused. A new pair of gloves must be used for each patient and changed as soon as they are cut, torn or punctured. Gloves must be removed or overgloves worn before touching any environmental surface without a barrier or before accessing clean areas. Gloves must be removed as soon as clinical treatment is complete and hand hygiene undertaken immediately to avoid the transfer of microorganisms to other patients or environments.

Non-sterile examination gloves may be worn for non-surgical general dental procedures. Gloves supplied for use in dental practice are required to conform to AS/NZS 4011. Sterile gloves must be worn when a sterile field is necessary for procedures such as oral, periodontal or endodontic surgery.

Gloves also need to be worn when cleaning instruments and environmental surfaces. The type of glove worn must be appropriate to the task. For instance, disposable latex or nitrile gloves are appropriate for cleaning the dental operatory during changeover between patient appointments. Heavy-duty utility, puncture-resistant gloves must be used during

instrument cleaning, rather than disposable latex gloves. These utility gloves can be reused, but must be washed in detergent after each use, stored dry and replaced if torn, cracked, peeling or showing signs of deterioration.

The use of powder-free gloves for patient care is recommended strongly because this reduces exposure of staff to latex proteins via both respiratory and contact routes, and thereby minimises the risk of developing latex allergy. If the dental practitioner, clinical support staff member or patient has a proven or suspected allergy to latex, alternatives such as neoprene or nitrile gloves must be used. A latex-free protocol must also be followed including use of non-latex rubber dam, and use of non-latex materials such as prophylaxis cups. Note that patients with multiple food allergies have an elevated possibility of latex allergy and it is prudent to use a latex-free approach when treating such patients.

For further information on latex sensitivity see the ADA's *The Practical Guides* and www.ada.org.au.

Masks

Dental procedures can generate large quantities of aerosols of three microns or less in size and a number of diseases may be transmitted via the airborne (inhalational) route. In the dental surgery environment, the most common causes of airborne aerosols are the high speed air rotor handpiece, the ultrasonic scaler and the triplex syringe. The aerosols produced may be contaminated with bacteria and fungi from the oral cavity (from saliva and dental biofilms), as well as viruses from the patient's blood.

Therefore, dental practitioners and clinical support staff must wear suitable fluid-resistant surgical masks that block particles of three microns or less in size. Because masks protect the mucous membranes of the nose and mouth, they must be worn wherever there is a potential for splashing, splattering or spraying of blood, saliva or body substances, or where there is a probability of the inhalation of aerosols with a potential for transmission of airborne pathogens. However, it is suggested that masks be worn at all times when treating patients to prevent contamination of the working area with the operator's respiratory or nasal secretions/organisms. Surgical masks for dental use are fluid-repellent paper filter masks and are suitable for both surgical and non-surgical dental procedures that generate aerosols. The filtration abilities of a mask begin to decline with moisture on the inner and outer surfaces of the mask after approximately 20 minutes. Masks supplied for use in dental practice are required to conform to AS 4381.

The following are some basic protocols to be observed in relation to masks as items of personal protective equipment.

Masks must:

- be fitted and worn according to the manufacturer's instructions – this means using both tie strings where the mask has two ties, and adapting the mask to the bridge of the nose;
- cover both the nose and mouth, and where possible be folded out fully to cover the chin and upper neck; and
- be removed by touching the strings and loops only.

Masks must not:

- be touched by the hands while being worn; or
- be worn loosely around the neck while the dental practitioner or clinical support staff member walks around the premises, but be removed and discarded as soon as practicable after use.

Eye protection

Dental practitioners and clinical support staff must wear protective eyewear to protect the mucous membranes of the eyes during procedures where there is the potential for penetrating injury or exposure to aerosols, splattering or spraying with blood, saliva or body substances. Reusable or disposable eyewear that is supplied for use in dental practice is required to conform to AS 1337. An alternative to protective eyewear is a face shield. However, this does not protect from inhaled microorganisms and must be worn in conjunction with a surgical mask.

Eyewear protects the eye from a broad range of hazards including projectiles and for this reason eyewear should be worn for most clinical procedures. Protection from projectiles is particularly important during scaling, when using rotary instruments, when cutting wires and when cleaning instruments and equipment.

Eyewear must be optically clear, anti-fog, distortion-free, close-fitting and should be shielded at the sides. Prescription lenses are not considered a substitute for protective eyewear unless they are inserted in frames the design of which provides a suitable level of protection to the orbital region.

Patients must be provided with protective eyewear to minimise the risk of possible injury from materials or chemicals used during treatment. Tinted lenses may protect patients from the glare of the operating light. Spectacles for vision usually do not provide sufficient protection. All patients must be offered protective eyewear. If patients refuse to wear the protective glasses, the risks should be explained and the refusal noted in their dental records.

With regard to cleaning, eyewear for patients may be either single use or can be reused after cleaning with detergent and water.

Protective clothing

Protective clothing (e.g. reusable or disposable gown, laboratory coat or uniform) should be worn while treating patients when aerosols or splatter are likely to be generated or when contamination with blood or saliva is possible. The most suitable type of protective clothing varies according to the nature of the procedure and the equipment used and is a matter of professional judgement. Where there is a risk of large splashes with blood or body substances, impermeable protective clothing must be worn. Items of disposable protective clothing should be placed in general waste after use, or if visibly contaminated with blood these must be disposed of according to local waste management regulations.

Items of protective clothing must be changed as soon as possible when they become visibly soiled or after repeated exposure to contaminated aerosols. The protective gown worn in the clinical area must be removed before eating, drinking, taking a break or leaving the practice premises for a meal or other break, or at the end of the day.

Uniforms worn by dental practitioners and clinical support staff must be clean and in good condition.

Footwear

Dental practitioners and clinical support staff should wear enclosed footwear that will protect them from injury or contact with sharp objects (e.g. accidentally dropped sharps or spilt chemicals).

3. Surgical procedures and aseptic technique

The principles of sterile aseptic technique must be applied to all surgical procedures undertaken in the dental practice setting. Sterile gloves must be used when EPPs such as incision into mucosal soft tissues, surgical penetration of bone or elevation of a muco-periosteal flap are undertaken. Likewise, sterile gloves are required for the surgical removal of teeth, for minor oral surgery procedures, for periodontal surgery, surgical endodontics and for dental implant placement. The following additional requirements are necessary to provide for asepsis and a sterile field: long hair must be tied back and covered and beards must be covered.

In addition, these procedures include specific requirements for surgical handwashing (using an anti-microbial handwashing solution), gowning and gloving. Sterile gloves supplied for use in dental practice are required to conform to AS/NZS 4179.

4. Management of sharps

The practise of dentistry frequently involves the use of sharp instruments. Occasionally, conditions of limited access and poor visibility will exist such that there is a risk of a penetrating injury to dental staff with the subsequent possibility of exposure of the patient to the blood of the dental staff member.

Inappropriate handling of sharps, both during and after treatment, is the major cause of penetrating injuries which involve potential exposure to bloodborne diseases in the dental surgery. Consequently, it is essential that all sharp instruments must be handled and used with care, and that the techniques employed minimise the risk of penetrating injuries to dental staff.

Sharp instruments such as scalpels and scalers must never be passed by hand between dental staff members and must be placed in a puncture-resistant tray or bowl after each use. Instruments and sharp items must be carried from the surgery to the sterilising area in a lidded puncture-resistant sharps transport container.

Needles must not be re-sheathed unless an approved recapping device or single-handed technique is used. Contaminated needles must never be bent or broken by hand or removed from disposable syringes.

The dental practice must have an easily accessible, clear set of written instructions on the appropriate action to take in the event of an exposure incident such as a sharps injury. These instructions must be understood and followed by all dental staff.

For further information see Appendix: *Blood and Body Fluid Exposure Protocol*, the ADA's *The Practical Guides* and www.ada.org.au.

Disposal of sharps

The clinician who has used a disposable sharp item must be responsible for its immediate safe management or disposal after use. This must be at the point of use (i.e. the operatory or treatment room) unless transferred in appropriate containers.

Used disposable needle syringe combinations, empty or partially used cartridges of local anaesthetic solution, burs, needles, scalpel blades, orthodontic bands, endodontic files and other single use sharp items must be discarded in clearly labelled, puncture and leakproof containers. Appropriate sharps containers are those that conform to AS 4031 or AS/NZS 4261 as applicable.

A separate sharps container should be located in each operatory, close to the point of use of any disposable sharp. Sharps containers must be placed in a safe position within the treatment room to avoid accidental tipping over and must be out of the reach of small children. Sharps containers must be sealed when they have been filled to the line marked on the container, and then collected by licensed waste contractors for disposal according to local waste management regulations.

5. Management of clinical waste

Management of medical and related waste must conform to local State or Territory regulations. Waste in the dental practice should be separated according to its category (medical or non-medical) at the point of generation. Bags and containers for medical waste should be appropriately colour coded and labelled as biohazard or medical waste. Medical waste includes recognisable human tissues (excluding teeth) and material or solutions containing free-flowing blood. Such waste must be placed in appropriate leak-resistant bags and then yellow containers bearing the international black biohazard symbol and clearly marked medical waste.

Standard precautions (gloves, mask, protective eyewear) must be used when handling medical waste bags and containers. These must not be overfilled and must not be compacted by hand.

Medical waste and hazardous chemical waste (which includes some chemicals and mercury used in dental practise) must never be disposed of at local refuse tips that use compaction of an open landfill. Medical waste and sharps containers must be stored securely before collection by licensed waste contractors for final disposal using approved technologies by licensed/accredited contractors.

Extracted teeth once cleaned of visible blood and saliva may be given to the patient, or alternatively wrapped in paper towel or placed in a disposable cup and covered with setting plaster before disposal in the general waste. In some states and territories it is illegal to incinerate teeth restored with amalgam because of issues with mercury vapour emissions, therefore those teeth must not be placed in medical waste or into sharps containers. Local regulations on waste management and disposal of teeth may apply.

6. Environment

A range of environmental controls can be used to reduce the risk of transmission of infectious agents in the dental practice. These should be considered when designing or refurbishing a dental practice.

Design of premises

The design of the premises and the layout of the dental surgery and treatment areas are important factors in implementing successful infection control. Work areas should be well lit and well ventilated with sufficient uncluttered and easily cleaned bench space to accommodate necessary equipment.

The dental operatory and the instrument reprocessing rooms must have clearly defined clean and contaminated zones. The clean zones of the dental practice include office areas, the staff room, waiting and reception areas as well as those areas used for storage of supplies and of sterilised instruments and equipment. The contaminated zone is the area contaminated with material from patient care, as well as the instrument cleaning area. After gloving, staff may move from the clean zone to the contaminated zone but never the reverse direction. In the dental operatory, workflow for instruments and materials must be from the clean to the contaminated zone. Care must be taken to avoid contaminated instruments or equipment re-entering clean areas.

Moreover, dental chairside assistants should put on new gloves for cleaning working surfaces during the changeover between patients, rather than using gloves contaminated during chairside assisting work on the previous patient.

Floor coverings in the dental operatory must be non-slip and impervious with sealed joints. Welded vinyl flooring is widely used as it is long wearing and easily cleaned. Coved joints of the flooring with the walls are preferred for ease of cleaning. Carpet is acceptable in the waiting room but must not be used in clinical, laboratory and instrument reprocessing areas as it is not impervious.

Computer keyboards in the dental operatory may harbour microorganisms such as *Staphylococcus aureus* (MRSA) and they should be covered where possible in treatment areas, and cleaned regularly in non-treatment areas. A number of keyboards are available that have flat surfaces and can be wiped over with detergent or with alcohol-impregnated wipes between patient appointments. Patient notes written up by hand or electronically must follow a protocol which prevents environmental contamination of the hard copy notes or computer keyboard.

Eating and common room areas for dental staff must be separate from patient treatment areas and the dental laboratory. Lunchroom crockery must not be washed in the handwash sinks or in instrument wash basins. Food must not be stored in a refrigerator with dental materials, sealed clinical specimens or medical products such as drugs or blood because of the risks of cross-contamination.

Cleaning the environment

Although surfaces such as floors, walls and curtains pose minimal risk of disease transmission in a dental practice, these surfaces nevertheless must be maintained in a clean and hygienic condition. State and Territory public health regulations require that premises be kept clean and hygienic.

Environmental surfaces such as bench tops outside the contaminated zone must be cleaned at least weekly using detergent and water. The practice should develop a sequence so that areas including floors, window sills, door handles, telephone handsets are cleaned on a weekly basis. Likewise, a schedule for cleaning of solid surfaces in the waiting room must be prepared. Walls, blinds and window curtains in patient care areas must be cleaned when they are visibly dusty or soiled.

Because cleaning methods must avoid the generation of aerosols, damp dusting, dust-retaining mops and vacuum cleaners are recommended. Brooms must not be used in clinical areas as these disperse dust and bacteria into the air. Mops and cloths must be cleaned after use and allowed to dry before reuse; alternatively single use, disposable mop heads or cloths may be used.

Treatment areas

Routine cleaning of the contaminated zone within the dental operatory is necessary to maintain a safe environment because deposits of dust, soil and microbes on environmental surfaces can transmit infection. Surfaces of dental units must be impervious as they may become contaminated with potentially infective material. Work surfaces and bench tops in treatment areas must be non-porous, impervious to water, smooth without crevices and have sealed joints to facilitate

cleaning and prevent the accumulation of contaminated matter. Working surfaces in the contaminated zone must be cleaned after every patient by wiping the surface with a neutral detergent. Standard precautions (including wearing of personal protective equipment as applicable) must be implemented when cleaning these surfaces.

A neutral detergent and warm water solution or commercially packaged pre-moistened, neutral detergent wipes should be used for all routine and general cleaning. Neutral pH detergents are best for environmental cleaning because they are less likely than acid or alkaline detergents to damage metals such as stainless steel or to cause skin irritation. Neutral detergents also leave little residue on surfaces. Fresh cleaning solutions of detergent should be prepared as instructed by the manufacturer daily. Containers for these fresh solutions should be emptied, washed and dried overnight prior to refilling for subsequent use.

Written cleaning protocols for the practice must be prepared, including methods and frequency of cleaning.

General work surfaces in the dental operatory that are outside the contaminated zone must be cleaned after each session or when they become visibly soiled. Sinks and wash basins must be cleaned at least daily, or more often if appropriate.

C. Infection control strategies within the contaminated zone

The boundaries of the contaminated zone need to be clearly defined, because this has implications for surface management and for the placement of equipment. The goal during dental treatment is to contain contamination within this zone, both by determining what is touched and where the spread of droplets, splash and splatter will occur.

Reducing the extent of contamination of the dental operator can be achieved in part by use of rubber dam, pre-procedural antiseptic mouthrinses, high volume evacuation and correct patient positioning. Rubber dam minimises the spread of blood or saliva. When rubber dam is not applied, high volume aspiration becomes essential.

All surfaces and items within the contaminated zone must be deemed contaminated by the treatment in progress. These surfaces must be cleaned and the items in the zone disposed of, decontaminated, or cleaned and sterilised before the next patient is treated. Clinical contact surfaces in the contaminated zone that are not barrier protected must be cleaned after each patient.

Note: Any instruments placed into the contaminated zone for a treatment session but not used during that session must be regarded as contaminated. For this reason all bulk supplies such as opened boxes of gloves, cotton rolls or gauze must be stored outside the contaminated zone and protected from contamination from splashes and aerosols.

For equipment that is difficult to clean, a protective covering such as a plastic wrap may be necessary. Items where barrier protection may be required include:

- the operating light handle, the X-ray head, tubing for suction, triplex syringe, and instrument cradles;
- the polymerising light, intra-oral camera and fibre-optic illuminator; and
- the bracket table and handle.

Any surface barriers used on such surfaces should be disposed of after each patient treatment, and a new barrier placed.

In an operatory utilised by multiple dental practitioners, and where dental assistants are not routinely assigned to the same operatory, use of barriers may be preferable. However, if barriers are not used, then a documented cleaning protocol should be followed.

1. Clean and contaminated zones

Within the dental surgery, clean and contaminated zones must be clearly demarcated. Clean areas include those surfaces and drawers where clean or sterilised instruments are stored and that never come in contact with contaminated instruments or equipment. All dental staff must understand the purpose of and requirements within each zone, and adhere to the outlined protocols. A system of zoning aids and simplifies the decontamination process.

Dental practitioners and clinical support staff should not bring personal effects, changes of clothing or bags into clinical areas where cross-contamination is likely to occur.

It is recommended wherever possible that materials such as cotton rolls, dental floss, gingival retraction cord and restorative materials should be pre-dispensed from bulk supplies that are kept in drawers or containers to keep these bulk supplies free of contamination from splashes or aerosols.

However, if additional instruments and materials have to be retrieved from outside the contaminated zone during a patient treatment, it must be by a method that does not contaminate other instruments or materials in the drawers.

The options include:

- drawers are opened by elbow touch, and retrieval of instruments and materials is undertaken using a no-touch technique such as use of transfer tweezers, the use of overgloves or single use barriers on drawer handles. If transfer tweezers are used, these must be kept separate from the other instruments;
- gloves must be removed and hands decontaminated with ABHR before dispensing additional materials.

Whenever it is necessary to move from the contaminated zone to a clean zone to touch non-clinical items without a barrier, gloves must be removed and hands washed or decontaminated with ABHR before touching the item. The individual then must re-glove before re-entering the contaminated zone.

Cartridges of local anaesthetic must be stored appropriately to prevent their environmental contamination by aerosols, splatter and droplets generated by clinical patient care. Containers of medicaments, including topical anaesthetic tubes or jars and endodontic medicaments, must be kept free of environmental contamination.

2. Waterlines and water quality

Most dental unit waterlines contain biofilm, which acts as a reservoir of microbial contamination. Biofilm in dental unit waterlines may be a source of known pathogens (e.g. *Pseudomonas aeruginosa*, non-tuberculous mycobacteria, and *Legionella spp*). Waterlines must be cleaned and disinfected in accordance with the manufacturer's instructions. All waterlines must be fitted with non-return (anti-retraction) valves to help prevent retrograde contamination of the lines by fluids from the oral cavity.

An independent water supply can help to reduce the accumulation of biofilm. The manufacturer's directions for appropriate methods to maintain the recommended quality of dental water and for monitoring water quality should be followed. Biofilm levels in dental equipment can be minimised by using a range of measures, including water treatments using ozonation or electrochemical activation, chemical dosing of water (e.g. with hydrogen peroxide, peroxygen compounds, silver ions, or nanoparticle silver), flushing lines (e.g. triple syringe and handpieces) after each patient use, and flushing waterlines at the start of the day to reduce overnight or weekend biofilm accumulation. This is particularly important after periods of non-use (such as vacations and long weekends). Flushing each day has been shown to reduce levels of bacteria in dental unit waterlines.⁵

Air and waterlines from any device connected to the dental water system that enters the patient's mouth (e.g. handpieces, ultrasonic scalers, and air/water syringes) should be flushed for a minimum of two minutes at the start of the day and for 30 seconds between patients.

Water quality

Sterile irrigants such as sterile water or sterile saline as a coolant are required for surgical procedures such as dentoalveolar surgery and dental implant placement.

In line with the Australian drinking water quality guidelines, water for tooth irrigation during cavity preparation and for ultrasonic scaling should be of no less than potable standard (*Australian Drinking Water Guidelines 2011*).⁶ When treating immunocompromised patients, it is recommended that water from dental unit waterlines contain less than 200 colony forming units per mL. Bacterial levels can be tested using commercially available test strips or through commercial microbiology laboratories.⁷

3. Single use items

Single 'one patient' use sterile instruments should be used whenever indicated by the clinical situation. These items include, but are not limited to, local anaesthetic needles and cartridges, sutures and scalpel blades. Dental items designated as single use by the manufacturer must not be reprocessed and reused on another patient, but must be discarded after use.

Instruments that are very small and/or sharp and are difficult to clean should be considered single use. Such instruments must not be reused unless a validated and safe cleaning process is employed. This issue is very relevant to matrix bands, and stainless steel endodontic files, reamers and broaches. Such items are to be considered single use items as currently no cleaning method has yet been validated as being effective in removing organic material from these items.

Dental local anaesthetic solution and needles must be sterile at time of use and are single-patient use only. Incompletely used local anaesthetic cartridges must be discarded after each patient use. Similarly, suture materials, suture needles and scalpel blades must be used for one patient and then disposed of immediately into an approved sharps container.

⁵ Cobb CM, Martel CR, McKnight SA 3rd, Pasley-Mowry C, Ferguson BL, Williams K. How does time-dependent dental unit waterline flushing affect planktonic bacteria levels? *J Dent Educ.* 2002;66(4):549-55. Watanabe E, Agostinho AM, Matsumoto W, Ito I. Dental unit water: bacterial decontamination of old and new dental units by flushing water. *Int J Dent Hyg.* 2008;6(1):56-62.

⁶ See CDC (2003) *Guidelines for Infection Control in Dental Health-Care Settings*, page 29: "...the number of bacteria in water used as a coolant/irrigant for nonsurgical dental procedures should be ... at a minimum < 500 CFU/mL, the regulatory standard for safe drinking water established by EPA and APHA/AWWA."

⁷ Wirthlin MR, Marshall GW, Rowland RW. Formation and decontamination of biofilms in dental unit waterlines. *J Periodontol.* 2003 Nov; 74(11):1595-609.

D. Instrument reprocessing

Because contaminated instruments can transmit infections between patients, correct reprocessing of instruments between each patient use is essential. The type of instrument and its intended use will determine the method of reprocessing and, as a general rule, if an instrument cannot be cleaned it cannot be safely reprocessed. Reprocessing of instruments must be in accordance with AS/NZS 4815 for office practice or AS/NZS 4187 for hospital practice. For guidance on specific dental items in office practice, see section 12.4 of AS/NZS 4815.

1. Categories of instruments: infection risk relative to instrument use

Contaminated instruments can transmit infections to patients during clinical procedures. The risk of this happening is related to the site of use. How much reprocessing or preparation for reuse is required for reusable instruments and equipment depends on their intended use. The Spaulding classification describes three instrument/risk categories (critical, semi-critical and non-critical), each of which has specific reprocessing requirements.

Equipment and instruments that are used in the treatment of mucosal lesions or diseased soft tissue and that come in direct contact with mucosa and gingiva must be single use, disposable or cleaned and re-sterilised after each patient. Examples are electrosurgery, cryotherapy and related devices and tips.

Critical Item: Where there is entry or penetration into sterile tissue, cavity or bloodstream (e.g. surgical dental procedures such as the removal of a fully impacted tooth, extraction, and endodontic procedures on vital pulp tissue).

Examples: dental forceps and elevators, flap retractors and surgical burs, instruments used in the placement of implants, implantable items including mini implants, and surgical dental handpieces.

1. These instruments must be sterile at the time of use and must be either 'single use disposable' or capable of being steam sterilised.
2. Critical items must be used immediately after sterilisation or bagged prior to sterilisation and kept stored in bags until used. Instruments stored in bags that are found to be damaged must be re-sterilised before use.
3. It may be appropriate to use batch control identification for these surgical instruments.

Semi-critical Item: Where there is contact with intact non-sterile mucosa or non-intact skin.

Examples: mouth mirrors, restorative instruments, dental tweezers and probes, metal impression trays, and other non-critical items when used occasionally in the mouth (e.g. Le Cron carver).

1. Instruments must be sterilised where possible and when not possible a barrier must be placed (e.g. curing light tip).
2. Instruments should be 'single use disposable' or sterilised after use.
3. After processing, semi-critical instruments should be stored in a way to prevent contamination prior to use by being kept bagged in closed drawers or in dedicated containers such as instrument cassettes.
4. Instruments used in semi-critical procedures should, where possible, be sterilised between patients but do not need batch control identification and are not required to be sterile at the point of use.
5. In some rare instances thermal disinfection using heat and water is acceptable and professional judgement needs to be exercised (e.g. thermal disinfection of denture polishing buffs may be appropriate as these are unlikely to be contaminated with blood).⁸

Non-critical Item: Where there is contact with intact skin (lowest risk).

Examples: prosthetic gauges and measuring devices, face bows, protective eyewear, bib chains and Dappens dishes, Willis gauges. Cleaning alone with detergent and water is generally sufficient but in some cases thermal disinfection with heat and water is appropriate. After processing, these instruments should be stored in the same way as semi-critical instruments to prevent environmental contamination prior to use.

2. Instrument reprocessing area and workflow

Part of the dental premises must be designated as the reprocessing area for reusable instruments (including cleaning, packaging and sterilising) and not used for any other purpose. Ideally, this should be a dedicated room separate from the treatment room(s) but if not possible because of limited space, instrument reprocessing should occur well clear of the

⁸ This is based on the Spaulding classification system as described in section B4.1.1 of the 2010 NHMRC Guidelines

* Reprocessing is all steps necessary to make a contaminated reusable device ready for its intended use. These steps may include cleaning, functional testing, packaging, labelling, disinfection and sterilisation.

contaminated zone with good workflow processes established and when there is minimal risk of aerosol contamination of the reprocessing area.

The cleaning process should flow in one direction from contaminated area and items to clean area and items. If instrument washing must take place in the clinical or laboratory area due to limitations of space, then contaminated areas and instrument washing sinks must be clearly designated. Instrument flow must be in one direction: from contaminated through to clean. The instrument reprocessing area must be appropriate in layout and size for the volume of instruments being reprocessed.

To minimise particulate contamination and bio-burden (pathogenic bacteria, fungi and viruses), the principles of environmental control need to be observed. The reprocessing area must be divided into distinct areas for:

- receiving, cleaning and decontamination;
- preparation and packaging;
- sterilisation; and
- storage.

Processed instruments must not be stored in an area where contaminated instruments are held or cleaned or where there is a possibility of contamination from organisms carried in droplets or aerosols.

Design of the reprocessing area

The following are design features of the reprocessing area that will facilitate successful infection control:

- instrument flow in one direction – from dirty to clean;
- good lighting to minimise the risk of sharps injury and enable inspection of cleaned instruments;
- efficient ventilation;
- non-slip water-impervious flooring that is readily cleanable;
- smooth work surfaces without crevices made of non-porous materials such as stainless steel or laminate to facilitate cleaning. There must be no inaccessible areas where moisture or soil can accumulate;
- work benches of a standard height and storage cupboards located at heights that minimise bending over or stretching overhead;
- sinks must be deep enough and taps provided with anti-splash devices to prevent splashing. Ideally there should be several sinks - one for handwashing and one for washing contaminated instruments;
- both hot and cold water taps should ideally be non-touch or electronic in operation and liquid handwash dispensers should be operated by elbow, knee or foot;
- sufficient drawers, cupboards and shelves to keep work benches as clutter-free as possible and to facilitate storage of sterilised packages as well as general items such as labelling guns, logbooks, cleaning agents and self-sealing bags;
- sufficient bench space for drying and packaging areas to enable efficient work practices; and
- a cooling area for sterile items awaiting storage. This is essential to prevent damage to packs.

Trays of instruments, when removed from the steam steriliser, should be placed on racks and not directly on the bench to prevent damage from water condensation under the cooling packages.

3. Transfer of contaminated instruments and transfer of sharps

Instruments should be carried to the sterilising area in a cassette or in a container that preferably is lidded and puncture-proof, to minimise handling and prevent the potential for a penetrating injury if the container is dropped.

A systematic approach to the decontamination of instruments after use will ensure that dirty instruments are segregated from clean items. The contaminated instruments should be carried with gloved hands to the cleaning area and placed on the bench in the 'contaminated zone' of the sterilising room. The gloves must then be taken off and hands washed. Once the cleaning process commences, heavy-duty utility gloves must be worn.

Remember: instruments must pass in one direction only, from contaminated to clean.

4. Cleaning

Used dental instruments are often heavily contaminated with blood and saliva unless pre-cleaned by wiping at the chairside. Such pre-cleaning is strongly recommended because it improves the safety and effectiveness of instrument reprocessing. Dental instruments and devices that are contaminated with blood, saliva, cements and other contaminants must be treated to prevent the substances drying on them. This will reduce the need for intensive cleaning by hand at a later stage. It is recommended that gross soil be removed from instruments by wiping them at the chairside onto an adhesive-backed sponge or dampened gauze on the bracket table using a one-handed method to prevent the risk of sharps injury during the wiping action. Alternatively, if they are unable to be cleaned immediately, the instruments may be soaked in detergent or an enzymatic agent to prevent hardening of residue.

The presence of organic material left on instruments/equipment may prevent the penetration of steam during sterilisation therefore instruments must be completely cleaned before being disinfected or sterilised. Cleaning significantly reduces the number of microorganisms that need to be killed during sterilisation or disinfection. In addition, removing the organic material lessens the chance of microorganisms multiplying on the instruments before reprocessing commences. If saliva dries and coagulates – particularly if blood is present or if hot water is used for cleaning – it can entrap the organisms inside the mass formed and inhibit penetration of the sterilising/disinfecting agent. Even when these potentially disease-producing organisms are killed, released endotoxins may remain and may sometimes cause fevers in patients if introduced into cuts or wounds. Similarly, dislodged soil and foreign particles, even if sterile, can produce severe complications such as granulomas if they enter a cut in skin or ulcer in a breach of the oral epithelium.

Clinical support staff who clean and reprocess instruments must be given formal training in the relevant procedures. These staff must use heavy-duty utility (puncture and chemical-resistant) gloves, and wear eye protection/face shield and a mask. A waterproof/fluid-resistant gown/apron is also recommended. Cleaning techniques should aim to avoid spraying liquids into the air. Likewise, the lid should be kept on the ultrasonic cleaner when in use to prevent dispersion of aerosols and droplets of fluids.

Splashes of cleaning agents on a person's skin must be washed quickly with clean water and then treated in accordance with the manufacturer's instructions.

Instruments can be cleaned either by hand or mechanically (in either an ultrasonic bath or instrument washer/disinfector). Automated mechanical cleaning is preferred to manual cleaning as it more efficient, reduces the risk of exposure to blood and reduces the risk of penetrating skin injuries from sharp or pointed instruments.⁹

After either manual or mechanical cleaning, instruments should be checked visually under good lighting to ensure all soil/contaminants are removed. Damaged or rusted instruments must be repaired or discarded, and those with visible residue soil/contamination must be re-cleaned. If the item is not clean the sterilisation process for that item will be compromised.

Manual cleaning

Lukewarm tap water is suitable for manual cleaning of instruments. Hot water is not used at this stage as it coagulates protein which increases the difficulty of cleaning. In a like manner, cold water solidifies lipids and should not be used.

Cleaning dental instruments by hand is the least efficient method, but if used, the instruments should be fully immersed in a dedicated instrument cleaning sink that is pre-filled with warm water and detergent. A long-handled instrument brush should be used to remove debris until the item is visibly clean. A wire bur brush maintained in good condition may be used for cleaning tungsten carbide and diamond burs.

A mildly alkaline, low foaming, free rinsing non-abrasive liquid detergent should be used as this is much more effective than a neutral pH detergent in removing blood and fatty substances. Common household detergents must not be used due to their high foaming properties, and the difficulties in rinsing items free of detergent residue which in turn can interfere with the sterilising/disinfecting process. In addition, too much foam prevents the operator from seeing instruments under the water in the sink and thereby greatly increases the risk of cuts and penetrating injuries from sharp instruments.

⁹ See article by Miller CH, Tan CM, Beiswanger MA, Gaines DJ, Setcos JC & Palenik CJ. 'Cleaning dental instruments: measuring the effectiveness of an instrument washer/disinfector' *Am J Dent* 2000; 13(1): 39-43.

Abrasive cleaners such as steel wool and abrasive cleaning powders should not be used as these can damage instruments and residues may be left.

After manual cleaning, instruments are to be rinsed thoroughly to remove all traces of detergent with warm to hot running water, and then inspected visually under good light to ensure all surfaces of all instruments are clean.

Cleaning brushes used for manual cleaning must be washed, rinsed and then stored dry.

Mechanical cleaning

Mechanical cleaning of instruments can be carried out in instrument washers or ultrasonic cleaners. Instrument washers/disinfectors are more efficient at pre-sterilisation cleaning than either ultrasonic cleaners or manual cleaning. Instrument washers are also more efficient than a domestic dishwasher. It is not acceptable to use a domestic dishwasher to process dental instruments. Likewise, instrument washers must not be used as a substitute for sterilisation where the items can be sterilised.

There are both bench top and floor-mounted models of instrument washers for use in dental practice. These connect into the water supply and drainage systems and must be serviced according to the manufacturer's instructions. Such systems must comply with AS/NZS 2945 or AS 3836. Washer/disinfectors must be well maintained and cleaned regularly to prevent formation of biofilms that could contaminate the instruments being processed.

Ultrasonic cleaners that comply with AS 2773 may be used for instrument cleaning, especially for small items such as nickel-titanium endodontic files (following a validated protocol), and dental burs which are reprocessable. Ultrasonic cleaners are particularly useful for cleaning jointed instruments such as scissors, stainless steel syringes or those with serrated beaks such as artery and extraction forceps.

Items must be free of visible soil before being placed in an ultrasonic cleaner. In addition:

- lids, tank, gaskets and strainers must be cleaned daily;
- water must be de-gassed before use;
- cleaning fluid must be changed a minimum of twice daily (or when it appears heavily contaminated);
- an aluminium foil test (or another approved performance test) must be performed daily and the result recorded;
- the lid must be closed during operation (to avoid dispersal of aerosols);
- instruments must be completely submerged in fluid; and
- no part of the operator's fingers or hands is permitted to be immersed in the fluid during operation of the cleaner.

At the end of each day, the ultrasonic cleaner tank must be emptied, cleaned and left dry.

For further information see the ADA's *The Practical Guides* and www.ada.org.au.

Drying instruments

As residual moisture may impede the sterilisation process, instruments to be sterilised by steam should be dried. Suitable methods include using a drying cabinet, using a lint-free cloth or wipe, and using a short rinse in very hot water. Instrument washers have a drying cycle that eliminates the need for a separate drying step.

5. Packaging prior to steam sterilisation

Instruments that must be sterile at time of use (i.e. critical instruments that penetrate normally sterile tissue), must be bagged or wrapped prior to sterilisation. After sterilisation, critical instruments must remain bagged or wrapped until use. In an emergency situation a critical instrument may be processed unbagged and then transported to the operator in a sterile container for immediate use. Where possible, non-critical instruments should be stored in cassettes or bagged, since these methods facilitate storage and protect against contamination from aerosols.

Paper bags/wraps conforming to AS 1079.2 and textile linen wraps conforming to AS 3789.2 are suitable for steam sterilisation.

Paper and synthetic packaging is designed to be used once and then discarded, as contact with steam alters its properties.

Packaging and wrapping materials must permit the removal of air, the penetration of steam into the pack, and the removal of steam and water vapour after sterilisation. Likewise, cassettes used for packaging instrument sets must be perforated to allow for penetration of steam and efficient drying.

Instruments with hinges or ratchets must remain open and unlocked. Sharp instruments should be packaged in such a way as to prevent perforation of the pack.

Packs or bags must be sealed prior to processing. This can be done by using a heat sealing machine, applying steam steriliser tape, or by using bags that are self-sealing. String, domestic adhesive tape, staples and elastic bands are not suitable for sealing packs.

Identification colour-coded tapes on instruments must not be used as these can prevent the penetration of steam under the tape, may harbour microorganisms in their adhesive layer and may detach from the instrument during surgery, compromising patient safety. Further, silicone rubber rings used to identify instruments may impede sterilisation and if used, microorganisms may be present under the rubber ring after sterilisation, thus compromising the sterility of the instrument. Therefore, etching of instruments as a method of identification is preferred for critical instruments.

Adhesive stickers, felt tipped non-toxic marking pens, and rubber stamps using water-resistant ink may be used for the labelling of packs and bags on the laminated side of packs prior to sterilisation.

6. Steam sterilisation

Sterilisation is the process of rendering an item free of all forms of viable microorganisms, including spores. In office-based dental practice, the most efficient and simplest means of sterilising dental instruments is steam under pressure (commonly called steam sterilising or autoclaving). It involves the combination of heat and moisture maintained at the right temperature and pressure for the right length of time to kill microorganisms. The sterilisation process requires that all air in the chamber be replaced by steam.

Dry heat sterilisation and chemoclaves are not recommended for routine sterilising dental instruments and equipment. Ultraviolet light and boiling water do not sterilise instruments and must not be used.

Portable bench top steam sterilisers (formerly called autoclaves)

Small, portable or bench top steam sterilisers are the most reliable and efficient sterilising units for use in office-based practice. Such sterilisers must be TGA-approved and operated according to the standards AS/NZS 4187 and AS/NZS 4815 and manufacturer's instructions.

There are several types of sterilisation cycles including:

- N class cycles – used for unwrapped, solid items. Steam pushes the air downwards using gravity and forces it out a port in the bottom of the chamber;
- S class cycles – specified by the manufacturer and used with multi-pulse vacuum steam sterilisers to suit loads of certain types and configurations; and
- B class cycles – for hollow objects where the ratio of the length of the hollow portion to its diameter is more than 1:5. In these cycles there is a greater challenge for air removal. Air is exhausted by a mechanical pump to create a vacuum before steam is introduced into the chamber.

Some steam sterilisers are capable of being operated through more than one kind of cycle, depending on the circumstances and the type of instruments.

Maintenance and testing

All steam sterilisers must be commissioned on installation.

Validation of the sterilisation process

In order to ensure appropriate sterilisation of items in the surgery, a concept known as validation of the sterilisation process is undertaken. In order to ensure the items are sterilised, the function of the steriliser must be checked.

The validation process involves the following steps:

Commissioning (Installation qualification and operational qualifications)

A commissioning report includes installation documents and operation verification. This is performed by the service technician when new or repaired sterilisers are installed in the practice.

Performance qualification

- a. Physical qualification (by a qualified instrument technician or manufacturer's technician):
 - Calibration report (12-monthly); and
 - Penetration report which checks the physical attributes of the steriliser. This record is obtained after major repairs or when pack contents or packaging changes significantly.
- b. Microbiological Report to confirm functioning of the steriliser using a biological indicator (spore test).

The Validation Report summarises satisfactory completion of commissioning, operational and performance qualification. It is validation of the total process.

Monitoring of cycles

It cannot be assumed that sterilisation has been achieved without the appropriate testing and load checking. Time, temperature and, where applicable, pressure must be measured with continuous, automatic, permanent monitoring (e.g. process recorder, printer or data logger). Where these parameters are displayed on the devices/gauges of steam sterilisers which have no recording device, readings of the sterilising process should be documented at intervals of 10 seconds. Alternatively, a biological indicator (spore test) or chemical indicator (Class 4 or greater) for steam sterilisers or a Class 3 indicator for dry heat sterilisers can be used for each load. The processed chemical indicator must achieve all sterilisation parameters applicable to the indicator used and that information recorded.

The steam steriliser's performance must also be monitored by periodic testing (including daily and weekly tests as described in AS/NZS 4815).

Operating the steam steriliser

As with all infection control procedures, clinical support staff must be trained in the correct operation of the steam steriliser. An operator's manual must be available on site, and the unit must be used according to the manufacturer's instructions.

Before steam sterilising an instrument, the operator must verify that the item is suitable for the process (some instruments made of plastic cannot withstand the process).

Steam sterilisers which incorporate a **drying cycle** in their design can be used to process both wrapped and bagged items. Steam sterilisers **without a drying cycle** are suitable only for sterilising unwrapped items which must then be used immediately after sterilisation if they are critical items.

Steam steriliser performance tests

Steam sterilisers, particularly those capable of running a B Class cycle, are complex machines. It is necessary to regularly monitor the sterilisation process to ensure the process has met all parameters and that consequently the reprocessed instruments can be assumed to be sterile.

There are a range of tests that must be carried out prior to commencing the first sterilising cycle for sterilisers with a Class B cycle. In summary these include:

Leak rate test – A leak rate test is a simple push-button operation that is built into steam sterilisers with a Class B cycle. It tests the security of seals on the machine. Most modern pre-vacuum steam sterilisers incorporate automatic air leak

detection, and a leak rate test is only performed weekly. In the absence of automatic air leak detection, this test should be run every working day.

Air removal and steam penetration test (Class 2 chemical indicator) – Bowie-Dick-type test for use when processing porous loads, or a process challenge device (PCD) – also known as a helix test – for non-porous loads. For porous loads, a Bowie-Dick-type test must be performed before the first sterilising cycle of the day in order to determine whether the steam steriliser is operating correctly in terms of its air removal capabilities. When pre-vacuum sterilisers are used to process solid or cannulated (hollow) loads using type B cycles, a daily helix test is to be conducted.

Loading

The steam steriliser can only work effectively if steam can circulate freely and touch every surface of every instrument. The steam steriliser trays should not be crowded and items must not be packed one on top of the other. There are several stacking devices that enable correct loading of the steam steriliser. Correct loading also reduces damage to packs and their contents, and maximises the efficient use of the steam steriliser. To ensure air removal, hollow items should be loaded according to the manufacturer's instructions.

Items waiting to be sterilised must be stored in a dedicated 'pre-sterilisation' area, not in the steam steriliser. This will minimise the risk that these items might be recirculated as already sterilised instruments.

A Class 1 chemical indicator must be placed in each loading tray being processed if non-bagged items are loaded. For wrapped items, a Class 1 indicator must be included on the outside of each package as a visual check of the item having been through the process.

Drying

Steam sterilisers used to process packaged items must have a dedicated drying cycle so that a dry load is produced. Forced cooling of items by external fans or boosted air conditioning must not be used.

In those units without a drying cycle, allow unwrapped instruments to dry and cool in the steam steriliser before they are handled to avoid contamination and thermal injury. Cooling items must not be placed on solid surfaces since condensation of vapour inside the pack may result. Packaged or unpackaged items must never be dried by opening the door of the steam steriliser before the drying cycle is completed.

Unwrapped critical instruments that must be sterile at the time of use must be used immediately after completion of the sterilising process.

Checking the completed load

A number of variables influence the process of sterilisation: the quality of cleaning (residual bio-burden), the choice of packaging materials, the packaging technique, the steriliser loading technique, the sterilant quality (levels of ions and lubricants), and the cycle parameters (time, temperature, saturated steam). With regard to the latter, once the sterilising process (including the drying cycle) is complete, a number of checks need to be made and the results recorded.

Check the readings – pressure, temperature, time – on the steam steriliser's instruments and compare them to the recommended values. If any reading is outside its specified limits, the sterilisation cycle must be regarded as unsatisfactory (regardless of results obtained from chemical indicators) and the sterilising cycle repeated. If the second cycle is unsatisfactory, the steam steriliser must not be used until the problem has been rectified by an instrument technician. Logs and printouts must be retained for inspection and monitoring. Modern steam sterilisers have an integral printer or data logger to allow the parameters reached during the sterilisation cycle to be recorded for routine monitoring. For dental instruments and equipment, steam sterilisers must reach a holding temperature of 134-137 °C for three minutes for unwrapped loads. Existing older type bench top steam sterilisers must, where possible, be fitted with mechanisms to record these sterilising parameters electronically. If no such mechanism is available, parameters must be monitored and recorded manually or process indicators must be used for each cycle.

Visually check that bags and their contents are dry.

Check that the external (Class 1) chemical indicator on the bag and any internal (Class 4, 5 or 6) chemical indicators have made the required colour change. If one pack has not changed the whole load must be regarded as suspect.

Check each bag to ensure that it is undamaged and properly sealed.

Instrument packs must not be used if mechanical or chemical indicators indicate some flaw in the sterilising process.

If the bag/packaging is compressed, torn, unsealed or wet or if items have been dropped on the floor or placed on contaminated surfaces, the affected instruments must be considered contaminated and must be repackaged and reprocessed.

Steam steriliser monitoring tests

It is necessary to regularly monitor the sterilisation cycle to ensure the sterility of reprocessed instruments.

Chemical indicators

Chemical indicators show that certain temperatures, times and pressures have been reached during the sterilising process.

Instruments are assumed to have been sterilised when the correct sterilisation parameters have been achieved.

Chemical indicators provide information about conditions in the steam steriliser at the specific locations where they are placed, whether in the chamber, in packs of a steam steriliser load or in a process challenge device. Some indicators such as Class 1 types are only sensitive to changes of temperature whilst others such as Classes 5 and 6 are sensitive to variables such as temperature, time and water (as delivered by saturated steam).

Class 1 – these are intended for use on individual packs of wrapped instruments to indicate that the unit has been exposed to the sterilisation process (e.g. steam steriliser indicating tape, indicating labels). As noted earlier, if un-bagged semi-critical or non-critical instruments are processed, a Class 1 indicator must be placed in each load. For wrapped loads, the Class 1 indicator on each pack must be examined after the sterilising cycle to ensure that the pack has been exposed to a sterilising process. These indicators usually fail only when there is gross malfunction of the steam steriliser.

Class 2 – a specific test – either a Bowie-Dick-type test for use when processing porous loads or a helix process challenge device (PCD) for solid or hollow instruments – which measures the effectiveness of air removal and even penetration of steam in a pre-vacuum steriliser. Cool air pockets (which may be caused by an overcrowded chamber), incorrect wrapping, incorrect positioning, or incorrect use of packaging materials, are very common causes of failed sterilisation in downwards displacement steam sterilisers. Air pockets occur less often in pre-vacuum steam sterilisers.

With a pre-vacuum steam steriliser, an air removal test such as a helix test or Bowie-Dick-type test must be run each day. When using a B Class cycle to sterilise porous loads of cotton rolls, gauze post-extraction packs, cotton wool and the like a Bowie-Dick-type test is recommended. If hollow loads such as handpieces are to be sterilised in a B Class cycle the appropriate test is the helix type PCD.

Class 3 – indicators of this kind respond to only one critical variable (e.g. temperature). These indicators have poor accuracy and are only used with dry heat sterilisers. They have limited value in general dentistry.

Class 4 – are designed to react to two or more of the critical sterilising variables (e.g. time and pressure) and indicate exposure to a sterilisation cycle at the values of the variable as stated by the manufacturer. These show a gradual colour change during sterilising. Their accuracy is ± 2 °C and $\pm 25\%$ on time.

Class 5 – an integrating indicator indicating time, temperature and moisture sometimes called a biological emulator because it is timed to change colour at a temperature of 134 °C. It is at this point that the probability of residual viable organisms remaining is less than one in a million (the sterility assurance level). Their accuracy is ± 1 °C and $\pm 15\%$ on time.

Class 6 – Class 6 indicators have the highest precision – their accuracy is ± 1 °C and $\pm 5\%$ on time. A correct colour change indicates that the sterilising parameters of temperature, pressure and time have been achieved. A Class 6 indicator must be used in each load when using an 'on-loan' steam steriliser or when awaiting a technician to carry out IQ and PQ on a newly purchased or majorly-repaired steam steriliser or when using a steam steriliser without a printer.

Where instruments are intended to be sterile at point of use, and full validation of the cycle parameters has not yet been undertaken, an internal multi-parameter time and temperature chemical indicator should be used within each package. While AS/NZS 4815 permits chemical indicators between Classes 4 and 6 to be used for such a purpose, a Class 6 indicator is preferable because of its ability to provide additional information on steam quality that is not provided by Class 4 and 5 indicators.

Biological indicators

Only biological indicators that use highly heat-resistant spores actually show that sterility has been achieved. Steam sterilisers that have not been calibrated or validated should be monitored by a weekly test using a biological indicator or alternatively each load must be processed with a biological emulator. The preferred test organism for steam sterilisation is *Geobacillus Stearothermophilus*.

For further information see the ADA's *The Practical Guides* and www.ada.org.au.

7. Disinfection

Disinfection does not ensure the degree of safety associated with sterilisation because it does not always destroy all microbial forms (e.g. bacterial spores). It is not a sterilising process and must not be used where reusable instruments can withstand steam sterilisation. It may be used for non-critical instruments and some semi-critical (e.g. prosthetic instruments) which cannot be steam sterilised.

Thermal disinfection using washer-disinfectors

Thermal disinfection uses heat and water at temperatures which destroy pathogenic non-spore forming vegetative organisms. A common use for thermal disinfection in dentistry is for disinfecting some prosthetic instruments, polishing buffs and brushes. Most instruments used in dental prosthetics are semi-critical or non-critical items and many can be disinfected by heat and water in a thermal disinfectant. However, as single use disposable instruments are now available, the use of a thermal disinfectant should be minimised. If a high temperature thermal disinfectant is used the proper temperature and time parameters must be ensured.

The process

The item to be thermally disinfected must be cleaned prior to disinfection. If an item is not clean it cannot be disinfected. Wet instruments can be placed into the thermal disinfectant.

The chamber of the thermal disinfectant must be cleaned regularly. Most units connect directly to mains water and drain directly into the normal waste plumbing.

Small electric ovens and microwaves must not be used as a means of thermal disinfection in dental practice.

Chemical disinfection using instrument disinfectants – high level

For practical purposes there is no place for cold high level chemical disinfection (e.g. glutaraldehyde) in dentistry.

Chemical disinfectants should only be used when thermal disinfection is unsuitable (e.g. some prosthetic or laboratory items). Instrument disinfectants must be TGA-registered.

Different types of disinfectants must not be mixed or combined and must be used before expiry dates. Products must be used at the recommended concentration for soaking and exposure time. Unused product must be discarded each day – 'topping up' is not acceptable.

Instruments must not be stored in disinfectant solutions either before or after thermal disinfection or sterilising. Likewise, instruments must not be left overnight in solutions inside the chamber of an ultrasonic cleaner. Rather, the chamber should be emptied and the instruments rinsed thoroughly at the end of the day.

Ultraviolet cabinets must not be used for disinfection of instruments.

8. Storage of processed instruments

The correct storage of processed instruments is important to protect them from environmental contamination. In the dental surgery the major source of environmental contamination is splashes of fluids that strike items and surfaces, and aerosols of airborne bacteria and viruses which settle over time on instruments and equipment. Instrument cassettes and instrument packs must be kept in such a way that contamination from splashes and aerosols does not occur.

Semi-critical instruments

Storage of unwrapped semi-critical instruments and non-critical items must be in clean, dry, dust-free, dedicated containers or drawers to protect them from environmental contamination. Semi-critical instruments must be stored away from the contaminated zone, and in an area that is protected from splashing and aerosols produced during equipment washing, ultrasonic cleaning and reprocessing, or from clinical procedures and handwashing. Keeping trays and cassettes of semi-critical instruments in closed drawers, cupboards or lidded containers will help to protect them from contamination by aerosols and splashes. Storage containers used for semi-critical instruments must be kept clean, dry, dust-free and in good condition, and be cleaned periodically. Cardboard boxes must not be used as storage containers for instruments as these are porous, cannot be adequately cleaned and may harbour organisms.

Critical instruments

Critical instruments/items must be stored in a way that maintains the integrity of packs and prevents contamination from any source. This is necessary so that the instruments are sterile at the time of use. Items required to remain sterile must not be stored in ultra-violet cabinets or disinfectant solutions as these processes will compromise sterility.

It is important that critical wrapped instruments are stored in a clean dry area, and are subjected to minimal handling before use. During storage, packs can be contaminated by:

- over-handling – this can happen through excessive transferring from one place to another, or during rotation of instrument packs, from over-stocking storage areas or from bundling packs together using rubber bands;
- moisture – if the pack is placed on a wet bench top, splashed with water, other liquids or aerosols; or
- penetration – if instruments break through the surface of the pack.

A package is considered to be non-sterile when it:

- is damaged or open;
- comes out of the steam steriliser wet or is placed on a wet surface; or
- is dropped or placed on a contaminated surface.

Wrapped packages of sterilised instruments must be examined before opening to ensure the barrier wrap has not been compromised during storage. If there is any doubt that sterility was obtained during processing or the instrument pack has been compromised, re-clean, repack and re-sterilise.

Storage areas for sterilised instruments in packs must be dedicated for that purpose only and be free of dust, insects and vermin. For open shelving, all items must be stored above floor level by at least 250 mm, from ceiling fixtures by at least 400 mm, and protected from direct sunlight. This will facilitate environmental cleaning, allow unrestricted airflow and prevent heating and degradation of the packaging material.

Drawers or sealed containers are preferred for the storage of sterile wrapped items because the drawers or containers can be located at a height that allows the contents to be easily seen so that the most recently processed items are placed towards the back of the drawer. If the area used for storage is too small, too high, crowded or awkward it makes access difficult, which in turn increases the likelihood of compromising the packaging.

User checks to be made before using

The integrity of bagged/wrapped packs must be checked before using the instruments. Packages that show evidence of damage must not be used. Care should be taken when moving packages of instruments within drawers to reduce the chance of a surface breach through instruments perforating the paper or textile of the package.

Unwrapped semi-critical and non-critical items

As mentioned above, instruments must be stored dry, and in a way that will prevent contamination prior to use.

This can be achieved by storing in:

- instrument cassettes in drawers, cupboards or the like;
- trays in closed drawers lined with plastic sheeting; or
- trays or cassettes in sealable plastic containers with lids.

The drawers or containers must be cleaned with detergent and water periodically and all instruments in the drawers must be reprocessed before replacement in drawers.

Care must be taken to ensure that storage areas in the dental operator do not become contaminated. As described earlier, during patient treatment, de-gloving, overgloving or using a suitable no-touch technique (transfer tweezers) must be used to access items.

E. Documentation and practice protocols for infection control

1. Maintaining sterilisation records

Under section 8.2 of AS 4815, dental practitioners have a duty to maintain records relating to the sterilisation process. These sterilisation records include maintenance records, performance tests performed on the sterilising equipment (such as spore tests, air leakage and air removal tests), records of validation, and daily steriliser cycle records. The latter must incorporate batch information where batch control identification is used for packages of critical instruments. It is also necessary that records are maintained for daily tests on ultrasonic cleaners (such as the foil test).

Maintenance of these records provides evidence of quality management processes and allows for batch control identification of critical instruments. How long documentation needs to be kept varies depending on the states or territories, but is typically seven years. Since it is necessary to keep documentation for an extended period, if the steriliser data is not scanned or in electronic form, it is important that printer readouts remain legible for at least seven years. For this reason, ink based printouts are preferred as thermal printouts may need to be copied to ensure that they remain readable when archived.

For **each** sterilising cycle (even those that do not include any packs of critical instruments) the results of the cycle must be recorded, as follows:

- steam steriliser number or code (to identify the machine the item was sterilised in);
- date;
- cycle or load number;
- contents of load – e.g. wrapped or unwrapped items;
- cycle parameters used (time and temperature) – ensuring these are appropriate for the load type being processed – whether wrapped or unwrapped);
- batch numbers of packs included in that load (if any);
- result of the steam steriliser physical readouts or printout for that cycle;
- result of the chemical indicators used in the cycle. This checking should include all external and internal chemical indicators; and
- identification (signature or initials) of the person who has checked the steam steriliser readouts and chemical indicator result, and who authorises release of the load for use.

The above data showing that the steam steriliser met performance data must be recorded. The cycle record should be initialised by the dental staff member reviewing them. Keeping chemical indicators is not required as these are not a substitute for a permanent record of a sterilising process and because exposed chemical indicators may change with time and therefore are not a reliable record.

Routine recording of cycle data from sterilises enables identification of items should the question arise as to whether sterility problems or another failure occurred with the load.

The results of any performance qualification tests for sterilisers must also be recorded, including:

- the date of the test;
- the brand and type of packaging system tested;
- the type of biological indicator used and the batch number. It is important to check that the biological indicators to be used have not expired;
- the location and number of the steam steriliser (if there are multiple steam sterilisers in the practice);
- the name of the operator running the performance qualification; and
- the exact parameters which have been tested.

A certificate of calibration and operational qualification should be issued by the technician carrying out the process and also must be kept as part of the documentation for the dental practice.

Whenever instruments are packaged, it is essential to determine what steam steriliser cycle parameters are required for successful air removal and steam penetration. This validation of the conditions is necessary when there is a change in

the type of packaging material used. Validation must be repeated annually, even when there has been no change in the type or method of instrument packaging.

Validation of cycle parameters involves using multiple biological (**spore**) tests. For long thin pouches, it is necessary to use three biological indicators in each test pack, one placed at each end and one in the middle of the pouch. With larger packs, one indicator should be placed in each corner and one in the centre of the pack. The test pack with multiple indicators must be prepared in triplicate such that one can be processed on each of three consecutive cycles. A 10th indicator is not sterilised, but rather is used as a positive control. After the three cycles have been completed, the 10 biological indicators comprising the nine which have been processed, and the 10th (as a control) are then developed and the results recorded.

Where the parameters are appropriate for the removal of air and the penetration of steam, then all nine steam steriliser indicators should show no colour change, in other words, they should indicate complete killing of the spores or deactivation of the spore enzymes as appropriate. If there is a colour change, which signifies a failed test result, the holding time for the steam steriliser should be increased in increments of one or two minutes, and the entire validation procedure repeated, in order to establish the minimum time required. The results of the validation process must be recorded.

The information should include:

- The date of the test;
- The brand and type of packaging system tested;
- The type of biological indicator used and the batch number. It is important to ensure prior to the validation process that the biological indicators to be used have not expired;
- The location and number of the steam steriliser (if there are multiple steam sterilisers in the practice);
- The name of the operator running the validation tests; and
- The exact parameters which have been validated.

With instruments for routine dentistry that are handled in trays and do not require packaging, problems of air removal are minimal. For such loads, validation is not necessary. Rather, validation is directed to items required to be sterile at point of use (critical items).

For further information see the ADA's *The Practical Guides* and www.ada.org.au.

2. Batch control identification

As a quality assurance or risk reduction measure, dental practices should use a system for critical packages of equipment, i.e. those critical instruments used in surgical procedures. This requirement arises from AS 4815 section 8.5.2.1 which states that batch control numbers should be in place to link steriliser cycle batch information of a critical item that has been sterilised, to the patient. Batch control identification links a pack of surgical instruments used on a patient to a particular sterilising cycle and thereby allows dental practitioners to demonstrate that those critical dental instruments used on that patient have been through a particular steriliser cycle with verifiable performance data. This approach does not apply to semi-critical items used in routine dentistry. Thus, in office-based general dental practice the use of batch code identification would be limited.

A batch code comprises a simple sequence of numbers, such as that produced from a labelling gun, or can be combinations of a number sequence with codes for the date and the steam steriliser number (if the practice has several steam sterilisers). As described in AS 4815 section 8.5.2.1, the batch control identification includes the steriliser identification number or code (if there is more than one steriliser within the facility), the date of sterilisation, and the cycle or load number.

Batch information can be recorded on packs prior to steam sterilising using non-soluble permanent marker ink, or by using adhesive labels applied with a labelling gun, provided that the inks and adhesives used can tolerate steam sterilising. Several segmented (piggyback) adhesive label systems are available, where one part of the label is peeled off the pack when setting up for the procedure, and placed directly under the day's entry on the patient's hard copy chart.

At the time of the critical procedure, as instruments are removed from their packages, the now-empty packages should not immediately be placed into the waste, but rather put to one side in a clean zone of the operatory so that the batch

number information can later be recorded into the treatment records of the patient by the clinician responsible, as part of their writing up the notes for the procedure.

For further information on batch control identification see the ADA's *The Practical Guides* and www.ada.org.au.

3. Infection control for dental practitioners and clinical support staff

Immunisation

Dental practitioners and clinical support staff are at risk of exposure to many common vaccine-preventable diseases (VPDs) through contact with patients and the general community. Immunisations substantially reduce the potential for acquisition of disease, thereby limiting further transmission to other dental staff and patients. All dental practitioners and clinical support staff are to be advised to have immunisations and are to be offered relevant vaccinations consistent with the NHMRC's *The Australian Immunisation Handbook*.¹⁰

The current edition of the *Australian Immunisation Handbook* is the 9th edition, published in 2008. This resource can be accessed at: <http://www.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook-home>

The Immunise Australia website <http://www.immunise.health.gov.au/> provides further information and resources.

The expectations for all healthcare workers – and thus for dental practitioners and clinical support staff – is immunisation to HBV; varicella (if seronegative); measles – mumps – rubella (if non-immune); pertussis (whooping cough); and annual immunisation for viral influenza. Those who work with remote indigenous communities are advised to also receive immunisation for hepatitis A, while those at high risk of exposure to drug-resistant cases of tuberculosis should also undergo vaccination with BCG.

All dental practitioners and clinical support staff should be vaccinated against HBV if they have no documented evidence of pre-existing immunity (from natural infection or prior vaccination) and ensure they are assessed for immunity post-vaccination. After a full course of HBV immunisation or rubella vaccination, testing for antibody levels should be carried out to identify poor responders.

Dental practices should have education programs to support their immunisation strategy, and all dental staff should be advised of the potential consequences of non-immunisation. Any staff member has the right to refuse vaccination; however, this refusal must be documented with their reason for refusal noted and signed by him/her.

Immunisation records

The practice must develop and maintain regularly updated immunisation/health records for dental staff. It is recommended that dental staff also maintain their own immunisation and screening records.

Education

Dental staff must be provided with comprehensive training in the full range of infection control procedures that they are expected to know about and carry out in their day-to-day work. Regular refresher training is also appropriate to ensure that the necessary infection control measures are being complied with and understood.

New clinical dental staff should complete an induction program. This pre-service training should include the practical implementation of occupational health and safety and infection control measures used in the practice.

This induction program should comprise the following:

- general orientation to the physical environment of the practice;
- practice expectations in terms of infection control and safe working procedures;
- recommendations for vaccination prior to commencing work (HBV and others);
- reporting requirements for sharps injuries and workplace incidents;
- policy on wearing and cleaning of uniforms;
- emergency procedures for fire and medical emergencies;

¹⁰ See National Health and Medical Research Centre *The Australian Immunisation Handbook, 9th Edition* (2008), pp 104-107. <http://www.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook-home>.

- first aid procedures;
- management of waste streams and hazardous substances;
- confidentiality of patient information;
- identification of clean and contaminated zones;
- use of personal protective equipment;
- safety rules in terms of hair, footwear and jewellery;
- procedures for changeover between patients; and
- instrument cleaning and sterilisation.

To supplement and update the information provided from the initial induction, regular staff meetings should be held to discuss infection control matters.

Exposure incident protocol

In the healthcare environment, the term 'exposure incident' refers to any incident where a contaminated object or substance breaches the integrity of the skin or mucous membranes or comes into contact with the eyes. This includes:

- penetrating injuries of the skin caused by sharps (e.g. dental instruments, needles and scalpel blades);
- an injury that involves direct skin contact with blood or saliva visibly contaminated with blood and where there is compromised skin integrity, such as a cut, open wound, abrasion or dermatitis;
- bites or scratches inflicted by patients; and
- direct contact with blood or body fluids with the mucous membrane of the mouth, nose or eyes.

While the site where such sharps injuries are sustained can become infected with microorganisms, the major area of concern to dental practitioners and clinical support staff is the risk of the transmission of HIV, HBV and HCV by contaminated blood.

For exposures involving the skin, the larger the area of skin exposed and the longer the time of contact, the more important it is to verify that all the relevant skin area is intact.

To comply with occupational health and safety legislation, all exposure incidents must be recorded, and followed up. For sharps injuries, the required post-injury counselling may be undertaken by a designated medical practitioner or infection control practitioner. Services such as sharps injury telephone hotlines may also be of value.

Follow-up tests must be offered after a significant exposure incident, and blood samples for testing are obtained from the source (i.e. the patient) wherever practicable. These tests include HBV, HCV and HIV. Where the source is positive, follow-up tests will need to be repeated at intervals for the injured person, to assess the status of seroconversion. Post-exposure prophylaxis may be available from public hospitals. This process would normally be overseen by specialists in infectious diseases.

For further information see *Appendix: Blood and Body Fluid Exposure Protocol*.

4. Infection control manual and other practice management issues

Each dental practitioner has a duty to:

- take a detailed medical history to establish if a patient may be more susceptible to infection and therefore may require transmission-based precautions to prevent infection (e.g. patients with leukaemia or neutropenia may require antibiotic prophylaxis);
- ensure adequate physical facilities are maintained and all equipment is always in sound working order by regular quality checks; and
- provide infection control education and training in hygiene and management of infectious hazards.

This information should be provided when employees are first appointed.

Dental practices should:

- maintain awareness of new vaccine-preventable diseases (such as H1N1 and other forms of viral influenza), and ensure dental staff at risk are fully immunised when these vaccines become available (including annual influenza immunisation);
- offer testing following occupational exposure such as a sharps injury;
- ensure dental staff are adequately informed of the rights and responsibilities of patients, especially in their right to refuse to give information on their infectivity status or to refuse to be tested for a bloodborne virus;
- develop a plan for infection control within the practice;
- provide dental staff infection control measures including personal protective equipment and immunisation, effective reporting systems for breaches of protocols and safe work practices;
- inform dental staff when they are employed of the health screening policies of the practice;
- inform patients of the risks associated with their dental care and the protocols in place for protecting their privacy and confidentiality;
- inform patients of the infection control strategies in place and provide information about procedures for dealing with concerns about infection control procedures; and
- provide a specific program of education and training in infection control principles, policies and procedures for dental staff.

Infection control manual

A comprehensive infection control manual which is pertinent to the daily routines of the practice must be developed. It must describe the infection control procedures for the practice as a whole and be used as the foundation for training dental staff. All staff in the practice need to know who is responsible for ensuring certain activities are carried out and to whom to report any accidents or incidents.

The manual must include information about and specifications for:

- methods of hand hygiene (both routine and surgical);
- personal protective equipment requirements;
- setting up the treatment area between patients;
- environmental cleaning protocol;
- defined zones that require barrier protection and cleaning between patients;
- protocol following an exposure incident, e.g. a sharps injury;
- handling and disposal of sharps;
- waste disposal;
- processing of reusable items (cleaning, packaging, sterilisation, disinfection, storage);
- processing of radiographs in a manner to avoid cross-contamination;
- quality control mechanisms including documentation for the maintenance and monitoring of equipment;
- immunisation requirements;
- single use items;
- recording of information during patient treatment in a manner to avoid cross-contamination;
- use of computers and computer-run equipment during patient treatment in a manner to avoid cross-contamination;
- management of waterlines used in direct patient contact; and
- handling latex allergy in dental patients and dental staff.

Practice manuals must be updated regularly if and when new guidelines are produced from the Dental Board, the ADA and the NHMRC.

F. Special areas and their particular dental infection control requirements

Some aspects of dental care, or particular settings in which dental care is provided, present specific challenges to dental practitioners and clinical support staff in implementing effective infection control measures. These are outlined below.

1. Dental radiology and photography

Any items or materials placed in a patient's mouth which are subsequently removed for processing must be considered biologically contaminated and must be handled in a safe manner. Gloves must be worn when taking radiographs and handling contaminated film packets or sensors. Other personal protective equipment (e.g. mask, protective eyewear) must be used if spattering of blood or other body fluids is likely. The use of heat-tolerant or disposable intra-oral radiograph devices (unless using digital radiography) is recommended wherever possible and these semi-critical items (e.g. film-holding and positioning devices) must be cleaned and then either heat-sterilised or barrier protected before use on subsequent patients.

Exposed radiographs need to be transported and handled carefully to avoid contamination of the developing equipment. After exposure of the radiograph, dry the film packet with a paper towel to remove blood or excess saliva and place in a container (such as a disposable cup) for transport to the developing area.

Protective barriers should be used on developing equipment where possible, and when surfaces become contaminated the surfaces must then be cleaned.

Radiography equipment (e.g. radiograph tube head and control panel) which has become contaminated must be cleaned after each patient use. Alternatively, barrier protection can be applied which must be changed after each patient use. Digital radiography sensors come into contact with mucous membranes and are considered semi-critical devices and they must be cleaned and covered with a barrier before use on subsequent patients.

Most state regulations accept film packets and barrier envelopes that have been contaminated with saliva or blood to be disposed of as general waste. However, some regional authorities require these to be treated as contaminated medical waste which is placed in yellow containers or plastic bags which are appropriately marked with the international biohazard symbol and collected and disposed of by a licensed operator.

2. High technology intra-oral equipment and devices

High technology intra-oral equipment and devices include, for example:

- the handle and tip of the curing light;
- CAD/CAM;
- computer components associated with CAD/CAM and other electronic devices;
- air abrasion;
- intra-oral cameras and image capture devices;
- lasers;
- apex locators;
- electronic periodontal probe;
- occlusal analysers; and
- electrosurgery units.

Dental practitioners and clinical support staff should consult the manufacturers about the appropriate barrier and cleaning/sterilisation procedures required for these devices. If the item is exposed to mucous membrane or body fluids and cannot tolerate heat sterilisation then, at a minimum, it must be cleaned first then protected with a single use barrier before patient use.

When replacing barriers:

- remove the contaminated barrier/covering while gloves are still on;
- remove gloves and decontaminate/wash hands;
- if there is any chance of saliva or blood contamination of the item it should be cleaned by wiping with a neutral detergent before the next barrier is put in place; and
- it is not always essential (but it is highly recommended) to clean items between change of barriers.

Barrired items must be cleaned each day.

Curing light

Curing light tips are semi-critical pieces of equipment and should be heat sterilised or have an appropriate barrier placed over the tip for each patient. Although some curing light tips may be heat sterilised this is not necessary if an appropriate barrier has been applied to the tip during the treatment of the patient. Another advantage of a barrier is that the sensitive light-conducting rods are protected from accidental damage or material contamination. Barrier protection is an appropriate level of infection control for all light curing tips, as the equipment is not intended to contact mucosa. The handle of the curing light and the tips must always be cleaned prior to having the barriers placed and a new barrier used for each patient.

Air abrasion, electrosurgery units and lasers

Electrosurgery units, dental lasers and air abrasion/particle beam devices create particular bio-aerosol hazards, and high volume suction devices are essential during their use. Air abrasion devices create alumina dust, which can be a respiratory irritant for dental practitioners and clinical support staff as well as patients.

Some pathogenic viruses such as human papilloma virus are not inactivated by laser or electrosurgery procedures and remain viable within the plume (smoke) created from soft tissue vaporisation. Most bacteria and viruses are rendered non-viable by laser or electrosurgery, even though fragments may be present in the plume. Moreover, the presence of an infectious agent in plume might not be sufficient to cause disease from airborne exposure, especially if the agent's normal mode of transmission is not airborne. There is no evidence that bloodborne viral diseases such as HIV or HBV can be transmitted through aerosolisation and inhalation of plume or other dental aerosols. High filtration surgical masks combined with high volume suction can prevent inhalation of particles in plume by dental practitioners, clinical support staff and patients. As well as particles of tissue and fragments of microorganisms, plume also contains gases (e.g. hydrogen cyanide, benzene and formaldehyde) which are irritant and noxious. Evacuation systems which will remove plume vapour and particles must be used whenever electrosurgery units, dental lasers and air abrasion/particle beam units are in use.

Implants

In the surgical procedures involved in the placement of implants both the instruments used and the implants must be sterile at the time of use. Full aseptic procedures with sterile fields must be employed. Explanted devices must not be reprocessed and reused.

3. Dental laboratory and dental prosthetics

Standard precautions and safe work practices must be used in the dental laboratory. The most important phase is the thorough cleaning of material that has contacted oral tissue (e.g. impressions). Thorough rinsing with cold running water, followed by the application of a diluted detergent and further rinsing must continue until all visible contamination is removed.

Manufacturers' instructions for disinfectants need to be carefully followed when cleaning and disinfecting prosthetic items and materials. Even after cleaning there may still be biological contamination present and at all stages of handling of the prosthetic item standard precautions must be applied.

These include:

- all materials, impressions, dental prostheses, intra- and extra-oral appliances must be thoroughly cleaned before insertion and adjustment;
- the area for grinding or cutting plaster and making models and the area for instrument management and sterilisation must be well separated and not used at the same time if both procedures utilise the same room;
- implantable items must be sterile at time of implantation;
- any instruments, equipment, attachments and materials which are used in the operatory on contaminated prostheses or stages of prosthetic work should be either single use or cleaned and preferably heat sterilised after each patient use. If unsuitable for heat sterilisation these items should be thermally disinfected (e.g. polishing mops); and
- when polishing appliances which have been worn in the mouth, repaired appliances or relined appliances, polishing pumice should be dispensed for individual use and the pumice tray cleaned after each use.

All materials transported to and from dental laboratories must first be cleaned and placed in a sealed bag or container.¹¹

For further information on infection control in the dental laboratory see the ADA's *The Practical Guides* and www.ada.org.au.

4. Handpiece management

All dental handpieces must be cleaned and lubricated in accordance with the manufacturer's instructions and must be sterilised after each patient. Similarly, ultrasonic scaler handpieces must be sterilised between patients. The exterior surfaces of handpieces must be cleaned thoroughly, and then their internal aspects cleaned and lubricated prior to sterilising, according to the manufacturer's instructions (e.g. using an aerosol spray can or an automated lubricating device). Care needs to be taken to ensure lubricants used do not compromise the sterilisation process and this can be achieved by replacing each week the deionised water in steam sterilisers which recycle water from one cycle to the next. Because of their lower oil dosing rates, it is strongly recommended that automatic flush-through and lubricant systems be used for cleaning and lubricating dental handpieces. After sterilising, handpieces must then be stored in a way to prevent contamination. Handpieces should not be fitted to the dental unit until the time of use on a patient and once fitted to the dental unit and exposed to contamination during treatment they must be reprocessed even if not actually used on that patient.

There continues to be debate about the effective decontamination of handpieces. In theory, a pre-vacuum steam steriliser will remove the air from the lumen of a dental handpiece, allowing steam to penetrate more quickly. Current opinion is that effective pre-sterilisation cleaning of dental handpieces and subsequent processing in a downward displacement steam steriliser is acceptable for general dental treatment. Surgical handpieces must be sterilised using a B type cycle in a pre-vacuum steriliser.

If a dedicated handpiece cleaning system is not used, the following protocol should be adopted for the pre-sterilisation cleaning of handpieces:

- place a blank bur in the chuck during cleaning to prevent contamination and damage of the handpiece bearings;
- clean the outside of the handpiece with detergent and water – never clean or immerse the handpiece in disinfectant solutions or the ultrasonic cleaner;
- lubricate the handpiece with pressurised oil for the recommended period;
- clean off excess oil;
- sterilise in a steam steriliser; and
- run the handpiece briefly before use to clear excess lubricant.

For further information on handpiece management see the ADA's *The Practical Guides* and www.ada.org.au.

¹¹ Some states/territories specify disinfection plus cleaning; check with local authorities about transport process requirements.

5. Specimens

To protect those handling and transporting biopsy specimens, each specimen must be placed in a sturdy, leak-proof container labelled with the biohazard symbol. Gloves must be worn when handling pathology specimens and specimen containers. Once the specimen has been placed in the container, this must be packaged appropriately in a sealed container to prevent leakage during transport. Appropriate biohazard labelling must be placed on pathology specimen containers before dispatch. It is preferable to use plastic zipper bags carrying the appropriate designation provided by the pathology laboratory. If a biopsy specimen container is visibly contaminated, clean and disinfect the outside of the container before placing it into the transport bag or container.

6. Nickel-titanium (NiTi) endodontic files

When nickel-titanium endodontic rotary files are reprocessed the pre-sterilising cleaning process must be validated as being effective. A verifiable process is described below.¹²

Cleaning rotary nickel-titanium endodontic files

- Immediately after use remove stoppers and insert the files into a scouring sponge soaked with chlorhexidine gluconate aqueous solution;
- Clean the files by using 10 vigorous in-and-out strokes in the sponge;
- Place the files in a wire mesh basket and immerse in a suitable enzymatic cleaning solution for 30 minutes;
- Follow this by 15 minutes ultrasonification in the enzymatic cleaning solution;
- Drain and rinse in running water for 20 seconds;
- Proceed to steam sterilisation.

Relative Analgesia

Most componentry of relative analgesia equipment can be sterilised. The exceptions are usually the scavenger control valve, (the vacuum control block) and depending on the model the fresh gas hose. Re-usable masks must be cleaned and sterilised. Cleaning can be done manually or by thermal disinfectant. All sterilisable components can be processed in a steam steriliser at 134 °C. Some nasal hoods (masks) are disposable and these must be discarded, not reused.

7. Nursing home visits

There are many dental patients whose dental treatment must be provided in a nursing home, and occasionally there is a bedridden patient at a private home or hospital who needs dental care. The often inadequate facilities can make the provision of treatment difficult.

In providing dental care in these settings, standard precautions apply – these include wearing gloves and other protective clothing and proper hand decontamination. Dental practitioners and clinical support staff may need to carry all necessary personal protective equipment with them.

During transport, all instruments and materials must be carried in lidded metal or rigid plastic clean containers to prevent damage or spillage. After use the instruments must be placed in a rigid sealed container for transport back to the dental surgery for cleaning and reprocessing. Where possible, instruments should be cleaned immediately after use with detergent and water or sprayed with a cleaner to prevent hardening of debris before transport back to the dental clinic or laboratory.

Items such as impressions, try-ins and articulators must be transported in sealed plastic containers. Impressions should be rinsed of blood and saliva prior to transportation to the laboratory.

Waste should be separated at the point of generation. General waste should be disposed of in the general waste of the nursing/private home or hospital. Sharps and medical waste must be dealt with according to State regulations (a designated sharps container (AS/NZ 3816) must be transported with other instruments and equipment for this purpose).

¹² Taken from: Parashos P, Linsuwanont P, Messer HH. 'A cleaning protocol for rotary nickel-titanium endodontic instruments' *Aust Dent J* 2004; 49 (1): 20-27.

G. Infectious diseases, allergies and transmission-based precautions for infection control

There are some situations that require additional infection control measures from those standard precautions already outlined.

These additional measures are now referred to as transmission-based precautions. Transmission-based precautions must be applied for patients with known or suspected infectious diseases not managed by standard precautions alone, for example, tuberculosis, measles, avian flu and SARS. Transmission-based precautions are tailored to the specific infectious agent concerned and may include measures to prevent airborne, droplet or contact transmission.

1. Creutzfeldt-Jakob disease (CJD)

In all patients with potential CJD infection, including those in both high and low risk categories, instruments used in routine dental and endodontic procedures which come into contact with lower infectivity tissues can be routinely reprocessed.¹³

Nearly all patients and dental procedures fall in this category.

For further information see the link on the ADA's website to the chapter on Classical Creutzfeldt-Jakob disease in the *Creutzfeldt-Jacob Disease Infection Control Guidelines*.

2. Measles, mumps, tuberculosis

Infection by airborne transmission of respiratory secretions can occur with pulmonary tuberculosis and measles. Tuberculosis is spread by droplets or by direct contact and has been transmitted as a result of dental procedures. Patients with these diseases should have their dental treatment deferred until they are no longer infectious.

A dental practice which considers treating such patients should only do so after having conducted a written risk assessment. Most patients for whom transmission-based precautions are required would normally be quarantined to their home or too ill to consider any treatments other than relief of the most severe dental infection, given that pain can be reduced through the appropriate use of analgesics until the patient is no longer infectious and has reached the end of any mandatory period of quarantined.

Where treatment cannot be deferred (e.g. facial swelling) transmission-based precautions must be used for provision of dental treatment. The patient should be seen as the last patient of the day, appropriate barrier precautions must be used and staff assisting in the dental treatment must be aware of their immune status for the relevant infectious disease of the patient. The use of rubber dam, where possible, for restorative work is recommended to reduce exposure of dental practitioners and clinical support staff to potentially infected aerosols. When treating such patients it would also be prudent for clinical staff to wear well-adapted close fitting masks with high filtration capabilities (such as P2/N95 surgical respirators). It would also be prudent to use additional cycles of surface cleaning at the end of the appointment.

3. *Staphylococcus aureus* (MRSA)

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacterium which is resistant to common antibiotics and, as a result, infections caused by this organism are difficult to treat. MRSA colonises the nose, axillae and perineum, and abnormal skin (such as wounds, ulcers and eczematous skin). It is not normally found in the oral cavity but may occasionally be isolated from oral infections. No special infection control precautions are necessary for the dental treatment of patients colonised with MRSA but care should be taken to prevent colonisation of the operator. Care should be taken to limit the zone of contamination and in disposal of waste. MRSA can survive on surfaces such as computer keyboards for days and for weeks under acrylic nails.¹⁴ Dental staff who are known to be colonised with MRSA must not undertake or assist with major surgical procedures in hospitals.

¹³ See section B5.2 of the 2010 NHMRC Guidelines

¹⁴ See e.g. articles by: Schultz, Gill, Zubairi, Huber, Gordin (2003) Bacterial contamination of computer keyboards in a teaching hospital; and Rutala, White, Gergen, Weber (2006) Bacterial Contamination of Keyboards: Efficacy and Functional Impact of Disinfectants.

4. Avian flu

Avian flu is a highly pathogenic and contagious Type A H5N1 influenza virus which normally only infects birds and occasionally pigs. Should avian flu enter Australia as a human-to-human transmission of the virus, transmission-based precautions will be essential.

For further information on avian flu see www.ada.org.au.

5. Latex sensitivity of dental practitioners and clinical support staff or patients

Suspected natural latex allergy (NLA) in dental practitioners, clinical support staff or patients must be treated as a serious medical issue.

Symptoms may manifest as delayed hypersensitivity such as rash, conjunctivitis or rhinitis (Type 4), which could then progress with time to an acute allergic anaphylactic reaction (Type 1), which may result in death.

All patient medical histories and new dental staff employment forms must include questions about NLA and/or sensitivity or allergy to latex/rubber products. Patients, dental practitioners or clinical support staff with proven anaphylactic reactions to latex may need to wear a medical alert bracelet and carry self-injectable adrenaline.

If latex sensitivity is identified, then a 'latex free' environment should be created for the persons affected. This involves the use of latex-free gloves and removal from the operatory of other identifiable latex products that are likely to cause a reaction. Such items would include latex gloves, bungs in some local anaesthetics, latex prophylaxis cups, latex components of relative analgesia equipment, latex rubber dam, rubber bite blocks, and latex rubber alginate mixing bowls. Non-latex versions of gloves, prophylaxis cups, dental dam, bite blocks, and alginate mixing bowls are available. When selecting hand care creams, care should be taken to ensure latex and chlorhexidine compatibility. These creams should not be petroleum-based.

For further information on latex sensitivity see the ADA's *The Practical Guides* and www.ada.org.au.

6. Bloodborne viruses and the infected dental practitioners

Infection control against bloodborne viruses is based on the premise that for a person to be infected all of the following three conditions must be present:

- a susceptible host (i.e. anyone who is exposed to body fluids containing Human Immunodeficiency Virus (HIV), HCV or HBV or anyone who has not been vaccinated against HBV or who does not have HBV antibody);
- a virus with sufficient virulence (infectivity) and dose (numbers) to cause infection; and
- a portal through which the virus may enter the host, that is, a break in the skin or sharps injury.

Although transmission of bloodborne pathogens (e.g. HBV, HCV, and HIV) in dental healthcare settings can have serious consequences, such transmission is rare. Exposure to infected blood can result in transmission from patient to practitioner, from practitioner to patient, and from one patient to another. All patients need to be treated as potentially infectious and standard precautions applied to minimise the risk of transmission of infection from person to person.

Exposure prevention methods and exposure prone procedures

Avoiding occupational exposures to blood is the primary way to prevent transmission of HBV, HCV, and HIV. Exposures occur through percutaneous injury (e.g. a penetrating injury or cut with a sharp object), as well as through contact between potentially infectious blood, tissues, or other body fluids and mucous membranes of the eye, nose, mouth, or non-intact skin (e.g. exposed skin that is chapped, abraded, or shows signs of dermatitis).

The majority of exposures in dentistry are preventable, and methods to reduce the risk of blood contacts have included: use of standard precautions, use of devices with features engineered to prevent sharp injuries, and modifications of work practices. Dental practitioners and students have a responsibility to know their antibody status for bloodborne viruses such as HBV, HCV and HIV. Those who carry a bloodborne virus have a legal, professional and ethical responsibility to review the way they practice dentistry in line with medical advice from their treating specialist physician and advisory panels. They must avoid exposure prone procedures if they are viraemic. Current national policies for managing healthcare workers with a bloodborne viral illness should be followed.

Appendix

Blood and Body Fluid Exposure Protocol

First aid

- Stop work immediately, regardless of the situation (e.g. even if administering local anaesthetic or undertaking another type of invasive procedure).
- Allow the wound to bleed and clean it thoroughly with soap and lukewarm water. There is no benefit in squeezing the wound. Do not apply disinfectants as some are irritants and retard healing.
- Flush mucous membranes/conjunctiva with normal saline or water. If contact lenses are worn, remove after flushing eye and clean as usual.
- Further management of the wound is dependent on the nature of the injury.

Assessment and record

An assessment of the risk of transmission is an urgent priority to determine whether post-exposure prophylaxis (PEP) is necessary.

Expert medical advice from an S-100 prescriber or an infectious diseases specialist is usually required to determine the need and type of PEP for the exposed person and the necessity or otherwise of testing the blood of the patient after appropriate pre-testing counselling.

Each dental practice should have a clear set of written instructions on the appropriate action to take in the event of a sharps injury to either staff or patients. These instructions should include emergency contact numbers for expert advice (this should name the medical practitioner experienced in dealing with such cases; they must be easily accessible and understood; and all dental practitioners must follow them.

A full record of the incident should be made including details of:

- who was injured;
- how the incident occurred;
- the type of exposure;
- the presence of visible blood on the device causing the injury;
- whether a solid sharp object or hollow bore object or needle was involved;
- the gauge of the needle;
- the time the injury occurred;
- what action was taken;
- who was informed and when; and
- the details of the patient being treated.

Factors that influence whether an exposure has the potential to transmit a bloodborne virus (BBV) infection include:

- the type of exposure (mucosal splash vs. a deeply penetrating skin injury);
- the type of body substance (e.g. how much blood is present in the saliva);
- the volume of blood or body fluids;
- the length of time in contact with blood or body fluids; and
- the time which has elapsed since the exposure.

In addition, to complete an accurate assessment after a sharps injury, the following factors should be considered:

- the type of device involved;
- the procedure for which the device was used (e.g. into a vein or artery);
- whether the injury was through a glove or clothing;

- whether a deep injury occurred in the exposed person; and
- whether the source patient is viraemic (e.g. with advanced/terminal HIV disease or a high viral load).

Finally, the record of all these details should be signed by those involved in the incident.

Testing

Testing should be offered following all occupational exposure to blood or body substances, particularly all 'contaminated' sharps injuries (e.g. those involving exposure to blood or blood-contaminated saliva via an instrument, bur, or contaminated wire).

Baseline tests

Baseline serum is requested from the injured staff member AND the patient (known source). The staff member should be tested at the time of the injury to establish their serological status at the time of the exposure for:

- HIV antibody;
- HCV antibody; and
- antibody to hepatitis B surface antigen (anti-HBs).

This testing should be done as soon as possible after the injury (ideally the same day), bearing in mind the window period of the tests. If the source patient is found to be positive for a BBV, additional testing of the injured person may be required and assessment by an infectious disease physician is recommended.

If the injured staff member has ever had a blood test that demonstrates HBV immunity (anti-HBs antibodies > 10 IU/mL) – whether from vaccination or past infection – they are protected, and there is no need for hepatitis B immunoglobulin after a potential or confirmed exposure to HBV.

Testing the source patient

If a situation arises where there is a need to know the infectious status of a patient (such as a sharps injury), the patient has a responsibility to provide information or consent for testing that enables the practice or responsible health professional to ensure the safe management of the injured staff member. Informed and voluntary consent must be obtained before taking a blood sample to test for any purpose. When the responsible medical practitioner is obtaining this consent, the patient should be offered pre-test counselling to provide details on the test procedure, and the long and short-term consequences to the patient of the test results.

Post-test counselling may also be required, particularly if the result is positive.

The source individual should be tested for:

- HIV antibody;
- HBsAg (hepatitis B surface antigen); and
- HCV antibody (hepatitis C antibody).

If the source individual tests positive for either of these hepatitis B or C markers, additional tests would usually then be ordered to assess infectivity (e.g. hepatitis B 'e' antigen, HBV DNA, and HCV RNA – the latter two by polymerase chain reaction assay).

Refusal for testing

If the source patient refuses testing, this refusal for testing should be documented. In this case, treat the situation the same as the 'positive patient' scenario below, and consider whether post-exposure prophylaxis and appropriate long-term follow-up should be offered.

Source negative

If blood tests show that the source patient is negative for HIV, HBV and HCV, no further follow-up of the exposed staff member is generally necessary, unless there is reason to suspect the source person:

- is seroconverting to one of these viruses; or
- was at high risk of bloodborne viral infection at the time of the exposure (because they have recently engaged in behaviours that are associated with a risk for transmission of these viruses).

The window period causes a FALSE NEGATIVE test result. The patient may be infectious, but this is undetectable by testing. The window period for HIV is usually three months but it can, very rarely, be longer. The use of the polymerase chain reaction (PCR) testing for HIV/viral RNA can identify 90% of infections within four weeks, significantly reducing this window period. The window period is six months for HBV and HCV.

Source positive for hepatitis B

If the source is KNOWN or SHOWN to be positive for hepatitis B surface antigen (HBsAg), the level of antibodies is important. If the staff member is immune to HBV (anti-HBs antibodies > 10 IU/mL), they are protected. If levels of immunity are relatively low (i.e. between 10 and 100 IU/mL), a booster injection would be prudent.

If the staff member is NOT IMMUNE (e.g. has never been immunised, did not seroconvert to the vaccine (a non-responder), or has antibody levels to HBsAg less than 10 IU/mL), the correct treatment is to:

1. Give a single dose of hepatitis B immunoglobulin (HBIG) within 48-72 hours;

AND

2. Start a course of HBV immunisation. HBV vaccine should be given within seven days of exposure, and then repeated at one to two months and again at six months after the first dose. Following the final vaccine dose, the level of immunity (antibodies to surface antigen) should be checked two to four weeks later.

If this HBV prophylaxis is not undertaken, the risk of transmission of HBV is 6.3% if the source is 'e' antigen negative, but more than 30% if the source is hepatitis B 'e' antigen positive.

Source positive for hepatitis C

If the source is KNOWN or SHOWN to be positive for antibodies to HCV, there is no effective post-exposure prophylaxis (PEP) for HCV. The risks of transmission after a sharps injury from a positive source varies according to whether active viral replication is occurring. If the source is HCV RNA negative by PCR assay, the risk is 1.8–3.1%; however, the risk increases to 10% if the source is PCR positive.

The injured staff member should be re-tested for HCV antibodies at three and six months, in addition to their baseline test. In addition, regular liver function tests such as ALT and AST (e.g. at two, three and six months) can be undertaken and possible clinical signs and symptoms monitored by an infectious diseases physician or gastroenterologist, and specific therapy considered if appropriate.

Source positive for HIV

If the source is KNOWN or SHOWN to be positive for antibodies to HIV (or is at high risk of seroconverting), the assessment of the injured person needs to take into account the risk of seroconversion, which is as follows:

- after a sharps injury with HIV-infected blood: 0.3%
- after a mucous membrane exposure to HIV-infected blood: 0.09%

As only a very small proportion of occupational exposures to HIV result in transmission of the virus, the side effects and toxicity of HIV post-exposure prophylaxis (PEP) must be carefully considered against its efficacy.

PEP is only indicated if there has been a significant exposure, and a proper risk assessment has been undertaken by a medical practitioner experienced in HIV management. HIV PEP is typically two or three orally administered anti-retroviral drugs and should

be administered to the recipient within 24-36 hours after exposure (and preferably within two hours). This therapy should be continued for four weeks, on the advice of an infectious diseases physician.

- PEP is recommended for percutaneous (skin penetrating) exposure to potentially infectious blood or body fluids (because of the increased risk of HIV transmission).
- PEP should be offered (but not actively recommended) for exposure of ocular mucous membrane or non-intact skin to potentially infectious blood or body fluids (as there is less increased risk of HIV transmission).
- PEP should not be offered for an exposure to non-bloodstained saliva (as this is not potentially infectious for HIV).

Counselling

Some people find the experience of an occupational exposure to HCV and HIV very distressing, and they should be given the opportunity for immediate counselling to address anxieties. The exposed person should be advised on ways to prevent transmission of bloodborne viral diseases to others. This will include advice about safe sex, safe injecting/safe needle use, breastfeeding, blood donation and safe work practices. A staff member who has been exposed to HIV (or HCV) should not donate blood, semen, organs or tissue for six months, and they should not share implements that may be contaminated with even a small amount of blood (e.g. razors or toothbrushes).

Follow up

Testing for injured person

Follow-up blood tests for the injured person should be undertaken at one, three and six months, and follow-up undertaken to detect any febrile illness occurring within three months of exposure (possibly representing a HIV seroconversion illness).

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