Infection Prevention and Control in the Dental Office:

An opportunity to improve safety and compliance

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Dentists and Dental Health Care Personnel have dealt with the concepts and principles of infection control and infection prevention since early in the history of the profession. Historically, the profession of dentistry has been at the forefront of developments in infection control in ambulatory health-care settings. Due to the biologic and micro-floral realities of the oral environment, as well as the difficulties in managing the surfaces and equipment involved in oral health care, creating a medical surgical operating room level of sterility is not necessary, as the oral cavity is not a sterile environment.

The Canadian Dental Association has provided information on infection control and infection prevention by publishing the following past resources:

- Considerations re: Infection Control Procedures
- Recommendations for Implementation of Infection Control Procedures
- Statement on the Ethical and Legal Considerations of Treating Patients with Infectious Diseases
- CDA Workbook on Infection Control: A Companion to the CDA Guidelines on Infection Control
- CDA Statement on Dental Handpieces
- Considerations re: Use of Latex in Dentistry
- CDA Guideline: Needle Use
- CDA Guidelines on Dental Unit Waterline Maintenance

This document compiles the information found in the above resources, updates the information that has been gained in scientific discovery and technical advances in the past decade.

The term “Infection Prevention and Control” will be used throughout this document, as this phrase identifies the objectives of preventing cross-contamination and controlling infection spread in the dental setting.

Due to the very nature of infection prevention and control, it is difficult, if not impossible, to establish the scientific validity for every recommendation provided in this document. Wherever possible, these recommendations are based on data from well-designed scientific studies. (see References; IPC-07-01)

However, only a limited number of well-designed, rigorous scientific studies exist which characterize actual risk factors and the effectiveness of procedures. Many of the infection-control practices routinely used by health-care practitioners cannot be meticulously examined for ethical or logistical reasons. In the absence of high levels of evidence for such practices, many of these recommendations are based on strong theoretical rationale, suggestive evidence, or opinions of respected authorities based on clinical experience, descriptive studies or committee reports. As scientific knowledge regarding infection prevention and control in the dental health-care setting continues to evolve, many of these recommendations will be validated, some will be challenged and others may be added.

This document is intended to protect dentists, their staff and their patients from infectious disease transmission. Dental Health Care Personnel are encouraged to apply this information in a diligent, conscientious manner.

> In this document, Dental Health Care Personnel (DHCP) refers to the variety of paid and unpaid personnel in the dental health-care setting who might be exposed to infectious materials, including body substances (blood, saliva, etc.) and contaminated supplies, equipment, environmental surfaces, water, or air. DHCP includes dentists, dental hygienists, dental assistants, dental laboratory technicians (in-office and commercial), students and trainees, contractual personnel, as well as other personnel that may not be directly involved in patient care, but may be potentially exposed to infectious agents (e.g., administrative, clerical, housekeeping, maintenance, or volunteer personnel).

Acknowledgement

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Dentists in Canada have a professional duty to cause no harm to their patients, and to provide a safe working environment for the other DHCP in their practice. Due to the biologic nature of the oral cavity, as well as the nature of dental and oral health care, transmission of infectious diseases before, during or after dental and oral health care is possible.

The dental profession in Canada has a long tradition of providing appropriate and compassionate care to the public, including special groups with special needs. Individuals with infectious diseases should have access to oral health care, including dental treatment. This care and treatment should provide for the well being of these patients, as well as for the protection of the health of the public and all DHCP.

- As professionals with a unique body of knowledge and skills rendered by their educational preparation and license to practice, dentists recognize a moral and ethical requirement to provide necessary dental treatment to all members of the public without discrimination. Accordingly, dentists and all DHCP must not refuse to treat a patient on the grounds of the patient's infectious state.

  People living with infectious diseases may, however, be severely or profoundly medically compromised as a result of that infectious disease. Such individuals may have severe hepatic or renal dysfunction, coagulopathies, respiratory depression, altered states of consciousness and may be taking multiple medications which may interact or interfere with planned oral health care.

  Any DHCP providing oral health care to such individuals must be familiar with the oral manifestations of the specific infectious disease involved, the oral and systemic effects of the medications used to treat that infectious disease, any potential medication interactions, as well as any treatment modifications necessary to realistically provide appropriate oral health care. When a person living with an infectious disease is severely or profoundly medically compromised, it may be safest for the patient to treat that individual in a multidisciplinary hospital setting.

- A dentist infected by an infectious agent does not pose a significant risk of infecting patients, other DHCP or the public, provided he or she is practicing current recommended infection prevention and control procedures. However, if the condition has either immediately affected, or may affect over time, his or her ability to practice safely and competently, the dentist should inform their licensing authority of the infectious status. In some provinces, this reporting is mandatory. Appropriate measures will then be taken to ensure the protection of the public and other DHCP, including possible review by an expert panel.

- The dentist has a professional obligation to maintain the standards of practice of the profession and, accordingly, should ensure that infection prevention and control procedures are carried out in his or her practice. Only those products specifically designed to be used for infection prevention and control should be utilized in a dental health-care setting.

- DHCP have an obligation to maintain currency of knowledge of infection prevention and control procedures and to apply these procedures in the practice setting. Dental personnel should accept a responsibility to contribute to public understanding of effective approaches to infection prevention and control.

Recommendations in this document are designed to prevent or reduce the potential for infectious disease transmission from patient to DHCP, from DHCP to patient and from patient to patient.

Dental patients and DHCP can be exposed to pathogenic microorganisms including viruses: cytomegalovirus (CMV), HIV, HBV, HCV, herpes simplex virus types 1 and 2, bacteria: *Mycobacterium tuberculosis*, staphylococci, streptococci, and other microbes that colonize or infect the oral cavity and respiratory tract.

Modes of Transmission

These organisms can be transmitted in dental settings through:

1. **Direct transmission**
   Direct physical contact with blood, oral fluids, or other patient materials,
2. **Indirect transmission**
   Contact with an intermediate contaminated object (e.g., instruments, equipment, or environmental surfaces),
3. **Aerosolization**
   Contact of conjunctival, nasal, or oral mucosa with droplets (e.g., spatter) containing microorganisms generated from an infected person and propelled a short distance (e.g., by coughing, sneezing, or talking), and
4. **Airborne infective droplets**
   Inhalation of airborne microorganisms that can remain suspended in the air for long periods.

Criteria for infection

Infection transmission through any of these routes requires that **all** of the following conditions are met:

- The presence of a **pathogenic organism** of sufficient **virulence** and in adequate **numbers** to cause disease;
- The presence of a **reservoir or source** that allows the pathogen to survive and multiply (e.g., blood);
- The presence of a **vector of transmission** from the source to the host;
- The presence of an appropriate **portal of entry** through which the pathogen can enter the host (e.g., needle-stick injury); and
- The presence of a **susceptible host** (i.e., someone who is not immune).

The simultaneous occurrence of these criteria for infection transmission is referred to as the **chain of infection**. Effective infection prevention and control procedures interrupt one or more links in this chain.

Medical histories and symptomology, whether written or verbal, physical examinations and laboratory tests may not always reveal the presence of an infectious process, disease, carrier state or pre-symptomatic phases of disease in an individual. Thus, the same infection prevention and control protocols should be used for all patients, regardless of known or suspected infectious status.

This concept is known as **Standard Precautions** or **Routine Practices**.

All DHCP should understand that comprehensive consistency in the implementation and practice of these recommendations helps to ensure a safe work environment and a safe treatment environment for their patients.

(Note: The term “Universal Precautions” specifically dealt with those recommendation to prevent the transmission of blood-borne pathogens; specifically HBV, HCV and HIV. This term has been replaced by the term “Standard Precautions” to address the universal application of recommendations to prevent the transmission of pathogens that can be spread not only by blood, but by any body fluid, excretion, or secretion.)

A written office infection prevention and control program should be developed to maintain and improve the health of all DHCP.

The office infection prevention and control program should include the following elements:

1. An infection prevention and control manual that clearly describes policies, procedures, and practices. This manual should include, but not be limited to, a record of immunizations, all local and provincial guidelines and policies relating to infection prevention and control, as well as a record of all exposures to infectious agents, and the actions taken.
2. Identify an Office Infection Prevention and Control Officer (dentist or other DHCP) assigned to instigate, coordinate and evaluate the infection prevention and control program. This individual's duties would include the education of DHCP regarding the principles of infection control, identifying work-related infection risks, instituting preventive measures, and ensuring prompt exposure management and medical follow-up.
3. Guidelines for education and training
4. Immunizations
5. Exposure prevention and post-exposure management
6. Special considerations regarding medical conditions, work-related illness, and associated work restrictions
7. Considerations regarding contact dermatitis and latex hypersensitivity
8. Maintenance of records, data management, and confidentiality
9. Maintenance of equipment involved in infection prevention and control procedures (e.g., ultrasonic instrument cleaners and heat sterilizers)

Infection control and infection prevention services from external health-care facilities and health-care providers should be identified and established well before their services are necessary (e.g., in the event of a significant exposure to infectious material). Referral arrangements should be made with qualified health-care professionals in an occupational health program of a hospital, with educational institutions, or with health-care facilities that offer personnel health services. Provincial dental associations may establish their own referral service, or liaisons may be established with infection control and prevention health-care professionals in hospitals or with the offices of a local Medical Officer of Health.

Compliance of infection prevention and control procedures is improved when DHCP understand the reasons why the recommendations exist.

DHCP should receive infection-control training as part of the practice orientation, whenever new tasks or procedures are introduced, and then annually reviewed. Education and training should be appropriate to the assigned duties of specific DHCP (e.g., techniques to prevent cross-contamination, instrument sterilization).

For DHCP who perform tasks or procedures likely to result in occupational exposure to infectious agents, training should include:

1. A description of an individual's exposure risks
2. A review of prevention strategies and infection-control policies and procedures
3. A discussion regarding how to manage work-related illness and injuries, including Post-Exposure Prophylaxis
4. A review of work restrictions for the exposure or infection.

Educational materials should be appropriate in content and vocabulary for each person's educational level, literacy and language, as well as be consistent with existing federal, provincial and municipal regulations.

Immunizations substantially reduce both the number of DHCP susceptible to infectious diseases and the potential for disease transmission to other DHCP and patients.

All dental care workers should be adequately immunized against:

- Hepatitis B
- Measles
- Mumps
- Rubella
- Varicella
- Influenza

DHCP are at an increased risk of acquiring hepatitis B in an occupational setting. Therefore, all DHCP should be immunized against hepatitis B. DHCP should be tested for the presence of adequate amounts of hepatitis B surface antibody approximately 1-2 months following completion of the 3-dose vaccination series. Serologic testing should produce antibody levels of anti-HBs ≥10 mIU/mL.

DHCP who do not develop an adequate antibody response (i.e., anti-HBs <10 mIU/mL) to the primary vaccine series should complete a second 3-dose vaccine series or be evaluated to determine if they are HBsAg-positive. Re-vaccinated persons should be re-tested for anti-HBs at the completion of the second vaccine series.

If an inadequate antibody response occurs following the second series of immunizations, testing for HBsAg should be performed. Persons who prove to be HBsAg-positive or HBeAg-positive should be counseled regarding how to prevent HBV transmission to others and regarding the need for medical evaluation.

Non-responders to vaccination who are HBsAg-negative should be considered susceptible to HBV infection and should be counseled regarding precautions to prevent HBV infection and the need to obtain hepatitis B immunoglobulin (HBIg) prophylaxis for any known or probable parenteral exposure to HBsAg-positive blood.

Exposure to blood through percutaneous injury, or by contact with mucous membranes of the eye, nose or mouth, or by contact with non-intact skin is the primary method DHCP are exposed to blood-borne pathogens, such as HBV, HCV, and HIV, in dental health-care settings. Percutaneous exposures involve the greatest risk for transmission, and would include needle-sticks or cuts with contaminated sharp objects. Non-intact skin includes all exposed skin that is chapped, abraded or has dermatitis.

Avoiding contact with blood, or any other body tissues, or fluids should be of paramount importance in any infection prevention and control program.

The majority of exposures in a dental health-care setting are preventable by using:

Standard Precautions

Standard Precautions includes the consistent and universal use of Personal Protective Equipment, including the use of gloves, masks, protective eyewear or face shields and protective clothing (see IPC-03-01).

Engineering Controls

Engineering controls are technology-based safer designs for equipment, and devices intended to reduce percutaneous exposures. Examples of engineering controls include needle guards and self-sheathing anesthetic needles, as well as dental units designed to shield burs on handpieces.

Work-Practice Controls

Work-practice controls are those practices established to avoid handling, using, assembling or cleaning contaminated sharp instruments, equipment or appliances, and the use of sharps containers. Sharps would include all needles, scalers, laboratory knives, burs, explorers and endodontic files and reamers. Work-practice controls can include, but are not limited to:

- Avoiding or using extreme caution when passing sharps during four-handed dentistry.
- Removing burs before removing the handpiece from the dental unit.
- Not using fingers in tissue retraction or palpation during suturing and administration of anesthesia.
- Identifying and removing all sharps from an instrument tray prior to instrument cleaning.

As percutaneous exposures comprise the greatest risk of transmission of blood-borne pathogens, avoiding percutaneous exposures should be a primary concern to the DHCP. The careful handling of needles and other sharps is an important aspect of avoiding percutaneous exposures.

Engineering controls and work-practice controls for needle handling safety are of particular importance to prevent percutaneous exposures. Aspirating anesthetic syringes, and self-sheathing needles should be considered for routine use. Newer designs should be considered as they become available.

Work-practice controls for needles and other sharps would include:

- Used disposable syringes and needles, scalpel blades and other sharp items should be placed in appropriate puncture-resistant containers located as close as feasible to where the items were used.
- Needles should be capped prior to use.
- Needles should not be bent or otherwise manipulated by hand, or handled so that they are pointed towards any part of a DHCP's body.
- Used needles should not be recapped by hand. A one-handed scoop technique, a mechanical device designed for holding the needle cap or an engineered sharps injury protection device (e.g., needles with re-sheathing mechanisms) should be used for recapping needles.
- Needles should be recapped as soon as possible after use, and before removing the needles from the syringe for disposal.
- One needle may be used for multiple injections on the same patient; however, the needle should be recapped between each use.
- Extreme caution should be used whenever contaminated sharps are passed between DHCP, such as during four-handed dentistry.

Percutaneous Injury

Exposure to blood or saliva by percutaneous injury is the greatest risk for acquiring a blood-borne pathogen in the dental health-care setting. Every effort should be made by all DHCP to avoid percutaneous injury.

Significant exposures should be dealt with immediately. A significant exposure exists whenever any of the following events occurs:

- Percutaneous injury, where the skin of the DHCP is punctured (i.e. blood is drawn).
- Blood, saliva or other body fluid is splashed onto non-intact skin (dermatitis, cuts or abrasions).
- Blood, saliva or other body fluid is splashed onto mucosa of the eyes, the mouth or the nose.

The steps in managing a significant exposure are:

1. Remove gloves or immediate clothing, if necessary, to assess the extent of the injury.
2. First-aid should be administered, if necessary, for percutaneous exposures.
3. Immediately wash the area, including the puncture or wound using antimicrobial soap and water. Exposed eye, mouth or nose mucosa should be flushed with copious amounts of water.
   The application of caustic agents such as bleach, or the injection of antiseptic agents into the wound is not advisable.
4. Report the injury to the Office Infection Prevention and Control Officer, who should then contact the appropriate health-care professional for advice and possible referral, and begin the necessary documentation. Ensure that the confidentiality of the health and personal data is strictly maintained.
   Documentation should include (see IPC-02-08):
   - The name of the exposed DHCP, and details regarding the exposed person's vaccination status.
   - The date and time of the exposure.
   - The nature of the exposure, including the dental procedure being performed, the extent of the exposure, and immediate action taken.
   - The name and health status of the source person, including details regarding any infectious diseases known or suspected.
   - Follow-up counseling and post-exposure management.

Every significant exposure should be evaluated by a qualified health-care professional for the potential to transmit an infectious disease. The assessment of risk to transmit an infectious disease will be based on the following:

- The type and amount of body fluid or tissue involved.
- The nature of the exposure (e.g., percutaneous injury, mucous membrane or non-intact skin exposure).
- The known or unknown infection status of the source.
- The susceptibility of the exposed person.

All of these factors should be considered in determining the need for further follow-up care, including Post-Exposure Prophylaxis (PEP).

If the need to administer PEP is determined to be necessary, it should be done as soon as possible after the exposure. For example, anti-retroviral drugs to treat an HIV exposure should be given within one to two hours after the exposure.

The PEP regimens considered will be determined by the health-care professional contacted by the Office Infection Prevention and Control Officer following the exposure. The PEP regimen should be consistent with current infection prevention and control guidelines, as recommended by the Public Health Agency of Canada or the U.S. Public Health Service.

As discussed in item IPC-02-01, having a written office Infection Prevention and Control Program, identifying an office Infection Prevention and Control Officer, as well as establishing exactly whom in the community should be called, and establishing exactly what should be done in the particular dental health care facility involved, should all be determined well before an actual significant exposure occurs.

(NOTE: Confidentiality of this form MUST be ensured, i.e. only those people who need to see this form may do so)

Name of Exposed Person: _____

Hepatitis B vaccination completed: date___/ ___ / ___ Post-vaccination titre:_____ mIU/mL

Date and **time** of Exposure: _____

Procedure being performed: _____

Where and how exposure occurred: _____

Did exposure involve a sharp device: Yes ❑ No ❑

Type and brand of device: _____

How and when during handling exposure occurred: _____

Extent of the exposure (describe)**:** _____

Blood ❑ Saliva ❑ Other body fluid ❑ Describe: _____

Percutaneous injury:

Depth of wound: _____

Gauge of needle:_____

Was fluid injected: Yes ❑ No ❑

Skin or mucous membrane exposure:

Estimated volume of fluid: _____

Duration of contact: _____

Condition of skin: Intact ❑ Chapped ❑ Abraded ❑

Source person information:_____

Known infectious disease(s): _____

HIV: Yes ❑ No ❑ Possible ❑

Anti-retroviral therapy: Yes ❑ No ❑ Viral load: _____

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Follow-up care (describe in detail):

Date	Caregiver	Action Taken

Hand hygiene is often the weak-link in an effective infection prevention and control program. The purpose of hand hygiene is to reduce the quantity and diversity of the transient microorganisms found on the surface of the hands, versus the resident microorganisms found in the deep skin layers. The spread of these transient microorganisms, through non-compliance with hand hygiene protocols, is connected with health-care associated infections and the spread of multi-resistant organisms.

Hand hygiene may be performed by thorough handwashing using a soap/water/towel combination, or hand disinfection using an alcohol hand-rub, depending on the situation.

Hand Washing

The hands of DHCP that come in direct contact with patients should be washed:

- At the beginning of the workday.
- After eating.
- After using the washroom.
- Whenever the hands have become contaminated with blood, saliva or some other body fluid, or whenever the hands have come in contact with some instrument, agent or surface that may have been contaminated with blood, saliva or some other body fluid.

Hand washing should be done using an anti-microbial soap with persistent activity (e.g., chlorhexidine, chloroxylenol [PCMX}, octenidine, or triclosan), cool or warm (not hot) water, and single use towels. Hands should be thoroughly dried after washing, as bacteria can quickly multiply on moist hands, particularly under gloves.

Hand Antisepsis

Hand antisepsis may be achieved using an alcohol hand-rub:

- Prior to beginning patient treatment, before donning gloves.
- Between patients, after removing gloves.
- Whenever gloves are changed during a patient visit.

Only commercial products specifically designed as an alcohol hand-rub should be used for hand hygiene. Hands should be rubbed until the alcohol rub is no longer wet (approximately 30 seconds), as the alcohol can cause glove material degradation and result in loss of glove integrity. If alcohol hand-rubs are not used in a practice, handwashing should be performed for all the above situations.

Hand hygiene products should be stored and dispensed according to the manufacturer's instructions. Liquid products should be stored in closed containers and dispensed from either disposable containers or from containers that have been washed and thoroughly dried between fillings. Liquid products should not be added to a partially empty dispenser or "topped up", due to the risk of bacterial contamination.

Hand care regimen: Emollient hand lotions should be considered for routine use at work and at home, in order to prevent hand irritation and dermatitis that comes from frequent hand hygiene and glove use. Petroleum based lotions should be avoided during the workday, as these may weaken the glove material, resulting in increased permeability. Washing hands in hot water should be avoided.

Manufacturers of hand hygiene products should be consulted regarding any possible interaction with hand lotions. Lotion manufacturers should be consulted regarding any interaction between the lotions, the antimicrobial soaps or alcohol hand-rubs, as well as other dental materials. For example, if using a chlorhexidine solution for hand hygiene, only non-anionic hand lotions should be used; otherwise, there will be a loss in persistence of the antimicrobial action of the solution. Typically, lotions, soaps and alcohol hand-rubs from the same manufacturer are compatible; however, actual compatibility should be checked with the manufacturer or from the manufacturer's literature.

Fingernails are a common area of blood impaction and bacterial contamination. Fingernails should be kept short and trimmed in order to thoroughly clean underneath them and prevent glove tears. Long natural or artificial nails should be avoided, as they are more difficult to clean, can make donning gloves more difficult and can cause gloves to tear more readily. Freshly applied nail polish on natural nails is acceptable, provided fingernails are kept short; however, chipped nail polish can promote bacterial growth and prevent adequate hand hygiene, and should be avoided.

Jewelry, including rings, arm and wrist bands and bracelets and watches should be avoided on the hands or arms, as they prevent adequate hand hygiene, make donning gloves more difficult and can cause increased tearing of gloves. Alternately, arm and wrist jewelry and watches should be covered by the cuffs and long sleeves of the protective clothing.

Personal Protective Equipment (PPE) protects the exposed tissue of a DHCP from exposure to potentially infectious material. PPE protects the skin of the hands and arms from exposure to splashing or spraying of blood, saliva or other body fluids, and also from introducing the surface flora into deeper tissues by traumatic and environmental injury. PPE protects the conjunctival mucosa of the eyes, as well as the lining mucosa of the respiratory tract.

Large particle droplets of water, saliva, blood, microorganisms and other debris are created by the use of rotary dental instruments from handpieces, ultrasonic and sonic scalers and endodontic equipment, and air-water syringes. This visible spray typically travels only a short distance (approximately two feet / 60cm. or less from the patient's mouth) and settles out quickly. This spray and spatter lands on nearby surfaces, including the operatory countertops and equipment, the DHCP and the patient. Aerosols, with particles less than 10µm in size, can also be created, and can be inhaled by the DHCP or patient.

Appropriate work-practice controls will minimize the spread of droplets, spatter, spray and aerosol. This includes the use of dental "rubber" dams whenever possible and high volume / high velocity suction whenever the creation of droplets, spatter, spray and aerosol is possible.

Primary PPE would include gloves, masks, protective eyewear and protective clothing. Wearing gloves, masks, protective eyewear and protective clothing will reduce the risk of exposure to potentially infectious material.

PPE should be removed prior to leaving the patient-care area. PPE designed to be re-used (e.g., protective eyewear and gowns) should be cleaned with soap and water. If the re-usable PPE are known to be contaminated, the item should be disinfected between patient use, according to the manufacturer's directions. Disposable PPE items should be discarded immediately following use.

Gloves are worn to protect the skin of the DHCP's hands from contamination. Gloves do not replace the need for proper hand hygiene (see IPC-02-08), as gloves may contain small, unapparent holes or can be torn during patient treatment or hands may become contaminated during removal.

Appropriate hand hygiene should be performed immediately before donning gloves, and immediately after removing gloves.

Gloves are designed as single-use disposable items. Thus, gloves should be used for only one patient, and then discarded. Gloves should be removed, hand hygiene performed, and then new gloves reapplied between patients, or whenever the gloves are torn or punctured.

The type of gloves selected for use depends on the procedure being performed. Types of gloves would include:

- **Patient examining gloves** – Used for routine patient care, examination and other non-surgical procedures involving contact with mucous membranes and skin, as well as laboratory duties. These are typically latex, nitrile or nitrile blends, polyurethane or styrene-based copolymers. Plastic (polyvinyl chloride) or vinyl gloves may also be used, however, gloves from these materials tend to tear easily and contain more defects from manufacturing. All of these gloves are for use on one patient only, and are discarded after use.
- **Sterile surgical gloves** - Used whenever an open surgical wound is anticipated. These are sterile, in appropriate hand size, and made of latex, nitrile or nitrile blends, polyurethane or styrene-based copolymers. All of these gloves are for use on one patient only, and are discarded after use.
- **Utility gloves** – Used for cleaning and disinfection procedures, such as during operatory cleanup and instrument processing. These are typically nitrile or latex-nitrile blends, chloroprene / neoprene, butyl rubber, fluoro-elastomer, polyethylene or other vinyl copolymer. Commonly referred to as utility, industrial or general purpose gloves, these are not for patient care, and should be puncture and chemical resistant. They are relatively thick and should be disinfected or sterilized, as appropriate for the material, at the end of each work day.

The integrity of gloves should be monitored after donning and during use, particularly when manipulating metal instruments. If the surface of the glove is compromised (e.g., manufacturing defect, punctured or torn during use), the glove should be changed as soon as possible.

Gloves should not be washed, as soaps (plain or antiseptic) and alcohols can compromise the surface of latex and synthetic materials, leading to micro-perforations and loss of integrity. Micro-porosities in the glove material can lead to wicking, where liquids such as water, blood or saliva, can be drawn through undetected holes and held against the skin surface of the hand.

Double-gloving may be utilized for some specific procedures, which may involve the handling of multiple sharp metal instruments or during longer procedures. However, double-gloving, if utilized, should be procedure specific, not patient specific. Double-gloving may affect manual dexterity and tactile sensitivity.

Gloves should not be stored exposed to heat sources, such as near X-ray unit controllers, lasers, fans, electrical generators, suction machines or motors.

Latex is a common material found in the manufacturing process of gloves used in dental health-care settings, as well as a large host of other materials found in the dental office. DHCP should not casually ascribe skin irritations to a latex allergy, given the ubiquitous nature of latex in dental health-care settings. The vast majority of skin reactions to gloves are, in fact, only irritant contact dermatitis or delayed hypersensitivity reactions, and not actually true allergic reactions to latex.

Adverse latex reactions range from mild to serious. These include:

- **Irritant Contact Dermatitis** is a non-immunologic chemical reaction resulting from the destruction of superficial skin cells. Acute irritant contact dermatitis presents as inflammation of the hands, and chronically as dry, cracking sores. Both the acute and chronic signs stop at the glove boundary on the wrist.
  Irritant contact dermatitis is due to skin reactions to soaps (plain and antimicrobial), surface disinfectants, powder from gloves, hyper-hydration from inadequate hand drying after washing and towel abrasion.
  Management of irritant contact dermatitis would include changing types or brands of soap, towels or gloves, rinsing hands thoroughly after washing and utilizing a proper hand care regimen.

- **Delayed Hypersensitivity Reactions (allergic contact dermatitis)** are Type IV immunologic reactions, which are T- lymphocyte mediated. Acute delayed hypersensitivity reactions present as clustered bumps, vesicles, itching, redness and pain, and chronically as dry, thickened skin, sores and spaced bumps. Both the acute and chronic signs extend beyond glove boundary onto the arm.
  Delayed hypersensitivity reactions are due to an immunologic response to the chemical accelerators (typically: thiurams, thiazoles and carbamates) used in the manufacturing of latex nitrile, and neoprene gloves, as well as to soaps (plain and antimicrobial), surface disinfectant and endotoxins found in the glove material or created by transient microorganisms not completely washed off the hands.
  Management of delayed hypersensitivity reactions include referral to a medical dermatologist, using washed (powderless) low-protein latex gloves or non-latex gloves.

- **Immediate Allergic Reactions** are Type I immunologic reactions, which are IgE antibody mediated. This type of reaction is exceedingly rare, and represents a true latex allergy. Immediate allergic reactions to latex may represent a life-threatening situation. Acute immediate allergic reactions present as urticaria, hives and swelling, which extends beyond the glove boundary, and may become systemic as dyspnea, tachycardia, hypotension and anaphylaxis.
  Immediate allergic reactions are due to an immunologic response to the natural rubber latex protein antigen.
  Management of immediate allergic reactions would include providing immediate emergency medical care, if necessary, and referral to a medical dermatologist, as well as the use of only non-latex, powder-free gloves, and the absolute avoidance of all latex products in the workplace and at home.

Dental patients with histories of true latex allergy may react to common dental products (e.g., gloves, rubber dams, prophylaxis cups, orthodontic elastics, and medication vials). Patients with a true latex allergy should be treated in an environment where contact with latex proteins, either directly or airborne, is kept as low as reasonably achievable ("ALARA"). Any latex-containing materials or devices should be removed from the treatment area, or adequately covered and isolated.

Medical histories for both patients and DHCP should include questions relating to possible latex allergy. Questions should include predisposing conditions for latex allergy, including previous history of allergies, a history of early latex exposure (e.g., spina bifida, urogenital anomalies), or related allergies to certain fruits and nuts, such as avocados, kiwis, hazelnuts or bananas.

Management of patients with true latex allergies in the dental health-care setting should consider the following additional precautions to ensure a safe treatment environment:

- As the sterilization process does not remove the latex proteins, all instruments to be potentially used on a patient with a known latex allergy should be prepared by DHCP wearing only non-latex gloves. The instruments should not come in contact with any other instruments that may have contacted latex (e.g., ultrasonic cleaner solution, wrapping towels). The operatory should be set-up by DHCP that are not wearing latex gloves.

- Latex protein antigens can exist in the ambient air for several hours after a room or operatory has been used. These airborne allergens can cause respiratory or anaphylactic symptoms in people with latex hypersensitivity. Patients with latex allergy may be scheduled for the first appointment of the day, in order to minimize exposure to airborne latex particles. The use of powder-free “washed” latex gloves will reduce aerosolization of particles, which may also contain adhesive latex proteins.

- Other DHCP should be aware of patients with latex allergy in the office or practice that day (e.g., by oral instructions, written protocols and posted signage), in order to prevent them from bringing latex-containing materials into the treatment area.

- All working areas that may have been contaminated with latex powder or dust should be frequently cleaned.

- Emergency treatment kits with latex-free products should be available at all times.

The respiratory mucosa of a DHCP should be protected from contact with potentially contaminated material by the wearing of a mask during a dental procedure which produces and aerosol. DHCP should wear a surgical mask that covers the nose and mouth during dental procedures whenever splashes, sprays or spatter of blood, saliva, other body fluids, or water contaminated with blood, saliva or other body fluids may be produced.

The surgical mask should have more than 95% filtration efficiency for particles 3-5 microns in diameter. The efficiency of filtration is reduced significantly whenever the outer surface of the mask becomes contaminated with droplets of spray of oral fluids, or from touching the mask with contaminated gloves or hands.

The mask should be changed whenever it becomes contaminated or wet. This would occur between patients whenever a handpiece, ultrasonic scaler or endodontic instrument was used, or if a splash, spray or spatter was created by an air-water syringe, or any other instrument or equipment. The mask should also be changed more often, such as during longer procedures, if it becomes wet during the procedure or from the DHCP’s exhaled moist air.

DHCP should ensure the mask fits tightly over their nose and mouth, so that the DHCP is breathing though the mask, and not around it.

If respiratory infection isolation precautions are necessary (e.g., for patients with active untreated tuberculosis / TB), a particulate-filter respirator or mask (e.g., N95, N99 or N100) should be worn. These masks will filter 1-µm particles in the unloaded state with a filter efficiency of greater than 95% (i.e., filter leakage <5%), given flow rates of <50 L/min, which is an approximate maximum airflow rate during breathing. Only masks specifically designed for this purpose should be used. When respiratory infection isolation precautions are necessary, these respirators or masks should be used in the context of a complete respiratory protection program. Such a program should include training and fit-testing of the respirator or mask to ensure an adequate seal between the edges of the respirator and the DHCP's face.

Single-use disposable masks should be properly disposed of after use.

The conjunctival mucosa of a DHCP should be protected from contact with potentially contaminated material by the wearing of protective eyewear during the dental procedure. DHCP should wear protective eyewear that covers the eyes during dental procedures whenever splashes, sprays or spatter of blood, saliva, other body fluids, or water contaminated with blood, saliva or other body fluids may be produced.

Protective eyewear with solid side shields or a face shield should be worn by DHCP during procedures and patient-care activities likely to generate splashes or sprays of blood or body fluids. Protective eyewear for patients should also be used to protect their eyes from spatter or debris created during dental procedures.

Protective eyewear for the DHCP and patient should be cleaned and disinfected after use, at least between patients, or whenever the eyewear becomes visibly contaminated.

An eye-wash station should be available in the office or practice, to aid in managing any chemical or body fluid splashes, sprays or spills into the eyes of a DHCP or patient. All DHCP staff should be orientated as to the location, function and indications for use of the eye-wash station.

The skin on the arms and chest of a DHCP should be protected from contact with potentially contaminated material by the wearing of protective clothing during any dental procedure where splash or spray are anticipated. Long-sleeve protective clothing, extending to the wrists, is ideal for this purpose. Short-sleeve protective clothing is acceptable, as long as there are no breaks in the skin integrity on the arms of the DHCP. If the arms are not protected, hand hygiene protocols should extend up the arms, past the wrists towards the elbows.

Protective clothing includes gowns and lab-coats, and is meant to be worn over regular clinic clothing, such as uniforms, scrubs or street clothing.

The protective clothing should be changed at least daily, or if it becomes visibly soiled or significantly contaminated, and as soon as feasible if penetrated by blood or other potentially infectious fluids.

Protective clothing should be removed before leaving the work area, and should not be worn home. Protective clothing should be washed between uses in a normal wash cycle, or professionally cleaned.

Patient-care items, such as dental instruments, handpieces, devices and equipment, can be categorized as critical, semi-critical, or non-critical, depending on the potential risk for infection associated with their intended use. This categorization is based on a modified Spaulding classification developed by the U.S. Centers for Disease Control and Prevention.

- **Critical items** are used to penetrate soft tissue or bone. Critical patient care items have the greatest risk of transmitting infection and should be sterilized by heat.

- **Semi-critical items** are those items that only touch mucous membranes or non-intact skin and have a lower risk of transmission. As the majority of semi-critical patient care items in dentistry are heat-tolerant, all semi-critical items should be sterilized by using heat. If a semi-critical item is heat-sensitive, it should be disinfected with high-level disinfection.

- **Non-critical items** contact only intact skin, which serves as an effective barrier to microorganisms. Non-critical patient care items pose the least risk of transmission of infection. In the majority of cases, cleaning, or if contaminated by blood, saliva or other body fluid, cleaning followed by disinfection is adequate. Cleaning or disinfection of some non-critical items may be difficult or may damage the surfaces. In those instances, the use of disposable barriers to protect these surfaces may be a preferred alternative.

Critical patient care items includes any instrument which penetrates soft tissue, contacts bone, enters into or contacts the bloodstream or any other normally sterile body tissue. Examples of critical items would include surgical instruments, periodontal scalers, scalpel blades and dental burs.

Critical items should be sterilized by heat in order to prevent cross-contamination and infection spread in the dental setting. DHCP can be exposed to microorganisms on contaminated critical instruments and devices through percutaneous injury, contact with non-intact skin on the hands or other body part, or contact with mucous membranes of the eyes, nose or mouth.

Operatory Clean-up: Contaminated instruments should be handled carefully to prevent exposure to sharp instruments that can cause a percutaneous injury. Instruments that have been used on a patient should be handled with puncture-resistant utility gloves during operatory clean-up (see Gloves, IPC-03-02).

Transportation: Instruments should be placed in a rigid or puncture-resistant container at the point of use to prevent percutaneous injuries during transport to the instrument processing area.

Instrument processing requires multiple steps to achieve sterilization. These steps include: Holding, cleaning, rinsing, corrosion reduction, drying, packaging, heat-processing, cooling / drying, storage and delivery.

Sterilization is a complex process requiring specialized equipment, adequate space, qualified DHCP who are provided with ongoing training and regular monitoring for quality assurance. Correct cleaning, packaging, sterilizer loading procedures and sterilization methods should be followed to ensure that an instrument is adequately processed and safe for re-use on patients. The goal is to break the chain of infection of the potential for patient to patient transmission.

Instrument Processing Area: A designated instrument processing area should be constructed in the dental office or practice. This central processing area should have clear sections for:

- Receiving, cleaning, and decontamination
- Preparation and packaging
- Sterilization
- Storage of processed instruments (or, suitable storage in the operatories)

Walls or partitions should separate the sections to control traffic flow and contain contaminants generated during processing. If physical separation of these sections is not possible, adequate spatial separation is necessary, provided the DHCP processing the instruments are trained in work practices to prevent contamination of clean areas. Space should be adequate for the volume of work anticipated and the items to be stored.

Decontamination: The surface of an instrument cannot be sterilized if there is blood, saliva, other body fluids or other debris adhering to the surface. Decontamination and cleaning should precede all disinfection and sterilization processes. Cleaning involves the removal of debris as well as organic and inorganic contamination. Removal of debris and contamination is achieved either by scrubbing with a surfactant, detergent, and water, or by an automated process (e.g., ultrasonic cleaner or washer-disinfector) using chemical agents. After cleaning, instruments should be rinsed with water to remove chemical or detergent residue, taking care to minimize splashing.

An automated process using equipment specifically designed for cleaning medical instruments (e.g., ultrasonic cleaner or washer-disinfector) is preferable to hand scrubbing in order to reduce the risk of DHCP injury.

If cleaning cannot be done immediately, a **holding solution** may be used. Instruments are placed in a puncture-resistant container and soaked with a detergent, a disinfectant/detergent, or an enzymatic cleaner to prevent drying of patient material and make cleaning easier and less time-consuming. Use of a liquid chemical sterilant or high-level disinfectant (e.g., glutaraldehyde) as a holding solution is not recommended, due to the fixative nature of these chemicals making surfaces more difficult to clean, and the general toxicity of these solutions.

Work-practice controls should be used to keep the hands away from sharp instruments; e.g. using puncture-resistant utility gloves and long-handled brush when handling or manually cleaning contaminated instruments and devices. DHCP should not reach into trays or containers holding sharp instruments that cannot be seen (e.g., sinks filled with soapy water in which sharp instruments have been placed). Work-practice controls should include the use of a strainer-type basket to hold instruments and forceps to remove the items. PPE should be worn during instrument decontamination to avoid exposure from splashing.

Instrument preparation and packaging

Decontaminated and cleaned instruments should be inspected, assembled into sets or trays, and wrapped, packaged or placed into container systems for sterilization. Packaging and wrapping materials that are specifically designed for sterilization should be used. Semi-critical and critical instruments should not be sterilized unwrapped. Hinged instruments should be processed open and unlocked. Hinged instruments should be immersed in a rust inhibitor prior to sterilization. An external chemical indicator (e.g., chemical indicator tape) should be placed on the outside of every instrument package. DHCP should refer to the manufacturer's instructions regarding use and correct placement of chemical indicators.

Critical instruments that will be stored should be wrapped or placed in containers (e.g., cassettes or organizing trays) designed to maintain sterility during storage. Packaging materials should be specifically designed for the type of sterilization process utilized in that practice.

Sterilization

Heat-tolerant dental instruments are sterilized in a dental office using:

- Steam under pressure (autoclaving)
- Dry heat
- Unsaturated chemical vapor

All sterilization should be performed using medical sterilization equipment specifically designed for the sterilization of instruments. Sterilization times, temperatures and other operating parameters should be used as recommended by the specific manufacturer of the equipment used. Instructions regarding the correct use of containers, wraps, placement and type of chemical or biological indicators should be followed as recommended by the specific manufacturer of the equipment used.

Items should be arranged in the sterilizer in such a way as to permit free circulation of the sterilizing agent (i.e., steam, dry heat or chemical vapor). The manufacturer's instructions for loading the sterilizer regarding capacity and arrangements of the instruments or packs within the sterilizer chamber should be followed. Instrument packs should be allowed to dry inside the sterilizer chamber before removing and handling, in order to avoid wicking of moisture and, potentially, microorganisms from hands or gloves.

The ability of equipment to attain physical parameters required to achieve sterilization should be monitored by mechanical, chemical, and biological indicators. The sterilizer manufacturer should be consulted regarding selection and use of chemical and biological indicators (see IPC-04-04).

So-called “liquid chemical sterilants” should not be used to sterilize critical or semi-critical instruments in dentistry. These sporicidal chemicals (e.g., glutaraldehyde, peracetic acid and hydrogen peroxide) are highly toxic and their effectiveness cannot be verified with biological indicators.

So-called “bead sterilizers” should not be used to sterilize critical or semi-critical instruments (e.g. endodontic files), as their effectiveness is inconsistent for sterilization. Bead sterilizers may be used during a procedure to disinfect instruments used on an individual patient; however, sterility cannot be assured to prevent cross-contamination between patients when re-using the instruments.

Low-temperature sterilization using ethylene oxide gas (ETO) is used extensively in larger health-care facilities, such as hospitals. Heat- and moisture-sensitive patient-care items may be sterilized with ETO without damaging effects. The extended sterilization times (typically, 10 to 48 hours), as well as the hazardous vapours produced, make this method impractical for private-practice dental care settings. As well, handpieces cannot be effectively sterilized using ETO due to the decreased penetration of ETO gas through small lumens. Other types of low-temperature sterilization methods (e.g., hydrogen peroxide gas plasma) exist; however, these methods are not yet practical for dental offices.

Semi-critical items contact mucous membranes or non-intact skin, but do not penetrate soft tissue, contact bone, enter into or contact the bloodstream or other normally sterile tissues. Examples of semi-critical patient care items would include dental mouth mirrors, amalgam condensers and reusable impression trays.

Semi-critical items should be sterilized by heat in order to prevent cross-contamination and infection spread in the dental setting. All steps for the sterilization of critical items should be followed for semi-critical items.

Semi-critical patient care items that are heat sensitive and cannot be sterilized should receive high-level disinfection. All steps involved in critical instrument handling, transportation, decontamination and storage should be followed for semi-critical item processing, with the exception that high-level disinfection is utilized instead of heat sterilizer processing.

High-level disinfection destroys all microorganisms, but not necessarily high numbers of bacterial spores. High-level disinfection can be achieved by using a mechanical automatic washer-disinfector, or by liquid immersion in a high-level disinfectant (e.g., glutaraldehyde, glutaraldehyde with phenol or high-concentration hydrogen peroxide; see IPC-07-02).

Following high-level disinfection by liquid immersion, semi-critical items should be thoroughly rinsed with sterile water after removal to remove toxic or irritating residues. Manufacturer instructions regarding dilution, immersion time, temperature and safety precautions should be followed carefully.

Due to the toxicity of these chemicals, appropriate precautions should be taken to protect the DHCP, including using closed containers to limit vapor release, chemically resistant gloves and aprons, goggles and face shields.

Monitoring of sterilization procedures and equipment, utilizing mechanical, chemical and biological indicators, ensures the condition of sterility.

Mechanical techniques for monitoring sterilization include assessing cycle time, temperature, and pressure by observing the gauges or displays on the sterilizer and noting these parameters for each load. Correct readings do not ensure sterilization, however, incorrect readings may be an early indication of a problem with the sterilization cycle.

Chemical indicators use sensitive chemicals to assess physical conditions (e.g., time, temperature or the presence of steam) during the sterilization process. Even though chemical indicators do not prove sterilization has been achieved, they allow detection of certain equipment malfunctions, and they can help identify procedural errors. Chemical indicators (e.g., chemical indicator tape or special markings) change color rapidly when a specific parameter is reached. This verifies that the package has been exposed to the sterilization process. Chemical indicators should be used for each package to signify that the package has undergone a sterilization cycle.

If either mechanical indicators or internal or external chemical indicators indicate inadequate processing, items in the load should not be used until reprocessed.

Biological indicators (BI) (i.e., spore tests) verify the sterilization process directly by assessing the killing of known highly resistant microorganisms. As spores used in BIs are more resistant and present in greater numbers than the common microbial contaminants found on patient-care equipment, an inactivated BI signifies that other potential pathogens in the load have been killed.

Correct functioning of sterilization cycles should be verified for each sterilizer by the periodic use of BIs, at least weekly. Every load containing implantable devices should be monitored with a BI, and the items stored until BI results are known.

Manufacturer's directions should determine the placement and location of BIs in the sterilizer. A control BI, from the same lot as the test indicator and not processed through the sterilizer, should be incubated with the test BI; the control BI should yield positive results for bacterial growth.

Mail-in sterilization monitoring services (e.g., from private companies or dental schools) should be used to test both the test BI and the control BI. In-office biological monitoring systems, processed by the office DHCP, are available, and may be preferable to mail-in services, given the increased safety provided by decreasing turn-around time.

In the event of a positive spore test, the BI test should be repeated immediately after correctly loading the sterilizer and using the same cycle that produced the failure. The sterilizer should be removed from service, and all records reviewed of chemical and mechanical monitoring since the last negative BI test.

Sterilizer operating procedures should be reviewed, including packaging, loading and spore testing, with all DHCPs who work with the sterilizer to determine whether operator error could be responsible. Common reasons for a positive BI in the absence of mechanical failure of the sterilizer include:

- Overloading
- Failure to provide adequate package separation
- Incorrect or excessive packaging material

A second monitored sterilizer in the office can be used, or a loaner from a sales or repair company obtained, to minimize office disruption while waiting for the repeat BI results.

If the repeat BI test is negative and chemical and mechanical monitoring indicates adequate processing, the sterilizer may be put back into service. If the repeat BI test is positive, and packaging, loading, and operating procedures have been confirmed as performing correctly, the sterilizer should remain out of service until it has been inspected, repaired, and re-challenged with BI tests in three consecutive empty chamber sterilization cycles. Whenever possible, items from suspect loads dating back to the last negative BI test should be recalled, re-wrapped, and re-sterilized.

Results of biological monitoring should be recorded and retained.

Non-critical patient-care items pose the least risk of transmission of infection, contacting only intact skin, which serves as an effective barrier to microorganisms. Examples of non-critical items would include radiograph heads / cones, blood pressure cuffs, facebows and pulse oximeters.

Non-critical patient care items should be cleaned, or, if contaminated, cleaned and then disinfected with a hospital-grade tuberculocidal intermediate-level disinfectant. Cleaning and disinfection of some non-critical items may be difficult or may damage the surfaces. In those instances, the use of disposable barriers to protect these surfaces may be a preferred alternative. (See IPC-05-03)

Environmental surfaces in the dental operatory that do not contact the patient directly are not a direct risk to patient safety. These surfaces (e.g., light handles, drawer knobs), however, can become contaminated during patient care, and then act as a reservoir for microbial contamination. Transmission of this type occurs primarily though DHCP hand contact, or by touching the environmental surface with a contaminated instrument. Microorganisms can then be transferred to other instruments or to the hands, nose, mouth or eyes of DHCP or patients.

Proper hand hygiene and the wearing of PPE is an essential part in minimizing such potential transferal. Surface protection, however, using either barrier protection or cleaning and disinfection, also protects against microbial transfer from environmental surfaces.

Environmental surfaces can be divided into:

- **Clinical Contact Surfaces:** These surfaces may come in direct contact with a DHCP's hands, patient-care items, or with a patient, and have a minimal, but potential risk of infectious disease transmission. Examples would include light handles, dental radiograph equipment, drawer handles and doorknobs.
- **Housekeeping Surfaces:** These surfaces have limited risk of disease transmission, unless they inadvertently come in direct contact with DHCP's hands, patient-care items or dental appliances. Examples would include floors, walls and sinks.

Environmental surfaces typically need to be cleaned only. However, whenever an environmental surface is known or is suspected to be contaminated with blood, saliva, other bodily fluids or water containing any bodily fluid, then the environmental surface should be cleaned and then disinfected.

An important first step in disinfecting any surface is cleaning. Cleaning removes debris such as organic matter, salts and soils that are adherent to a surface. This debris may interfere with microbial inactivation by a disinfectant.

Clinical contact surfaces can be directly contaminated with blood, saliva, other bodily fluids or water containing bodily fluids either by direct spray or spatter or by contact with contaminated instruments or a DHCP's gloved hands. These surfaces can subsequently contaminate other instruments, devices, hands or gloves. Examples of such surfaces include:

- Light handles
- Switches
- Radiograph equipment,
- Chairside computer keyboards and monitors
- Reusable containers of dental materials
- Drawer handles
- Faucet handles,
- Countertops,
- Writing utensils, such as pens
- Telephones
- Doorknobs

Clinical contact surfaces should be protected after use to avoid cross-contamination. Surface protection is accomplished by either:

- Surface cleaning and disinfection
  OR
- Barrier protection

Surface cleaning and disinfection

All clinical contact surfaces that have been contaminated or may have been contaminated should be cleaned and disinfected between patients and at the end of the workday using a hospital-grade tuberculocidal intermediate-level disinfectant. DHCP should wear appropriate PPE while cleaning and disinfecting clinical contact surfaces.

Treatment areas should be kept uncluttered of unnecessary equipment and supplies to make daily cleaning easier. Manufacturers' instructions should be consulted regarding compatibility of devices and equipment with liquid chemical disinfectants.

Barrier protection

Clinical contact surfaces and equipment can be protected from contamination using barrier protection. Barrier protection is particularly effective for those clinical contact surfaces that are difficult to clean and disinfect due to surface topography or material chemical incompatibilities. Barrier protection materials include:

- Clear plastic wrap
- Plastic bags
- Plastic sheets
- Plastic tubing
- Plastic-backed paper
- Other materials impervious to moisture

Barriers become contaminated during patient care. Barriers should be removed and discarded between patients using gloves. Following removal of the barrier, the clinical contact surface should be examined to ensure it did not become inadvertently contaminated. The surface should be cleaned and disinfected if contaminated.

Following removal of the barrier, gloves should be removed, hand hygiene should be performed and clean barriers should be placed prior to the next patient treatment.

Housekeeping surfaces, such as floors, walls and sinks, have a limited risk of disease transmission in dental health-care settings. Periodic cleaning with dilute detergents or household low-level disinfectants is typically all that is required. If the surface becomes contaminated with blood, saliva or other bodily fluids, the surface should be cleaned and then disinfected with a hospital-grade tuberculocidal intermediate-level disinfectant.

Floors should be cleaned regularly, and spills should be quickly cleaned up. Routine disinfection of floors, windows, walls, drapes, window blinds and other vertical surfaces is not necessary unless the surfaces are known or are suspected to be contaminated.

Cleaning tools, such as mop heads or cleaning cloths, should be cleaned after use and allowed to dry before reuse. Single-use, disposable mop heads and cloths are also available and should be used to avoid spreading contamination.

Dilute solutions of detergents or disinfectants, especially if prepared in dirty containers, stored for long periods of time or prepared incorrectly, may become reservoirs for microorganisms. Manufacturers' instructions for preparation and use should be followed. Fresh cleaning solution should be made each day, discarding any remaining solution and allowing the container to dry between uses.

Contaminated housekeeping surfaces should be dealt with promptly by cleaning and surface disinfection. Blood spills or splashes should be contained and managed as quickly as possible to reduce the risk of contact by patients and DHCP. The DHCP responsible to clean the spill should be pre-assigned so that a delay does not occur. This DHCP should wear appropriate PPE. Visible organic material should be removed with absorbent material (e.g., disposable paper towels discarded in a leak-proof container). Non-porous surfaces should be cleaned and then decontaminated with a hospital-grade tuberculocidal intermediate-level disinfectant. However, if such products are unavailable, a 1:100 dilution of sodium hypochlorite (e.g., approximately 60ml. [¼ cup] of 5.25% household chlorine bleach in 4 litres [1 gallon] of water) is an inexpensive and effective disinfecting agent.

Carpeting and cloth furnishings are difficult to clean and cannot be reliably disinfected. Carpeting and cloth furnishings should not be used in patient care areas.

General waste from dental health-care settings is no more infective than residential waste. Medical waste of concern requires special storage, handling, neutralization and disposal, according to provincial and municipal regulations. Such waste includes:

- Solid waste soaked or saturated with blood or saliva (e.g., gauze saturated with blood following surgery)
- Surgically removed hard or soft tissue (not including extracted teeth; see IPC-06-07)
- Contaminated sharp items (e.g., needles, scalpel blades, wires)

Any item that may have come in contact with blood, saliva, other bodily fluids or water or other liquid that contains bodily fluids is not likely to be infective, and treating all such waste as infective is not practical or necessary.

Non-sharp medical waste should be placed in a leak-resistant sturdy bag. Local regulations may require that this bag is labeled as “Biohazardous” waste. The exterior of the bag should not be contaminated prior to disposal. If the exterior of the bag is contaminated or punctured, the bag should be placed in a second study bag, similarly labeled, if required. All bags should be securely closed for transportation and disposal. Puncture-resistant sharps containers should be located at the point of use (i.e., in the operatory) for immediate disposal of scalpel blades, needles, syringes and unused sterile sharps.

Dental offices should dispose of general and medical waste regularly to avoid accumulation. Every dental care facility should have a plan for management of medical waste that complies with local provincial and municipal regulations to ensure health and environmental safety.

All containers with blood or saliva (e.g., suctioned fluids) may be safely poured into a utility sink, drain or toilet, which drains into a sanitary sewer system or septic tank. DHCP should wear appropriate PPE during this task.

Dental unit waterlines (DUW) (i.e., narrow-bore plastic tubing that carries water to handpieces, air/water syringe and ultrasonic scaler) can become heavily colonized with waterborne microorganisms, including bacteria, fungi, and protozoa. However, DUW are not a conducive environment for bacterial floral commonly found in the oral cavity.

High numbers of these opportunistic microorganisms are not necessarily dangerous to the general population, unless the DHCP or patient is a susceptible host. Susceptible hosts would include DHCP or patients that are immunocompromised (e.g., those living with HIV and people undergoing oncology treatment or organ transplantation procedures), those with cystic fibrosis, chronic bronchitis and bronchiectasis.

The potential risk of infection from DUW microorganisms can be effectively reduced to counts to potable water standards (i.e., less than 500 cfu/ml) by following regular waterline maintenance procedures. These procedures are as follows:

- Waterline heaters should not be used in a dental unit or in dental equipment, as these heaters encourage waterline microorganism growth.
- All waterlines should be purged at the beginning of each workday by flushing the lines thoroughly with water for at least 2-3 minutes. This purging should be done with handpieces, air/water syringe tips and ultrasonic tips not attached to the waterlines.
- Handpieces utilizing water coolant should be run for 20-30 seconds after patient care, in order to purge all potentially contaminated air and water. A sterilized handpiece can then be attached, following regular clinical contact surface management (see IPC-05-03).
- Sterile water or sterile saline should be used when irrigating open vascular sites and whenever bone is cut during invasive surgical procedures. Sterile water or sterile saline may be administered. Conventional dental units do not reliably deliver sterile solutions, even when equipped with independent water reservoirs, due to the formation of biofilm along the water pathway. Delivery systems, such as bulb syringe or sterile, single-use disposable products along the entire system, should be used to deliver sterile irrigation solutions.
- When closed water systems are used, DHCP should be careful not to touch the tubing with the fingers or gloved hand when changing the water coolant bottle, as this easily contaminates the entire system.
- Manufacturers' instructions of the dental units and dental equipment should be followed for daily and weekly maintenance whenever closed water systems or other special water delivery systems are utilized.

Boil water advisories occur whenever public health officials determine that municipally delivered tap water is unsafe to drink. Circumstances that compromise the safety of the municipal water system include compromises in the distribution system (e.g., water-main breaks), water treatment system failures and natural disasters (e.g., floods, hurricanes or earthquakes).

During a boil water advisory, the following precautions should be taken:

- Public water should not be delivered to the patient through the dental unit, ultrasonic scaler or other devices or equipment.
- Use alternative water sources through closed delivery systems.
- Postpone treatment delivery, if necessary.
- Patients should not rinse their mouths with tap water; bottled or distilled water should be used instead.
- Tap water should not be used for hand hygiene. Antimicrobial products that do not require water, such as alcohol-based hand-rubs, should be used for hand hygiene. If the hands have been known or suspected to be contaminated, hands should be washed using bottled or distilled water and an antimicrobial soap.
- When the boil water advisory is cancelled, all incoming public water system lines, including any taps or other waterlines in the dental office, should be flushed for 1-5 minutes. The dental unit waterlines in all dental units and equipment should be disinfected according to the manufacturer's instructions prior to use.

Several dental devices contact mucous membranes and expel air and water into the patient's mouth and potentially into open wounds. These devices are attached to the air or waterlines of the dental unit, and include:

- High- and low-speed handpieces, including low-speed motors
- Prophylaxis angles
- Ultrasonic and sonic scaling tips
- Ultrasonic and sonic endodontic devices
- Air abrasion devices
- Air and water syringe tips

These devices have the potential of retracting oral fluids into internal compartments of the device. This retained patient material can then subsequently be expelled in the oral cavity of a patient during later use. Restricted physical access often limits the cleaning of these internal compartments, and compromises decontamination.

Any dental device connected to the dental air/water system that enters the patient's mouth should be run to discharge water and air for a minimum of 20-30 seconds after each patient use. This procedure is intended to physically flush out any patient material that might have entered the turbine and air and waterlines.

Dental handpieces and other intraoral devices attached to air or waterlines should be sterilized after patient care use. Ethylene oxide gas (ETO) cannot adequately sterilize internal components of handpieces and should not be used to sterilize handpieces or other devices with small lumens (see IPC-04-02).

Manufacturer's instructions for cleaning, lubrication and sterilization should be followed closely to ensure both the effectiveness of the process and the longevity of handpieces.

Components of dental devices and equipment that are permanently attached to dental unit waterlines should be treated as clinical contact surfaces (see IPC-05-03). Such components (e.g., electric handpiece motors, handles for ultrasonic devices or dental unit attachments of saliva ejectors, high-speed air evacuators, and air/water syringes) should be covered with barriers that are changed after each use (see IPC-05-03). If the item is contaminated or is suspected to have been contaminated during use, the item should be cleaned and disinfected with a hospital grade intermediate-level disinfectant prior to use on the next patient.

Backflow in low-volume suction lines can occur when a seal around the saliva ejector is created (e.g., by a patient closing lips around the tip of the ejector, creating a partial vacuum). This can result in microorganisms from the suction lines to be retracted into the patient's mouth and a potential source of cross-contamination.

DHCP should be careful not to allow patients to seal their mouths over the saliva ejector tip. Engineering controls exist with specially designed saliva ejector tips that do not allow a negative pressure to form around the tip of the saliva ejector.

Suction lines should be rinsed at least with water between patients to remove loosely adherent debris and microorganisms and to reduce the likelihood of infectious material backflow. The procedure is to aspirate water or appropriate cleaning or disinfecting solution in the lines with air to produce turbulent flow in the lines. Suction lines should be cleaned at least once a week with an enzymatic cleaner.

Cross-contamination of radiographic equipment and environmental surfaces with blood or saliva is possible.

Gloves and other PPE should be worn when taking radiographs and handling contaminated film packets. Heat-tolerant versions of intraoral radiograph accessories are available and these semi-critical items (e.g., film-holding and positioning devices) should be heat sterilized between patient uses.

Radiography equipment (e.g., radiograph tube head and control panel) should be protected with surface barriers that are changed after each patient use. If barriers are not used, equipment that has come into contact with DHCP's gloved hands or contaminated film packets should be cleaned and then disinfected after each patient use.

After exposure of the radiograph and before glove removal, the film should be rinsed and dried to remove blood or excess saliva and protected for transport to the developing area. The film packet should be disinfected using a hospital-grade tuberculocidal intermediate-level disinfectant. The film packet should then be rinsed and dried before opening to develop the film. Alternately, the contaminated film packets may be opened using gloved hands, the film dropped onto a clean surface without touching and the empty packets disposed in an area where cross-contamination is not possible. The gloves should then be removed, and the film processed.

Film barrier pouches may alternately be used. The film packets should be carefully removed from the pouch to avoid contamination of the inner film packet.

Care should be taken to avoid contamination of the developing equipment. Protective barriers should be used, or any surfaces that become contaminated should be cleaned and disinfected using a hospital-grade tuberculocidal intermediate-level disinfectant.

Digital radiography sensors and other associated instruments (e.g., intraoral camera, electronic periodontal probe, occlusal analyzers and lasers) come into contact with mucous membranes and are considered semi-critical devices. These devices should be cleaned and heat sterilized or disinfected between patients. Alternatively, these devices should be barrier protected to reduce gross contamination during use. The device should be carefully inspected following removal of the barrier, and if contaminated, should be cleaned and disinfected prior to next patient use. Manufacturers' instructions should be carefully followed regarding appropriate barrier and disinfection/sterilization procedures for these devices.

A single-use device is designed to be used on one patient and then discarded, not re-processed for use on another patient (e.g., cleaned, disinfected or sterilized). Examples of single-use or disposable devices include syringe needles, prophylaxis cups and brushes and certain orthodontic brackets.

Single-use devices in dentistry are usually not heat-tolerant and cannot be reliably cleaned or disinfected. Certain items (e.g., prophylaxis angles, saliva ejectors, high-volume evacuator tips and air/water syringe tips) are commonly available in a disposable form and should be disposed of appropriately after each use.

Antimicrobial mouth rinses (e.g., chlorhexidine gluconate, essential oils or povidone-iodine) should be used by a patient prior to a dental procedure. This is done to reduce the number of microorganisms that might be released from the patient's mouth in the form of aerosols or spatter, which can subsequently contaminate DHCP and equipment operatory environmental surfaces.

Pre-procedural mouth rinses can also decrease the number of microorganisms introduced in the patient's bloodstream during invasive dental procedures, thus reducing the risk of transient bacteremias.

This procedure may not be practical in those patients that cannot rinse or spit, and considerations may be given where the antimicrobial solution is first brushed or swabbed in the mouth prior to beginning oral health care.

Biopsy specimens should be placed in a sturdy, leak-proof container with a secure lid for transportation. The DHCP should take care when collecting the specimen to avoid contaminating the outside of the container. If the outside of the container becomes or is suspected to be contaminated, it should be cleaned and disinfected or placed in an impervious bag prior to transportation.

Local provincial or municipal regulations may require a biopsy container to be labeled with the biohazard symbol during storage, transport, shipment and disposal.

Extracted teeth may be returned to a patient without any special considerations for infection prevention and control.

Extracted teeth that are being discarded should be handled carefully and disposed in general waste. Extracted teeth sent to a dental laboratory for shade or size comparisons should be cleaned and surface-disinfected with a hospital-grade tuberculocidal intermediate-level disinfectant. Extracted teeth containing dental amalgam should not be placed in waste containers that are subsequently incinerated.

Extracted teeth collected for use in preclinical educational training should be cleaned of visible blood and gross debris and maintained in a hydrated state in a well-constructed closed container during transportation. Liquid chemical germicides may be used as a transportation medium; however, these agents do not reliably disinfect both external surface and interior pulp tissue. Local regulations may require that the container should be labeled with the biohazard symbol.

Prior to being used in an educational setting, the teeth should be heat sterilized by autoclaving to allow safe handling. Extracted teeth containing amalgam restorations should not be heat sterilized, due to the potential health hazard from mercury vaporization and exposure. If extracted teeth containing amalgam restorations are to be used, the teeth should be immersed in a 10% formalin solution for at least 2 weeks.

Dental prostheses, appliances and items used in their fabrication (e.g., impressions, occlusal rims, and bite registrations) are potential sources for cross-contamination and should be handled in a manner that prevents exposure of DHCP, patients or the office environment to infectious agents.

The laboratory and dental practice personnel should communicate to ensure that appropriate cleaning and disinfection procedures are performed in the dental office or laboratory, that materials are not damaged or distorted because of disinfectant overexposure, and that effective disinfection procedures are not unnecessarily duplicated. Clinical materials that are not decontaminated and are transported from a dental office to an off-site laboratory may be subject to provincial and municipal regulations regarding transportation and shipping of infectious materials.

Dental prostheses, appliances or impressions brought into the laboratory may be contaminated with microorganisms. Dental prostheses, impressions, orthodontic appliances and other prosthodontic materials (e.g., occlusal rims, temporary prostheses, face bow forks or bite registrations) should be thoroughly cleaned of all debris, disinfected with a hospital-grade tuberculocidal intermediate-level disinfectant and thoroughly rinsed before being handled in the in-office laboratory or sent to an off-site laboratory. Cleaning and disinfection should be done as soon as possible after removal from the patient's mouth and before drying of blood or other organic debris occurs. “Wet” impressions or appliances should be placed in an impervious bag prior to transportation to an off-site laboratory. Manufacturers’ instructions should be consulted regarding the stability of specific materials during disinfection.

A separate receiving and disinfecting area should be established in the laboratory to reduce contamination. If no communication has been received regarding prior cleaning and disinfection of a material, the dental laboratory staff should perform cleaning and disinfection procedures before handling the material or device. If during manipulation of a material or appliance a previously undetected area of blood or other organic debris becomes apparent, cleaning and disinfection procedures should be repeated.

Dental laboratory staff should wear appropriate PPE (mask, gloves and protective eyewear) until cleaning and disinfection is completed (see IPC-03-01).

If laboratory items (e.g., burs, polishing points, rag wheels or laboratory knives) are used on contaminated or potentially contaminated appliances, prostheses, or other material, they should be heat sterilized, disinfected between patients or discarded.

Heat-tolerant items used in the mouth (e.g., metal impression trays or face bow forks) should be cleaned and heat sterilized before being used on another patient. Items that do not normally contact the patient, prosthetic device or appliance, but frequently become contaminated and cannot withstand heat sterilization (e.g., articulators, case pans or lathes) should be cleaned and disinfected between patients, according to the manufacturer's instructions. Pressure pots and water baths should be cleaned and disinfected between patients. Environmental surfaces should be barrier-protected or cleaned and disinfected in the same manner as in the dental treatment area (see IPC-05-01).

Waste generated in the dental laboratory (e.g., disposable trays or impression materials) may be discarded with general waste. Dental laboratory staff should dispose of sharp items (e.g., burs, disposable blades and orthodontic wires) in puncture-resistant containers.

Appliances and prostheses delivered to the patient should be free of contamination. If the dental laboratory staff provides the disinfection, a hospital-grade tuberculocidal intermediate-level disinfectant should be used and the item placed in a tamper-evident container before returning the item to the dental office. If such documentation is not provided, the dental office should provide final disinfection procedures.

The thermal destruction of tissue, during procedures that use a laser or electrosurgical unit, creates a smoke by-product, which may contain viable microorganisms.

Lasers transfer electromagnetic energy into tissues, resulting in the release of a heated plume that includes particles, gases (e.g., hydrogen cyanide, benzene, and formaldehyde), tissue debris, viruses and offensive odors.

DHCP should use work practice and engineering controls to avoid inhaling or otherwise coming in contact with laser and electrosurgical plumes and surgical smoke. These practices include using:

- Standard Precautions (e.g., high-filtration surgical masks and possibly full face shields)
- Central room suction units with in-line filters to collect particulate matter from minimal plumes
- Dedicated mechanical smoke exhaust systems with a high-efficiency filter to remove substantial amounts of laser plume particles

Local smoke evacuation systems may be used to improve the quality of the operating field.

Patients infected with *M. tuberculosis* (TB) occasionally seek routine and urgent dental treatment. DHCP or the community served by the dental facility are at risk for exposure to TB. DHCP treating patients infected with *M. tuberculosis* should understand the pathogenesis of the development of TB to help determine how to manage such patients.

M. tuberculosis is a bacterium carried in airborne infective droplet nuclei that can be generated when persons with pulmonary or laryngeal TB sneeze, cough, speak or sing. These small particles (1-5 µm) can stay suspended in the air for several hours.

Infection occurs when a susceptible person inhales droplet nuclei containing *M. tuberculosis*, which then travel to the alveoli of the lungs. Typically, within 2-12 weeks after initial infection with *M. tuberculosis*, immune response prevents further spread of the TB bacteria, although the bacteria can remain viable in the lungs for years, a condition termed “latent TB infection”. People with latent TB infection usually exhibit a reactive tuberculin skin test (TST), have no symptoms of active disease and are not infectious. However, people with latent TB infection can develop active disease later in life if they do not receive treatment for their latent infection.

Approximately 5% of persons who have been recently infected and not adequately treated for latent TB infection will progress from infection to active disease during the first 1-2 years after infection; another 5% will develop active disease later in life. Although both latent TB infection and active TB disease are described as TB, only the person with active disease is contagious and presents a risk of transmission. Symptoms of active TB disease include a productive cough, night sweats, fatigue, malaise, fever, unexplained weight loss and occasionally oral ulceration(s). Certain immunocompromising medical conditions (e.g., HIV disease) increase the risk that TB infection will progress to active disease at a faster rate.

Surgical masks typically used in the dental health-care setting do not prevent inhalation of *M. tuberculosis* droplet nuclei due to their small diameter, and therefore, Standard Precautions are not sufficient to prevent transmission of this organism.

TB transmission is controlled through a hierarchy of measures, including:

- **Administrative controls:** Administrative goals of a TB infection-control program include detection of a person with active TB disease and prompt isolation from susceptible persons to reduce the risk of transmission. Although DHCP are not responsible for diagnosis and treatment of TB, they should be trained to recognize signs and symptoms to help with prompt detection. Because potential for transmission of *M. tuberculosis* exists in outpatient settings, dental practices should develop a TB control program appropriate for their level of risk.
  DHCP who have contact with patients should have a baseline TST, preferably by using a two-step test at the beginning of employment. The facility's level of contact with patients at risk of TB risk will determine the need for routine follow-up TST.
  While taking patients' initial medical histories and at periodic updates, DHCP should routinely ask all patients whether they have a history of TB disease or symptoms indicative of TB. Patients with a medical history or symptoms indicative of undiagnosed active TB should be referred promptly for medical evaluation to determine possible infectious risk. These patients should not remain in the dental-care facility any longer than required to evaluate their dental condition and arrange a medical referral. While in the dental health-care facility, the patient should be isolated from other patients and DHCP, should wear a surgical mask when not being evaluated and should be instructed to cover their mouth and nose when coughing or sneezing. Elective dental treatment should be deferred until a physician confirms that a patient does not have infectious TB, or if the patient is diagnosed with active TB disease, until confirmed the patient is no longer infectious; typically, 48 hours following institution of anti-tuberculous therapy.

- **Environmental controls:** If urgent dental care is provided for a patient who has, or is suspected of having active TB disease, the care should be provided in a facility (e.g., hospital) that provides airborne infection isolation (i.e., using such engineering controls as TB isolation rooms, negatively pressured relative to the corridors, with air either exhausted to the outside or HEPA-filtered if recirculation is necessary).

- **Personal respiratory protection:** Standard surgical facemasks do not protect against TB transmission. DHCP treating patients with active TB should use respiratory protection (e.g., fit-tested, disposable N-95 respirators).

Creutzfeldt-Jakob disease (CJD) belongs to a group of rapidly progressive, invariably fatal, degenerative neurological disorders, called transmissible spongiform encephalopathies (TSEs). TSEs affect both humans and animals and are thought to be caused by infection with an unusual pathogen called a prion. Prions are isoforms of a normal protein, capable of self-propagation even though they lack nucleic acid. Prion diseases have an incubation period of many years or decades, and are typically fatal within 1 year of diagnosis. Prions are not inactivated by the standard sterilization methods used in dental health-care settings.

Human TSEs include CJD, Gerstmann-Straussler-Scheinker syndrome, fatal familial insomnia, kuru and variant CJD (vCJD). Occurring in sporadic, familial, and acquired (i.e., iatrogenic) forms, CJD is exceedingly rare. In approximately 85% of affected patients, CJD occurs as a sporadic disease with no recognizable pattern of transmission. A smaller proportion of patients (5%-15%) experience familial CJD caused by inherited mutations of the prion protein gene.

vCJD is distinguishable clinically and neuropathologically from classic CJD, and strong epidemiologic and laboratory evidence indicates a causal relationship with bovine spongiform encephalopathy (BSE), a progressive neurological disorder of cattle commonly known as “mad cow disease”. Compared to patients with CJD, those with vCJD are younger (28 years versus 68 years median age at death), and have a longer duration of illness (13 months versus 4.5 months). Patients with vCJD characteristically exhibit sensory and psychiatric symptoms that are uncommon with CJD.

CJD and vCJD are transmissible diseases, but not through the air or casual contact. Virtually all known cases of iatrogenic CJD have resulted from exposure to infected central nervous tissue (e.g., brain and dura mater), pituitary or eye tissue. Animal models and experimental designs indicate a theoretical risk of transmitting prion diseases through perioral neural tissue exposures.

DHCP should include medical history questions regarding dura mater transplantation, and familial history of CJD and vCJD. Dental instruments and devices touching pulpal tissue (e.g., endodontic broaches and files, access opening burs) should be discarded in sharps containers after each patient use.

The goal of a dental infection-control program is to provide a safe treatment environment for the patient and a safe working environment for the DHCP. This is accomplished by reducing the risk of health-care associated (nosocomial) infections in patients and occupational exposures in DHCP. Errors in infection prevention and control practices are caused by faulty systems, processes and conditions that lead DHCP to make mistakes or fail to prevent errors being made by others.

Effective program evaluation is a systematic way to ensure procedures are useful, feasible, ethical and accurate. Program evaluation is an essential organizational practice. Evaluation offers an opportunity to improve the effectiveness of both the infection prevention and control program and dental practice protocols. Such program evaluation should be practiced consistently across program areas, and should be well integrated into the day-to-day management of the infection prevention and control program.

A successful infection prevention and control program depends on developing standard operating procedures, evaluating practices, routinely documenting adverse outcomes (e.g., occupational exposures to blood) and work-related illnesses in DHCP and monitoring health-care associated infections in patients. Strategies and tools to evaluate the infection-control program can include:

- Periodic observational assessments
- Checklists to document procedures
- Routine review of occupational exposures to blood-borne pathogens

If deficiencies or problems in the implementation of infection-control procedures are identified, further evaluation is needed to eliminate the problems. Effective implementation of infection prevention and control programs is an on-going process, requiring the DHCP to monitor the scientific literature and stay abreast of new knowledge of emerging infectious diseases.

IPC-01-01 Introduction - Purpose of this document

CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).
McCarthy GM, Koval JJ, John MA, MacDonald JK. Infection Control Practices Across Canada: Do Dentists Follow the Recommendations? *J Can Dent Assoc* 1999; 65:506-11.

IPC-01-02 Introduction - Ethical Considerations

CDA. Statement on the Ethical and legal Considerations of Treating Patients with Infectious Diseases. CDA Guidelines 1999;16.

IPC-01-03 Introduction - Principles of Infection Prevention and Control In the Dental Setting

Bolyard EA, Tablan OC, Williams WW, Pearson ML, Shapiro CN, Deitchman SD, Hospital Infection Control Practices Advisory Committee. Guideline for infection control in health care personnel, 1998. *Am J Infect Control* 1998;26:289-354.
CDC. Recommendations for prevention of HIV transmission in health-care settings. *MMWR* 1987;36(suppl No. 2S).
Garner JS, Favero MS. CDC guideline for handwashing and hospital environmental control, 1985. *Infect Control* 1986;7:231-43.
Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol* 1996;17:53-80.
John M. Risk of Bacterial Transmission in Dental Practice. J Can Dent Assoc 2000; 66:550-2.
McCarthy GM. Universal Precautions. *J Can Dent Assoc* 2000; 66:556-7.

IPC-02-01 Personnel Health - General Considerations

CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).

IPC-02-02 Personnel Health - Education and Training

Gershon RR, Karkashian CD, Grosch JW, et al. Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *Am J Infect Control* 2000;28:211-21.
US Department of Labor, Occupational Safety and Health Administration. 29 CFR Part 1910.1030. Occupational exposure to bloodborne pathogens; needlesticks and other sharps injuries; final rule. *Federal Register* 2001;66:5317-25.

IPC-02-03 Personnel Health - Immunizations

Association for Professionals in Infection Control and Epidemiology. APIC position paper: immunization. *Am J Infect Control* 1999;27:52-3.
CDC. Immunization of health-care workers: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). *MMWR* 1997;46(RR-18).

IPC-02-04 Personnel Health - Exposure Prevention

Beltrami EM. The risk and prevention of occupational human immunodeficiency virus infection. *Seminars in Infection Control* 2001;1:2-18.

CDC. Recommendations for prevention of HIV transmission in health-care settings. *MMWR* 1987;36(No. S2).

CDC. Guidelines for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health-care and public-safety workers: a response to P.L. 100-607. The Health Omnibus Programs Extension Act of 1988. *MMWR* 1989;38(No. S6).

CDC. National Institute for Occupational Safety and Health. Selecting, evaluating, and using sharps disposal containers. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1998. DHHS publication no. (NIOSH) 97-111.

CDC. National Institute for Occupational Safety and Health. NIOSH alert: Preventing needlestick injuries in health care settings. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1999.

CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001;50(RR-11).

Chiarello LA, Bartley J. Prevention of blood exposure in healthcare personnel. *Seminars in Infection Control* 2001;1:30-43.

Cleveland JL, Gooch BF, Lockwood SA. Occupational blood exposure in dentistry: a decade in review. *Infect Control Hosp Epidemiol* 1997; 18:717-21.

Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol* 1996;17:53-80.

Gooch BF, Cardo DM, Marcus R, et al. Percutaneous exposures to HIV-infected blood among dental workers enrolled in the CDC needlestick study. *J Am Dent Assoc* 1995;126:1237-42.

Gooch BF, Siew C, Cleveland JL, Gruninger SE, Lockwood SA, Joy ED. Occupational blood exposure and HIV infection among oral and maxillofacial surgeons. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;85:128-34.

McCarthy GM, Jonathan E. Britton JE. A Survey of Final-Year Dental, Medical and Nursing Students: Occupational Injuries and Infection Control. *J Can Dent Assoc* 2000; 66:561.

Siew C, Gruninger SE, Miaw CL, Neidle EA. Percutaneous injuries in practicing dentists: a propective study using a 20-day diary. *J Am Dent Assoc* 1995;126:1227-34.

Younai FS, Murphy DC, Kotelchuck D. Occupational exposures to blood in a dental teaching environment: results of a ten-year surveillance study. *J Dent Educ* 2001;65:436-8.

IPC-02-05 Personnel Health - Exposure Management and Prophylaxis

CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001;50(RR-11).

IPC-02-06 Personnel Health - Exposure Documentation

CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001;50(RR-11).

IPC-02-07 Personnel Health - Post-Exposure Prophylaxis

CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001;50(RR-11).

PHAC. Public health Agency of Canada: An integrated protocol to manage health care workers exposed to bloodborne pathogens. 1997;23S2.

IPC-02-08 Personnel Health - Hand Hygiene

Association of Perioperative Registered Nurses. Recommended practices for surgical hand scrubs. In: Fogg D, Parker N, eds. 2003 Standards, Recommended Practices, and Guidelines. Denver, CO: AORN, Inc., 2003:277-80.

Baumgardner CA, Maragos CS, Walz J, Larson E. Effects of nail polish on microbial growth of fingernails: dispelling sacred cows. *AORN J* 1993;58:84-8.

CDC. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *MMWR* 2002;51(RR-16).

Faoagali J, Fong J, George N, Mahoney P, O'Rouke V. Comparison of the immediate, residual, and cumulative antibacterial effects of Novaderm Novascrub, Betadine Surgical Scrub, Hibiclens, and liquid soap. *Am J Infect Control* 1995;23:337-43.

Garner JS. CDC guideline for prevention of surgical wound infections, 1985. Supersedes guideline for prevention of surgical wound infections published in 1982. (Originally published in November 1985). Revised. *Infect Control* 1986;7:193-200.

John M. Hand Hygiene: Washing and Disinfection. J Can Dent Assoc 2000; 66:546-7.

Larson EL. APIC guideline for hand washing and hand antisepsis in health-care settings. *Am J Infect Control* 1995;23:251-69.

Larson EL, Butz AM, Gullette DL, Laughon BA. Alcohol for surgical scrubbing? *Infect Control Hosp Epidemiol* 1990;11:139-43.

Larson EL, Early E, Cloonan P, Sugrue S, Parides M. An organizational climate intervention associated with increased handwashing and decreased nosocomial infections. *Behav Med* 2000;26:14-22.

Lowbury EJ, Lilly HA. Disinfection of the hands of surgeons and nurses. Br Med J 1960;1445-50.

McCormick RD, Buchman TL, Maki DG. Double-blind, randomized trial of scheduled use of a novel barrier cream and an oil-containing lotion for protecting the hands of health care workers. *Am J Infect Control* 2000;28:302-10.

McGinley KJ, Larson EL, Leyden JJ. Composition and density of microflora in the subungual space of the hand. *J Clin Microbiol* 1988;26:950-3.
McNeil SA, Foster CL, Hedderwick SA, Kauffman CA. Effect of hand cleansing with antimicrobial soap or alcohol-based gel on microbial colonization of artificial fingernails worn by health care workers. *Clin Infect Dis* 2001;32:367-72.
Price PB. New studies in surgical bacteriology and surgical technique. JAMA 1938;111:1993-6.
Rotter M. Hand washing and hand disinfection. In: Mayhall CG, ed. Hospital epidemiology and infection control. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 1999:1339-55.
Steere AC, Mallison GF. Handwashing practices for the prevention of nosocomial infections. *Ann Intern Med* 1975;83:683-90.
Trick WE, Vernon MO, Hayes RA, et al. Impact of ring wearing on hand contamination and comparison of hand hygiene agents in a hospital. *Clin Infect Dis* 2003;36:1383-90.
Widmer AF. Replace hand washing with use of a waterless alcohol hand-rub? *Clin Infect Dis* 2000;31:136-43.

IPC-03-01 Personal Protective Equipment - General Considerations

CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).
Cochran MA, Miller CH, Sheldrake MS. The efficacy of the rubber dam as a barrier to the spread of microorganisms during dental treatment. *J Am Dent Assoc* 1989;119:141-4.

IPC-03-02 Personal Protective Equipment - Gloves

Albin MS, Bunegin L, Duke ES, Ritter RR, Page CP. Anatomy of a defective barrier: sequential glove leak detection in a surgical and dental environment. *Crit Care Med* 1992;20:170-84.
Merchant VA, Molinari JA, Pickett T. Microbial penetration of gloves following usage in routine dental procedures. *Am J Dent* 1992;5:95-6.
Adams D, Bagg J, Limaye M, Parsons K, Absi EG. A clinical evaluation of glove washing and re-use in dental practice. *J Hosp Infect* 1992;20:153-62.
Andersson T, Bruze M, Bjorkner B. In vivo testing of the protection of gloves against acrylates in dentin-bonding systems on patients with known contact allergy to acrylates. *Contact Dermatitis* 1999;41:254-9.
Avery CM, Hjort A, Walsh S, Johnson PA. Glove perforation during surgical extraction of wisdom teeth. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;86:23-5.
Baumann MA, Rath B, Fischer JH, Iffland R. The permeability of dental procedure and examination gloves by an alcohol based disinfectant. *Dent Mater* 2000;16:139-44.
Burke FJ, Baggett FJ, Lomax AM. Assessment of the risk of glove puncture during oral surgery procedures. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996;82:18-21.
Burke FJ, Wilson NH. The incidence of undiagnosed punctures in non-sterile gloves. *Br Dent J* 1990;168:67-71.
CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).

Cheung LK, Chow LK, Tsang MH, Tung LK. An evaluation of complications following dental extractions using either sterile or clean gloves. *Int J Oral Maxillofac Surg* 2001;30:550-4.
DeGroot-Kosolcharoen J, Jones JM. Permeability of latex and vinyl gloves to water and blood. *Am J Infect Control* 1989;17:196-201.
Dodds RD, Guy PJ, Peacock AM, Duffy SR, Barker SG, Thomas MH. Surgical glove perforation. *Br J Surg* 1988;75:966-8.
Giglio JA, Roland RW, Laskin DM, Grenevicki L. The use of sterile versus nonsterile gloves during out-patient exodontia. *Quintessence Int* 1993;24:543-5.
Jordan SL, Stowers MF, Trawick EG, Theis AB. Glutaraldehyde permeation: choosing the proper glove. *Am J Infect Control* 1996;24:67-9.
Kahn RL, Donovan TE, Chee WW. Interaction of gloves and rubber dam with a poly (vinyl siloxane) impression material: a screening test. *Int J Prosthodont* 1989;2:342-6.
Klein RC, Party E, Gershey EL. Virus penetration of examination gloves. *Biotechniques* 1990;9:196-9.
Korniewicz DM, Laughon BE, Butz A, Larson E. Integrity of vinyl and latex procedure gloves. *Nurs Res* 1989;38:144-6.
Kotilainen HR, Brinker JP, Avato JL, Gantz NM. Latex and vinyl examination gloves. Quality control procedures and implications for health care workers. *Arch Intern Med* 1989;149:2749-53.
Larson EL. APIC guideline for hand washing and hand antisepsis in health-care settings. A*m J Infect Control* 1995;23:251-69.
Martin MV, Dunn HM, Field EA, et al. A physical and microbiological evaluation of the re-use of non-sterile gloves. *Br Dent J* 1988;165:321-4.
Matis BA, Valadez D, Valadez E. The effect of the use of dental gloves on mixing vinyl polysiloxane putties. *J Prosthodont* 1997;6:189-92.
Mellstrom GA, Lindberg M, Boman A. Permeation and destructive effects of disinfectants on protective gloves. *Contact Dermatitis* 1992;26:163-70.
Morgan DJ, Adams D. Permeability studies on protective gloves used in dental practice. *Br Dent J* 1989;166:11-3.
Murray CA, Burke FJ, McHugh S. An assessment of the incidence of punctures in latex and non-latex dental examination gloves in routine clinical practice. *Br Dent J* 2001;190:377-80.
Nikawa H, Hamada T, Tamamoto M, Abekura H. Perforation and proteinaceous contamination of dental gloves during prosthodontic treatments. *Int J Prosthodont* 1994;7:559-66.
Nikawa H, Hamada T, Tamamoto M, Abekura H, Murata H. Perforation of dental gloves during prosthodontic treatments as assessed by the conductivity and water inflation tests. *Int J Prosthodont* 1996;9:362-6.
Olsen RJ, Lynch P, Coyle MB, Cummings J, Bokete T, Stamm WE. Examination gloves as barriers to hand contamination in clinical practice. *JAMA* 1993;270:350-3.
Otis LL, Cottone JA. Prevalence of perforations in disposable latex gloves during routine dental treatment. *J Am Dent Assoc* 1989; 118:321-4.
Patton LL, Campbell TL, Evers SP. Prevalence of glove perforations during double-gloving for dental procedures. *Gen Dent* 1995;43:22-6.

Pitten FA, Herdemann G, Kramer A. The integrity of latex gloves in clinical dental practice. *Infection* 2000;28:388-92.
Ready MA, Schuster GS, Wilson JT, Hanes CM. Effects of dental medicaments on examination glove permeability. *J Prosthet Dent* 1989;61:499-503.
Reitz CD, Clark NP. The setting of vinyl polysiloxane and condensation silicone putties when mixed with gloved hands. *J Am Dent Assoc* 1988;116:371-5.
Richards JM, Sydiskis RJ, Davidson WM, Josell SD, Lavine DS. Permeability of latex gloves after contact with dental materials. *Am J Orthod Dentofacial Orthop* 1993;104:224-9.
Schwimmer A, Massoumi M, Barr CE. Efficacy of double gloving to prevent inner glove perforation during outpatient oral surgical procedures. *J Am Dent Assoc* 1994;125:196-8.
Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection (Cochrane Review). *The Cochrane Library* 2003;(Issue 2):1-32.

IPC-03-03 Personal Protective Equipment - Adverse Latex Reactions

American Dental Association Council on Scientific Affairs. The dental team and latex hypersensitivity. *J Am Dent Assoc* 1999;130:257-64.
CDC. National Institute for Occupational Safety and Health. NIOSH Alert: preventing allergic reactions to natural rubber latex in the workplace. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1997.
Dillard SF, Hefflin B, Kaczmarek RG, Petsonk EL, Gross TP. Health effects associated with medical glove use. *AORN J* 2002;76:88-96.
Hermesch CB, Spackman GK, Dodge WW, Salazar A. Effect of powder-free latex examination glove use on airborne powder levels in a dental school clinic. *J Dent Educ* 1999;63:814-20.
Miller CH. Infection control strategies for the dental office [Chapter 29]. In: Ciancio SG, ed. ADA guide to dental therapeutics. 2nd ed. Chicago, IL: ADA Publishing, 2000:543-58.
Primeau MN, Adkinson NF Jr, Hamilton RG. Natural rubber pharmaceutical vial closures release latex allergens that produce skin reactions. *J Allergy Clin Immunol* 2001;107:958-62.
Turjanmaa K, Reunala T, Alenius H, Brummer-Korvenkontio H, Palosuo T. Allergens in latex surgical gloves and glove powder. *Lancet* 1990;336:1588.

IPC-03-04 Personal Protective Equipment - Masks

Baur X, Jager D. Airborne antigens from latex gloves. *Lancet* 1990; 335:912.
CDC. National Institute for Occupational Safety and Health. TB respiratory protection program in health care facilities: administrator's guide. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1999. DHHS publication no. (NIOSH) 99-143.
CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 1994. *MMWR* 1994;43(RR-13).

Miller CH, Palenik DJ. Aseptic techniques [Chapter 10]. In: Miller CH, Palenik DJ, eds. Infection control and management of hazardous materials for the dental team. 2nd ed. St. Louis, MO: Mosby, 1998.

IPC-03-05 Personal Protective Equipment - Protective Eyewear

CDC. National Institute for Occupational Safety and Health. TB respiratory protection program in health care facilities: administrator's guide. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1999. DHHS publication no. (NIOSH) 99-143.
Miller CH, Palenik DJ. Aseptic techniques [Chapter 10]. In: Miller CH, Palenik DJ, eds. Infection control and management of hazardous materials for the dental team. 2nd ed. St. Louis, MO: Mosby, 1998.

IPC-03-06 Personal Protective Equipment - Protective Clothing

Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Hospital Infection Control Practices Advisory Committee. Guideline for prevention of surgical site infection, 1999. *Infect Control Hosp Epidemiol* 1999;20:250-78.

IPC-04-01 Sterilization and Disinfection of Patient Care Items - General Considerations

Spaulding EH. Chemical disinfection of medical and surgical materials [Chapter 32]. In: Lawrence CA, Block SS, eds. Disinfection, sterilization and preservation. Philadelphia, PA: Lea & Febiger, 1968: 517-31.

IPC-04-02 Sterilization and Disinfection of Patient Care Items - Processing Critical Items

Alfa MJ, Olson N, Degagne P, Hizon R. New low temperature sterilization technologies: microbicidal activity and clinical efficacy [Chapter 9]. In: Rutala WA, ed. Disinfection, sterilization, and antisepsis in health-care. Champlain, NY: Polyscience Publications, 1998:67-78.
Association for the Advancement of Medical Instrumentation, American National Standards Institute. Steam sterilization and sterility assurance using table-top sterilizers in office-based, ambulatory-care medical, surgical, and dental facilities. ANSI/AAMI ST40-1998. Arlington, VA: Association for the Advancement of Medical Instrumentation, 1998.
Association for the Advancement of Medical Instrumentation, American National Standards Institute. Steam sterilization and sterility assurance in health care facilities. ANSI/AAMI ST46-2002. Arlington, VA: Association for the Advancement of Medical Instrumentation, 2002.
Favero MS, Bond WW. Chemical disinfection of medical and surgical material [Chapter 43]. In: Block SS, ed. Disinfection, sterilization and preservation. 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2001:881-917.
Joslyn LJ. Sterilization by heat [Chapter 36]. In: Block SS, ed. 5th ed. Disinfection, sterilization, and preservation. Philadelphia, PA: Lippincott Williams & Wilkins, 2001:695-728.

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;13:39-43.
Miller CH, Palenik CJ. Sterilization, disinfection, and asepsis in dentistry [Chapter 53]. In: Block SS, ed. 5th ed. Disinfection, sterilization, and preservation. Philadelphia, PA: Lippincott Williams & Wilkins, 2001:1049-68.
Parker HH 4th, Johnson RB. Effectiveness of ethylene oxide for sterilization of dental handpieces. *J Dent* 1995;23:113-5.
Rutala WA, Weber DJ. Clinical effectiveness of low-temperature sterilization technologies. *Infect Control Hosp Epidemiol* 1998; 19:798-804.
Rutala WA, Weber DJ. Choosing a sterilization wrap for surgical packs. *Infection Control Today* 2000;4:64,70.

IPC-04-03 Sterilization and Disinfection of Patient Care Items - Processing Semi-Critical Items

CDC. Epidemiologic notes and reports: symptoms of irritation associated with exposure to glutaraldehyde-Colorado. *MMWR* 1987;36:190-1.
CDC. Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR* 2003;52(RR-10).
Lehman PA, Franz TJ, Guin JD. Penetration of glutaraldehyde through glove material: tactylon versus natural rubber latex. *Contact Dermatitis* 1994;30:176-7.

IPC-04-04 Sterilization and Disinfection of Patient Care Items - Sterilization Monitoring

Andres MT, Tejerina JM, Fierro JF. Reliability of biologic indicators in a mail-return sterilization-monitoring service: a review of 3 years. *Quintessence Int* 1995;26:865-70.
Association of Perioperative Registered Nurses. Recommended practices for sterilization in the practice setting. In: Fogg D, Parker N, Shevlin D, eds. 2002 standards, recommended practices, and guidelines. Denver, CO: *AORN J* 2002:333-42.
Association for the Advancement of Medical Instrumentation, American National Standards Institute. Steam sterilization and sterility assurance using table-top sterilizers in office-based, ambulatory-care medical, surgical, and dental facilities. ANSI/AAMI ST40-1998. Arlington, VA: Association for the Advancement of Medical Instrumentation, 1998.
Association for the Advancement of Medical Instrumentation. Chemical indicators-guidance for the selection, use, and interpretation of results. AAMI Technical Information Report No. 25. Arlington, VA: Association for the Advancement of Medical Instrumentation, 1999.
Association for the Advancement of Medical Instrumentation, American National Standards Institute. Steam sterilization and sterility assurance in health care facilities. ANSI/AAMI ST46-2002. Arlington, VA: Association for the Advancement of Medical Instrumentation, 2002.
Favero MS. Developing indicators for sterilization [Chapter 13]. In: Rutala W, ed. Disinfection, sterilization, and antisepsis in health care. Washington, DC: Association for Professionals in Infection Control and Epidemiology, Inc., 1998:119-32.

Greene WW. Control of sterilization process [Chapter 22]. In: Russell AD, Hugo WB, Ayliffe GA, eds. Principles and practice of disinfection, preservation, and sterilization. Oxford, England: Blackwell Scientific Publications, 1992:605-24.
Miller CH, Palenik CJ. Sterilization, disinfection, and asepsis in dentistry [Chapter 53]. In: Block SS, ed. 5th ed. Disinfection, sterilization, and preservation. Philadelphia, PA: Lippincott Williams & Wilkins, 2001:1049-68.
Miller CH, Sheldrake MA. The ability of biological indicators to detect sterilization failures. *Am J Dent* 1994;7:95-7.

IPC-04-05 Sterilization and Disinfection of Patient Care Items - Processing Non-Critical Items

CDC. Guidelines for Environmental Infection Control in Health-Care Facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR* 2003;52(RR-10).
CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).

IPC-05-01 Environmental Infection Control - General Considerations

CDC. Guidelines for Environmental Infection Control in Health-Care Facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR* 2003;52(RR-10).
CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).
Danforth D, Nicolle LE, Hume K, Alfieri N, Sims H. Nosocomial infections on nursing units with floors cleaned with a disinfectant compared with detergent. *J Hosp Infect* 1987;10:229-35.
Favero MS, Bond WW. Chemical disinfection of medical and surgical material [Chapter 43]. In: Block SS, ed. Disinfection, sterilization and preservation. 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2001:881-917.
Maki DG, Alvarado CJ, Hassemer CA, Zilz MA. Relation of the inanimate hospital environment to endemic nosocomial infection. *N Engl J Med* 1982;307:1562-6.

IPC-05-02 Environmental Infection Control - Housekeeping Surfaces

CDC. Guidelines for Environmental Infection Control in Health-Care Facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR* 2003;52(RR-10).
Fauerbach LL, Janelle JW. Practical applications in infection control [Chapter 45]. In: Block SS, ed. 5th ed. Disinfection, sterilization, and preservation. Philadelphia, PA: Lippincott Williams & Wilkins, 2001:935-44.
Gerson SL, Parker P, Jacobs MR, Creger R, Lazarus HM. Aspergillosis due to carpet contamination. *Infect Control Hosp Epidemiol* 1994;15:221-3.
Maki DG, Alvarado CJ, Hassemer CA, Zilz MA. Relation of the inanimate hospital environment to endemic nosocomial infection. *N Engl J Med* 1982;307:1562-6.

Skoutelis AT, Westenfelder GO, Beckerdite M, Phair JP. Hospital carpeting and epidemiology of *Clostridium difficile*. *Am J Infect Control* 1994;22:212-7.
Suzuki A, Namba Y, Matsuura M, Horisawa A. Bacterial contamination of floors and other surfaces in operating rooms: a five-year survey. *J Hyg* (Lond) 1984;93:559-66.

IPC-05-03 Environmental Infection Control - Clinical Contact Surfaces

Bloomfield SF, Smith-Burchnell CA, Dalgleish AG. Evaluation of hypochlorite-releasing disinfectants against the human immunodeficiency virus (HIV). *J Hosp Infect* 1990;15:273-8.
CDC. Guidelines for Environmental Infection Control in Health-Care Facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR* 2003;52(RR-10).
Crawford JJ. Clinical asepsis in dentistry. Mesquite, TX: Oral Medicine Press, 1987.

IPC-05-04 Environmental Infection Control - Waste Management

Palenik CJ. Managing regulated waste in dental environments. *J Contemp Dent Pract* 2003;4:76.
Rutala WA, Mayhall CG. Medical waste. Infect Control Hosp Edidemiol 1992;13:38-48.
Rutala WA, Odette RL, Samsa GP. Management of infectious waste by US hospitals. *JAMA* 1989;262:1635-40.
Slade JS, Pike EB, Eglin RP, Colbourne JS, Kurtz JB. The survival of human immunodeficiency virus in water, sewage, and sea water. *Water Sci Tech* 1989;21:55-9.

IPC-05-05 Environmental Infection Control - Dental Unit Waterlines

Barbeau J, Tanguay R, Faucher E, et al. Multiparametric analysis of waterline contamination in dental units. *Appl Environ Microbiol* 1996;62:3954-9.
Martin MV. The significance of the bacterial contamination of dental unit water systems. *Br Dent J* 1987;163:152-4.
Mills SE. The dental unit waterline controversy: defusing the myths, defining the solutions. *J Am Dent Assoc* 2000;131:1427-41.
Santiago JI. Microbial contamination of dental unit waterlines: short and long term effects of flushing. *Gen Dent* 1994;42:528-35.
Shearer BG. Biofilm and the dental office. *J Am Dent Assoc* 1996; 127:181-9.
Whitehouse RLS, Peters E, Lizotte J, et al. Influence of biofilms on microbial contamination in dental unit water. *J Dent* 1991;19:290-5.
Williams JF, Johnston AM, Johnson B, Huntington MK, Mackenzie CD. Microbial contamination of dental unit waterlines: prevalence, intensity and microbiological characteristics. *J Am Dent Assoc* 1993;124:59-65.

IPC-05-06 Environmental Infection Control - Boil Water Advisories

CDC. Assessing the public health threat associated with waterborne cryptosporidiosis: report of a workshop. *MMWR* 1995;44(RR-6).

CDC, Working Group on Waterborne Cryptosporidiosis. Cryptosporidium and water: a public health handbook. Atlanta, GA: US Department of Health and Human Services, Public Health Service, CDC, 1997.

IPC-06-01 Special Considerations - Dental Handpieces and Other Devices

Andersen HK, Fiehn NE, Larsen T. Effect of steam sterilization inside the turbine chambers of dental turbines. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999;87:184-8.

Checchi L, Montebugnoli L, Samaritani S. Contamination of the turbine air chamber: a risk of cross infection. *J Clin Periodontol* 1998;25:607-11.

Crawford JJ, Broderius C. Control of cross-infection risks in the dental operatory: preventon of water retraction by bur cooling spray systems. *J Am Dent Assoc* 1988;116:685-7.

Epstein JB, Rea G, Sibau L, Sherlock CH, Le ND. Assessing viral retention and elimination in rotary dental instruments. *J Am Dent Assoc* 1995;126:87-92.

Gooch B, Marianos D, Ciesielski C, et al. Lack of evidence for patient-to-patient transmission of HIV in a dental practice. *J Am Dent Assoc* 1993;124:38-44.

Kuehne JS, Cohen ME, Monroe SB. Performance and durability of autoclavable high-speed dental handpieces. NDRI-PR 92-03. Bethesda, MD: Naval Dental Research Institute, 1992.

Leonard DL, Charlton DG. Performance of high-speed dental handpieces subjected to simulated clinical use and sterilization. *J Am Dent Assoc* 1999;130:1301-11.

Lewis DL, Arens M, Appleton SS, et al. Cross-contamination potential with dental equipment. *Lancet* 1992;340:1252-4.

Lewis DL, Boe RK. Cross-infection risks associated with current procedures for using high-speed dental handpieces. *J Clin Microbiol* 1992;30:401-6.

Mills SE, Kuehne JC, Bradley DV Jr. Bacteriological analysis of high-speed handpiece turbines. *J Am Dent Assoc* 1993;124:59-62.

IPC-06-02 Special Considerations - Saliva Ejectors

Barbeau J, ten Bokum L, Gauthier C, Prevost AP. Cross-contamination potential of saliva ejectors used in dentistry. *J Hosp Infect* 1998; 40:303-11.

Mann GL, Campbell TL, Crawford JJ. Backflow in low-volume suction lines: the impact of pressure changes. *J Am Dent Assoc* 1996;127:611-5.

Watson CM, Whitehouse RL. Possibility of cross-contamination between dental patients by means of the saliva ejector. *J Am Dent Assoc* 1993;124:77-80.

IPC-06-03 Special Considerations - Dental Radiology

Glass BJ, Terezhalmy GT. Infection control in dental radiology [Chapter 15]. In: Cottone JA, Terezhalamy GT, Molinari JA, eds. Practical infection control in dentisty. 2nd ed. Baltimore. MD: Williams & Wilkins, 1996:229-38.

Haring JI, Jansen L. Infection control and the dental radiographer. In: Haring JI, Jansen L, eds. Dental radiography: principles and techniques. Philadelphia, PA: WB Saunders Co., 2000:194-204.

Hokett SD, Honey JR, Ruiz F, Baisden MK, Hoen MM. Assessing the effectiveness of direct digital radiography barrier sheaths and finger cots. *J Am Dent Assoc* 2000;131:463-7.

IPC-06-04 Special Considerations - Single-Use or Disposable Devices

Filho IB, Esberard RM, Leonardo R, del Rio CE. Microscopic evaluation of three endodontic files pre- and postinstrumentation. *J Endodontics* 1998;24:461-4.

Kazemi RB, Stenman E, Spangberg LS. The endodontic file is a disposable instrument. *J Endodontics* 1995;21:451-5.

Rapisarda E, Bonaccorso A, Tripi TR, Condorelli GG. Effect of sterilization on the cutting efficiency of rotary nickel-titanium endodontic files. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999;88:343-7.

Silvaggio J, Hicks ML. Effect of heat sterilization on the torsional properties of rotary nickel-titanium endodontic files. *J Endodontics* 1997;23:731-4.

Villasenor A, Hill SD, Seale NS. Comparison of two ultrasonic cleaning units for deterioration of cutting edges and debris removal on dental burs. *Pediatr Dent* 1992;14:326-30.

IPC-06-05 Special Considerations - Pre-procedural Mouth Rinses

Dajani AS, Bisno AL, Chung KJ, et al. Prevention of bacterial endocarditis: recommendations by the American Heart Association. *JAMA* 1997;277:1794-1801.

Fine DH, Furgang D, Korik I, Olshan A, Barnett ML, Vincent JW. Reduction of viable bacteria in dental aerosols by preprocedural rinsing with an antiseptic mouthrinse. *Am J Dent* 1993;6:219-21.

Fine DH, Mendieta C, Barnett ML, et al. Efficacy of preprocedural rinsing with an antiseptic in reducing viable bacteria in dental aerosols. *J Periodontol* 1992;63:821-4.

Fine DH, Yip J, Furgang D, Barnett ML, Olshan AM, Vincent J. Reducing bacteria in dental aerosols: pre-procedural use of an antiseptic mouth rinse. J Am Dent Assoc 1993;124:56-8.

Klyn SL, Cummings DE, Richardson BW, Davis RD. Reduction of bacteria-containing spray produced during ultrasonic scaling. *Gen Dent* 2001;49:648-52.

Litsky BY, Mascis JD, Litsky W. Use of an antimicrobial mouthwash to minimize the bacterial aerosol contamination generated by the high-speed drill. *Oral Surg Oral Med Oral Pathol* 1970;29:25-30.

Lockhart PB. An analysis of bacteremias during dental extractions. A double-blind, placebo-controlled study of chlorhexidine. *Arch Intern Med* 1996;156:513-20.

Logothetis DD, Martinez-Welles JM. Reducing bacterial aerosol contamination with a chlorhexidine gluconate pre-rinse. *J Am Dent Assoc* 1995;126:1634-9.

Mohammed CI, Monserrate V. Preoperative oral rinsing as a means of reducing air contamination during use of air turbine handpieces. *Oral Surg Oral Med Oral Pathol* 1970;29:291-4.
Muir KF, Ross PW, MacPhee IT, Holbrook WP, Kowolik MJ. Reduction of microbial contamination from ultrasonic scalers. *Br Dent J* 1978;145:76-8.
Pallasch TJ, Slots J. Antibiotic prophylaxis and the medically compromised patient. *Periodontology* 2000 1996;10:107-38.
Wyler D, Miller RL, Micik RE. Efficacy of self-administered preoperative oral hygiene procedures in reducing the concentration of bacteria in aerosols generated during dental procedures. *J Dent Res* 1971;50:509.

IPC-06-06 Special Considerations - Handling of Biopsy Specimens

CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).
Chiarello LA, Bartley J. Prevention of blood exposure in healthcare personnel. *Seminars in Infection Control* 2001;1:30-43.

IPC-06-07 Special Considerations - Handling of Extracted Teeth

CDC. Guidelines for Infection Control in Dental Health-Care Settings – 2003. *MMWR* 2003;52(RR-17).

IPC-06-08 Special Considerations - Dental Laboratory Asepsis

American Dental Association's Council on Scientific Affairs and Council on Dental Practice. Infection control recommendations for the dental office and the dental laboratory. *J Am Dent Assoc* 1996;127:672-80.
Chau VB, Saunders TR, Pimsler M, Elfring DR. In-depth disinfection of acrylic resins. *J Prosthet Dent* 1995;74:309-13.
Dental Laboratory Relationship Working Group, Organization for Safety and Asepsis Procedures (OSAP). Laboratory asepsis position paper. Annapolis, MD: OSAP Foundation, 1998. Available at http://www.osap.org/issues/pages/position/LAB.pdf.
Gerhardt DE, Sydiskis RJ. Impression materials and virus. J Am Dent Assoc 1991;122:51-4.
Giblin J, Podesta R, White J. Dimensional stability of impression materials immersed in an iodophor disinfectant. *Int J Prosthodont* 1990;3:72-7.
Kugel G, Perry RD, Ferrari M, Lalicata P. Disinfection and communication practices: a survey of U. S. dental laboratories. *J Am Dent Assoc* 2000;131:786-92.
Leung RL, Schonfeld SE. Gypsum casts as a potential source of microbial cross-contamination. *J Prosthet Dent* 1983;49:210-1.
McNeill MR, Coulter WA, Hussey DL. Disinfection of irreversible hydrocolloid impressions: a comparative study. *Int J Prosthodont* 1992;5:563-7.

Merchant VA. Infection control in the dental laboratory equipment [Chapter 16]. In: Cottone JA, Terezhalamy GT, Molinari JA, eds. Practical infection control in dentisty. 2nd ed. Baltimore, MD: Williams & Wilkins, 1996:239-54.
Molinari JA. Dental. In: Association for Professionals in Infection Control and Epidemiology, Inc. (APIC). APIC text of infection control and epidemiology. Washington, DC: Association for Professionals in Infection Control and Epidemiology, Inc, 2002.
Plummer KD, Wakefield CW. Practical infection control in dental laboratories. *Gen Dent* 1994;42:545-8.
Powell GL, Runnells RD, Saxon BA, Whisenant BK. The presence and identification of organisms transmitted to dental laboratories. *J Prosthet Dent* 1990;64:235-7.
Sofou A, Larsen T, Fiehn NE, Owall B. Contamination level of alginate impressions arriving at a dental laboratory. *Clin Oral Invest* 2002;6:161-5.

IPC-06-09 Special Considerations - Laser / Electrosurgery Plumes and Surgical Smoke

Baggish MS, Poiesz BJ, Joret D, Williamson P, Rafai A. Presence of human immunodeficiency virus DNA in laser smoke. *Lasers Surg Med* 1991;11:197-203.
Capizzi PJ, Clay RP, Battey MJ. Microbiologic activity in laser resurfacing plume and debris. *Lasers Surg Med* 1998;23:172-4.
CDC. National Institute for Occupational Safety and Health. Control of smoke from laser/electric surgical procedures. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1996. DHHS publication no. (NIOSH) 96-128.
Garden JM, O'Banion MK, Shelnitz LS, et al. Papillomavirus in the vapor of carbon dioxide laser-treated verrucae. *JAMA* 1988;259: 1199-1202.
Hagen KB, Kettering JD, Aprecio RM, Beltran F, Maloney RK. Lack of virus transmission by the excimer laser plume. *Am J Ophthalmol* 1997;124:206-11.
Hughes PS, Hughes AP. Absence of human papillomavirus DNA in the plume of erbium: YAG laser-treated warts. *J Am Acad Dermatol* 1998;38:426-8.
McKinley IB Jr, Ludlow MO. Hazards of laser smoke during endodontic therapy. *J Endodontics* 1994;20:558-9.
Sawchuk WS, Weber PJ, Lowry DR, Dzubow LM. Infectious papillomavirus in the vapor of warts treated with carbon dioxide laser or electrocoagulation: detection and protection. *J Am Acad Dermatol* 1989;21:41-9.

IPC-06-10 Special Considerations - Patients Infected with *M. tuberculosis*

CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. *MMWR* 1998;47(RR-20).
Smith WH, Davies D, Mason KD, Onions JP. Intraoral and pulmonary tuberculosis following dental treatment. *Lancet* 1982;1:842-4.

Wells WF. Aerodynamics of droplet nuclei [Chapter 3]. In: Wells WF, ed. Airborne contagion and air hygiene: an ecological study of droplet infections. Cambridge, MA: Harvard University Press, 1955.

IPC-06-11 Special Considerations - Creutzfeldt-Jakob Disease and Other Prion Diseases

Bernoulli C, Siegfried J, Baumgartner G, et al. Danger of accidental person-to-person transmission of Creutzfeldt-Jakob disease by surgery. *Lancet* 1977;1:478-9.
Carp RI. Transmission of scrapie by oral route: effect of gingival scarification. *Lancet* 1982;1:170-1.
CDC. World Health Organization consultation on public health issues related to bovine spongiform encephalopathy and the emergence of a new variant of Creutzfeldt-Jakob Disease. *MMWR* 1996;45:295-6.
CDC. Epidemiologic notes and reports: rapidly progressive dementia in a patient who received a cadaveric dura mater graft. *MMWR* 1987;36:49-50, 55.
Duffy P, Wolf J, Collins G, DeVoe AG, Streeten B, Cowen D. Possible person-to-person transmission of Creutzfeldt-Jakob disease. *N Engl J Med* 1974;290:692-3.
FDI. Policy Statement Transmissible Spongiform Encephalopathies: Implications for the Practice of Dentistry. 2001;Sept.
Ingrosso L, Pisani F, Pocchiari M. Transmission of the 263K scrapie strain by the dental route. *J Gen Virol* 1999;80:3043-7.
Thadani V, Penar PL, Partington J, et al. Creutzfeldt-Jakob disease probably acquired from a cadaveric dura mater graft. Case report. *J Neurosurg* 1988;69:766-9.

IPC-06-12 Special Considerations - Infection Prevention and Control Program Evaluation

CDC. Framework for program evaluation in public health. *MMWR* 1999;48(RR-11).
Institute of Medicine, Committee on Quality of Health Care in America. Kohn LT, Corrigan JM, Donaldson MS, eds. To err is human: building a safer health system. Washington, DC: National Academy Press, 1999.

IPC-07-02 Managing Contaminated Surfaces

CDC. Rutala WA, Weber DJ. New Disinfection and Sterilization Methods. *MMWR* 2001;7(2).
Health Canada. Infection control guidelines: Hand washing, cleaning, disinfection and sterilization in health care. *Canada Communicable Disease Report* 1998;24S8:15-7.
Molinari JA. Demystifying disinfectants. *OSAP Newsletter: Infection Control in Practice* 2002;1(3):1-5.
Sokol WN. Nine episodes of anaphylaxis following cystoscopy caused by Cidex OPA (ortho-phthalaldehyde) high-level disinfectant in 4 patients after cytoscopy. *J Allergy Clin Immunol* 2004 Aug;114(2):392-7.

Patient Care Items

Category	Description	Examples	Management
Critical Items	Penetrates soft tissue or bone	Surgical instruments, scalers, scalpel blades, burs	Heat sterilization or discarded
Semi-Critical Items	Touches intact mucous membrane or non-intact skin	Mouth mirrors, amalgam condensers, reusable impression trays	Heat sterilization, or high-level disinfection
Non-Critical Items	Contacts intact skin only	Radiograph heads/cones, blood pressure cuffs, facebows	Protect with barriers, or clean then intermediate-level disinfection if contaminated

Environmental Surfaces

Category	Description	Examples	Management
Clinical Contact Surfaces	Direct contact with DHCP hands, patient-care items or patient skin	Light handles, radiograph equipment, drawer handles, doorknobs	Protect with barriers, or clean then intermediate-level disinfection if contaminated
Housekeeping Surfaces	Inadvertent contact with DHCP hands, patient-care items or dental appliances	Floors, walls, sinks	Periodic cleaning, or clean and intermediate-level disinfection if blood/saliva spills, splashes or otherwise contaminated

Disinfectants

Category	Examples	Advantages	Disadvantages
High-level disinfectant (destroys vegetative bacteria, mycobacteria, fungi and enveloped / lipid and non-enveloped / non-lipid viruses; bacterial spores if long exposure time)	Glutaraldehyde 2.4-3.5% Glutaraldehyde 1.12% with phenol 1.93%	Non-corrosive to metal Active in presence of organic material Compatible with most materials, including lensed instruments Sterilization may be possible in 6-10 hours	Extremely irritating to skin and mucous membranes Shelf life shortens when diluted (effective for 14-30 days depending on formulation) High cost Monitor concentration in reusable solutions Fixative
	Hydrogen peroxide 7.5%	Strong oxidant Fast acting Breaks down into water and oxygen	Can be corrosive to aluminum, copper, brass or zinc
	Hydrogen peroxide 1.0-7.35% with peracetic acid 0.8-0.23%	As for hydrogen peroxide, plus: Innocuous decomposition (water, oxygen, acetic acid, hydrogen peroxide) Rapid action at low temperature Active in presence of organic materials	As for hydrogen peroxide, plus: Can be corrosive Unstable when diluted
	Ortho-phthaladehyde 0.55%	Fast acting Relatively less toxic than other high-level disinfectants Non-irritating to skin and exposed mucous membranes Little or no odour Very stable	Sensitivity reactions, including anaphylaxis Stains protein gray, including skin

Category	Examples	Advantages	Disadvantages
Intermediate-level disinfectant (destroys all vegetative bacteria, mycobacteria, most viruses and most fungi, but not bacterial spores)	Chlorine-based products (sodium hypochlorite diluted in-office, chlorine dioxide, commercial preparations with surfactants)	Low cost Fast acting Readily available	Corrosive to metals May destroy fabrics Inactivated if not well cleaned Irritating to exposed skin and mucous membranes Chlorine dioxide is poor cleaner Unstable when diluted; must be prepared daily
	Halogens (sodium bromide & chlorine)	Fast acting Simple to mix Minimal storage space required	Used on hard surfaces only Strong chlorine odour
	Iodophors (iodine combined with surfactant)	Rapid action Relatively less toxic and less irritating Residual action Effective cleaner and disinfectant	Stains fabrics and synthetic materials Irritating to exposed skin and mucous membranes Inactivated by alcohol and hard water Unstable when diluted; must be prepared daily
	Quaternary ammonium compounds with alcohols (“dual” or “synergized”)	Generally non-irritating Non-corrosive	Older generation had narrow spectrum Inactivated by anionic detergents and organic matter Can damage some materials
	Phenolics (“complex” or “synthetic” containing multiple phenolic agents)	Residual, substantive action Available with detergents to be used as cleaner and disinfectant	May be absorbed through skin or by latex May dissolve or discolour plastics Not to be used on food contact surfaces
Low-level disinfectant (destroys most vegetative bacteria and some fungi, as well as enveloped / lipid viruses, e.g. HBV, HIV)	Hydrogen peroxide 3% Iodophors Quaternary ammonium compounds (single, simple or old generation) Phenolics	As above	As above