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Introduction

The Basic Protocol was first published in 1999. It is intended to protect all dental health care personnel (DHCP) and the patients within the settings of the Dental Service, Department of Health.

The contents of the Protocol is based on the concept of 'Standard Precautions' which, as defined by the US Centers for Disease Control & Prevention, are a set of safety measures designed to prevent transmission of bloodborne infectious agents, human immunodeficiency virus (HIV) and hepatitis B virus (HBV) for instance, among the parties involved. Diseases that have other modes of transmission like airborne spread (active open tuberculosis, etc.) may require additional precautions. Such precautions range from a simple rescheduling of treatment to a later date (after recovery or at a time when the disease is controlled and rendered non-infective) to the employment of extra protective gears as recommended by medical experts in the hospital isolation wards.

The standard precautions involve the use of protective barriers including gloves, gowns, masks and protective eyewear, which can reduce the risk of exposure of the DHCP's skin or mucous membranes to potentially infectious materials.

Proper safety measures should also be taken to prevent sharps injuries by needles, scalpels, and other pointed instruments or devices. To prevent transmission of bloodborne pathogens among patients, used or contaminated instruments must be appropriately processed and sterilized. Single-use items should be properly disposed of after use.

This manual is divided into two sections. Section ONE outlines the basic principles of infection control. Section TWO depicts infection control in practice.

It is essential to bear in mind that there is more than one way to achieve the desirable outcomes. The rationales of our recommendations must be understood and suitable adjustments be carried out to fit different scenarios. Sound knowledge in the epidemiology, natural history, signs and symptoms, modes of transmission and prevention of common bloodborne pathogens certainly facilitates the appreciation of the recommendations in the *Basic Protocol*.

To keep abreast of the latest developments in the field, the *Basic Protocol* will be revised from time to time.

1. The Basic Principles

Transmission of infectious diseases has aroused concerns from both the general public and health care workers in the past few decades because of the emergence of potentially lethal infections such as HIV and HBV infections. The recent outbreak of severe acute respiratory syndrome (SARS) has highlighted the importance of proper infection control in the community, clinic and personal levels. Dentistry, in particular, deals with the oral cavity which is inhabited with commensal oral flora. DHCP are at an increased risk of being infected because of the potential presence of bloodborne pathogens in the saliva and blood and the increased chances of needle-stick injury (Porter et al., 1990; Cleveland et al., 1995).

1.1 Disease Transmission

The general routes for disease transmission in dentistry involve:

- a) Direct contact with a lesion, infected body fluids (blood, saliva, etc.) or tissue debris during intraoral procedures; including inoculation injury like needle-stick injury, and splatters of blood, saliva, or nasopharyngeal secretions onto breached or intact skin/mucosa.
- b) Indirect contact via contaminated dental instruments, equipment or materials.
- c) Inhalation of infectious aerosols, from tooth preparation with high-speed handpiece and ultrasonic scaling for examples, that can remain suspended in the air for some time.

It must be emphasized that the simple presence of a pathogenic micro-organism does not necessarily warrant an infection. The following conditions must also be present (CDC, 2003a):

- ❖ a pathogenic organism of sufficient virulence and in adequate number to cause disease;
- ❖ a reservoir or source that allows the pathogen to survive and multiply (e.g. blood);
- ❖ a mode of transmission from the source to the host;
- ❖ a portal of entry through which the pathogen can enter the host; and
- ❖ a susceptible host (i.e. one who is not immune).

1.2 Cross-infection

Cross-infection is the transmission of infectious agents between patients and health care workers in a clinical environment (Figure 1).

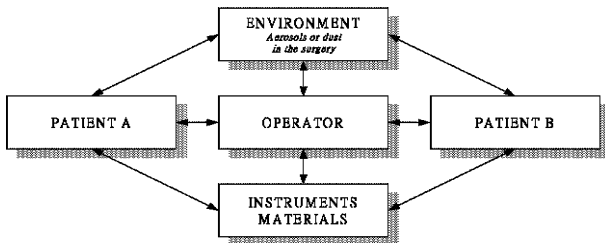


Figure 1: Simplified schematic illustration on the concept of cross-infection.

1.3 Infection Control

Infection control is a multifaceted discipline (Figure 2). **The goal of infection control is to break the chain of disease transmission.**

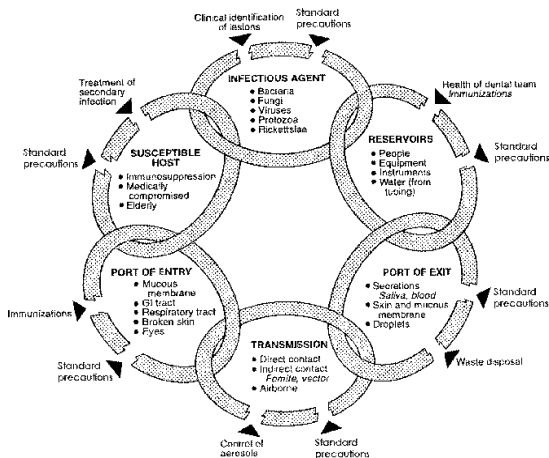


Figure 2: Interventions to break the chain of disease transmission. A break in the chain of six major links is required for the spread of an infectious agent. Standard precautions are applied to interrupt the chain. (Modified from Wilkins EM (1994). Clinical Practice of the Dental Hygienist, 7th edition. Baltimore: Williams & Wilkins, p.76.)

1.4 Standard Precautions

In the past, infection control in dentistry involved the identification of the 'high risk' (potentially infectious) patients who were then treated with extra precautions (Garner & Simmons, 1983).

However, some patients may be unaware of their infected status, for the reason that they are asymptomatic carriers or the disease has long incubation period. More importantly, some patients are unwilling to tell the dentists their disease status (Perry et al., 1993; McCarthy et al., 1995). These subjects can unknowingly transmit the disease to others.

It was the US Centers for Disease Control & Prevention (CDC), in 1985, that first coined the phrase 'Universal blood and body-fluid precautions' to overcome the many problems related to the 'Identification-and-Isolation' approach. **All patients are considered potentially infectious and, therefore, the same precautions should be applied on everyone.** The approach is then widely known as the 'Universal Precautions' (CDC, 1987).

Universal precautions did not apply to faeces, nasal secretions, sputum, sweat, tears, urine or vomitus unless they contained visible blood. In 1996, CDC revised the 'Universal Precautions' and expanded it further into the 'Standard Precautions' (Garner & HICPAC, 1996).

'Standard Precautions' are applicable to contact with (1) blood; (2) body fluids, secretions and excretions (except sweat) - regardless of whether they contain blood; (3) nonintact skin; and (4) mucous membranes. As saliva has always been considered potentially infectious in dental infection control, no actual operational difference exists between the 'Universal Precautions' and 'Standard Precautions' in a clinical dental practice (Bjerke, 2002; CDC, 2003a).

(Please refer to Appendix I for additional precautions, beyond the 'Standard Precautions', to guard against disease transmission in health care facilities by patients known or suspected to be infected with epidemiologically important pathogens that are not bloodborne.)

1.5 The Basic Protocol

VACCINATION:

- a) *Vaccinations* should be considered for all personnel at risk to transmittable diseases. (Section 2.1)

PERSONAL BARRIERS: Appropriate attire must be worn for patient treatment and management, including chair-side assistance, surface disinfection, pouring impression, sorting laundry and handling waste.

- b) *Hand Hygiene and Gloving* (Section 2.2)
- c) *Face Mask* (Section 2.3)
- d) *Eye Protection* (Section 2.4)
- e) *Protective Clothing* (Section 2.5)

DISINFECTION , STERILIZATION,AND WASTE DISPOSAL:

- f) *Surfaces* prone to contamination should be covered with a barrier or disinfected with a surface disinfectant right after. (Section 2.6)
- g) Critical and semi-critical *instruments* should be autoclaved. (Section 2.7)
- h) *Sharps* have to be handled carefully and *clinical waste* should be disposed of properly. (Section 2.8)
- i) *Dental unit waterlines* should be properly maintained. (Section 2.9)
- j) For *occupational exposure to infectious materials*, adhere to the most current recommendations. (Section 2.10)

The *Basic Protocol* reflects the common-sense approach to control infection in the dental settings. The dental surgery is not a risk free environment. **Our emphasis is on the prevention rather than the elimination of contamination.**

2. Infection Control in Practice

2.1 Vaccination

Protection against some infections can be achieved through vaccinations. Vaccine induced antibodies decline gradually with time. But immunity continues to prevent clinical disease or detectable viral infection. Booster doses of vaccine and periodic testing to monitor antibody concentrations after completion of vaccine series are not necessary for vaccine responders (CDC, 2003a).

Most of the native born have had immunization against hepatitis B, mumps, measles, tetanus, rubella, poliomyelitis, whooping cough and tuberculosis. Departmental policy recommends the vaccination of all clinical staff against hepatitis B. For female staff, vaccination against rubella is also advised.

Screening and vaccination services are provided. In-service colleagues, including staff of the Workman grade, who is not sure of their immunity state against hepatitis B, could contact the Special Preventive Programme. Advance booking and GF181 are required.

HBV vaccination
Viral Hepatitis Prevention Service:
Integrated Treatment Centre
8/F Kowloon Bay Health Centre
9 Kai Yan Street, Kowloon Bay
Tel: 2116 2888

Rubella vaccination for female staff can be received from the Maternal and Child Health (MCH) centres.

2.2 Hand Hygiene and Gloving

2.2.1 HAND HYGIENE

Hand hygiene is considered a critical measure in reducing the risk of transmitting pathogens to patients and health care personnel.

Handwashing reduces the bacterial load on hands, which will flourish under the warm and moist environment beneath gloves. The handwashing process may be more important than the handwashing agent used. Care should be taken to ensure that all parts of the hands are washed. Hand jewelry should be removed and special attention should be paid to areas that are easily missed, such as the fingertips, nails, thumb, and the dominant hand. When short-sleeved uniforms are worn, the exposed forearms should be included in the handwashing process. The hands should be dried properly with paper towels before donning gloves because moisture trapped under gloves enhances bacterial growth and skin sensitivity.

For routine dental procedures, handwashing with plain soap is adequate. For surgical procedures, an antimicrobial (surgical) handscrub should be used, e.g. Hibiscrub which contains 4% chlorhexidine gluconate w/v. Skin irritation can come about with frequent use of chlorhexidine gluconate though true allergic reactions are uncommon. Alternative handwashing agents like iodophors can be used for those who are sensitive to chlorhexidine.

At the beginning and end of each clinical session, a 15-second handwashing is recommended. For invasive surgical procedures, 2 to 6 minutes scrub of the hands and forearms is necessary. Comply with proper hand hygiene regimes after patient treatment.

If the hands are not visibly soiled, an alcohol-based hand rub is considered adequate because of its rapid action and accessibility (CDC, 2003a). Hand rubbing with an alcohol-based solution, after contact with patients, can achieve a greater reduction in bacterial contamination than conventional handwashing with medicated soap (Girou et al., 2002).

The drying effect of alcohol can be reduced or eliminated by adding glycerol (1% to 3%) or other skin-conditioning agents (Rotter et al., 1991). Alcohol-based gels containing emollients have been found to cause less skin irritation and dryness relative to soaps or antimicrobial detergents (Boyce et al., 2000).

HANDCARE:

Damaged skins, cuts and wounds should be covered by dressings to guard against bacterial invasion. Skin loses moisture and chaps easily with frequent handwashing. Regular use of moisturizing hand cream helps to prevent dry skin. Petroleum-based lotions, however, can weaken latex gloves and increase permeability. When sensitivity is apparent, change to another handwashing agent and seek medical attention when required.

2.2.2 GLOVING

Gloves act as barriers between patients and operators. Their role as effective barriers depends on their quality and the way they are used. It must be stressed that gloving does not replace handwashing; they are not mutually exclusive.

Disposable latex (patient examination) gloves can be used for routine operative procedures. Sterile gloves should be used when surgical asepsis is desirable, e.g. in minor oral surgery. As for simple dental extraction, the operator may choose to use either disposable or sterile gloves. It has been shown that the use of sterile gloves does not offer an advantage over clean gloves in dental extraction (Cheung et al., 1999). Latex gloves should be avoided if either the operator or the patient is sensitive to latex. Non-latex disposable gloves are available.

A new pair of gloves must be worn for every patient. Washing latex gloves is not recommended. Washing with plain soap, chlorhexidine gluconate, or alcohol can lead to the formation of micropunctures, which can then allow penetration of liquids (wicking) and subsequent hand contamination (Adams et al., 1992; Martin et al., 1988).

Gloves should be changed if their integrity is compromised or when they are grossly contaminated.

2.3 Face Masks

Face masks are designed to guard against splatters and aerosols from getting into contact with the mucous membranes of the nose and mouth. (Aerosols are unnoticeable tiny droplets suspended in the air. Splatters are much bigger droplets, 100 microns or more in diameter, which are visible to the naked eyes).

Paper masks without filters are inappropriate for patient treatment. **Surgical masks**, with >95% bacterial filtration efficiency, **should be used routinely** for patient treatment and management.

N-95 respirators, certified particulate-filter respirators by the US National Institute for Occupational Safety and Health (NIOSH), are able to filter 1 μm particles in the unloaded state, with a filter efficiency of >95% at a flow rate of <50L/min. A properly fit N-95 mask protects health care providers from inhaling respiratory pathogens when treating patients with active TB and SARS. **Users must FIRST read and understand the users' instructions before use.**

Face masks should be changed at least once every session or when contaminated. The frequency of change depends much on the room humidity and procedure carried out.

When a mask gets 'wet', from exhaled moist air, the resistance to airflow through the mask will increase, causing more air to pass round the edges. A 'wet' mask will also be aspirated against the nose and mouth, which can be hazardous if it is soaked with pathogens. With procedures of long duration, or which generate lots of splatters or aerosols, a more frequent change of mask is justified, even in the course of a procedure.

Do not place hands over a worn mask, which should be treated as a contaminated object and disposed of properly after use.

2.4 Eye Protection

Protective eyewear or face shields should be worn at all times during patient contact when there is a possibility that a patient's body fluids may splash or spray onto the face/eyes (WHO, 2003a).

Proper protective eyewear should have solid top and side shields. Plain spectacles which commonly lack solid top and side shields are ineffective protective eyewear. Protective eyewear suitable for eyeglasses users are also available.

Face shields offer effective protection against splatters. They cannot, however, safeguard aerosols from entering the nose and must be used in conjunction with face masks.

Face shields and protective eyewear should, after use, be disinfected with low-level disinfectants such as alcohol. If there is clear blood contamination, they should be disinfected with intermediate-level disinfectants. To avoid the possibility of eye irritation, all traces of disinfectants must be rinsed off thoroughly.

2.5 Protective Clothing

Protective clothing (uniforms or disposable gowns) prevents contamination of street clothing and protects the skin of DHCP from exposure to blood and body substances (CDC, 2003a). Protective clothing should be changed daily; or when contamination is evident.

Cardigans or sweaters should be put on clean uniforms only and not be taken as protective tops. Care should be taken to minimize splashes and splatters when cleaning instruments and handling disinfectants. In these circumstances, an additional disposable gown is always desirable.

Disposable caps that completely cover the hair may be used when splashes of blood and body fluids are expected. They are also useful in keeping aerosols from lodging on the hair, which may then be transferred to family members or onto inanimate objects (WHO, 2003a).

Soiled uniforms (and linens) should be gently handled by personnel fitted with proper personal protective gears including face masks, gloves and protective clothing.

2.6 Surface Asepsis

Surface asepsis is a collection of procedures that prevent or remove contamination from surfaces (Miller, 1992). Exposed surfaces within the confines of the dental operatory are prone to be contaminated by splatters, aerosols, direct touch, etc. Eating, drinking and handling of contact lens are therefore not advisable in the operative areas.

The logical approach to realize infection control is,

1. **limit contamination** by proper zoning, suitable aseptic techniques, use of barriers, etc.
2. **disinfect the contaminated surfaces.**

2.6.1 LIMIT CONTAMINATION

ZONING:

The area for cleaning and processing used instruments (**Dirty Zone**), and the area for holding sterilized and clean instruments (**Clean Zone**), along with the area for patient treatment (**Working Zone**) **must be clearly delineated** from each other. It is essential to **ensure a unidirectional flow of items from the Clean Zone to the Dirty Zone.**

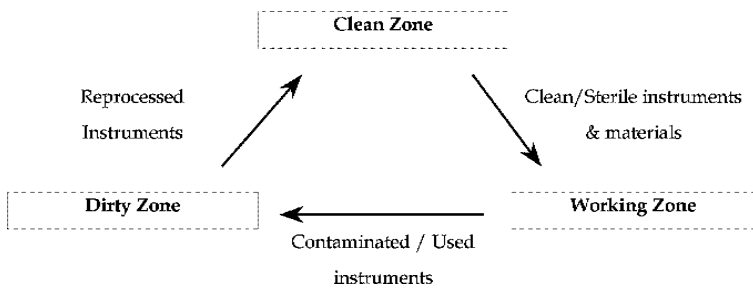


Figure 3: The unidirectional flow of instruments between zones.

Great care must be exercised to **avoid contamination when crossing zones**, see Figure below.

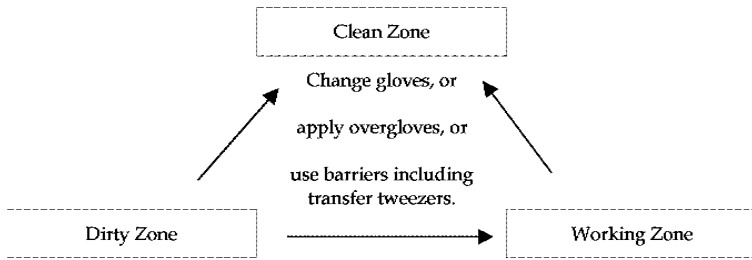


Figure 4: Zone crossing precautions.

STORE AWAY FROM CONTAMINATION

The number of items lying open on bench tops, bracket tables, and shelves should be kept to a minimum. Bur stands, cotton roll and gauze dispensers, salivary ejectors, mixing glass slabs and pads should be kept in covered containers or drawers. Only the least amount of stock (inventory and stationery items) should be held inside the surgery. Foods and drinks should be separately kept from dental materials or other potentially infectious materials (OPIM).

USE OF BARRIERS:

It is always easier and more reliable to **prevent contamination with the proper use of barriers** than to disinfect afterwards. Handpieces, 3-in-1 syringes, ultrasonic scalers and suction tubes must be protected by barrier sleeves. Disposable plastic covers should be placed on the bracket table, handpiece holder and suction tube holder. Patient's clothing can be protected with disposable plastic-backed paper bib.

To prevent contamination of equipment and office items, consider putting on a pair of clean gloves over the contaminated gloves (overgloving). Overgloving can be applied in adjusting chair and light position, taking hold of the light curing unit and suction, picking up instrument from drawer, mixing dental material, and answering phone call. Be sure to put on the overgloves only when you are about to proceed, and remove them straight afterwards. Overgloves are not meant for operative procedures and hence can be let loosely fit. The plastic examination gloves or simple plastic bags can adequately serve as overgloves.

LIMIT CONTACTS:

It has been clearly demonstrated that contact and subsequent spread of a patient's oral fluid occurs frequently during dental procedures.

Adjustment of the dental light and bracket table should be completed before operation. When necessary, barriers such as plastic overgloves should be applied. Both operator and assistant should refrain from laying hands, inadvertently, on objects with contaminated gloves. High vigilance on differentiating 'clean' and 'unclean' is required and efforts should be paid to prevent contaminating the 'clean' by the 'unclean'.

Under the right circumstances, the DSA can change his/her position from being a 'chair-side nurse' to a 'scout nurse'. He/She then limits his/her role to instrument or material transfer to the operator. Good co-ordination between the dental officer and the DSA, together with proper workflow, is needed.

CONTROL AEROSOLS AND SPLATTERS:

Aerosols and splatters are often generated during dental treatments (and instrument cleaning). High volume suction, positioned close to the mouth, significantly reduces the number of aerosolized particulates by 90% (Jacks, 2002). Handpieces, ultrasonic scalers, etc. should be operated with efficient high-volume suction.

Bacterial counts in aerosols can be greatly decreased if patients perform pre-treatment mouth rinsing or brushing. Even rinsing with water can cause a substantial reduction in bacterial counts (Fine, 1992). Rinsing with chlorhexidine gluconate (0.12 to 0.2%) is advisable for its residual action. Rubber Dam application effectively isolates the operation field and reduces the bacterial counts in aerosols significantly (Cochran et al., 1989; Samaranayake et al., 1989).

GOOD WORK PLAN:

It is advisable to **do more work in a single appointment** than to schedule multiple appointments. A good work plan avoids rush and hurry, which are rivals to effective infection control. Prior set-up of instruments in a tray (**tray-system**) with materials necessary for a treatment procedure ready (**pre-dispensing**) reduces zone crossing and the chance of contamination.

2.6.2 SURFACE DISINFECTION

Different instruments/equipment/surfaces require different disinfection regimes. In the dental operatory, environmental surfaces can be divided into *clinical contact surfaces* and *housekeeping surfaces* (CDC, 2003a). Please refer to Section 2.7 for the CDC/Spaulding classification of clinical items. Because housekeeping surfaces (e.g. floors, walls and sinks) have limited risk of disease transmission, they can be decontaminated with less rigorous means than those used on patient-care items and clinical contact surfaces (CDC, 2003 a & b).

Surface disinfection can be achieved with either intermediate-level or low-level disinfectants. It is a 2-step procedure. The first pre-cleaning step aims to reduce the organic loads which interfere with the action of disinfectants. The second step is to allow the disinfectant to act for the required length of time.

WHEN AND WHAT TO DISINFECT:

If waterproof surface barriers are used properly, and carefully removed and replaced, the protected surfaces do not need to be disinfected in-between patients.

Unprotected clinical contact surfaces or housekeeping surfaces with obvious blood/saliva contamination should receive intermediate-level disinfection in-between patients. A low-level disinfection of the clinical contact surfaces is, otherwise, sufficient once daily.

HOW TO DISINFECT:

When handling disinfectants, utility gloves, protective eyewear, face mask, and protective clothing must be worn. The soak-wipe-soak regime can generally be adopted in most situations. The first soak and wipe (with disposable paper towels) is the pre-cleaning step that lowers the bioburden. The disinfection time of the second soak should follow the manufacturer's recommendations. For intermediate-level disinfection, 10 minutes are usually required. Residual disinfectant can then be removed with disposable towels (along with water). Be aware that the organic component of gauze or paper towel will affect the activity of sodium hypochlorite containing disinfectant. Do not immerse beforehand. Use the same agent for pre-cleaning and disinfection simplifies the inventory stock list.

CHOICE OF AGENTS:

Household bleach (5-6% sodium hypochlorite) diluted to 10 parts is a generally accepted surface disinfectant for intermediate-level disinfection. Ten minutes contact time is recommended. Its action on micro-organisms is well documented (Rutala & Weber, 1997). However, it is unstable at this concentration and has to be prepared fresh every day. In addition, its corrosive effects on metals and bleaching effect on fabrics warrant its use judiciously. Proper barrier application will greatly reduce the need for in-between patient intermediate-level disinfection.

70% ethyl alcohol is not accepted for intermediate-level surface disinfection. It can only be used for low-level disinfection. Intermediate-level disinfectants differ from low-level disinfectants in that they are tuberculocidal and virucidal. Other low-level disinfectants include 1:100 sodium hypochlorite, chlohexidine gluconate, etc.

Ortho-phthalaldehyde(OPA) is used for immersion disinfection and should not be used for surface disinfection.

(Refer to Appendix II for the surface asepsis in dental radiography. For the disinfection of impressions, prostheses and appliances, refer to Appendix III.)

2.7 Instrument Sterilization and Disinfection

Instruments or clinical items can be divided into 3 categories according to CDC/Spaulding classification (CDC, 2003a; Spaulding, 1968).

Critical items are those which will be used to penetrate soft tissues or bone. The risk of disease transmission is high. Therefore they must be sterilized. These include forceps, surgical instruments and scalars.

Semi-critical items are those which touch mucous membranes but will not be used to penetrate tissues. The risk of disease transmission is intermediate. The items should be sterilized or, if susceptible to heat damage, they should be subjected to high-level disinfection (with agents registered with the US Food and Drug Administration (FDA) - as a chemical sterilant / high-level disinfectant); for instance, mirrors, amalgam condensers and hand instruments for operative procedures.

Non-critical items, are those that make contact with intact skin only. The risk of disease transmission is low. Intermediate-level or low-level disinfection is required depending on the visible presence of blood / OPIM. Intermediate-level disinfectants are those registered with the US Environmental Protection Agency (EPA) as a "hospital disinfectant" with "tuberculocidal" activity. They include phenolics, iodophors, and chlorine-containing compounds. Low-level disinfectants are those registered with EPA as "hospital disinfectants" that are not labeled for "tuberculocidal" activity (e.g. alcohol, quaternary ammonium compounds).

Items not designed to be reused or cannot be satisfactorily sterilized should be disposed of after use. Plastic saliva ejectors, paper cups, brushes and prophylaxis cups, scalpel blades, needles, LA cartridges, sutures, gloves and matrix bands are some of the examples.

2.7.1 THE STERILIZATION SEQUENCE

The entire process of managing contaminated instruments is very sensitive to procedural variables and is composed of the following steps:

PRE-STERILIZATION CLEANING:

This is one of the most important steps that is always overlooked. It removes substantial number of microbes and the organic remnants (blood, saliva, etc.) on instruments that may otherwise inactivate the action of chemicals or insulate the microbes from heat.

It is more difficult to clean an instrument when contaminants are allowed to dry on it. Thus if cleaning is delayed, it is advisable to keep soiled instruments wet in a holding solution, which may simply be detergent in water, disinfectant, ultrasonic cleaning agent, or any proprietary product for precleaning.

When ultrasonic cleaners are available, they should be used for pre-sterilization cleaning. Such practice cuts down hand processing and minimizes the chance of getting injured by contaminated instruments or sharps. The manufacturer's instructions on operation should be followed. Be sure to **secure the lid properly** to avoid generating aerosols. Detergent-in-water is an inexpensive and effective cleaning agent in most cases, which should be replaced once a day or with heavy use. The proprietary ultrasonic cleaning agent usually contains ingredients effective in dissolving organic contaminants. Cleaned instruments should be rinsed thoroughly in water to get rid of all remains of the cleaning agent. The basket and tank of the ultrasonic cleaner should be cleaned at the end of the day.

Instruments should then be checked for residual contaminants and hand cleaned as necessary. Do note that heavy duty utility gloves, protective eyewear, face mask and protective clothing should be worn in the process. Being more puncture resistant and less affected by chemicals, utility gloves provide better protection than latex gloves. Utility gloves should be decontaminated at the end of the day and can be reused unless they are worn out.

(The pre-cleaning of handpieces warrants special attention and is addressed in Appendix IV.)

DRYING:

Instruments must be dried (and oiled if necessary) before sterilization. Most hand instruments can be towel dried. For hinged instruments or those with inaccessible small parts, they can be blown dry with compressed air. It is a misconception that sterilization by autoclaves is a wet procedure and thus instruments can be left wet when putting into sterilizers. The vaporisation of water on wet instruments takes extra time. More importantly, water trapped at small spaces such as the hinges of pliers may be unable to vapourize completely. The intended sterilization state may, thus, not be reached within the set time. The chance of corrosion is also increased.

PACKAGING:

Packaging should be done in the Dirty Zone. Critical items / instruments not intended for immediate use should be packaged to prevent recontamination after sterilization. For regularly used operative hand instruments, they can be put in perforated aluminum trays with or without wrapping (tray-system). Handpieces can be packaged in pouches or perforated trays.

STERILIZATION:

Moist-heat should be used for sterilizing instruments. **Autoclaves are the most reliable tools in instrument sterilization.** Effective sterilization can be achieved in relatively short time. Operate and maintain the autoclaves as mentioned in the users' manuals. Do not take short-cuts. The chamber of the autoclave should not be overloaded and regular monitoring (refer to Section 2.7.2 for details) is necessary to verify the efficacy of the machine. All critical and semi-critical items should be autoclaved*.

The gravity displacement and the pre-vacuum (vacuum assisted) autoclaves are both available. For the gravity displacement brands, air is displaced by steam physically. Improper packaging and loading could prevent the escape of air, leading to ineffective sterilization. On the contrary, air is first drawn out (to create a vacuum) before the chamber is pressurized with steam for the pre-vacuum autoclaves. Effective steam penetration is attained for all types of loads - solid, hollow and porous, pouched, single / double wrapped items (Joslyn, 2001).

STORAGE:

Sterilized items should be properly stored to prevent re-contamination. Packaging simplifies storage. Sterility can be maintained indefinitely unless an event causes contamination (e.g. torn or wet wrapping). (CDC, 2003a; Mayworm, 1984). The storage condition is vital. Instruments in compromised wrappings should be re-cleaned, re-packaged and re-sterilized. **All packages should be dated**, to facilitate recall should effective sterilization break down.

For unwrapped frequently used operative items, they should be stored in covered, non-perforated containers or cabinets with tight doors. Instruments autoclaved in perforated trays should be treated as unwrapped items. **Unwrapped items should be re-sterilized, and the storage cabinets and containers for such items should be disinfected with low-level disinfectant (or sterilized if applicable), at least every 3 months.**

* NOTES:

For heat sensitive semi-critical items, they can be subjected to high-level disinfection with ortho-phthalaldehyde (OPA). If the items have been pre-cleaned sufficiently, 5-minute immersion is usually adequate (Rutala & Weber, 2001). Be sure to rinse off thoroughly before drying and putting to storage. OPA is different from glutaraldehyde (GA). It has a very low vapour pressure and special ventilation, as recommended for GA, is not required under normal use condition.

2.7.2 STERILIZATION MONITORING

A completed autoclave cycle does not guarantee effective sterilization. There are a number of reasons for sterilization to fail (Miller, 2001), for instance:

- ❖ Overloading in a cycle.
- ❖ Improper equipment maintenance.
- ❖ Damaged door seal.
- ❖ Improper sterilization time.
- ❖ Inappropriate packaging (e.g. instruments in non-perforated trays).

Therefore, it is critical to incorporate, in the daily routines, means to monitor the effectiveness of the sterilization processes. The means include physical, chemical and biological indicators.

PHYSICAL INDICATORS:

When putting an autoclave to operation, the time taken at the required temperature and pressure should be noted. Such readings should side with the recommendations in the users' manual. Some autoclaves provide printouts in connection with the physical conditions during the cycle. The printouts are useful for documentation purpose.

CHEMICAL INDICATORS:

Chemical indicators are heat-sensitive materials that display definite colour or physical change with temperature and/or steam over time. They could be turned out as pads, cards, strips, vials and most commonly tapes.

A chemical indicator designed solely to indicate the heat change in a sterilization cycle is known as a process indicator. The bands on the autoclave tape or the markers on a sterilization pouch are process indicators; they turn brown, in a given time, at a definite temperature. Process indicators, albeit being the most basic chemical indicator, can be conveniently used to differentiate the processed from the unprocessed items. To find out if heat penetrates throughout the load, **a chemical indicator should be put in the most inaccessible area of every load** (usually the center, for tabletop autoclaves).

BIOLOGICAL INDICATORS:

Biological monitoring is the ultimate means to substantiate effective sterilization, though the physical and chemical monitoring provides reliable indication of the sterilization conditions. The employment of calibrated biological indicators (spore test) remains the single most important assurance in this instance (Miller, 2001; Molinari et al, 1996).

Biological indicators are live, nonpathogenic bacterial (*Geobacillus stearothermophilus*) spores that are highly resistant to heat, much more so than the viral, fungal and bacterial pathogens (including HIV, HBV and Coronavirus); and present in greater number than the common microbial contaminants found on patient-care equipment. Therefore, if the spores are inactivated after a sterilization cycle, no other organism should survive and the related load is sterile.

Sterilization cycles should be verified by spore test at least weekly. Additional spore tests should be carried out for the first cycle after repair/of a new sterilizer. **The spore test results should be kept for at least a year at the clinic level.**

To conduct a spore test in the Dental Service, Department of Health,

- ❖ Pouch a vial (ensure that the glass ampule is intact) and place it in the most inaccessible area of a load, start the sterilization cycle as usual.
- ❖ At the end of the cycle, check if the process indicator on the pouch has changed colour. Check the integrity of the ampule again.
- ❖ Stick the "code number label" of the request form (DH161) on the pouch.
- ❖ Pack and dispatch to the Bacteriology Laboratory, Institute of Pathology, straight away, for incubation.

If the spore test fails, the following steps should be taken:

1. Stop using the autoclave in connection. Use other autoclaves in the clinic.
2. A **2nd spore test** should be carried out (**mark "REPEAT", on the DH161, in red**). Review if other factors could account for the event, overloading for example.
3. If the signs of all physical and chemical monitoring are normal, the 1st failure probably does not signify a malfunctioning.

4. Should the 2nd spore test fail, the autoclave must be examined by the EMSD and the exact cause has to be established. Though adverse effects have not been associated with the contrary, it will be prudent to recall and reprocess, in so far as possible, items autoclaved since the last successful spore test.
5. The "failed" autoclave could only be used if a negative spore test is established again.

2.8 Waterlines / Suction Asepsis

WATERLINES ASEPSIS:

Dental unit waterlines (DUWL) refer to the pipeline system that delivers water to handpieces, 3-in-1 syringe, and ultrasonic scaler. Studies have shown that DUWL promote both bacterial growth and the development of biofilm (CDC, 2003a). Oral debris of patients can also enter the DUWL even when the dental units are fitted with anti-retraction valves which are subject to clogging due to biofilm deposition and fatigue (Pankhurst et al, 1998).

Although no epidemiologic evidence suggests DUWL pose a public health concern, exposing patients and DHCP to water of uncertain microbiological quality is inconsistent with the infection control principle (CDC, 2003a). While the appropriate DUWL treatment is being explored, it is prudent to **flush the waterlines at the beginning of a day and in-between patients**. The handpieces, air/water syringe tip, scaler insert must be removed and allow water to discharge for 2-3 minutes at the beginning of each working day. And on completion of treatment, run the contaminated handpieces, ultrasonic scalers, and air-water syringes for 20 to 30 seconds. **For surgical procedures, use sterile saline or water as coolant / irrigant.**

SUCTION / EVACUATION SYSTEM:

This is different from the dental unit waterlines in that the contents along the suction system will not go back to patient's mouth. Intermittent flushing with water during treatment and in-between patients can help to prevent the tubing from clogging. At the end of a working day, rinse the system with appropriate agent as recommended by the manufacturer. The detachable suction filters and hoses should be cleaned with reference to the manufacturer's instructions.

2.9 Waste Disposal

Similar to the cleaning of used instruments and handling disinfectants, proper personal protective gears are required in the disposal of wastes.

MANAGING SHARPS:

Ample evidence indicates that percutaneous injury with sharps is the most common mode of blood-borne pathogen transmission in health care settings. Gloves alone cannot provide protection against sharps injuries.

All sharps and pointed instruments should be handled with extreme care. Vigilance must be exercised when working with needles, scalpels, scaler inserts and even probes. Do not recap used needles with both hands or other technique that involves directing the point of a needle toward any part of the body. Do not bend, break or remove needles before disposal (CDC, 2003a).

Used sharps and fragile items should be placed in a puncture-resistant sharps box, which should be located, securely, as close to the operating field as possible. Keep a sharps box about 3/4 full at most. Sharps boxes must be tightly closed before disposal as clinical waste.

CLINICAL WASTE:

Clinical waste, including sharps box containing used / contaminated sharps and teeth, dressing dribbling or caked with blood or containing free-flowing blood, should not be kept for more than 3 months. All clinical waste must be disposed of in red plastic bags conspicuously marked with 'Biohazard' symbol and labeled as 'Clinical Waste' in both Chinese and English on the outside. A second red bag is indicated if a leak is suspected. The bags filled with clinical waste should be tied up using the "Swan-neck" method of sealing (Appendix V). Special management by licensed clinical waste collectors is required (Environmental Protection Department, 2001).

NON CLINICAL WASTE:

Unless specified as clinical waste, all trash could be treated as domestic waste and disposed of in black plastic bags. Liquid waste, other than the chemical waste, can be emptied into the drain and flushed down with water.

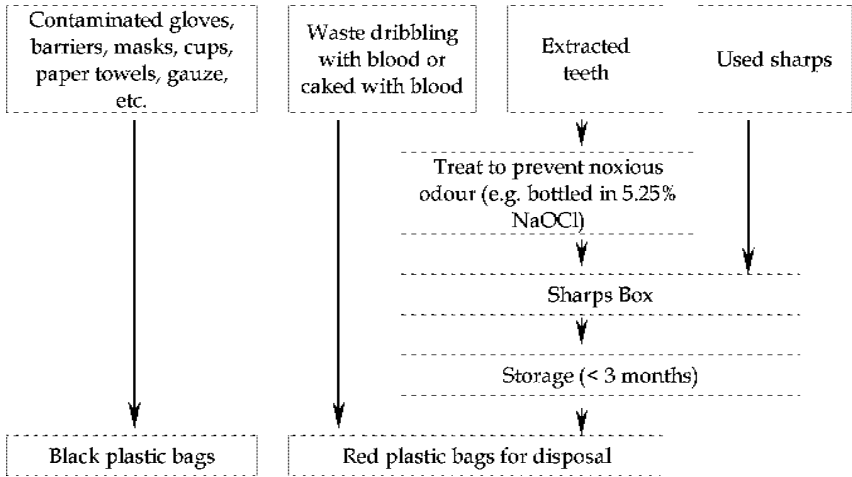


Figure 5: Outline of waste management.

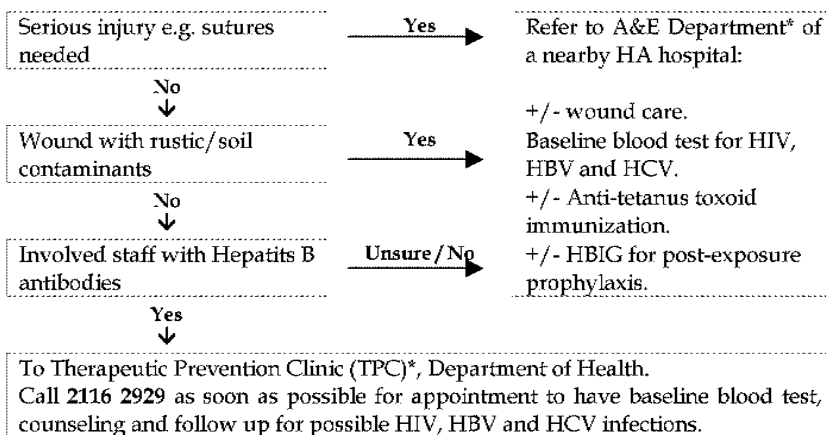
2.10 Occupational Exposure to Infectious Materials

When there is nonintact skin, eye, mucous membrane or parenteral contact with blood or other potentially infectious materials, it is defined as occupational exposure (CDC, 2003a). The principle management, in our current setting, includes:

1. FIRST AID:

- Wash wounds with soap and water; flush mucous membrane with water.
- Dress wound if necessary.

2. REFERRAL:



* It is essential to have a completed **Referral** (Appendix VI), along with a GF181, when attending A&E or TPC.

3. ESTABLISH THE SEROLOGICAL STATUS OF SOURCE PATIENT:

If the source patient belongs to the "high-risk" groups, refer him/her (with informed consent) for blood test; the related dental instruments/needles normally contains too little source material for laboratory tests. The test results will provide information for follow-ups. (Some hotlines can provide additional information: Hepatitis B - 2116 2888, AIDS - 2780 2211)

4. REPORTING:

Complete the **Record of Sharps Injury & Mucosal Contact** (Appendix VII) and post it to the Infection Control Standing Committee. Copies of which should be kept by clinic i/c and the wounded staff.

TRANSMISSION-BASED PRECAUTIONS

There are three types of Transmission-based Precautions:

- ❖ Airborne Precautions,
- ❖ Droplet Precautions and
- ❖ Contact Precautions.

The *Basic Protocol* has covered the measures for droplet and contact precautions.

Airborne precautions should be considered for certain respiratory diseases, such as tuberculosis and SARS. It is fortunate that tuberculosis and SARS are not usually infectious before signs and symptoms appear (Chan et al., 2003; Molinari & Terezhalmay, 1996; WHO 2003b; Yu et al., 2004). Though SARS is transmitted by droplets, it is important to bear in mind that droplets could be aerosolized in the aerosol-generating procedures.

Airborne precautions should be based on community risk assessment and performed appropriately for the level of risk of disease transmission in the facility (CDC, 1994 & 2003a). They are based on a hierarchy of measures, including administrative controls, environmental (engineering) controls, and personal respiratory protection (CDC, 1994 & 2003a).

Administrative controls aim for early detection of a person with active disease and prompt isolation from susceptible persons to reduce the risk of transmission. Appropriate medical history taking and screening are important. For example, temperature check during the SARS epidemic has been considered a key measure to control the spread of SARS (WHO, 2003c). A suspected case should be referred for medical evaluation and care without delay. Elective dental treatment should be deferred until he / she is confirmed to be non-infectious. Urgent dental treatment should be performed, preferably, in special operatory with engineering controls on airflow, air filtration, etc. Special PPE such as properly fit N95 mask should be worn.

TAKING AND PROCESSING DENTAL RADIOGRAPHS

Barrier application and surface disinfection should be extended to the taking and processing of radiographs. Make use of barriers to align the cone, set the control panels and set off the machine. Gloves should be worn and additional personal protective gears such as mask, protective eyewear and gown should be used for possible blood/body fluid splatters.

Film processing in clinics using darkrooms

Remove any saliva/blood on the film pack with paper towel. Open the film pack (dirty) inside the dark room and let the exposed film drop onto a clean paper towel or surface barrier. Be sure not to contaminate the film. Put on a new pair of gloves and take the clean film for development.

Film processing in clinics not using darkrooms

The developing and processing of films in clinics not using darkrooms require extra attention to prevent cross-infection.

Wrap the film pack with a barrier (with proper seal) before exposure. Remove the barrier and let the clean film pack drop onto a clean surface. Put on a new pair of gloves and take the film for development.

DISINFECTION OF IMPRESSIONS, PROSTHESES AND APPLIANCES

Impressions and appliances (from patient's mouth) are contaminated items. They must be appropriately disinfected before sending out to the dental laboratories, with suitable disinfectant and disinfection time to ensure dimensional stability. Good communication with the dental laboratories should be maintained to avoid a skip or unnecessary duplication of disinfection procedures. In practice (ADA, 1996; CDC, 2003a; Merchant, 1996; OSAP, 1998),

- ❖ Remove, first of all, saliva, blood and organic debris by thorough rinsing (in water).
- ❖ Dip & Store* with 1:10 sodium hypochlorite, for 10 minutes in general, for all prostheses, appliances and impressions (except zinc oxide eugenol (ZOE) which should be immersed in OPA for 5 minutes).
- ❖ If dimensional stability is not of prime concern, or if there is a choice, immersion in OPA for 5 minutes or 1:10 sodium hypochlorite for 10 minutes is an alternative.
- ❖ All disinfected items should be rinsed and dried, properly packed and transferred to the laboratories.

The corrosion of metal parts by sodium hypochlorite is a theoretical possibility that may not happen with the few disinfection cycles in the entire fabrication process (Merchant, 1996).

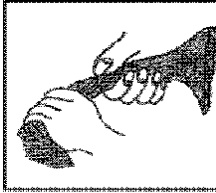
* Dip & Store: The item is first dipped in 0.5% sodium hypochlorite solution (1:10 dilution of bleach), then stored moist inside a covered container.

STERILIZATION OF HANDPIECES

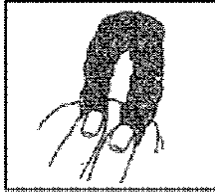
Most handpieces cannot withstand ultrasonic cleaning while their inner recesses have to be cleaned prior to sterilization because oral debris/microbes may be retracted into the turbine space and waterline. The general guidelines for handpiece processing are as follows:

1. Leave the handpiece attached after patient treatment. Remove visible debris from the handpiece. Run, to flush the waterlines, for 20 to 30 seconds into a container or absorbent material.
2. Remove it from the coupling and clean the outer surface thoroughly in water or disinfectant, rinse and dry. Do not soak unless recommended by the manufacturer.
3. Clean/lubricate the inner recesses as recommended by the manufacturer. Some handpieces require lubrication before, after, or before and after sterilization, or not at all. Check with manufacturer's instruction. Use separate cans of lubricants for pre and post-sterilization lubrications.
4. Wipe residual lubricant away from the outer surface. For handpieces fitted with fibre optic, be sure not to leave any lubricant on the fiber optic contact.
5. Packaged in pouch, bag or container.
6. Follow the manufacturer's recommendations on sterilization.
7. If post-sterilization lubrication is required, handle the sterilized handpiece aseptically.

When clinical waste bags are filled to three-quarters capacity the "Swan-neck" method of sealing should be used



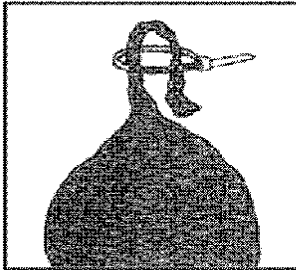
Seal plastic bag when no more than 75% full.



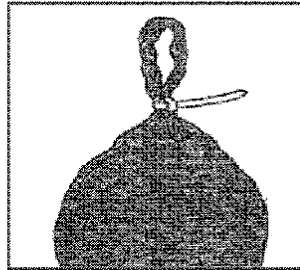
Twist firmly then double over



Hold the twist firmly



Pass the seal over the neck of the bag.



Tighten the seal manually to create an effective seal.

ONLY those bags which are securely sealed, using the above method, and in the designated area will be uplifted from the pickup points.

SEALING AND TAGGING METHOD FOR CLINICAL WASTE BAGS

Source: Environmental Protection Department, HKSAR Government

Exposure to Blood / Body Fluid - Form 1
Referral to Therapeutic Prevention Clinic / A&E Department

Referral Chart

Serious injury e.g. sutures needed	Yes →	Attend A&E Department of a nearby HA hospital (Take this referral, along with GF181)
No ↓		
Wound with rustic/soil contaminants	Yes →	
No ↓		
Involved staff with Hepatitis B antibodies	Unsure/No →	
Yes ↓		
To Therapeutic Prevention Clinic (TPC) , Department of Health 1. Call 2116 2929 as soon as possible for appointment 2. Take this referral, along with GF181 when attending TPC		

To: Therapeutic Prevention Clinic, DH / A&E Department (Delete as appropriate)

Request for Post-exposure Management / Follow-up

Name of the person: _____ **Post:** _____ **HKID No:** _____

Date of incident: _____ **Dental clinic:** _____

Cause of contact:
 LA needle
 Suture needle
 Irrigation needle
 Wire
 Probe
 Bur
 Elevator
 Scalpel blade
 Blood / Body fluid splatter (on mucosa)
 Others, please specify: _____

Contact process:
 Recapping used needle
 Disposal of sharps
 Tidying up bracket table, trays
 Pre-sterilization cleaning
 During treatment, please specify: _____
 Others, please specify: _____

First-Aid on site:
 Yes
 No

Other information: _____

Referring Dental Officer's Signature: _____

Name: _____

Date: _____

Appendix VII

On completion of 1) First Aid & 2) Referral, please 3) complete this form and post it to Infection Control Standing Committee through **Personal Secretary (PS) to Consultant Dental Surgeon (Ops)** under *Confidential Cover*.

You will receive an acknowledgement within 2 weeks (notify PS by phone if no reply is received).

<p>Exposure to Blood / Body Fluid -Form 2</p> <p>Record of Sharps Injury & Mucosal Contact</p> <p>(Applicable to all staff including Workman, Lab. Attendant, etc.)</p>

Name of the person: _____ **Date of incident:** _____

HKID No: _____ **Grade:** _____ Permanent NCSC

Name of clinic i/c: _____ **Dental clinic:** _____

<p>Cause of contact: <input type="checkbox"/> LA needle <input type="checkbox"/> Suture needle <input type="checkbox"/> Irrigation needle <input type="checkbox"/> Wire</p> <p><input type="checkbox"/> Probe <input type="checkbox"/> Bur <input type="checkbox"/> Elevator <input type="checkbox"/> Scalpel blade</p> <p><input type="checkbox"/> Blood / Body fluid splatter (on mucosa)</p> <p><input type="checkbox"/> Others, please specify: _____</p>
<p>Contact process: <input type="checkbox"/> Recapping used needle <input type="checkbox"/> Disposal of sharps</p> <p><input type="checkbox"/> Tidying up bracket table, trays <input type="checkbox"/> Pre-sterilization cleaning</p> <p><input type="checkbox"/> During treatment, please specify: _____</p> <p><input type="checkbox"/> Others, please specify: _____</p>

<p>Source patient: <input type="checkbox"/> Known <input type="checkbox"/> Unknown</p> <p>Name: _____ Tel no: _____ HKID No: _____</p> <p>Address: _____</p> <p>Verbally questioned on history of HBV, HCV, HIV infections <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Referral for blood test: <input type="checkbox"/> Yes <input type="checkbox"/> No</p>
--

<p>Follow-up actions:</p> <p>First Aid on site: <input type="checkbox"/> Wound care / Water Flush (splatter on mucosa) <input type="checkbox"/> No</p> <p>Further action: <input type="checkbox"/> Yes (please provide details below)</p> <p><input type="checkbox"/> No, please state reason(s): _____</p>
<p>Attended: <input type="checkbox"/> Therapeutic Prevention Unit <input type="checkbox"/> A&E</p> <p><input type="checkbox"/> Others, please specify: _____</p>
<p>Actions taken: <input type="checkbox"/> Baseline blood test (Injured staff)</p> <p><input type="checkbox"/> Hepatitis B Immunoglobulin prophylaxis</p> <p><input type="checkbox"/> Anti-tetanus toxoid (ATT)</p> <p><input type="checkbox"/> Source patient blood test</p> <p><input type="checkbox"/> Others, please specify: _____</p>
<p>Follow-up actions planned: <input type="checkbox"/> Blood test to be repeated at <input type="checkbox"/> 3 months <input type="checkbox"/> 6 months</p> <p><input type="checkbox"/> ATT booster</p> <p><input type="checkbox"/> Others, please specify: _____</p>

Appendix VIII

SPECIMEN COLLECTION, HANDLING AND TRANSPORTATION WITH STANDARD PRECAUTIONS (reprint from Consultant Pathologist i/c, ref (21) in IP/C 23.10 dated 18 December 1998)

Having obtained consent from the patient, all specimens should be placed into a leakproof primary container with a secure closure. The laboratory should provide specifications for leakproof containers and evaluate performance prior to purchase. Full-circumference screw caps with a flexible liner produce efficient seals. Snap-top closures may produce a spray when opened and their use should be avoided. Care should be taken by the person collecting the specimen not to contaminate the outside of the primary container.

Before being transported to the laboratory the primary container should be placed into a secondary container, which will contain the specimen if the primary container breaks or leaks in transit to the laboratory. Some specimens are regularly contaminated on the outside (e.g., hematocrit tubes). Any primary container actually or potentially contaminated on the outside should be placed into a sealed secondary container.

Secondary containers may consist of large receptacles into which primary containers are placed (e.g. racks containing filled evacuated tubes may be placed into square plastic basins for bulk transport). A plastic bag with a sealable, preferably leakproof, closure can also be used as the secondary container; metal closure or staples should not be used. Bags used to transport specimens should be discarded after use. Secondary containers must be labeled with the "biohazard" symbol.

For detailed recommendations, please refer to the most current edition of NCCLS documents GP16 - Routine Urinalysis and Collection, Transportation, and Preservation of Urine Specimens.

Preparation of Aliquots

Serum, plasma, or blood used to prepare aliquots should be pipetted using a Pasteur type pipette. Aliquots should not be poured into tubes or sample cups since spillage is common.

Laboratory Requisition Slips

Laboratory requisition slips should be protected from contamination, and separated from the primary container. Contaminated requisition slips should be discarded in the biohazard waste and replaced.

Disposable plastic bags with separate pockets for the laboratory slip and specimen are available to minimize contamination of the laboratory slips.

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