INFECTION CONTROL

IN DENTAL PRACTICE

This series of booklets are directed to undergraduate dental students and GDP. The booklets are aimed to serve as an outline guide to the user during reading in more comprehensive text-books.

FORWARD

Cleanliness and proper sterilization techniques has been a part of dental practice for many years. However, recently a number of disease causing organisms such as AIDS, hepatitis B and C and herpes viruses have made these techniques even more important.

Diseases can be transmitted in dental clinic from patient to patient, from patient to dental health care workers (DHCWs) and to less extent from DHCWs to patients. The unique nature of the dental clinic procedures, instrumentation and patient care settings require a specific strategies regarding the prevention of disease transmission among the DHCWs and their patients.

These booklet is directed to undergraduate dental students and GDP. It aim to serve as an outline and a pocket manual for policy of infection control in dental practice. ■

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CONTENT

INREODUCTION

Dentists have a duty to take appropriate precautions to protect their patients and their staff from the risk of cross-infection. Failure to provide and use adequate decontamination, disinfection and sterilization facilities may lead to proceedings for professional misconduct**.**

To minimize the risk of transmission of infection between patients and between patients and Dental Health Care Workers (DHCW's) a sensible and practical routine for the prevention of cross-contamination and cross-infection should be followed. Clinical dental and auxiliary staff should additionally protect themselves by ensuring up-to-date immunization against hepatitis B and other infectious diseases including tuberculosis, poliomyelitis, rubella, tetanus, diphtheria and varicella zoster. It is the responsibility of the dentist/employer to make all staff aware of standards of infection control required in the workplace.

INFECTION CONTROL PRECAUTIONS

There are two levels of infection control precautions, standard precautions which are applied to all patients and additional precautions for certain 'at risk' patient groups. These consist of transmission based precautions and protective isolation guidelines.

1. Standard Precautions

Standard precautions are designed to reduce the risk of transmission of microorganisms from known and unknown sources of infection (blood, body fluids, excretions, secretions etc). These precautions apply to the care of all patients regardless of their diagnosis or presumed infection status. The principles of standard precautions include:

- Hand washing
- Protective barriers i.e. the use, of personal protective clothing, e.g. gloves, surgical masks, eye protection.
- Management of healthcare waste (Appendix II)
- Correct handling and disposal of needles and sharps. (Appendix III)
- Effective cleaning, decontamination and sterilization of equipment, instruments and environment.
- Use of appropriate disinfectants at the correct working dilution and for the appropriate disinfection time on clinical contact surfaces, non-sterilizable instruments and equipment.

2. Transmission Based Precautions

Transmission based precautions, are for "at risk" assessed patient groups known or suspected to be infected or colonized with highly transmissible diseases. There are four types of transmission based precautions:

- Airborne precautions: e.g. for active TB, influenza and varicella. This may involve the use of appropriate respiratory masks by immunized DHCW's preferably in negative pressure rooms.
- Droplet precautions: e.g. for meningococcal disease or whooping cough. This involves the use of respiratory masks and eye protection by DHCW's.
- Contact precautions: e.g. for Impetigo, Shingles or methicillin-resistant staphylococcus aureus (MRSA). This involves the use of gloves and plastic aprons by DHCW's when performing clinical procedures.
- Sterilization precautions: e.g. for transmissible spongiform encephalopathies. This involves incineration, even of non-disposable instruments, following treatment of a patient known to have a transmissible spongiform encephalopathy.

ACCEPTANCE OF PATIENTS

A dentist/dental hygienist has an obligation to provide care to those in need. A decision not to provide treatment to an individual because the individual has AIDS or is HIV seropositive or is HBV or HCV seropositive, based solely on that fact is unethical.

Decisions on the type of treatment to be provided or referrals made or suggested in such instances, should be made on the same basis as those made for all patients. Refusing treatment to those patients whose infective status is definitely known is not only unethical but also illogical since undiagnosed carriers of infectious diseases pass undetected through practices and clinics every day. Once a patient has been accepted the dentist must be prepared to carry out or arrange for all treatment necessary to secure and maintain oral health.

Patient Confidentiality

All information disclosed by a patient in the course of consultation and treatment, including information about infection risk, is confidential. No part of the information obtained may be disclosed to a third party without the patient's consent except, when required by law, when directed by a court of law, or when necessary to protect the interest of the patient or the welfare of society.

INFECTED DENTAL HEALTH CARE WORKERS

It is the ethical responsibility of DHCW's who believe that they themselves may have been infected with a blood-borne virus to obtain medical advice, including any necessary testing, and if found to be infected, to place themselves under specialist medical care. Their medical supervision will include counseling, in particular, in respect of any changes in the DHCW's practice, which might be considered appropriate in the interest of protecting their patients. It is the duty of such dentists/dental hygienists/dental nurses to act upon the medical advice they have been given, which may include the necessity to modify their practice or to cease the practice of dentistry altogether. The exclusion of exposure prone procedures may be warranted in some countries.

Exposure Prone Procedures

Exposure prone procedures are invasive procedures where there is a risk that injury to the DHCW may result in exposure of the patient's open tissues to the blood of the DHCW. Such procedures

include where the DHCW's gloved hand may be in contact with sharp instruments or sharp tissues (e.g. bony spicules or teeth) inside a patient's mouth where the hands or fingertips of the DHCW may not be visible at all times.

Hepatitis B

It is important that all workers are vaccinated. If a DHCW is diagnosed with hepatitis B he/she may be required on medical advice to:

- Undergo annual monitoring to determine his/her viral load. Eligibility to carry out exposure prone procedures will depend on this viral load and the accepted national recommendations for exposure prone procedures at that date.
- Discontinue exposure prone procedures.

Human Immunodeficiency Virus-Infection (HIV) and Hepatitis C

Eligibility to carry out exposure prone procedures will depend on the viral load and the accepted national recommendations for exposure prone procedures at that date.

LAW RELATING TO INFECTION CONTROL

Dentists as employers have a legal responsibility to ensure that all their employees are appropriately trained and are proficient in the procedures necessary for working safely. Employers also have a responsibility to protect staff, patients and others attending their practices.

Members of the dental team should adopt appropriate infection control precautions to prevent the spread of infection to themselves or to their patients. Most carriers of latent infections, including blood borne viruses, are unaware of their condition and therefore it is important that appropriate infection control procedures are adopted for all patients.

Careful medical history taking is essential and may assist in identifying immunocompromised patients requiring particular care. The use of medical history sheets and questionnaires is recommended but they must be supported by direct questioning and discussion between patient and dentist. The medical history must be revised at subsequent appointments. It is important that discussions are conducted in an environment which permits the disclosure of sensitive personal information.

ROUTES OF DISEASE TRANSMISSION

Diseases can be transmitted through direct contact with blood, oral fluids and other secretions. However, the more serious route of disease transmission is through the indirect contact route with the patient material. Contact with contaminated instruments, operatory equipment, environmental surfaces and also contact with air borne contaminants present in either droplet spotter or aerosol of oral and respiratory fluids are all possible sources for indirect disease transmission.

Most of the DHCWs are well aware about the direct contact route of disease transmission. The problem, however, is in the indirect route. Chain of infection is shown in figure. 1. (Page 8)

TRAINING IN INFECTION CONTROL

All dental staff engaged in any aspect of the care of patients should receive thorough training and understand the policies adopted in the practice for the prevention of cross-infection and cross-contamination. *Adequate training should be given to new staff. Training should be updated annually and appropriate records kept.*

The dentist should ensure that the immunization status of all staff is up-to-date at the commencement of employment and is maintained during employment.

RISK ASSESSMENT ON TRANSMISSION OF INFECTIONS.

Staff should be trained to assess the level of risks and possible sequelae to allow them to recognize situations where exposure might be likely and to know how to avoid or minimize risks to patients, staff and others. Practices should have documented standard operating procedures. These should cover accidental spillage, personal injury or exposure to body fluids or tissues, particularly inoculation injuries. Appropriate reporting procedures should be in place as well as details of how to obtain information on the recommended medical management.

All procedures should be reviewed twice yearly in light of best practice and new evidence to ensure that they are being carried out correctly. ■

CHAIN OF INFECTION

Infectious Disease

Any microorganism that can cause a disease such as a bacterium, virus, parasite, or fungus. Reasons that the organism will cause an infection are virulence (ability to multiply and grow), invasiveness (ability to enter tissue), and pathogenicity (ability to cause disease).

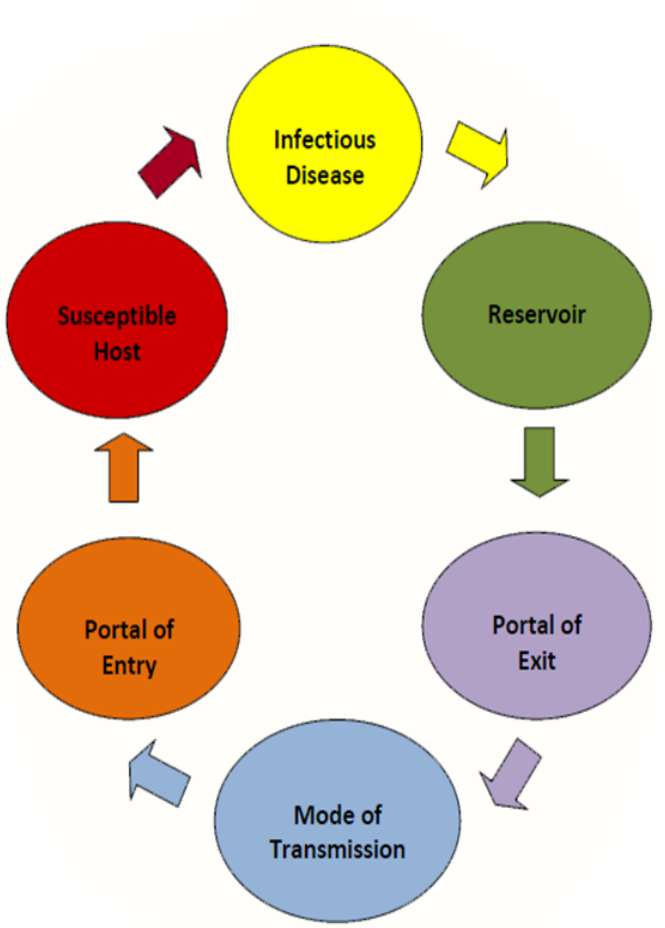


Fig. 1. Chain of infection.

Reservoir

The place where the microorganism resides, thrives, and reproduces, i.e., food, water, toilet seat, elevator buttons, human feces, respiratory secretions.

Portal of Exit

The place where the organism leaves the reservoir, such as the respiratory tract (nose, mouth), intestinal tract (rectum), urinary tract, or blood and other body fluids.

Mode of Transmission

The means by which an organism transfers from one carrier to another by either direct transmission (direct contact between infectious host and susceptible host) or indirect transmission (which involves an intermediate carrier like an environmental surface or piece of medical equipment).

Portal of Entry

The opening where an infectious disease enters the host's body such as mucus membranes, open wounds, or tubes inserted in body cavities like urinary catheters or feeding tubes.

Susceptible Host

The person who is at risk for developing an infection from the disease. Several factors make a person more susceptible to disease including age (young people and elderly people generally are more at risk), underlying chronic diseases such as diabetes or asthma, conditions that weaken the immune system like HIV, certain types of medications, invasive devices like feeding tubes, and malnutrition. ■

CONTAMINATED INSTRUEMENTS PROCESSING

All instruments and equipment must be cleaned and sterilized after use. Sterilization destroys all forms of microorganisms, including viruses, bacteria, fungi and spores. Disinfection eliminates most microorganisms but not necessarily all microbial forms.

Sterilization or decontamination of equipment or instruments is a multi-step sequential process:

- Step 1 Transportation
- Step 2 Cleaning and decontamination
- Step 3 Preparation and packaging
- Step 4 Sterilization (or disinfection of equipment not suitable for sterilization)
- Step 5 Storage

a) Transportation

Handling should be kept to a minimum. Instruments should be carried in a covered container and procedures should be in place to ensure that there is no contact between contaminated and sterilized instruments.

b) Cleaning and decontamination of instruments and equipment

All instruments must be cleaned thoroughly to remove visible deposits preferably by using washer/disinfectors which are more efficient at pre-sterilization cleaning than ultrasonic cleaners.

c) Preparation and packing

Instruments should be dried and checked for debris, function and damage before packing.

d) Sterilization of instruments

All instruments likely to be contaminated must be sterilized after use. Any instruments or equipment being sent for repair must be decontaminated before dispatch. Sterilization procedures must be effective against all known pathogens. The method of choice for most instruments is steam autoclave.

In the light of present knowledge, steam sterilizers without a vacuum phase, in which air is removed from the chamber by steam displacement (i.e. downward displacement autoclaves), are

not to be used for wrapped instruments. They should only be used for solid unwrapped instruments for immediate use only if items are transported aseptically to point of use. Storage is not allowed (not suitable for lumened devices including suction tips, handpieces etc)

Vacuum Autoclaves (air is sucked out of the chamber pre commencing the sterilizing process) are suitable for sterilizing:

- Wrapped solid instruments and utensils
- Porous loads.
- Hollow instruments and utensils (wrapped or unwrapped)

All dental autoclaves must be regularly serviced and maintained to ensure they are achieving appropriate sterilization conditions. This would include:

- A validation process at commissioning.
- Regular performance monitoring by periodic testing (daily, weekly user tests)
- Documented periodic maintenance according to manufacturer's instructions including safety checks.
- Documentation of in-use operational readings.

Disinfection of equipment not suitable for sterilization: Equipment should be cleaned and disinfected (see manufacturer's instructions and refer to effectiveness claim by the manufacturer). Note chemical hazards and material safety data sheets.

Hot air ovens, chemical solutions, boiling water, UV light and hot bead sterilizers are all inadequate for sterilization and should not be used in dental practice for such purposes.

e) Storage of sterile instruments and equipment

Wrapped sterilized instruments should be stored in covered or closed areas. All sterilized instruments should be stored in dry, covered conditions so as to minimize re-contamination. Stored material should also be dated. A system based on stabilizable trays is recommended. *Storage is not recommended for unwrapped instruments*

METHODS OF STERILIZATION AND DISINFECTION

The main methods of sterilization and disinfection in dental clinic are physical methods, as heat and irradiation or chemical methods.

I. Heat

A. Boiling water

This method was commonly used in the dental clinics in the past, now it is seldom if ever used. Boiling kills most bacteria within short time. However, bacterial spores survive boiling for a very long time and viruses probably survive indefinitely. For this reason boiling is considered a method

Fig. 2. Steam Autoclave use steam under pressure with/without vacuum the use of vacuum is more efficient. Instruments must be wrapped or packed. Instruments are left inside for 15-20 minutes at 135 ^{o}C.

for disinfection and not for sterilization.

B. Autoclave (Pressure Steam Sterilizer)

This method of sterilization is the most acceptable method for use in the dental clinics nowadays. It works on the basis of the steam cooker and is an extremely efficient method for sterilization of instruments. The steam is at pressure of about 15 -30 lb/in. This pressure is enough to destroy all organisms and spores. (Fig. 2.)

Chemiclave **i**s another method for sterilization where a chemical is used instead of water. However, this method is not common in dental clinics.

C. Hot-Air Sterilizer (Dry Hot Oven)

It was the most common method used in dental clinics. The disadvantages of this method are:

- In dry condition the organisms are more harder to kill than when they are wet. Also dry heat has very little power of penetration and unless a very high temperatures are used the method is very slow.
- After sterilization the instruments need a considerable time to cool.
- Not suitable for plastic instruments and instruments which have soft solder.
- The heating space is very irregular, the temperature may reach very high degrees in one part and in other part it may not reach the required degree. This is called "Cool spot".

If this method is used in dental clinics a great care must be taken not to open the oven during the

sterilization cycle. Such action, as for adding new instruments, will lower the temperature in the heating space and will mix the dirty and sterile instruments. For proper sterilization the instruments must remain inside the oven at the required temperature for 120 minutes.

D. Flaming

Some small dental instruments may be sterilized by this method, for example hypodermic needles. However, this method has the disadvantage that the temper of the metal may be spoilt. Irriadioplatinum hypodermic needles can be sterilized by this method. However this is not advisable now as disposable needles are available.

II. Chemical Methods

These methods involve the use of chemical liquid or gaseous compounds. Generally liquids are very unreliable for achieving sterilization. Viruses and both vegetative and sporing bacteria may survive liquid chemical sterilization. It is to be used when other methods of sterilization are unsuitable. The most common used liquid chemical in dental clinics is glutaraldehyde (Cidex). However, this method is used mostly for disinfection as achieving sterilization will take long time (10-12 hours). ■

UNIVERSAL PRECAUTIONS OF INFECTION CONTROL

The use of effective infection control procedures and universal precautions in dental office and dental laboratory will minimize the risk for cross-infection that could extend to the dentist, dental clinic staff, dental technicians and patients.

The term universal precautions refers to a method of infection control in which all human blood and certain human body fluids, saliva in dentistry, are treated as if known to be infectious to human immune deficiency syndrome (HIV) and hepatitis B (HBV) and other bloodborne pathogens. Universal precautions means that the same infection control procedures are used for all patients.

I. VACCINATION

DHCWs are at greater risk than the general population of acquiring hepatitis B through contact with the patients. For this reason all dentists and their staffs, having patient contact, should be vaccinated against hepatitis B.

II. BARRIER TECHNIQUE

Gloves

The dentist is most likely to contact blood with his hands. When the skin of the hands is intact it provides good protection from microorganisms that may be in blood. However, in many instances there may be a small unapparent breaks in the skin of the hands. Wearing gloves will provide an extra barrier against the entry of the microorganisms through any break in the skin. Gloves should be used whenever the dentist put his hands in any patients mouth or touch instruments, equipment or surfaces that may be contaminated with blood or saliva of the patient. A new pair of gloves is used for every patient. Instruction for using gloves are listed in table

TABLE 1. INSTRUCTIONS FOR USING GLOVES.

- Wash hands before wearing gloves and never wash hands while wearing the gloves.
- Watches, rings and similar items are not allowed during gloving and working.
- Never reuse surgical or examination gloves. Washing these gloves cause wicking which increases the flow of liquids through undetected holes in the gloves.
- If the gloves are cut or punctured remove them immediately and dispose them properly then wash hands again and put on a new pair of gloves.
- When treatment is finished discard the gloves and wash hands again.

Fig. 3. Nonsterile examination gloves (left) and Sterile surgical gloves (right)

Fig. 4. Chin Length plastic face shield (right), Face Mask and Protective Eye Glasses (left).

1. Three types of gloves are available, these are:

- **Examination disposable gloves:** Used for procedures involving contact with the oral mucous membrane. (Fig. 3, left)
- **Sterile disposable gloves:** Used when sterility is essential as when performing surgical procedures. Generally this type of gloves is to be used whenever a procedure that involve a break in the mucous membrane of the oral cavity is performed. (Fig. 3, right)
- **General purpose utility gloves:** Used for cleaning instruments, equipment and contaminated surfaces. Rubber household gloves are suitable and can be decontaminated and reused.

Face Protection

Chin length plastic face shield that protect the eyes, the nose and the mouth from spatter must be used whenever blood or oral fluids contaminated with blood may be spattered, for example during using airrotors. (Fig. 4, right)

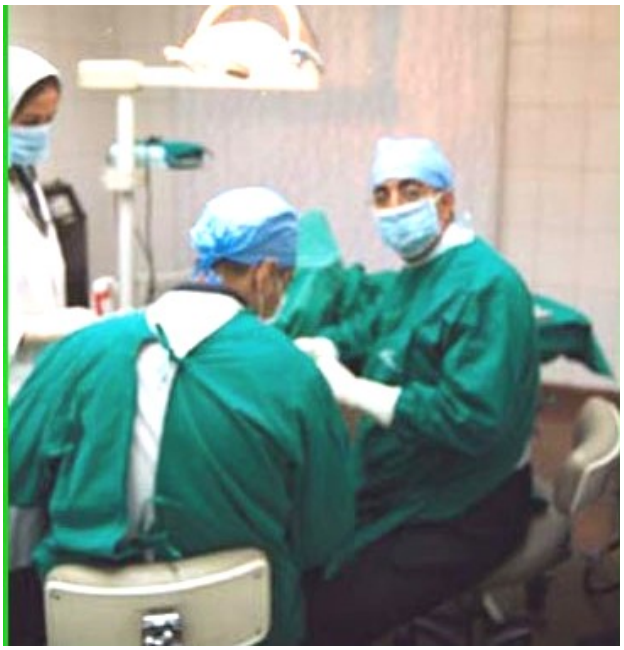


Fig. 5. For surgical procedures in the dental clinics scrub suits and sterile gowns are used. Gowns must be changed after each patient

Fig. 6. In theater room complete clothes and face protection are essential and should be changed after every operation. All gloves and gowns used must be sterile.

When face shield is not available eye glasses and face mask must be used. A new surgical mask must be used for every patient and if the mask becomes wet during the treatment of the patient it must be replaced. The eye glasses are disinfectant between patients. (Fig. 4, left)

Clothes Protection

Protect your street clothes from contamination by covering them with a gown or coat or wearing a uniform. Change these work clothes at least once daily and more often if they become visibly contaminated with blood. (Figs 5, 6)

III. HAND WASHING AND CARE OF HANDS

The hands should be washed before gloving and after removal of gloves using soap and water, in case of performing dental examination and nonsurgical procedures. Before and after performing any surgical procedure an antimicrobial agent is used in washing hands.

Skin lesions in the hands of the operator or any personnel of the dental team should be treated and he is not allowing to work before subsidence of these lesions. Finally watches, rings and similar items are not allowed during gloving and working.

IV. HANDLING OF SHARP INSTRUMENTS AND NEEDLES

Sharp items contaminated with patient's saliva and blood should be considered as potentially infectious and handled with care. The following should be considered:

- Do not try to recap the needle of the cartilage syringe, by its plastic cover, using your two hands. Use one hand scope technique, table technique or a mechanical device designed for

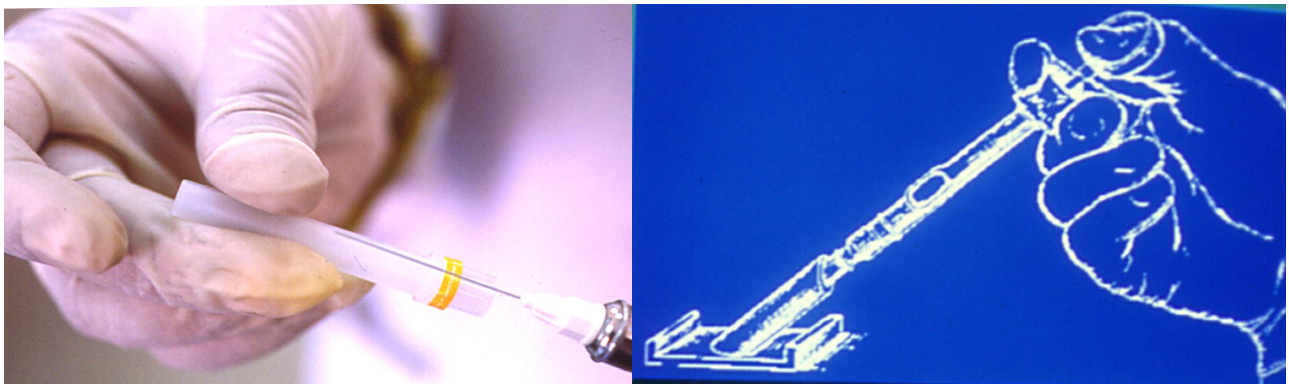


Fig. 7. Using the two hand to recover the used cartilage needle carry the risk of inserting the needle in your hand. Stick with needle contaminated with blood of hepatitis carrier increases risk of transmitting the diseases by 10-30% (left). Simple device for safe recapping of the used needle using one hand (right)

this purpose. The needle should be recovered before removal from the syringe. Fig. 7)

- Used needles, scalpels, disposable syringes and similar sharp items should be discarded in a puncture resistance container. (appendix II)

V. DISINFECTION AND STERILIZATION OF INSTRUMENTS

Cleaning, disinfection and sterilization are all decontamination processes. These processes differ in the number and type of microorganisms killed. Cleaning is the basic first step for all decontamination. By cleaning debris are removed and the number of microorganisms present are reduced. You always need to clean before disinfect or sterilize.

Disinfection is a process that kills disease causing organisms, but not necessary all microorganisms. There are three levels of disinfection, low, intermediate and high.

- ***Low level disinfection:*** Is the least effective disinfection process. It dose not kill bacterial spores or mycobacterium tuberculosis.
- ***Intermediate level disinfection:*** Is a disinfection process that dose kill mycobacterium tuberculosis but not bacterial spores.
- ***High level disinfection:*** Is a disinfection process that kill mycobacterium tuberculosis and some, but not all, bacterial spores. This process also kills fungi and viruses.

The choice of how to decontaminate an instrument should be based on how it will be used. Accordingly, dental instruments are divided into three groups regarding the level of decontamination required. These are:

- ***Critical instruments:*** Are those instruments that will come in contact with bone or penetrate tissue. Forceps, scalpels and scalers are examples for critical instruments. These instruments must be sterilized.
- ***Semi-critical instruments:*** These are instruments that will touch mucous membrane but will not penetrate the soft tissue. Example of this group is mirrors, amalgam condensers and prosthetic impression trays. These instruments should be heat sterilized or if they will be damaged by heat, use high level disinfection.

- ***Noncritical Instruments:*** Are those instruments and environmental surfaces that will come in contact only with the intact skin of the patient. An intermediate or low level disinfection is used for these instruments and equipment.

Sterilization, on the other hand, is the process that kills all microbial life, including bacterial spores, which is the most difficult form of microorganisms to kill.

Sterilization of Handpiece

It is essential to sterilize the handpiece between patients. Use handpiece with anti-retraction valve (one way valve) to prevent aspiration of the patient's material into the handpiece and then expelling it to another patient. The handpiece should be autoclaved at 135^{o}C for 15 - 20 minutes between patients. The following should be considered:

- After each patient allow the handpiece to work for 20-30 seconds to expel water and air. This will help to remove any contaminated material.
- After removal from the unite the handpiece is cleaned, lubricated and warped before placing in the autoclave.
- Overnight bacterial accumulation can be significant, to run and to discharge water into a sink or container for several minutes at the beginning of the clinic day is recommended

Scaler Tips and Air/water Syringe Tip

Scalers tips should be autoclaved between patients while air/water syringe tip should receive a high level disinfection between patients. A disposable plastic cover can be used for the air/water syringe and disposable single use tips are available.

Dental Laboratory Items

Items such as impressions, casts, prosthetic devices and restorations that have been in the patient's mouth should receive an intermediate level disinfection before sending to the dental lab. The same should be done after manipulation of these items in the dental lab and before placing it in the patient's mouth. The stability of the material during the disinfection process should be confirmed by the manufacture. (Appendix V)

Cleaning and Disinfection of the Dental Unite and Environmental Surfaces

The purpose of this procedure is to remove patient's material that is possibly contaminating the dental unite and environmental surfaces. (Appendix I) This should be done between patients and at the end of the working day. The following methods can be used:

- Disposable towels are used to cover the head rest.
- Aluminum foils or plastic covers are used to cover the light handles, control buttons, X-ray handle, tube and control buttons, as well as handles of saliva ejectors and suction.
- A chemical germicide spray is used to spray the dental chair and the practice table. An inexpensive methods is the use of fresh solution of sodium hypochlorite (1/4 cup to 1 gallon of water) for swapping the surfaces. This method will give an intermediate level of disinfection.
- A germicide powder is used to disinfect tubes of saliva ejector and suctions. ■

SIX STEPS OF INSTRUMENT REPROCESSING

Safe practices for instrument reprocessing are an important aspect of modern health care, and dental health care in particular, as it helps to minimize the patient's risk of infection. The following is an overview of the six recommended steps for instrument reprocessing; cleaning, inspection, packaging, sterilization, sterile storage, and quality assurance.

STEP 1: CLEANING

The first and most important step in instrument reprocessing is cleaning, as studies have shown that a dirty instrument cannot be effectively sterilized. This is because the soil shields bacteria and viruses from the sterilizing agent. As a result, bacteria and viruses may very well survive the sterilization process and can cross infect the next patient.

The most common method of cleaning instruments is manual cleaning (cleaning by hand). Manual cleaning has the advantage of flexibility, in that any type of instrument can be cleaned manually. Drawbacks to manual cleaning are that the cleanliness of the instruments can vary between workers as well as that employees are at risk of being exposed to possible cross infection as they are in contact with contaminated instruments. For these reasons staff are required to wear proper personal protection equipment (PPE) when working with contaminated instruments. Recommended procedures for manual cleaning are as follows :

- Soak the instrument in a tepid or lukewarm water or detergent bath for at least 10 minutes. This step softens and loosens much of the soil that may have dried on the instrument between the time it was used and the time cleaning has started. The duration of the soak depends upon how much soil is on the instruments and how long the soil has been allowed to dry.
- The next step is to completely brush the instrument with a medium-soft bristle brush while it is in the soak bath. In the case of tubed devices like dental handpieces, the insides (lumens, channels, etc.) should be brushed out as well whenever this is possible. Care should be taken to use brushes recommended by the manufacturer to avoid damaging the instrument. Brushing should be done under the surface of the water to minimize aerosols and with brush strokes away from the body to avoid exposure to spray from the brush.
- The instrument should then be rinsed with clean water.
- If difficult-to-remove soil remains, another soak followed by brushing and rinsing should be done.

Ultrasonic Cleaning

Although manual cleaning removes most or all of the visible soil from instruments, it may not remove small or microscopic particles that are protected by the texture of a surface or design features like hinges. Ultrasonic cleaners create microscopic bubbles in the solution that collapse when they contact the instrument releasing energy.

This energy "kicks" any soil that is in the area off the instrument. This process is called cavitation. The detergent in the ultrasonic bath suspends the soil particles and keeps them from attaching back to the instruments. The following should be considered:

- Ultrasonic cleaning should be done for a duration specified by the instrument, detergent, or ultrasonic bath manufacturer, whichever is longer.
- Following ultrasonic cleaning, the instruments are rinsed with clean water and dried.
- After drying, the instruments may be packaged for sterilization.

Automatic Washers

These machines may resemble home dishwashers or be specialized for the specific needs of cleaning complex instruments, e.g., endoscopic instruments. Validated to meet the special needs of cleaning instruments, automatic washers offer a wide range of temperature settings that allow the instruments to be processed at the maximum safe temperature for their use. Higher temperatures speed cleaning and provide some disinfection.

Instruments must be prepared for processing before being placed into a washer, with the extent of preparation depending upon the capabilities of the washer and the washer manufacturer's instructions. For the simplest washers, manual presoaking and sonication remain as necessary reprocessing steps. More sophisticated washers include a presoaking step in the automated process.

STEP 2: INSPECTION

- Each and every instrument should be inspected for function and cleanliness after cleaning. Any damaged instrument should be replaced and any instrument with visible soil or residual debris should be returned for further cleaning.
- Never clean a dirty instrument in a clean area unless you have proper PPE. The cleaning action can cross contaminate other instruments and work surfaces.
- Instruments with stiff joints may be a sign of inadequate cleaning, an example is the extraction forceps

STEP 3: PACKAGING

Sterile packaging, i.e., pouches, wrap, or rigid containers serve to maintain the sterility of processed instruments and allow for aseptic opening at point of use.

Fig. 8. packaging and sealing machine.

Packaging should be done in a clean area using FDA-cleared materials such as pouches, wrap, or rigid containers.

Pouches

- Sterilization pouches are used for small, lightweight instruments
- Prior to sealing a sterilization pouch, it is important to include chemical indicator and remove excess air.
- With self-sealing pouches, be sure to fold the adhesive flap on the perforation line and make contact with both the paper and plastic film (ideally 50% each).
- Some sterilization pouches come printed with both external and internal chemical indicators. This complies with CDC guidelines.

Wrap

- Sterilization wrap is commonly used for instrument trays or cassettes. There are many different types and sizes of wraps available.
- Typically, two sheets are needed to provide an effective barrier and a specific technique is recommended to allow for aseptic opening.
- Wrapped instruments should be secured with sterilization tape that also serves as an external indicator. Before closing, a multi-parameter chemical indicator should be included inside along with the instruments.
- Be sure to select the correct size wrap and be careful not to wrap too tight or too loose as either can compromise sterility by creating air pockets or allowing strike through. Recently,

wrap manufacturers have stated not to stack wrapped items during storage as this can compromise sterility.

Rigid Containers

- Sterilization containers are used for heavy instrument trays, i.e., orthopedic sets. A maximum weight of 25 pounds has been established regardless of the instrument trays being wrapped or placed in rigid containers.
- There are many different types and sizes of rigid containers, all of which provide excellent protection during storage and can be stacked during storage without compromising sterility.
- For quality assurance chemical indicator should be included on each layer of multilayered sets and in opposite corners of rigid containers.

STEP 4: STERILIZATION

Steam sterilization is the most commonly used process for sterilizing instruments, trays, and cassettes. According to the center of disease control organization (CDC), steam under pressure is the process of choice whenever possible as it is considered safe, fast, and the most cost-effective for health care facilities. Steam sterilizers come in many different sizes and sterilizer cycles can vary among manufacturers. The cycle a sterilizer runs can typically be found in the sterilizer manual and varies from 3 minutes to 30 minutes exposure and 15-30 minutes drying time.

STEP 5: STERILE STORAGE

- Sterilized packages should be stored in a manner that reduces the potential for contamination, i.e., clean, dry, and temperature- and traffic-controlled areas. Sterility is event related and sterile items are considered sterile unless damaged or open.
- Therefore, it is important for sterilized packages to be handled with care: avoid dragging, crushing, bending, compressing, or puncturing. During transport, they should be protected from environmental contaminants.
- Prior to use, each sterilized package should be inspected for integrity. If a package is suspect, it should not be used and the item should be reprocessed. Sterile packages should not be opened until point of use.

STEP 6: STERILITY ASSURANCE

Sterility assurance of processed instruments should be routinely verified using three types of indicators; physical, chemical, and biological.

Physical Indicators

Physical indicators consist of the time, temperature, and pressure gauges built into sterilizers. For each sterilization cycle, these readings should be observed and verified prior to unloading the sterilizer. Large freestanding sterilizers, which are often found in surgery centers and hospitals, are required to have a chart or printout that is initialed after each cycle. This physical indicator is then

TABLE 2- PRINCIPLES OF USE OF BIOLOGICAL INDICATORS.

- Used to evaluate the effectiveness of sterilization processes.
- Essential in performing sterilization cycle validation.
- Used for Ethylene Oxide, Dry Heat, Steam and Radiation sterilization processes.
- Available in a wide range of organisms, populations and packaging.
- Available as strips (standard size or mini), discs, suspensions, self-contained, ampoules and custom configurations
- Following sterilization the biological strip is cultured and monitored.

maintained as part of their overall infection-control records. Many tabletop sterilizers do not provide physical indicator printouts.

Chemical Indicators

Chemical indicators (CIs) change color or show movement during the sterilizer cycle to verify that some or all sterilization parameters were met. As stated earlier, CIs should be used on the outside and inside of all sterilized packages. CIs range in performance characteristics and health care facilities should select the CI that best fits their monitoring needs.

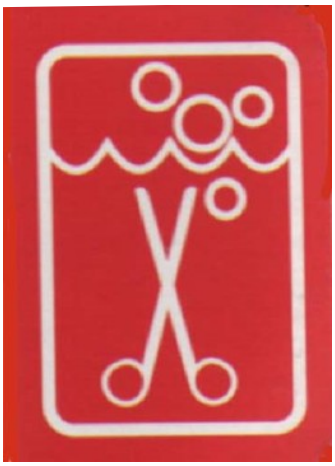
Indicator tape is an example of an external CI and it simply indicates that a package was run in the sterilizer. Internal CIs are used to ensure the sterilant penetrated the packaging system and a Class 5 integrating indicator demonstrates that ALL of the parameters necessary for sterilization were met for that specific cycle.

If using a dynamic air removal (pre-vacuum) sterilizer, an air removal test should be run daily. This is called a Bowie-Dick type test and passes when the chemical indicator sheet inside a process challenge device (PCD) changes to a uniform color after processing at 134°C/274°F for 3.5- or 4-minute exposure time. This test should be run in an empty sterilizer and drying time is optional as this daily air removal test is performed without a load.

Biological Indicators

Biological Indicator (BI) monitoring is the gold standard for sterility assurance as BI's contain bacterial spores that test the lethality of sterilizers. The science behind this is, if your sterilizer can effectively kill the highly resistant spores in the BI, then we can be confident it is capable of killing the less resistant organisms found on our instruments. Biological Indicators are available in both mail-in and in-office systems. BIs should be run at least weekly, per CDC guidelines. Weekly BI monitoring is completed by running a BI in the sterilizer with a load. In-office BI testing requires test vials, a preset incubator, and a record notebook. After processing, the BI is incubated at a preset. Table 2 shows the principles of use of BIs. ■

MANUAL FOR INFECTION CONTROL IN DENTAL PRACTICE



I.PRE-SOAKING

WHY ?

- To make cleaning easier and more efficient by preventing drying of patients material.
- Reduces the level of airborne contaminants by including them in liquids
- The Holding solution begin the cleaning process by reducing the level of contamination of the instruments.

HOW ?

- Use a NO-TOUCH technique to handle instruments for the entire sterilization process by using transfer baskets or cassettes
- Keep instruments in holding solution until time is available for full cleaning
- Drain the holding solution and change it daily. ■

Instrument cassette (left). Transfer basket (right) can be used for chemical sterilization-disinfection and for impression tray and lab appliances disinfection.

II. ULTRASONIC CLEANING

WHY ?

- To remove blood saliva, tissue and other complex proteins that may interfere with disinfection or sterilization
- Ultrasonic is recommended as it increases cleaning efficiency and avoid possible splatter during manual brushing

HOW ?

- Use basket or cassette to suspend instruments in tank
- Always cover tank to prevent splatter and sonic induced aerosol
- Drain solution and disinfect chamber daily. ■

A basket or cassette is used to suspend the instruments in the ultrasonic cleaner (left). Ultrasonic cleaner for small dental instruments (right, upper), Hand cleaning using a suitable hard brush (not recommended as it is less efficient) (right lower)

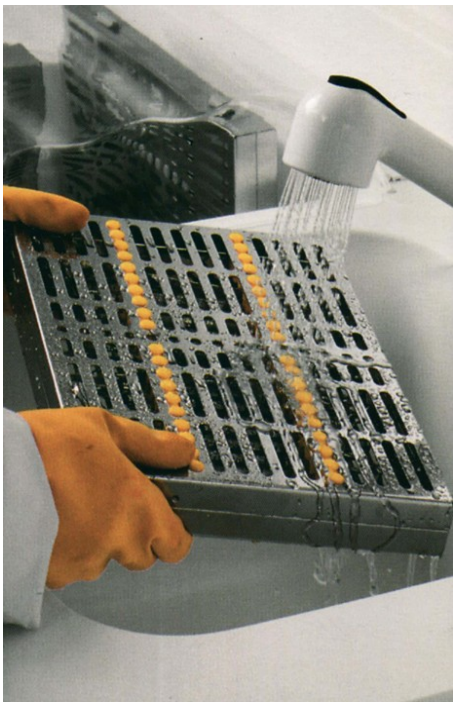
III. RINSING

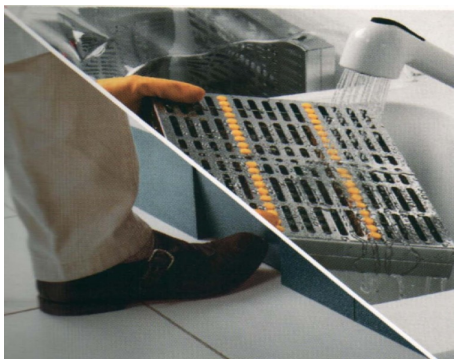
WHY ?

- To remove dislodged debris, microorganisms, detergent and residual cleaning solution
- It completes the cleaning process.

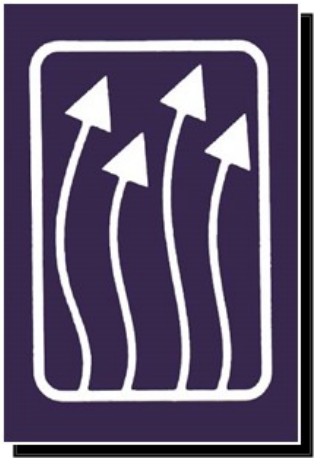
HOW ?

- Run tap water
- Rinse instruments in a basket or cassette
- Avoid splashing.
- Use water foot control.
- Use hygienic sink. ■





Rinse in a running tap water (left) using water foot control (right, upper). Use a hygienic sink, The use of standard sink permit harmful dirt and bacteria deposits. (right, lower)



IV. DRYING

WHY ?

- Wetness interfere with all methods of sterilization.
- Moisture affect sterilization efficiency as it decrease steam quality and interfere with exposure of the surface.
- Prevent corrosion, rusting, dulling, spotting of instruments

HOW ?

- Better to use dryer
- Put instruments in transfer basket or cassette
- Shake instruments to remove excess water.■

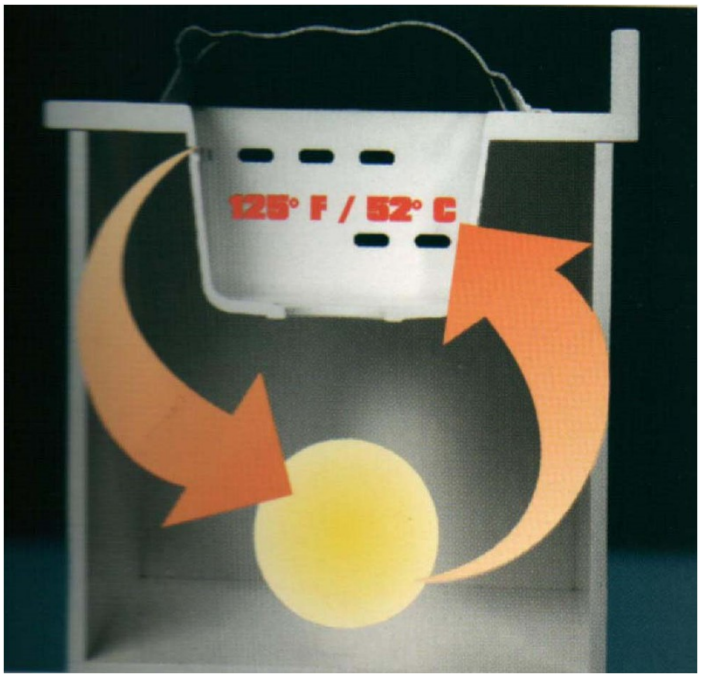


Diagram for a dryer.

IV. PACKING

WHY ?

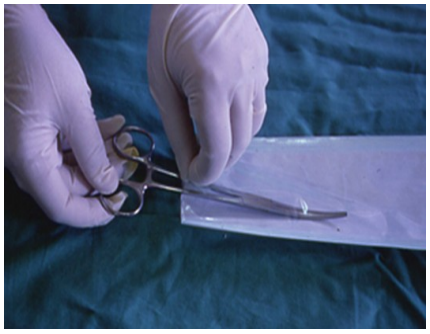
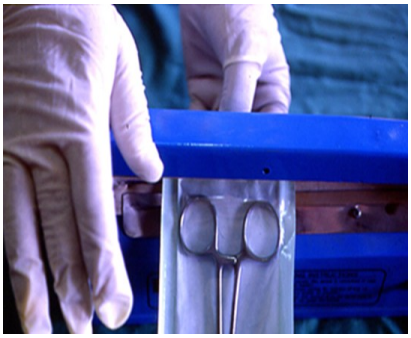
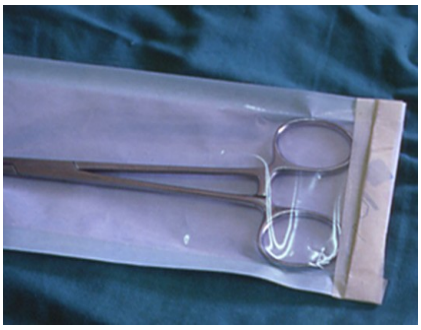
- To Protect items and maintain sterility.
- Unpacked items should e used immediately as exposure to environment result in contamination by dust aerosols, improper handling or contact with contaminated surfaces.

HOW ?

- Make sure that instruments are clean and dry
- Arrange instruments in functional sets to be used in a single patient
- Put chemical indicator inside and in the center of each multiple instruments pack or cassette
- Keep instruments packed until use
- Indicate on the package name of item and date of sterilization. ■

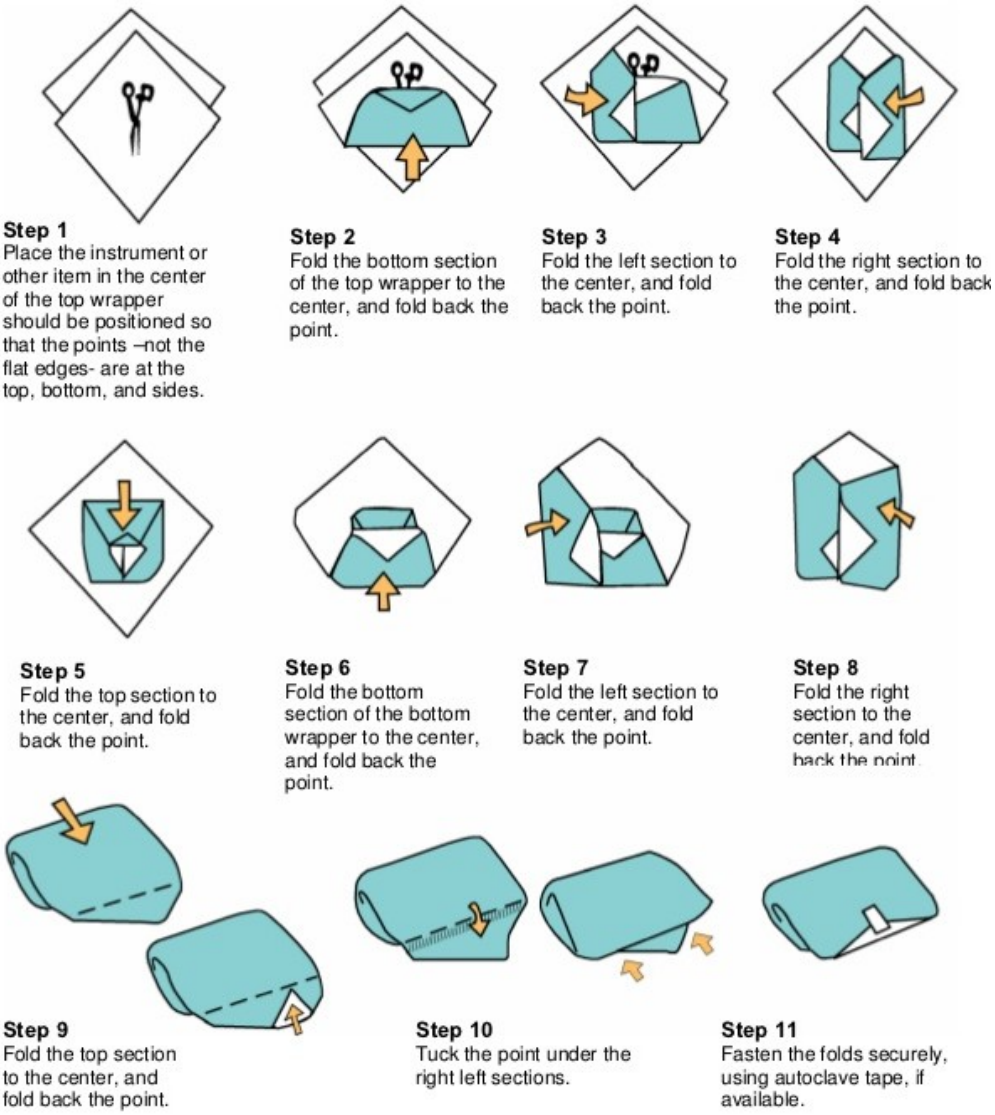
PACKING PAPERS

- The packing papers may be supplied in the form of rolls of different width and length.
- The pack have an color indicator that changes color when subjected to temperature in the autoclave
- The date at which the pack is placed in the autoclave should be registered on the pack as instruments that has not been used for one month after sterilization should be repacked and re- sterilized.

PACKING PAPERS (CONTINUED)

- The pack should be sealed (air-tight) after placing the tool inside and before placing it in the autoclave
- Sealing can be done using a sealing machine that seal the pack on three successive lines to ensure air-tight sealing. Sealing tape can also be used



Steps for warpping instruments and other items.

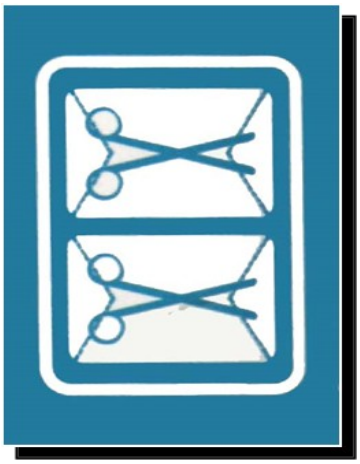
V. STERILAIZATION

WHY ?

- To Protect dental personnel and patients from infection.
- Critical Items should be Sterilized (Skin or Mucous membrane penetrating instruments)
- Semi Critical Items, high-level Disinfection (Non penetrating instruments).
- Non Critical Items, low-Level Disinfection (Instruments that will not come in contact with blood or saliva or other body secretions)

HOW ?

- Sterilize only clean and dry items
- Instruments must be probably packed
- Operate and never interrupt a cycle
- Spore test the sterilizer weekly.
- Remember that hand pieces are also serializable. ■



VI. STORAGE

WHY ?

- To Protect instruments from contamination
- Prevent package tear or punctum.

HOW ?

- Storage area should be dray, dust free and away from heat, water and drain
- Keep items warped until use
- Use “first-in-first-out” system
- After “One month” re-warp and re-sterilize unused warped items. ■

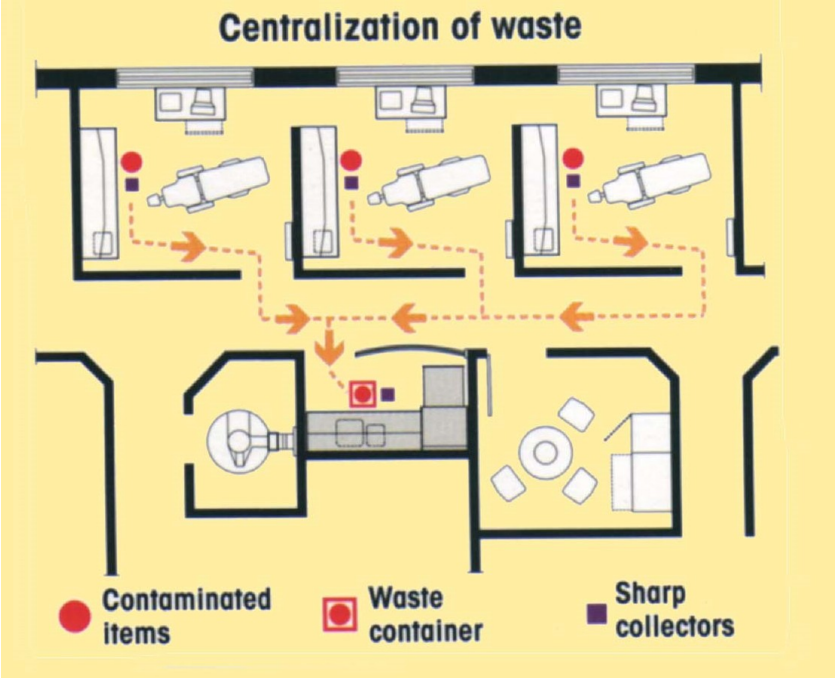
VII. WASTE MANAGEMENT

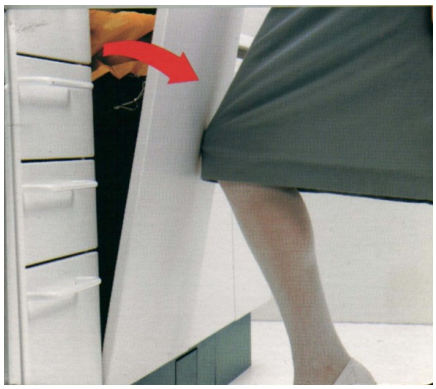
WHY ?

- To prevent access to medical waste by unauthorized persons
- To prevent destruction or spillage of waste
- To protect waste from insects

HOW ?

- Sharp Items and human tissues should be discarded in the operatory room in a special non-puncture container
- Minimize movements with sharp items and biological material
- Contaminated Items and biological materials should always kept out of sight and discarded immediately according to proper requirements. ■





Centralization of waste (upper) and hand free knee opening waste container (right)

VIII. STERILITY ASSURANCE

WHY ?

- To insure efficiency of your sterilizer autoclave.
- To ensure the efficiency of the warpping process

HOW ?

- Sterility assurance of processed instruments should be routinely verified.
- For each sterilization cycle the time, temperature and pressure should be monitored and recorded.
- Use paper pouches with a chemical indicator that change color when run into a cycle.
- Biological Indicator monitoring is the gold standard for sterility assurance as it contain bacterial spores that test the lethality of sterilizers.
- Biological Indicators are available in both mail-in and in-office systems. BIs should be run at least weekly, per CDC guidelines.

APPENDICES

I. CLEANING AND DISINFECTION

II. DISPOSABLE AND DISPOSAL OF WAST

III. NEEDLE-STICK INJURY POLICY

IV INFECTION CONTROL IN DENTAL RADIOLOGY

V. DECONTAMINATION OF IMPRESSIONS AND PROSTHETIC APPLIANCES

APPENDIX I

SURFACE CLEANING AND DISINFECTION

The surfaces of dental units may accumulate infective material and should be impervious. When selecting equipment, consideration should be given to the ease with which it can be cleaned and disinfected. During use all surfaces liable to become contaminated with body fluids or infected matter should be covered with impervious disposable coverings. Between patients, the coverings must be changed and the underlying surface cleaned.

Where it is necessary for the operator's hands to touch light and chair controls they should be protected with impervious disposable coverings which also should be changed between patients. Effective infection control is greatly aided and simplified by a strict system of zoning and the use of sterilisable or disposable (instrument and equipment) trays.

Zoning involves defining the area within the surgery which will become contaminated during clinical procedures. Only this defined area needs to be cleaned and disinfected between patients. A separate area should be used for writing charts etc.

Cabinets, drawers and inserts should be cleanable. Easily cleaned seam free floor covering should be used and the area should have good ventilation.

Between clinical sessions all work surfaces including those apparently uncontaminated (outside zoned area), should be thoroughly cleaned and decontaminated with detergent and a suitable viricidal disinfectant.

Fresh solutions of disinfectant should be made up and used according to the manufacturer's instructions. Glutaraldehyde should not be used to disinfect surfaces in dental practice because of its toxicological profile.■

APPENDIX II

DISPOSABLES AND DISPOSAL OF WASTE

Disposables (Single use items)

Single use equipment, such as scalpels, aspirators and salivary ejectors should be discarded after use within one treatment session and never re-used. Disposable local anaesthetic cartridges may contain blood or fluids aspirated from the patient and they must never be used for a second patient.

Disposal of Waste

Health care waste is defined as the solid or liquid waste arising from health care or health related facilities. Categories include;

- **Health Care Non-Risk Waste**: Waste not contaminated with body fluids.
- **Health Care Risk Waste:** (waste contaminated with body fluids and hazardous to others).

Any human tissue and disposable items and materials that have been used on patients and which may be contaminated with bodily fluids, e.g. dressings, swabs, wipes, gloves, aprons and paper tissues".

All waste generated in dental practice must be segregated into one or other of these categories and disposed of appropriately. All producers of waste have a duty to ensure that the necessary precautions are taken when disposing of health care waste. Therefore:

- Waste should be carefully labelled, secured and stored safely.
- Protective clothing should always be worn when handling waste, e.g. apron, overalls and gloves.
- Waste should be disposed of in appropriate coloured bags
- Persons involved in the disposal of waste should have hepatitis B and tetanus vaccinations and should be trained in proper waste management techniques.
- Do not put hands inside bags/containers
- Do not throw or drop bags/containers
- Do not clasp bags against the body
- Re-bag split/leaking bags
    - **Black bags** are used for Health Care Non-Risk waste and can be disposed of to a landfill site
    - **Yellow bags** are used for Health Care Risk Waste, and must be disposed of in compliance with the law and the regulations/policies of the Department of Health and Children and the Department of the Environment.

Waste Type	Classification	Colour Coding	Description
Infectious Clinical Waste	Hazardous		Poses a known or potential risk of infection including anatomical waste, diagnostic specimens, regent or test vials.
Infectious Clinical Waste	Hazardous		Potentially infectious waste, autoclave and laboratory waste.
Offensive/non infectious waste	Non Hazardous		Healthcare waste which is classed as non infectious, including nappy, incontinence, sanitary waste and other waste produced from human hygiene.
Pharmaceutical waste	Non Hazardous		Includes expired, unused, contaminated and spilt pharmaceutical drugs, products and vaccines. Including bottles, boxes or vials with residues. Also including products contaminated from the use of handling pharmaceuticals including gloves, masks, connecting tubes, syringe bodies and drug vials.*
Cytotoxic and Cytostatic drugs	Hazardous		Hormone and cancer treatment medicinal waste must be separated from other medicinal waste as they are classed as hazardous. Located list can be found in BNF or NIOSH list of medicines. Failure to segregate from non-hazardous medicines will mean that the waste must be treated as hazardous and incur associated hazardous waste charges.
Controlled drugs	Non Hazardous		Controlled drugs must be denatured to render them safe and without value and then disposed of with other non hazardous waste medicines.*

Color code for disposal waste bages

Health Care Risk Waste

Sharp items, including syringes, needles and suture needles, scalpels, small amounts of broken glass and local anaesthetic cartridges, should be placed in a rigid “safe” container or specifically designed puncture resistant bin which should not be filled to more than two-thirds of its capacity. Great care must be taken to avoid inoculation injuries. The container should be kept as close as is practicable to the work station and ideally should be wall mounted or on a trolley and should not be stored on the floor or in areas accessible to children etc. Non-sharp Healthcare risk waste contaminated with blood or saliva should be placed in sealed, sturdy, impervious yellow bags to prevent leakage and clearly labelled as infective waste. Dentists should make their own arrangements for the disposal of Health Care Risk Waste either with a licensed private contractor or with a local authority. ■

APPENDIX III

NEEDLE-STICK INJURY POLICY

Avoiding occupational blood and body fluid exposure is the primary way of preventing transmission of hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) in health care settings. However, hepatitis B immunization and post exposure management are integral components of a complete program to prevent infection following blood borne pathogen exposure and are important elements of workplace safety. The Safety, Health and Welfare at Work Act 2005 places a responsibility on employers to provide staff with information, instruction and training. This is applicable to the risks of acquiring HBV, HCV and HIV and procedures for their prevention. In addition, employers are required to make a suitable and sufficient assessment, and to ensure that appropriate health surveillance, as identified by the assessment, is provided. An exposure that might place health care staff at risk for HBV, HCV, or HIV infection may be-:

A percutaneous injury (e.g., a needle stick or cut with a sharp object) or contact of mucous membrane or non intact skin e.g., (exposed skin that is chapped, abraded, or afflicted with dermatitis) with blood, tissue, or other body fluids that are potentially infectious.

The risk of sero-conversion post sharps injury, blood or body fluid exposure from a source will depend on the status of the source, the type of injury and the status of the victim.

All dental practices should have standard operating procedures to:

- Prevent needle stick injuries
- Manage needle stick injuries, if they occur.

1. Measures to prevent needlestick injuries:

- Recapping needles represents a significant hazard and should be avoided, if possible, by using safe needle systems.
- If recapping is used, single-hand recapping of needles (Bayonet Technique) should be practiced.
- Never handle sharp instruments by the working end.
- Safe disposal of sharps is essential and they should be disposed of at point of use.
- Consider the use of a proprietary system to minimize the handling of sharps.
- Ensure you take responsibility for your own sharps.
- Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal

2. Management of needlestick injuries

- The practice Safety Statement should outline in detail the appropriate protocol to be followed in the event of a sharps injury, blood or body fluid exposure. In this protocol the staff member affected (the victim) should:.

- Report the incident immediately.
- Wash the area immediately under running water or use an eye-washing bottle as appropriate
- Make the wound bleed for three to four minutes whilst continuing to wash the area. Dry area with paper towel.
- Cover the wound with a water-impermeable sticking plaster and consider double gloving any hand injury, if continuing to work.
- Seek appropriate medical advice.
- The source patient should be identified and arrangements made for a blood sample to be obtained, with informed consent. This should be tested for the presence of the blood borne viruses hepatitis B, hepatitis C and HIV.
- Arrangements should be made for blood samples to be taken from the staff member (victim) with informed consent. One sample is marked “for storage” and is retained in the relevant laboratory. The other is analyzed to determine the staff member’s hepatitis B antibody level.
- Further assessment, treatment and follow up of the staff member are performed in accordance with current best practice. Arrangements should be in place for speedy assessment and treatment.
- Counseling, reassurance and information may be required and arrangements for accessing this should be in place as appropriate.
- Appropriate records must be kept.

Protocol for DHCW recipients of an inoculation injury from known HIV positive source patients.

- Implement all the above action points.
- In addition, note, if possible the degree of HIV progression of the patient (CDC status) and the antiviral drugs that the patient is taking.
- Have arrangements in place for accessing appropriate specialist medical care urgently (within an hour). Post exposure prophylaxis (PEP) may be recommended to health care workers who sustain injuries with the highest risk of HIV transmission. ■

APPENDIX IV

INFECTION CONTROL IN DENTAL RADIOLOGY

When taking radiographs for patients, ensure that; ·

- Protective plastic covered I/0 films (barrier pouches) are used ·
- Prevent contamination of the processing equipment
- Gloves are used to position film, holder and tube
- Film is released onto clean area
- Gloves are used prior to selecting and taking exposure
- Tube head and surfaces are disinfected
- Bite blocks and holders are serializable ■

APPENDIX V

DECONTAMINATION OF IMPRESSIONS AND PROSTHETIC APPLIANCES

- All impressions should be rinsed in running water to remove all visible signs of contamination and be disinfected with an appropriate disinfecting agent before being sent to a dental laboratory.
- The single use of disposable impression trays is recommended.
- Impressions and prosthetic appliances should be suitably packaged when sending to the laboratory.
- Technicians should wear gloves when handling impressions and pouring models.
- Prosthetic appliances received from a laboratory should be disinfected prior to insertion into the patient's mouth. ■

REFERENCES AND FURTHER READINGS

1. Australian Dental Association: Guidelines for infection control. 2nd Ed, 2012.
2. New Zealand Dental Association and the Dental Council of New Zealand: Control of cross infection in dental practice (Code of Practice).
3. The Dental Council: Code of practice relating to infection control in dentistry. Dublin, Ireland.
4. William G. Kohn, et al: Guidelines for Infection Control in Dental Health-Care Settings. MMWR, 16, 2003.

LINKS

The Environmentally Responsible Dental Office: A Guide to Proper Waste Management in Dental Offices

Best Management Practices for Hazardous Dental Waste Disposal—Updated Fall 2014

Best management practices for hazardous dental waste disposal

Dental Biomedical Waste Management

BEST MANAGEMENT PRACTICES FOR DENTAL WASTE