

# Infection Control

by

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Reviewed and Updated January 2012

A Two-Hour Home Study Course

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## Table of Contents

Cover Sheet	1
Instructions	2
Table of Contents	3
Course Description	4
Learning Objectives	4
Howard J. Pactovis, DMD	4
Introduction	5
CDC Regulations	5
Terminology and Definitions	6
Chain of Infection	9
Tuberculosis	11
AIDS	12
Hepatitis	13
Handwashing	16
Surfaces and Waste Disposal	19
Steps in Instrument Processing	25
Methods of Sterilization	30
Sterilization Monitoring—Types of Indicators	31
Summary Checklist	33
Timetable Checklist	35
The Absolute Bottom Line	35
Conclusion	36
Post Examination	37

## Course Description

This course begins with an historical overview of aseptic surgical techniques and early infection control. The course continues with a list of important terms the reader needs to know as defined within state and federal regulations and which are commonly used when discussing infection control. Infection control techniques for sterilizing instruments, surfaces, and work areas as well as the chain of infection are discussed, and brief narratives of tuberculosis, AIDS, and hepatitis follow. Finally, the course ends with a summary checklist dental personnel may find useful.

## Learning Objectives

Upon completion of the course, the student should be able to:

- List and define important terms in infection control.
- List standard precaution measures mandated by state and federal guidelines.
- Describe the chain of infection.
- Describe correct aseptic handwashing procedures.
- List disinfecting and sterilization techniques for non, semi and critical instruments, devices, and surfaces.
- List and describe PPEs for DHCP.

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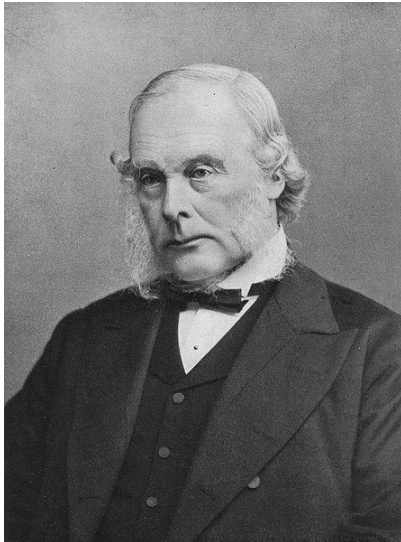


## Professional Memberships

- American Dental Association
- Massachusetts Dental Society
- North Shore District Dental Society
- OSAP – Organization for Sterilization and Asepsis Procedures

## Introduction

Fundamental infection control techniques date back to the mid 1800's with the pioneering work of Dr. Joseph Lister, a British surgeon. While working as professor of surgery at the University of Glasgow, Lister read a paper written by Louis Pasteur that indicated rotting and fermentation could occur under anaerobic conditions if microorganisms were present. Lister confirmed Pasteur's conclusions with his own experiments and developed antiseptic techniques for wounds.



In August 1865 at Glasgow Infirmary, Lister applied lint dipped in carbolic acid onto the wound of an eleven year old boy suffering from a compound fracture after a cart wheel had run over his leg. After four days, Lister changed the dressing and discovered no infection had developed, and after six weeks, Lister was amazed to find the boy's bones had fused back together. He subsequently published his results in *The Lancet* in a series of five articles, running from March through July 1867, entitled: "*On a New Method of Treating Compound Fracture, Abscess, etc.: with Observation on the Conditions of Suppuration*". Later, on August 9, 1867, he read a paper before the British Medical Association in Dublin, on the "*Antiseptic Principle of the Practice of Surgery*", which was reprinted in *The British Medical*

*Journal*. Lister successfully introduced carbolic acid (now known as phenol) to sterilize surgical instruments and to clean wounds, which reduced postoperative infections and made surgery safer for patients.

Lister left Glasgow in 1869, and returned to Edinburgh as Professor of Surgery at the university. He continued to develop methods of antiseptics and asepsis. Lister's fame spread, and audiences of more than 400 people came to hear him lecture. As the germ theory of disease became more widely accepted, it was realized infection could be better controlled by prevention. Some consider Lister the father of modern antiseptics. In 1879, Listerine mouthwash was named after him for his work in antiseptics. Also named in his honor is the bacteria genus *Listeria*, typified by the food borne pathogen *Listeria monocytogenes*. Aseptic techniques and hospital quality sterilization and disinfection are commonplace in dental offices today. (Wikipedia)

## CDC Recommendations

Infection control is concerned with preventing nosocomial or healthcare associated infection, a practical (rather than academic) sub discipline of epidemiology. Infection control and hospital epidemiology are akin to public health practice, practiced within the confines of healthcare delivery systems. Infection control addresses factors related to the spread of infections within the healthcare setting whether from patient-to-patient, patient-to-staff, staff-to-patient, or among staff members. Infection control includes prevention through hand hygiene/hand washing, cleaning/disinfection/sterilization, vaccination, surveillance and outbreak investigation, monitoring/investigation of demonstrated or suspected spread of infection, and management of outbreaks.

## CDC Recommendations

Improve effectiveness and impact of public health interventions.

Inform clinicians, public health practitioners, and the public.

Are developed by advisory committees, ad hoc groups, and CDC staff.

Are based on a range of rationale and form systematic reviews of expert opinions.

The CDC develops a broad range of guidelines which are intended to improve the effectiveness and impact of public health interventions and inform key audiences, most often clinicians, public health practitioners, and the public.

Guidelines can be developed by formal advisory committees, ad hoc work groups, and CDC staff. Development processes can vary, depending on the topic, available scientific data, urgency, resources, etc. and are based on a range of rationale, depending on the availability of scientific evidence.

The 2003 Guidelines identify infection control practices the CDC recommends for all settings where dental treatment is provided. Although CDC recommendations are not regulatory, some practices are mandated by federal, state, or local regulations. These are identified in the recommendations section of the CDC guidelines.

The basic aim of infection control is to reduce the number of pathogenic microbes in the field of operation to a level where the body's normal resistance can prevent infection.

## Terminology and Definitions

Consider the following definitions from The Webster's New World Dictionary:

**Clean:** Free from dirt and impurities; unsoiled.

**Sterile:** Free from living microorganisms.

**Disinfect:** To destroy harmful bacteria, viruses; to sterilize.

Unfortunately, this is not an acceptable definition of disinfect. Disinfection is not the same as sterilization. For the precise needs of the dental environment:

An item is **clean** if all visible soil (organic and inorganic) debris and OPIM are removed by manually or mechanically using water with detergents or enzymatic products.

True **sterilization** involves killing **all** microorganisms including hardy bacterial spores on a surface or instrument.

**Disinfection** lies somewhere in between these two. Disinfection may kill all kinds of disease producing microorganisms but cannot kill bacterial spores.

## Terminology

**Standard Precautions:** is a set of combined precautions that include major components of universal precautions (designed to reduce the risk of transmission of blood borne pathogens) and body substance isolation (designed to reduce the risk of transmission of pathogens from moist body substances). They are a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed

infection status, in any setting in which healthcare is delivered. These include hand hygiene, use of gloves, gowns, masks, eye protection, or face shields, depending on anticipated exposure, as well as, safe handling of sharps. Standard precautions must be used for care of all patients regardless of their diagnoses or personal infectious status.

**Standard Precautions:**

Apply to all patients.

Integrate and expand universal precautions to include organisms spread by blood and body fluids, secretions, and excretions except sweat, whether or not they contain blood.

**Elements of Standard Precautions**

Hand washing.

Use of gloves, masks, eye protection, and gowns.

Cleaning, disinfection, sterilization.

Safe procedures for handling sharps.

Infection control.

**Universal Precautions:** Infection control procedures and barrier techniques are determined by exposure to blood and blood contaminated products, and are used on all patients, regardless of their disease state. The procedures are designed to prevent transmission of HIV, HBV, and other blood borne pathogens in health care settings.

**Sterilization:** Sterilization is a validated process used to render a product free of all forms of viable microorganisms including viruses, bacteria, fungi, and spores.

**Disinfection:** Destruction of most forms of microorganisms, but not bacterial and mycotic spores, which are highly resistant.

**Sanitization:** Using chemicals or procedures that reduce the microbial flora to a safe public health level.

**Asepsis:** Using techniques designed to keep all microorganisms out of the working field and from spreading to other areas.

**Cleaning Agent:** A surfactant used to remove debris on surfaces prior to disinfection.

**Disinfectant:** A chemical that can be applied on an inanimate object or surface that kills microorganisms.

**Antiseptic:** A chemical that can be applied on living tissues to kill or inhibit microorganism activity.

**Cidal agents:** Chemicals that completely kill microorganisms.

**Germicide:** Germicides are chemical agents that can be used to disinfect items and surfaces based on the level of contamination.

**Static agents:** Chemicals that inhibit the growth of microorganisms without killing them.

**Cross infection:** Passage of disease from one person to another.

**Cross contamination:** Passage of microorganisms from one person or inanimate object to another.

**Personal Protective Equipment:** Personal protective equipment (PPE) is specialized clothing or equipment worn or used for protection against a hazard. PPE items may include, but are not limited to, gloves, masks, respiratory devices, protective eyewear and protective attire which are intended to prevent exposure to blood, body fluids and OPIM, and chemicals used for infection control. General work attire such as uniforms, scrubs, pants and shirts, are not considered to be PPE.

Other Potentially Infectious Materials (OPIM): OPIM means any of the following:

Human body fluids such as saliva in dental procedures and any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.

Any unfixed tissue or organ (other than intact skin) from a human (living or dead).

Any of the following if known or reasonably likely to contain or be infected with HIV, HBV, or HCV.

Cell, tissue, or organ cultures from humans or experimental animals.

Blood, organs, or other tissues from experimental animals.

Culture medium or other solutions.

**Dental Healthcare Personnel:** (DHCP) are all paid and non paid personnel in the dental healthcare setting who might be occupationally exposed to infectious materials, including body substances and contaminated supplies, equipment, environmental surfaces, water, or air. DHCP includes dentists, dental hygienists, dental assistants, dental laboratory technicians (in office and commercial), students and trainees, contractual personnel, and other persons not directly involved in patient care but potentially exposed to infectious agents (administrative, clerical, housekeeping, maintenance, or volunteer personnel).

All DHCP shall comply with infection control precautions and enforce the following minimum precautions to minimize the transmission of pathogens in healthcare settings mandated by the California Division of Occupational Safety and Health (CalOSHA) and other state and federal guidelines.

Standard precautions shall be practiced in the care of all patients.

A written protocol shall be developed, maintained, and periodically updated for proper instrument processing, operatory cleanliness, and management of injuries. The protocol shall be made available to all DHCP at the dental office.

A copy of this regulation shall be conspicuously posted in each dental office.

**The major components of infection control are:**

Aseptic technique.

Patient screening and evaluation.

Personal protection.

Instrument sterilization.

- Environmental surface disinfection.
- Equipment asepsis.
- Laboratory asepsis.

**Modes of disease transmission are:**

- Direct contact with an infectious lesion, blood, or saliva.
- Indirect transmission from contaminated objects.
- Aerosolization of infected blood, saliva, or nasopharyngeal secretion droplets.

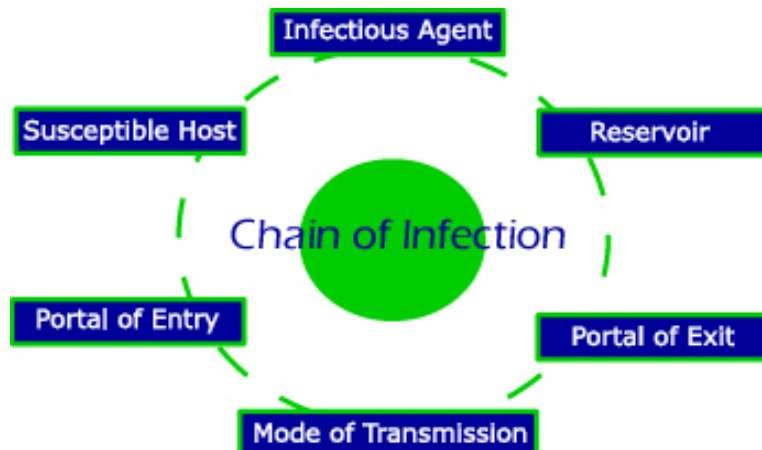
**Modes of Transmission**

- Direct contact with blood or body fluids.
- Indirect contact with a contaminated instrument or surface.
- Contact of mucosa of the eyes, nose, or mouth with droplets or spatter.
- Inhalation of airborne microorganisms.

Dental patients and dental healthcare personnel (DHCP) may be exposed to a variety of disease causing microorganisms that are present in the mouth and respiratory tract. These organisms may be transmitted in dental settings through several routes, including:

- Intact or non-intact skin in direct contact with blood, oral fluids, or other potentially infectious patient materials.
- Indirect contact with a contaminated object.
- Contact of mucous membranes of the eyes, nose, or mouth with droplets containing microorganisms generated from an infected person and propelled a short distance.
- Inhalation of airborne microorganisms that can remain suspended in the air for long periods of time.

**Chain of Infection**





Infection through any of these routes requires that all of the following conditions be present:

An adequate number of pathogens, or disease-causing organisms, to cause disease (infectious agent).

A reservoir or source that allows the pathogen to survive and multiply (reservoir such as blood).

A portal of exit from the reservoir or source to new host (aerosol droplets from cough).

A mode of transmission from the source to the host (contaminated instrument).

An entrance through which the pathogen may enter the host (broken skin).

A susceptible host (one who is not immune).

The occurrence of these events is considered the chain of infection. Effective infection control strategies prevent disease transmission by interrupting one or more links in the chain.

### **Chemical Agents that Kill Microorganisms**

**Chemical sterilizers:** Most effective method. Kills all microorganisms usually within 10 hours.

**High level disinfection:** Kills some, but not necessarily all, bacterial spores. This process kills *Mycobacterium tuberculosis var bovis*, bacteria, fungi, and viruses.

**Intermediate disinfectants:** Kills *Mycobacterium tuberculosis var bovis* indicating that many human pathogens are also killed, but does not necessarily kill spores. This process does not necessarily kill spores.

**Low level disinfection:** Is the least effective disinfection process. Kills some viruses, bacteria, and fungi, but not bacterial spores, or *Mycobacterium tuberculosis var bovis*, a laboratory test organism used to classify the strength of disinfectant chemicals or non lipid viruses and fungi.

**Germicides:** are agents destructive to microbes. All germicides must be used in accordance with intended use and label instructions.

### **Classification of Common Dental Items**

**Critical instruments:** All instruments, devices, and other items used to penetrate tissue or which contacts bone, blood, or other normally sterile tissues or touches broken skin including: needles, hand instruments, surgical instruments, probes, burs, scalers, ultrasonic scaler tips, curettes, and endodontic instruments. These must be sterile, and if reusable, sterilized after each use. Critical items confer a high risk of infection if they are contaminated with any microorganism.

**Semi critical instruments:** Semi critical items are instruments, devices and other items that are not used to penetrate soft tissue or bone, but contact oral mucous membranes, non intact skin or other potentially infectious materials (OPIM). Semi critical instruments include anything handled, such as mouth mirrors, amalgam condensers, and dental handpieces that during a procedure, contacts oral tissue but does not penetrate mucous

membranes, and anything within the range of droplets from the air/water syringe, high-speed drill, or the patient coughing. These ideally should be sterilized and must be disinfected at a high level if they cannot be sterilized.

**Non critical instruments and devices:** Non critical items are instruments, devices, equipment, and surfaces that come in contact with soil, debris, saliva, blood, OPIM and intact skin, but not oral mucous membranes. Examples are x-ray heads, facebows, pulse oximeters, and blood pressure cuffs. Anything else in the operatory that does not come in contact with the patient's mucosa, like walls, floor, cabinets must be cleaned and disinfected at least with a low to intermediate level of disinfectant.

## Tuberculosis

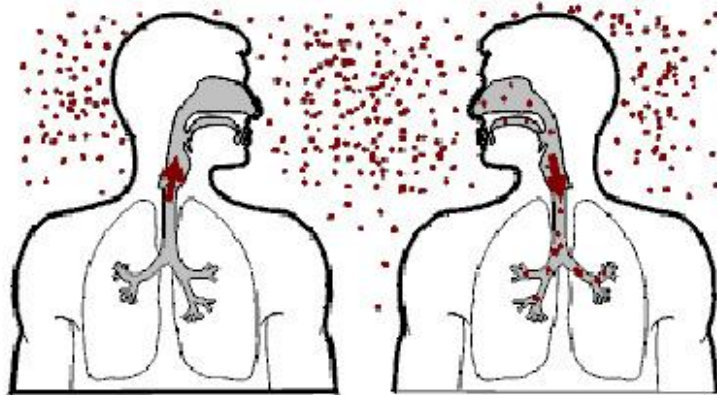
Tuberculosis is a lung infection caused by *Mycobacterium tuberculosis*. The bacterium is carried in airborne infective droplet nuclei by sneezing, coughing, speaking or singing. The nuclei can stay suspended in the air for hours. Prolonged exposure to the disease is usually required for infection.

### Transmission of *Mycobacterium tuberculosis*

Spread by droplet nuclei.

Immune system usually prevents spread.

Bacteria can remain alive in the lungs for many years (latent TB infection).



The dental team's relatively brief interaction reduces the risk of tuberculosis transmission during treatment. Nevertheless, dental health care personnel can be exposed to persons with infectious TB, and should have a baseline two step test tuberculin skin test at the beginning of employment. Some strains of the disease are resistant to standard drug treatment regimens. Most adults with a properly functioning immune system are able to resist a tuberculosis infection. More than 90% of current TB cases occur in people who have been previously infected with the disease (reactivation rather than new onset). The CDC recommends the following protocol for treating dental patients with tuberculosis:

Ask patients about TB symptoms and history of TB.

Refer patients with symptoms of active TB to a physician for evaluation.

Postpone elective dental treatment until diagnostic tests rule out active tuberculosis.

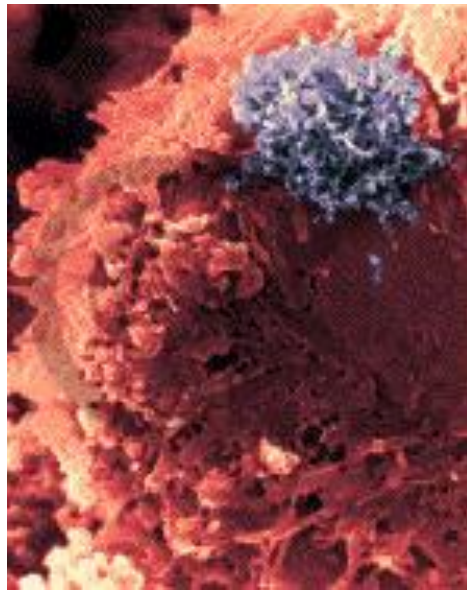
Implement isolation protocol in a medical center if emergency dental care is required. Dental care providers must use HEPA filter masks during treatment.

Limit treatment to relieve immediate pain.

Refer any dental health care worker with TB symptoms to a physician for evaluation. The worker may return to practice after diagnostic tests rule out active tuberculosis or once therapy has eliminated infectivity.

## **AIDS**

Acquired immune deficiency syndrome (AIDS) was identified and reported in the Morbidity and Mortality Weekly Report (MMWR) for the first time on June 5, 1981. It is caused by a retrovirus, called human immunodeficiency virus (HIV). This virus suppresses critical human T-cells in the immune system. Patients are susceptible to diseases that are harmless to a person with a normal immune system.



The patient may be completely asymptomatic for quite some time (even up to 7 years). Both a symptomatic AIDS patient and an asymptomatic HIV positive patient are equally infectious. Dr. Robert Siliciano from Johns Hopkins University conducted research using the blood of 50 Baltimore AIDS patients to measure the virus' resistance to treatment. —'What HIV has done is tap into the most fundamental aspect of the immune system, and that is its immunological memory.' (Dr. Siliciano)

Siliciano said the virus lies silent inside resting memory T-cells, whose job is to store a record of the germs they encounter to keep the body ready for return battles. Inside these sleeping cells, HIV lies dormant but dangerous. AIDS cells die off very slowly. Based on data from his Baltimore patients, Siliciano estimated it takes 73 years for AIDS cells to die, and he can imagine no way to speed the process. Scientists now say this latent reservoir is the single biggest obstacle to curing AIDS.

Signs and symptoms of HIV infection include persistent generalized lymphadenopathy, fever lasting more than a month, involuntary weight loss of more than 10% of baseline body weight, diarrhea lasting more than a month, or any combination of these. This disease is called AIDS when the patient acquires what is known as an AIDS defining illness (Pneumocystis pneumonia, Kaposi's sarcoma and recurrent bacterial pneumonia are examples), or when their T-cell count drops below 200 or 14% of their total lymphocyte count.

Many patients who test positive for HIV infection may have been carrying the disease undiagnosed for a long time. It is currently not a legal requirement for anyone to disclose his or her HIV status in a health history. Many times patients do not disclose this information for fear of being denied treatment or discriminated against.

**Health Care Workers with Documented and Possible Occupationally Acquired HIV/AIDS**

	Documented	Possible
Dental Worker	0	6
Nurse	24	35
Lab tech, clinical	16	17
Lab tech, non clinical	3	3
Physician, non surgical	6	12
Other	8	69
<b>Total</b>	<b>57</b>	<b>142</b>
<b>*3 dentists, 1 oral surgeon, 2 dental assistants</b>		

**Transmission of HIV from Infected Dentists to Patients**

Only one documented case of HIV transmission from an infected dentist to a patient.

No transmissions documented in the investigation of 63 HIV infected DHCP (including 33 dentists or dental students).

Immediate (within 24 hrs) treatment with antiretroviral drugs is recommended for these situations in order to further reduce the likelihood of contraction. The course for these drugs is usually 4 weeks.

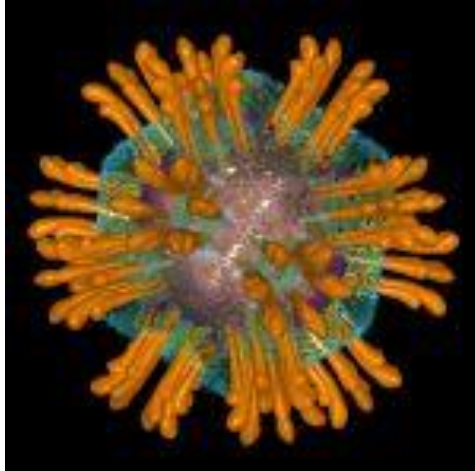
**Hepatitis**

Viral hepatitis is categorized in three types:

**Infectious: A**

**Serum: B and D**

**Non A or B: C, E**



Hepatitis A and E are spread through food or water contaminated by infected human feces. Hepatitis B, C, and D are spread through percutaneous or permucosal contact with infected body fluids or blood. Hepatitis E is rare in the US and not encountered in the dental setting very often.

Hepatitis B virus (HBV) is transmitted either through percutaneous modes (IV drug use or prick wounds), by sexual contact, from mother to fetus or infant, and nonpercutaneous modes (transfer of infectious body secretions like saliva, blood, and crevicular fluid to mucous membranes or open wounds in the skin). Approximately 80% of all HBV infections are undiagnosed. HBV has been demonstrated to survive in dried blood at room temperature on environmental surfaces for up to one week. Hepatitis B virus damages liver cells and can be found in high numbers in the blood of an infected individual.

The symptoms of hepatitis B infection include: anorexia, malaise, nausea, vomiting, abdominal pain, fatigue, and jaundice in varying combinations. Other symptoms may be skin rashes, arthralgias, and arthritis. If left untreated, the patient may become a carrier or develop cirrhosis, acute hepatitis, or primary liver cancer.

The greatest concentration of HBV in an infected patient's mouth is in the gingival sulcus. Inflammation may be present due to gingivitis. Probing or scaling will result in easy, profuse bleeding. The dental hygienist is at high risk for infection because of the bleeding associated with routine prophylaxis.

Other risky procedures include packing cord for crown impressions, oral surgery, needle sticks, injuries from contaminated sharps, blood and saliva contamination of cuts and cracks on the skin, and spraying of blood and saliva onto mucous membranes.

### **Transmission of HBV from Infected DHCP to Patients**

Nine clusters of transmission from dentists and oral surgeons to patients, 1970–1987.

Eight dentists tested for HBeAg were positive.

Lack of documented transmissions since 1987 may reflect increased use of gloves and vaccines.

One case of patient-to-patient transmission, 2003.

The American Dental Association and The Centers for Disease Control recommend dental professionals vaccinate against hepatitis B. Employers should provide easy access to a qualified health care professional who can administer the vaccine and provide appropriate follow up testing. The plasma derived hepatitis B vaccine, "Heptavax-B" was introduced in the United States in 1982. Ninety-six percent of healthy adults seroconvert and have the correct antibody levels to prevent infection by the end of the series.

Two vaccines are currently available: Recombivax HB (Merck Sharp and Dohme), and Engerix B (SmithKline). They are made using recombinant DNA technology, and results in 99% of healthy adults seroconverting. Anyone who is hypersensitive to yeast should consult their personal physician before being immunized with these products.

The standard protocol for administration of the HBV vaccine is three doses in the deltoid muscle. The first dose should be given at baseline, the second, one month later, and the third, six months later. Test for anti HBs at one to two months after third dose. If an unvaccinated person is exposed to HBV, a single dose of hepatitis B immunoglobulin is given within 24 hours of exposure, and the first vaccine dose within seven days. If someone is exposed while in the middle of their series, one dose of immunoglobulin is given immediately and then the series continues as scheduled.

Anyone who has been vaccinated and then exposed to HBV should have his blood tested. If he has a low antibody response, he should be given a booster dose of the vaccine and a dose of hepatitis B immunoglobulin. People who are exposed to HBV but have been unresponsive to the vaccine should have a dose of hepatitis B immunoglobulin immediately, then another one month later. Everyone should have a blood test after completing the vaccine series to confirm its effectiveness. Currently, the CDC does not recommend boosters for vaccine responders.

### **Personal Protective Equipment**

All DHCP must wear surgical facemasks in combination with either chin length plastic face shields or protective eyewear whenever there is potential for aerosol spray, splashing, or spattering or the following: droplet nuclei, blood, chemical or germicidal agents, or OPIM. Chemical resistant utility gloves and appropriate, task specific PPE must be worn when handling hazardous chemicals. After each patient treatment, masks must be changed and disposed.

Protective attire must be worn for disinfection, sterilization, and housekeeping procedures involving the use of germicides or handling contaminated items. All DHCP must wear reusable or disposable protective attire wherever there is a potential for aerosol spray, splashing, or spattering of blood, OPIM, or chemicals and germicidal agents. Protective attire must be changed daily or between patients if they should become moist or visibly soiled. All PPE used during patient care shall be removed when leaving laboratories or areas of patient care activities. Reusable gowns must be laundered in accordance with CalOSHA Bloodborne Pathogens Standards (Title 8, California Code Regulations, section 5193) or other state or federal regulations.

Gloves, eyewear, masks, face shields, and protective apparel are classified as medical devices and are regulated by the FDA. The employer is responsible for purchase of personal protective equipment.

## Handwashing

All DHCP must thoroughly wash their hands with soap and water at the start and end of each workday. DHCP must wash contaminated or visibly soiled hands with soap and water and put on new gloves before treating each patient. If hands are not visibly soiled or contaminated, an alcohol rub may be used as an alternative to soap and water. Hands must be thoroughly dried before donning gloves in order to prevent bacterial growth and washed again immediately after glove removal. A DHCP must refrain from direct patient care if conditions are present that may render the DHCP or patients more susceptible to opportunistic infection or exposure.

All DHCP who have exudative lesions or weeping dermatitis of the hands must refrain from all direct patient care and from handling patient care equipment until the condition resolves.



## Hand Hygiene Definitions

**Handwashing:** Washing hands with plain soap and water.

**Antiseptic handwash:** Washing hands with water and soap or other detergents containing an antiseptic agent.

**Alcohol based handrub:** Rubbing hands with an alcohol containing preparation.

**Surgical antisepsis:** Handwashing with an antiseptic soap or an alcohol based handrub before operations by surgical personnel.

The primary defense against infection and transmission of pathogens is healthy, unbroken skin. Keeping nails short is considered key, because the majority of flora on the hands are found under and around the fingernails. Hands are the most common mode of pathogen transmission. Hand hygiene reduces the spread of bacteria. Hand hygiene is considered the single, most critical measure reducing the risk of transmitting organisms to patients and health care personnel. Dental care workers should wash their hands thoroughly (for a minimum duration of 15 seconds) with an antimicrobial handwash at the beginning of the day and in between patients.

## Gloves

Medical exam gloves must be worn when there is contact with mucous membranes, blood, OPIM, and during all pre clinical, clinical, post clinical, and laboratory procedures. When processing contaminated sharp instruments, needles, and devices, DHCP must

wear heavy duty utility gloves to prevent puncture wounds. Gloves must be discarded when torn or punctured, upon completion of treatment, and before leaving laboratories or areas of patient care activities. All DHCP must perform hand hygiene before donning gloves and after removing and discarding gloves. Gloves must not be washed before or after use.

Gloves are not a substitute for handwashing! Washing hands thoroughly with antimicrobial soaps disinfect hands, but will not make them sterile. Medical exam gloves must be worn when there is potential contact with mucous membranes, blood or OPIM. Properly fitting gloves should be snug but not restrictive and should cover the cuffs of a long sleeved gown. Gloves must be discarded upon completion of treatment and before leaving laboratories or areas of patient care activity. Wear a new pair of gloves for each patient.

Healthcare workers should wash their hands after removing and discarding gloves. Do not wash, disinfect or sterilize gloves for reuse. Do not touch your face, nose, or mouth with contaminated gloves. For most dental procedures, single use non sterile rubber gloves are acceptable. It is recommended that sterile surgical gloves be worn for surgical extractions and more invasive procedures. Sterile gloves will theoretically limit contamination of the surgical site.

Disinfectant chemicals can cause defects in latex gloves, so it is better to use heavy utility gloves when using or mixing chemicals. Do not use petroleum or oil based lotions before donning gloves, because these damage gloves and reduce their effectiveness. Store gloves according to manufacturer's directions. If gloves are torn, cut, or punctured, change them as soon as possible. Wash hands thoroughly and replace gloves before continuing with a procedure. Sharp nail edges or broken nails are likely to increase glove failure. Long artificial or natural nails can make donning gloves difficult and can cause gloves to tear more readily. Gram negative organisms are more prevalent on artificial nails.

Any cuts should be covered with Band Aids. Use antibacterial ointment on cuts if indicated. Slip one layer of gauze between the Band Aid and glove to keep the Band Aid from becoming moist. Inexpensive plastic gloves can be worn over sterile gloves when writing data in charts or retrieving an item out of a drawer. These gloves may not be used alone as hand barriers or for intraoral patient care.

Gloves are available as ambidextrous or right and left specific. Ambidextrous gloves are less expensive, but right/left specific gloves are more comfortable on hands and wrists. In oral surgery, effectiveness of wearing two pairs of gloves to prevent disease transmission has not been demonstrated, but the majority of studies have demonstrated a lower frequency of inner glove perforation and visible blood on surgeon's hands. Double gloving does not appear to substantially reduce manual dexterity or tactile sensitivity. Some health care workers have reported allergies to latex or the powder used in gloves.

### **Latex Allergy**

Type I hypersensitivity to natural rubber latex proteins.

Reactions may include nose, eye, and skin reactions.



More serious reactions may include respiratory distress, rarely shock or death.



### **Gowns**

Health care workers must wear reusable or disposable protective attire when clothing or skin is likely to be in contact with blood or OPIM. Gowns should be fluid resistant, high necked, and provide coverage to the knees. Gowns must be changed in between patients and when they are visibly soiled or moist. They must be removed and placed in laundry or disposal bags when leaving laboratories and after patient care.

Wash uniforms in hot soapy water and bleach. Reusable gowns must be laundered in accordance with Cal-DOSH Blood borne Pathogens Standards, Title 8, California Code Regulations Section 5193 or other applicable state and federal regulations. Machine dry reusable gowns at 100°F. Cost analyses will reveal the most economical protective apparel choice for your office.

### **Masks**

Wear surgical masks in combination with either chin length plastic face shields or protective eyewear to protect the face, mouth, and nasal cavity when blood, OPIM, or other body fluid splatter is expected. Masks should be well constructed. Pleated, soft masks have better filtration than cup masks. A tight seal at the bridge of the nose on the mask will minimize eyewear fogging. Use a mask with at least a filtration rate of 95% of particles three to five microns.

Masks must be changed after each patient and during patient treatment (if applicable). Microbes pass more easily through moisture, so change your mask if it becomes wet or visibly soiled. Some professionals change masks after one hour. Be careful not to touch your mask with soiled gloves if it is to be reused. After each patient, face shields and protective eyewear must be cleaned, and if visibly soiled, disinfected.

### **Protective Eyewear**

Debris can be irritating to the eye, and microorganisms can enter the body through the eye's mucous membrane. Wear protective eyewear to shield your eyes from blood, OPIM, or other body fluid spatter. Wrap around goggles or face shields are recommended. Face shields used during air abrasion deflects aluminum oxide particles.

Protective eyewear also keeps healthcare workers from touching their eyes during procedures and when mixing chemicals. After each patient, face shields and protective eyewear must be cleaned, and if visibly soiled, disinfected. The patient can also wear

protective eyewear. Some offices provide sunglasses to patients to reduce overhead light glare and protect the patient's eyes from spatter.



## Personal Hygiene

The staff should wear clean, fresh uniforms every day. Wear a long sleeved fluid resistant lab coat (or a disposable gown) over your uniform when any spatter is possible (even during cleaning). Do not wear the lab coat or uniform out of the office. Wash uniforms in hot soapy water and bleach. Machine dry at 100°F. Clean uniforms on site or by a third party. Pull longer hair back away from the face. False fingernails can lift at the edge, creating an area for fungi and microorganisms to breed. Keep fingernails trimmed, so they do not stress or puncture gloves. Keep cuts and sores covered. Do not touch your face, nose, or mouth with contaminated gloves.

## Surfaces and Waste Disposal

### Surface Covers

Many surfaces in the dental operatory become contaminated, and they are difficult to clean or cannot be autoclaved. Cover chair buttons, control buttons on the air/water syringe, switches on the unit, light handles, hoses, handpieces, and air/water syringe holders with plastic wrap, aluminum foil, or other disposable material that is impervious to water. Replace with fresh covers after each patient. Covers are faster and easier to remove and throw away than cleaning and disinfecting these areas. Make sure not to contaminate underlying surfaces by touching them or removing covers.

### Surface Cleaning

Countertops should be disinfected after each patient. Surface barriers can be used and changed between patients OR dental practitioners should clean and disinfect all clinical contact surfaces not protected by impervious barriers using an EPA registered, hospital grade low to intermediate level disinfectant after each patient. Low level hospital disinfectants must be effective against HBV and HIV; intermediate level hospital disinfectants are effective against TB.

When using disinfectants, follow manufacturer's instructions. Routinely clean all housekeeping surfaces (floors, walls, sinks) with a detergent and water or an EPA registered, hospital grade disinfectant. Preclean surfaces with a detergent cleaner

before disinfecting. Disinfectants that have detergent properties can be used for this step. Prepare cleaning and disinfecting solutions daily. Use water, not alcohol, to dilute concentrates or other chemicals.

Wear utility gloves, a mask, protective eyewear, and protective clothing during surface cleaning and disinfection to reduce skin, mucous membrane, or eye contamination. Generously spray cleaner onto surfaces, and wipe or scrub with paper towels or brush. If possible, rinse over a sink. After precleaning surfaces, spray disinfectant and leave undisturbed for ten minutes or by the amount of time given by manufacturer's directions. (Spray - Wipe - Spray) Clean mops and cloths and dry them thoroughly before reusing.

### **Spilled Blood**

Absorb any spilled blood with paper towels, saturate the area with bleach, and place soiled cleaning supplies in appropriate containers. Always wear utility gloves when cleaning up spilled blood.

### **Disposal of Contaminated Wastes**

Contaminated, solid waste must be disposed of according to applicable local, state, and federal environmental standards. Local ordinances vary from area to area in regard to waste management. Check with local authorities for specific regulations.

### **Regulated Medical Waste Management**

Properly label waste containers to prevent injuries and leakage.

Medical wastes are treated in accordance with state and local EPA regulations.

Processes for regulated waste include autoclaving and incineration.

### **Limiting Contamination**

Perform dental procedures by conscientiously limiting the amount of droplet nuclei, spatter, and aerosols. Use high speed evacuation, proper patient positioning, and a rubber dam if appropriate. Use over gloves if it is necessary to make a chart entry during treatment. Anything used in the patient's mouth must be sterile. Put all instruments for a patient on a sterile tray with a cover, and place all instruments back onto this tray after use. Wipe down the area where the tray rests with disinfectant after each patient. Use of any irrigating solution should be delivered using a sterile delivery system.

### **Preprocedural Mouth Rinsing**

It is an excellent idea to use a pre procedural mouth rinse to reduce microbial levels in the patient's mouth. There is no mouthwash currently available that is a perfect preprocedural mouthrinse. Chlorhexidine gluconate seems to be the best wide spectrum mouthrinse currently available.

The American Heart Association recommends chlorhexidine rinses as an adjunct to antibiotic prophylaxis, especially if patients are high risk or have poor oral hygiene. Much research regarding CHG indicates it reduces the patient's chances of developing

infections during procedures. CHG helps to control opportunistic infections in compromised patients who have bone marrow transplants, cancer, or HIV infection.

## **Needles**

Strict guidelines need to be followed for handling and disposing of sharps. Use a new, sterile disposable needle and fresh carpule of anesthetic for every patient requiring anesthesia. Handle needles and sharps like scalpels and scalers carefully, because they easily puncture gloves and injure skin. Recap needles using the scoop technique or a protective device. One safe recapping method uses forceps to steady the cap. Whatever technique is used, do not direct the needle point toward any part of the body.

Needles must not be bent or broken for the purpose of disposal.



Contaminated needles, disposable needles, syringes, scalpel blades, and other sharp items and instruments must be placed into sharps containers for disposal as close as possible to the point of use according to all applicable local, state, and federal regulations. They must be disposed of as soon as possible after use. They should be placed in color coded, puncture resistant, leakproof containers until they can be properly processed. Continue to watch for new needle safety technology.

Disinfection will kill disease producing microorganisms but not bacterial spores. Office disinfection procedures employ a liquid chemical at room temperature to kill microorganisms. If the chemical used is not sporicidal, it is called a disinfectant (for example, iodophors, synthetic phenolics, phenols, alcohol/phenolics, sodium hypochlorite, low concentration glutaraldehyde) and will not completely sterilize surfaces.

Liquid glutaraldehydes (at concentration levels for immersion sterilization) are not acceptable as surface disinfectants because of dangerous vapors. Properly diluted iodophor, sodium hypochlorite, and complex phenol preparations have been shown to be superior in comparison with other disinfectants for initial precleaning.

An ideal disinfectant should:

- Have a wide spectrum of antibacterial activity.
- Be tuberculocidal, effective against hepatitis B and HIV.
- Be effective in the presence of bioburden and debris.
- Be compatible with soaps and other chemicals.

Be non corrosive, non staining, and non toxic.

Have a residual effect.

Be odorless, economical, and easy to use.

Be registered with the EPA.

Each dental office must take its own needs into account when selecting an appropriate surface disinfectant. Is it easy to use, economical, and compatible with materials in the office? Is it tuberculocidal within a reasonable period of time at room temperature? What are the disposal requirements, and will it cause allergic reactions in patients or staff? If it needs to be diluted, can it mix with common tap water or will you need to purchase distilled water? When comparing product costs, take into account shelf life and mixing time.

### **Sterilization and Disinfection**

All germicides must be used in accordance with intended use and label instructions.

Cleaning must precede any disinfection or sterilization process. Products used to clean items or surfaces prior to disinfection procedures must be used according to all label instructions.

Critical instruments, items and devices must be discarded or precleaned, packaged or wrapped and sterilized after each use. Methods of sterilization must include steam under pressure (autoclaving), chemical vapor, and dry heat. If a critical item is heat sensitive, it must, at minimum, be processed with high level disinfection and packaged or wrapped upon completion of the disinfection process. These instruments, items, and devices must remain sealed and stored in a manner so as to prevent contamination and must be labeled with the date of sterilization and the specific sterilizer used if more than one sterilizer is utilized in the facility.

Semi critical instruments, items, and devices must be precleaned, packaged or wrapped and sterilized after each use. Methods of sterilization include steam under pressure (autoclaving), chemical vapor and dry heat. If a semi critical item is heat sensitive, it must, at minimum, be processed with high level disinfection and packaged or wrapped upon completion of the disinfection process. These packages or containers must remain sealed and must be stored in a manner so as to prevent contamination, and must be labeled with the date of sterilization and the specific sterilizer used if more than one sterilizer is utilized in the facility.

Non critical surfaces and patient care items must be cleaned and disinfected with applicable state, federal or California Environmental Protection Agency (CalEPA) registered hospital grade disinfectants (low level disinfectants) labeled effective against HBV and HIV. When an item is visibly contaminated with blood or OPIM, a state, federal or California Environmental Protection Agency (CalEPA) registered hospital grade intermediate level disinfectant with a tuberculocidal claim must be used.

All high speed dental handpieces, low speed handpieces, rotary components and dental unit attachments such as reusable air/water syringe tips and ultrasonic scaler tips, must be packaged, labeled and heat sterilized in a manner consistent with the same sterilization practices as a semi critical item.

Single use disposable items such as prophylaxis angles, prophylaxis cups and brushes, tips for high speed evacuators, saliva ejectors, air/water syringe tips, and gloves shall be used for one patient only and discarded.

Proper functioning of the sterilization cycle of all sterilization devices must be verified at least weekly through the use of a biological indicator (such as a spore test). Test results must be documented and maintained for 12 months.

### **Irrigation**

Sterile coolants/irrigants must be used for surgical procedures involving soft tissue or bone. Sterile coolants/irrigants must be delivered using a sterile delivery system.

### **Facilities**

If non critical items or surfaces likely to be contaminated are manufactured in a manner preventing cleaning and disinfection, they must be protected with disposable impervious barriers. Disposable barriers must be changed when visibly soiled or damaged and between patients.

Clean and disinfect all clinical contact surfaces that are not protected by impervious barriers using a state, federal or California Environmental Protection Agency (CalEPA) hospital grade low to intermediate level disinfectant after each patient. The low level disinfectants used must be labeled effective against HBV and HIV.

Use disinfectants in accordance with the manufacturer's instructions. Clean all housekeeping surfaces (floors, walls, sinks) with a detergent and water or a state, federal or California Environmental Protection Agency (CalEPA) registered hospital grade disinfectant. Products used to clean items or surfaces prior to disinfection procedures must be clearly labeled, and DHCP must follow all material safety data sheet (MSDS) handling and storage instructions.

Dental unit water lines must be anti retractive. At the beginning of each workday, dental unit lines and devices must be purged with air or flushed with water for at least two (2) minutes prior to attaching handpieces, scalers, air water syringe tips, or other devices. The dental unit lines and devices must be flushed between each patient for a minimum of twenty (20) seconds.

Contaminated solid waste must be disposed of according to applicable local, state, and federal environmental standards.

### **Lab Areas**

Splash shields and equipment guards must be used on dental laboratory lathes. Fresh pumice and a sterilized or new ragwheel must be used for each patient. Devices used to polish, trim, or adjust contaminated intraoral devices must be disinfected or sterilized, properly packaged, or wrapped and labeled with the date and the specific sterilizer used if more than one sterilizer is utilized in the facility. If packaging is compromised, the instruments must be recleaned, packaged in a new wrap, and sterilized again. Sterilized items must be stored in a manner so as to prevent contamination.

All intraoral items such as impressions, bite registrations, and prosthetic and orthodontic appliances must be cleaned and disinfected with an intermediate level disinfectant

before manipulation in the laboratory and before placing in the patient's mouth. The Dental Board of California and Dental Hygiene Committee of California shall review this regulation annually and establish a consensus.

### **Iodophor Solutions**

Iodophors are probably the most commonly used surface disinfectants. They have low toxicity, no offensive odor, and are not irritating to the skin. However, they do not produce a residual effect on the treated surface. Iodophors are rated by the EPA as a tuberculocidal hospital disinfectant. Some solutions are poor detergents, so the surface must be precleaned with another product. Residual effects are cumulative with each treatment. Longer lasting disinfection results if surfaces are allowed to dry completely. Follow manufacturer's directions for mixing and contact time.

### **Complex Phenolics**

Some complex or synthetic phenols are excellent for surface disinfection. They have a good detergent effect, so the same solution can be used for precleaning and disinfection.

### **Alcohol-Quaternary Ammonium Compounds**

Alcohol combined with quaternary ammonium compounds enhances the antimicrobial spectrum. Alcohol quaternary compounds are appropriate disinfectants.

### **Sodium Hypochlorite (Bleach)**

Bleach should be mixed with water in a dilution of 1:10 or 1:100 of a 5.25% solution. Use a 1:100 solution (approximately  $\frac{1}{4}$  cup of 5.25% household chlorine bleach to one gallon of water) when cleaning blood and debris. Make a fresh solution every day, and wear heavy utility gloves when cleaning with bleach. A bleach and water mixture is not recommended as a surface disinfectant after every patient because of its odor and corrosive nature. It is a good solution for applying to contaminated paper products before their disposal. Any instruments that may have been sprayed with bleach should be rinsed well before soaking in detergents or disinfectants.



### **Unacceptable Solutions**

#### **Quaternary Ammonium Compounds**

The Council for Dental Therapeutics of The American Dental Association has declared all older quaternary ammonium compounds unacceptable for use in dentistry. They are not tuberculocidal, sporicidal, or virucidal and will not kill all gram negative bacteria. They are inactivated by soap, hard water, and organic debris.

## **Alcohol**

Alcohol (both types: ethyl and isopropyl) is ineffective against bacterial spores, not consistently effective in killing viruses, evaporates rapidly, has no residual effect, and is inactivated by organic matter. Alcohol is not EPA approved for instrument or surface disinfection.

## **Steps in Instrument Processing**

### **Instrument Processing Area**

Use a designated processing area to control quality and ensure safety. Divide processing areas into work areas such as:

Receiving, cleaning, and decontamination.

Preparation and packaging.

Sterilization.

Storage.

### **Storage of Sterile and Clean Items and Supplies**

Use date or event related shelf life practices.

Examine wrapped items carefully prior to use.

When packaging of sterile items is damaged, reclean, rewrap, and resterilize.

Store clean items in dry, closed, or covered containers.

### **Presoaking**

Soak contaminated instruments in a mild detergent to prevent blood, saliva, and debris from drying on the instruments. Presoaking for longer than a few hours may cause corrosion of some instruments. Employees should not reach into trays or containers holding sharp instruments that cannot be seen (sinks filled with soapy water in which sharp instruments have been placed).

Work practice controls should include use of a strainer type basket to hold instruments and forceps to remove the items. If possible, use an ultrasonic cleaner basket set in a pan of presoak, so instruments can be directly immersed in ultrasonic cleaner without additional handling. Always wear heavy utility gloves, protective eyewear, a mask, and protective clothing when handling contaminated instruments.

### **Precleaning**

Preclean debris and blood from instruments and surfaces after the presoak and before a sterilization cycle, because this bioburden will prevent chemicals or heat from contacting the instruments. Clean instruments by hand or by submerging in an ultrasonic cleaner. If hand scrubbing is the only option, wear heavy utility gloves, a mask, protective eyewear, and protective clothing. Be especially careful of spatter during hand scrubbing, and keep sterile instruments away from the scrubbing area. If safe, try to scrub instruments while submersed in a sink of water and use careful, light motions. Always rinse and dry instruments.



Ultrasonic cleaners are very effective and greatly reduce the risk of puncture injury to health care workers. Arrange the cleaning area so the ultrasonic cleaner is on one side, a sink is in the middle, and the sterilizer is on the other side. Use solutions designed specifically to aid in cavitation. These solutions are generally not disinfectants, so the instruments will emerge free from bioburden but will still be contaminated.

Match the cleaning activity with the type of instruments being cleaned (a light purpose cleaner for lightly soiled instruments, heavy duty for more heavily soiled instruments). Place the instruments in the basket before submersion to avoid spatter and keep them off the bottom of the ultrasonic cleaner. Use bur blocks, and be careful of overloading sharp instruments that may be dulled by contact with other items. Check manufacturer's directions regarding burs, because some cannot be cleaned ultrasonically.

Make sure the lid is securely in place before turning the unit on. Instruments should be free of debris before removing them from the ultrasonic cleaner. Increase ultrasonic cleaning time for instruments contained in plastic or resin type cassettes. Visually inspect the tips of instruments to make sure the bioburden is removed. Use heavy utility gloves for handling instruments from the ultrasonic since they are still contaminated.

Instruments must be rinsed and dried before sterilization. Wet instruments may corrode in chemical vapor sterilizers and cause paper wraps to burst making the packaged instruments open to air and contamination after the sterilization process. Always follow the manufacturer's directions for use, care, and cleaning of ultrasonic devices. Change solutions in the ultrasonic cleaner daily.

Use heavy utility gloves, mask, protective eyewear, and protective clothing when changing the solution. The inside of the chamber should be disinfected, rinsed, and dried. Fill the container with fresh solution. Occasionally test the ultrasonic by suspending a piece of aluminum foil in the chamber and cavitate for 10 minutes. There should be a "peppering" effect on the foil from the ultrasonic action. Keep the foil pieces for comparison.

### **Corrosion Control and Lubrication**

Rust inhibitors are available to protect non stainless instruments in steam autoclaves. If the manufacturer recommends lubrication before sterilization, be sure to remove excess lubricant so it does not bleed on the bags.

### **Packaging**

#### **Preparation and Packaging**

Critical and semi-critical items that will be stored should be wrapped or placed in containers before heat sterilization.

Hinged instruments opened and unlocked.

Place a chemical indicator inside the pack.

Wear heavy-duty, puncture resistant utility gloves.

Always use the correct type of instrument packaging for the sterilizing system you use.

Wraps that may work fine in a dry heat sterilizer (like closed metal or glass, and aluminum foil) can prevent penetration by steam or chemicals in other systems. Sterility will not be achieved if the sterilizing agent does not contact the surface of the instruments for the correct amount of time.

Plastics may melt in dry heat, causing damage to the sterilizing unit and the instruments. When using paper, make sure it is strong enough to hold the sharp tips of instruments within the bag to avoid contamination and possible injury. Use transparent materials or mark the contents clearly on the paper to avoid opening packages needlessly.

Use self-sealing bags, autoclave tape, heat-sealing, or double fold the open end of the bags to contain the instruments. Staples and paper clips rust easily and are not reliable for sealing bags. Use containers of some type, because loose instruments will become easily contaminated between the sterilizer and the operator, especially if stored in a drawer then sorted out later. Bag instruments in sets to be used on individual patients, and open them in front of the patient.

### **Backflow Prevention**

A majority of state and local health departments require backflow prevention devices in dental offices. Agencies are concerned about the potential for aspiration of oral fluids through high speed handpieces or air/water syringes. Risk of aspiration is nearly impossible, because the instruments are not immersed in oral fluids. Any incident would be precipitated by a pause in the water flow, which would signal the dental professional to discontinue the procedure.

### **High Speed Handpiece Asepsis**

The American Dental Association, the Food and Drug Administration, and the Center for Disease Control recommend heat sterilization for intraoral use of handpieces and prophylaxis angles between each patient with an acceptable method that assures internal as well as external sterility.

These agencies also stress running the handpiece waterline after use for 20 to 30 seconds to flush the internal lines. The Food and Drug Administration requires air/water syringes and ultrasonic scaler tips to be sterilized between each patient. Most states have laws requiring heat sterilization of all reusable hand instruments, handpieces, and prophylaxis angles.

If you do not have directions and information regarding a handpiece's tolerance to heat or the recommended sterilization and lubrication regimen, contact the manufacturer with the model number and request a written copy. Always follow the handpiece manufacturer's directions for proper maintenance, cleaning, sterilization, disinfection, and compatibility with chemical agents. Each handpiece is different. Some must be lubricated before and after sterilization. Some do not need lubrication at all.

### **Slow Speed Handpieces, Contra Angles, and Prophylaxis Angles**

If used intraorally, low speed handpieces and their components must be heat sterilized between each patient. Follow manufacturer's directions for cleaning, lubricating and

sterilizing. Use heat sterilizable or disposable prophylaxis angles and contra angles. If treating an immunocompromised patient, a sterile angle is recommended. Some disposables can be autoclaved prior to first use; check manufacturer's directions. Never reuse a disposable prophylaxis angle.

### **Air/Water Syringes and Ultrasonic Scalers**

Units that dispense water into the patient's mouth should be flushed for 30 seconds into a vacuum line between each patient. The tips of both air/water syringes and ultrasonic scaler tips must be removable and heat sterilized if possible. Plastic disposable tips are available for air/water syringes.

### **Lasers, Curing Lights, Electrocautery Devices**

Follow manufacturer's directions for all devices. Use barrier protection when possible, and preclean removable tips before sterilization.

### **Laser/Electrosurgery Plumes and Surgical Smoke**

Destruction of tissue creates smoke that may contain harmful byproducts.

Infectious materials (HSV, HPV) may contact the nose mucous membranes.

There is no evidence of HIV/HBV transmission.

There is a need for further studies.

Throw away all items (such as prophylaxis angles, prophylaxis cups and brushes, tips for high speed evacuators, saliva ejectors, and air/water syringe tips) designed by the manufacturers to be disposable after a single use. Do not try to disinfect or reuse items like disposable air/water syringes, plastic prophylaxis angles, saliva ejector tips, prophylaxis cups, or brushes and paper products.

### **Saliva Ejectors and High Speed Evacuation Systems**

The saliva ejector tip is disposable and should be thrown away after every patient. However, if the interior of the vacuum line is not disinfected, it is contaminated with microorganisms and debris. Many health care workers incorrectly instruct the patients to close their lips around the ejector tip, which causes a suck back effect. A study of saliva ejectors by Watson and Whitehouse published in 1993, clearly demonstrated this phenomenon. They thoroughly disinfected suction lines with a bleach/water solution, and then added a red disclosing solution. Patients were suctioned with the mouth open and no red dye was found in the oral cavity. The same patients were then told to make a seal around the tip, and red dye was seen coming back up the clear ejector, with a significant number of patients receiving red dye into their mouths (evidenced by the patient expectorating into a white tissue).

Out of 97 tests using 15 different dental units at 9 different locations, 20 cases of red dye aspiration into participants' mouths were documented. Several times the red dye was observed to come up the clear saliva ejector towards the patient's mouth, but these were not counted as positive results.

Since many offices do not decontaminate their suction lines after every patient, it is likely that some patients will aspirate bacteria and even debris from infected suction lines if they seal off the saliva ejector. More effective methods of preventing accidental suck back are currently being investigated (like safety valves and changing the construction of the saliva ejector).

Patients should be directed not to close their mouths around the suction tips. Flush the high speed evacuation system after every patient with a 2% glutaraldehyde or any other non foaming agent recommended by the manufacturer for disinfecting lines. At the end of the day, flush with a disinfectant that will remain in the vacuum system overnight to help reduce the number of microorganisms. Handle evacuation system traps with utility gloves, empty into the toilet, and clean the traps with a high-level disinfectant every day.

### **X-Ray Equipment and Film**

Heat sterilize heat tolerant radiographic accessories. Cover or disinfect collimating tubes between each patient. Once film is inserted into a patient's mouth, it is considered contaminated. Use disposable gloves in the darkroom to open the packets. Remove films from the packets without touching them, and collect contaminated packets on a disposable paper towel. When all films are out of the packets, discard the towel and the packets, and remove the gloves. After washing hands, process the films as usual; the darkroom equipment will not be contaminated. Film packets can also be decontaminated by wiping them with bleach before taking them into the darkroom.

### **Impression Materials**

Due to diversity of impression materials used today, there is no clear cut protocol for their disinfection. Each material has different properties that may be affected by the disinfection process. Furthermore, studies have shown a lack of communication between dental offices and labs regarding disinfection of impressions. This is an area that needs to be addressed.

The CDC recommends when an impression is sent to the lab, information should be included pertaining impression disinfection (type of disinfectant used and time of exposure). Cleaning and disinfecting impressions should be done as soon as possible after removing them from the patient's mouth. The Organization of Safety and Asepsis Procedures (OSAP) recommends the following: —Cleaning and disinfecting impressions before pouring in stone is an important aspect of laboratory asepsis. Different materials require different handling techniques. In general, impressions should be gently scrubbed with a camel hair brush (artists brush, one-half inch bristle) and a liquid detergent to remove bioburden.

Scrubbing gently with dental stone sprinkled into the impression will remove stubborn materials. Always consult the impression material manufacturer or instructions for use for advice on using compatible disinfectants. Hydrocolloid and polyether impression materials generally are sprayed to saturate for the required time with an intermediate level disinfectant and placed in a plastic bag or sealed container to prevent evaporation of the agent.

More stable silicone (vinyl polysiloxane) or rubber based impression material typically may be immersed for disinfection. Studies have shown that when submersing elastomer

impression materials (polyether, polysulfide, addition silicone and condensation silicone) in either 5.25% NaOCl for ten minutes or 2% glutaraldehyde for 30 minutes, there is no negative effect on dimensional accuracy.

Any disinfection procedure should be, at worst, tuberculocidal. It is possible to adequately disinfect alginate impressions in only ten minutes, thereby preserving their dimensional stability. As impression material technology is rapidly changing, it is wise to contact the manufacturer concerning proper disinfection of any new type of material.



## Methods of Sterilization

### Method Standard Sterilizing Conditions\* Advantages Precautions Spore Testing

METHOD	STANDARD STERILIZING CONDITIONS*	ADVANTAGES	PRECAUTIONS	SPORE-TESTING
<b>Steam autoclave</b>	20-30 min at 250 F 3-10 min at 273 F	Time efficient; Good penetration; Sterilize water-based liquid	Do not use closed containers; May damage plastic and rubber items; non-stainless steel metal items corrode; Use of hard water may leave deposits	<i>Bacillus stearothermo philus</i> strips, vials, or ampules.
<b>Unsaturated chemical vapor</b>	20 min at 270 F (20-40 psi)	Time efficient; No corrosion; Items dry quickly after cycle	Do not use closed containers; May damage plastic and rubber items; Must use special solution; Predry instruments or dip in special solution; Provide adequate ventilation; <b>cannot sterilize liquids.</b>	<i>Bacillus stearothermo philus</i> strips

<b>Dry heat oven Dry heat</b>	60-120 min at 320 F	No corrosion; Can use closed containers; Large capacity per cost; items are dry after cycle	Longer sterilization time; cannot sterilize liquids; May damage plastic and rubber items; Do not open door before end of cycle	<i>Bacillus subtilis</i> strips
<b>Rapid Heat Transfer</b>	12 min at 375 F (for wrapped items) 6 min at 375 F (for unwrapped items)	No corrosion; Short cycle; items are dry after cycle.	Predry instruments; Cannot sterilize liquids; May damage plastic and rubber items; Do not open door before end of cycle; Small capacity per cost; Unwrapped items quickly contaminated after cycle.	<i>Bacillus subtilis</i> strips
* These conditions do not include warm-up time and they may vary depending upon the nature and volume of the load. Sterilizing conditions in your office sterilizer should be defined by results of routine spore-testing.				
C.H. Miller. -Sterilization and disinfection: what every dentist needs to know.", JADA vol 123:46 © 1992 Reprinted by permission of ADA Publishing Co., Inc.				

The Centers for Disease Control and the American Dental Association recommend sterilization of any instruments, burs, and handpieces that come into contact with oral tissue, or penetrate soft tissue or bone after each use. Heat stable critical and semi critical instruments must be cleaned and sterilized before use by using steam under pressure (autoclaving), dry heat, or unsaturated chemical vapor. FDA cleared chemical sterilants/disinfectants must be used for sterilization of heat sensitive critical items and for high level disinfection of heat-sensitive semi critical items.

### **Sterilization Monitoring--Types of Indicators**

Mechanical.

Measure time, temperature, pressure.

Chemical.

Change in color when physical parameter is reached.

Biological (spore tests).

Use biological spores to assess the sterilization process directly.

Precleaned instruments submerged in glutaraldehyde solution at 2% or 3.2% concentration for ten hours will kill bacterial spores, but there is no test to verify the results. Currently, no single system will work for all the items used in a dental office. Most offices use at least two: a steam autoclave and glutaraldehyde chemical sterilization. The best and safest approach to preventing disease transmission from patient to patient via instruments is to sterilize all reusable instruments that are contaminated with blood or saliva instead of sterilizing some and disinfecting others. Many states require the sterilization of all reusable dental instruments. Sterilizers must be used correctly to achieve sterilization with every load of instruments.

Examples of common mistakes include:

Overloading sterilizer chamber.

Lack of separation between packs or trays in the chamber.

Incorrect packaging material for method of sterilization.

Excessive layering of wrap, inhibiting penetration.

Closed container not penetrated by steam or chemical vapor.

Insufficient time or temperature.

Dry heat sterilizer door opened to add more items without starting sterilization time over.

Sterilizer timer malfunction.

Sterilizer malfunction.

Improper cleaning of items to be sterilized.

When purchasing a sterilizer, take into account the needs of the office as well as the quality of support from the manufacturer. Any sterilizer purchased should be FDA approved for use in a dental office.

### **Sterilization Monitoring**

Two part systems of sterilization monitoring using both biological and chemical indicators help assure patient safety and sterilizer effectiveness. Biological monitoring (also called spore tests) ensures correct use of heat sterilizers (including operation, packaging, loading and timing) by demonstrating the sterilizer's ability to kill live spore samples. The spore test should be specific for the type of sterilizer used.

The test should be placed in the same type of container normally used for instruments, then run through a normal cycle with other instruments. The time, temperature, and pressure are recorded. The test is then sent back to the lab along with a control strip that has not been sterilized. Spores should grow on the control sample but not on the test. Spore survival in the test sample indicates sterilization failure and inactivation of spores is verification of successful sterilization. The laboratory notifies the office of the results. Weekly spore testing with a biological indicator (such as a spore test) is required by the Centers for Disease Control, the American Dental Association, the Association for Advancement of Medical Instrumentation, and the OSAP Research Foundation.

There are many spore testing services for steam, dry heat, unsaturated chemical vapor, and ethylene oxide gas sterilizers. They send the appropriate biological indicator strips, instructions, and return envelopes. Some personnel have expressed concern that delays caused by mailing specimens might cause false negatives. But studies have determined mail delays have no substantial effect on final test results. They call immediately for failures, and send written reports for each test.

### **Glutaraldehyde as a Sterilant**

Always wear gloves, masks, protective eyewear and protective clothing when preparing, using, or discarding glutaraldehyde. It is very harmful to skin, mucous membranes, and eyes. Check the Material Safety Data Sheet (MSDS) for this product. Follow the manufacturer's label directions to prepare and activate properly. Mark containers of activated solutions with the date of mixing to accurately assess shelf life. Mark used containers or pans with the word "Glutaraldehyde," the brand name, and the expiration date.

Monitors are commercially available to test the concentration of glutaraldehyde, but they do not assure instrument sterility. Preclean, rinse, and dry instruments to prevent sterilant dilution. Completely submerge instruments for proper contact time, usually ten hours. All glutaraldehyde solutions should be discarded and replaced with fresh solution when indicated. After correct processing time, thoroughly rinse instruments with water. Use sterile water if the item may penetrate tissue during use.

Instruments must be handled aseptically to prevent contamination from hands, aerosols, and dust before placing at chairside. Use sterile forceps to handle items and put them in bags or covers. Glutaraldehyde sterilants are indicated for immersion use only and are not recommended for use as a surface disinfectant. They should be kept in a closed container and in a well ventilated room, because repeated exposure to the fumes can cause breathing difficulties and dizziness. Some instruments will dull or corrode if soaked in glutaraldehyde for too long. Remember to start timing the sterile cycle after the addition of the last instrument is added to the solution, because each new addition contaminates the whole batch.

## **Summary Checklist**

In outline form, here are some of the main points of infection control for the dental office.

### **Before the patient is seated for treatment:**

All health care workers in direct contact with patients should be immunized against the hepatitis B virus.

Each patient should fill out a thorough medical health history form and this should be updated at each appointment.

Prostheses and appliances to be delivered to the patients should be disinfected before fitting.

Disposable coverings should be placed prior to seating each patient in operatory, and all surfaces should be disinfected.

Take a few seconds to look over the setup to see if anything is missing.

### **During patient treatment:**

Treat all patients as potentially infectious.

Use protective wear and barrier techniques such as gloves, mask, protective eyewear, and gowns, lab coats, or uniforms when in contact with body fluids or mucous membranes.

X-ray films that are contaminated should be opened for processing in the darkroom with gloves, being careful not to touch the film. Then, remove the gloves to place film in the developer.

Conduct procedures with the minimum amount of droplets, spatters, and aerosols. Use a rubber dam when appropriate. Use a high volume aspirator.



Use gloves correctly to protect hands. Wash hands before and after gloving. Change gloves in between each patient. Change gloves that are torn, cut, or punctured.

Avoid injury to hands by being careful with sharp items, placing disposable needles in an appropriate receptacle, and recapping needles using a recommended technique.

Try not to leave the treatment room if at all possible during a procedure.

Use an overglove if answering the phone, writing or going into a drawer.

Don't touch your face or hair.

At end of treatment: discard mask and gloves, wash hands, and remove gown.

Change gown between patients, and clean face shields and protective eyewear.

Make notes in chart and dismiss patient.

**After the patient leaves:**

Wear heavy rubber gloves while disinfecting surfaces after each patient and handling instruments.

Clear off all instruments that can be soaked, and put them in a container.

Clean all debris from instruments.

Sterilize instruments that penetrate soft tissue or bone. Also sterilize, when possible, all instruments that come in contact with oral mucous membranes, body fluids, or any contaminated secretions of patients. High level of disinfectant must be used if item is heat sensitive or oddly sized.

Run air/water syringe, ultrasonic scaler, and/or handpiece for 30 seconds to flush lines.

Clean suction lines with disinfectant by aspirating an acceptable, non foaming solution.

Dispose of all disposable items after one use.

Clean and sterilize handpieces if possible but must be sterilized for intraoral use of handpieces; follow manufacturer's directions.

Use caution when handling sharps, especially disposable needles and scalpels. Place them in a puncture resistant container before disposal.

Decontaminate all environmental surfaces. Use absorbent paper toweling and a detergent type disinfectant to preclean surface and remove debris. Dispose of towels appropriately. Spray area liberally with disinfectant and leave wet for the time indicated by the directions. Dispose of and replace any protective coverings on switches, light handles, x-ray unit head.

Decontaminate all outgoing materials such as impressions, bite registrations, and appliances being sent to a laboratory.

Use only small individual amounts of pumice in a disposable container for each patient, and discard any unused portion.

Appropriately dispose of wastes. Any blood, suctioned fluids, or other liquid waste should be, if your state allows it, poured in a drain connected to a sanitary sewer system. Solid wastes contaminated with blood or saliva, including tissue, extracted teeth, and bloody (dripping) gauze should be sealed in a sturdy impervious bag and disposed of according to local, state and federal government regulations.

Wash hands after removing gloves.

## **Timetable Checklist**

### **Daily**

Clean and disinfect floors, work surfaces, door knobs, sink handles, drawer pulls, and anything else that may have been touched but not disinfected after each patient. Clean sterilizing area, disinfect brushes, and wipe down heat sterilizers.

### **Weekly**

Clean and disinfect lower areas of walls, front office areas, phones, and other areas not disinfected daily. Check stock and supplies to make certain you have an adequate amount of barrier products, chemicals, solutions, and supplies for the next week. Check the expiration date on all chemicals like glutaraldehyde. Test heat sterilizer with biological test strips.

### **Monthly**

Clean out drawers and storage spaces, disinfect with a product that has a long lasting effect.

### **Annually**

Review cross infection control system. Check that your hepatitis B vaccine is up to date (usually needs a booster every 5 years). Communicate with the laboratory regarding infection control of incoming/outgoing cases.

## **The Absolute Bottom Line**

Be vaccinated against hepatitis B.

Treat all patients as if they were infectious.

Have patients use an antiseptic mouthrinse before invasive procedures.

Use an antiseptic handwash.

Wear a disposable mask or face shield.

Wear disposable latex gloves any time you touch mucous membranes.

Wear protective eyewear.

Wear a disposable gown or lab coat when spatter is expected.

Wear clinical attire at all times.

Use a rubber dam when appropriate.

Put needles and other sharps in a puncture resistant container.

Use sterilizable handpieces.

Use an ultrasonic cleaner instead of hand scrubbing instruments.

Correctly package instruments for sterilization.

Use a heat sterilizer.

As a general rule of thumb, if an instrument goes into a patient's mouth, it needs to be either discarded or sterilized before being used on another patient.

Monitor the sterilizer with appropriate spore tests weekly.

Use glutaraldehyde for items that cannot be heat sterilized for the appropriate time recommended.

Use an appropriate surface precleaner.

Use an appropriate surface disinfectant for the time recommended by the manufacturer.

Use surface covers.

Have an adequate waste disposal system according to local regulations.

Review scientific literature for technology at least annually to find safer devices to use in your practice.

Keep your dental unit water cleaner than 200 CFU/mL for regular procedures and use sterile water for surgical procedures.

## **Conclusion**

Infection control began with Dr. Joseph Lister and his pioneering efforts in sterilization techniques. As the chain of infection began to be understood, effective infection control strategies to prevent disease transmission were developed, and state and federal guidelines were written and mandated to control infection in all public health settings. Infection control, disinfection, and sterilization techniques, designed to protect patients and DHCP, were developed to stop the spread of pathogens between patients and DHCP, DHCP and patients, and from patient to patient. From these procedures and techniques, daily, weekly, monthly, and annual cleaning and disinfection schedules were developed and should be implemented in all dental practices to achieve infection control goals. In addition, personal protection equipment should be made available to all DHCP and sharps containers. By adhering to state and federal infection control guidelines and regulations, the spread of disease producing pathogens will be minimal, and the health and safety of patients and DHCP protected.

## **Post Examination Infection Control**

1. Destruction of most forms of microorganisms, but not bacterial and mycotic spores best describes:
  - a. Disinfection
  - b. Sterilization
  - c. Antiseptics
  
2. Three major components of infection control are:
  - a. Aseptic technique
  - b. Patient screening and evaluation
  - c. Personal protection
  - d. All the above
  
3. Critical instruments include instruments, devices and other items that are not used to penetrate soft tissue or bone, but contact oral mucous membranes, non intact skin or other potentially infectious materials (OPIM).
  - a. True
  - b. False
  
4. OPIM means any of the following:
  - a. Human body fluids such as saliva in dental procedures and any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.
  - b. Any unfixed tissue or organ (other than intact skin) from a human (living or dead).
  - c. Cell, tissue, or organ cultures from humans or experimental animals.
  - d. All the above.
  
5. Effective infection control strategies prevent disease transmission by interrupting one or more links in the chain of infection.
  - a. True
  - b. False
  
6. *Mycobacterium tuberculosis* is a laboratory test organism used to classify the strength of disinfectant chemicals or non lipid viruses and fungi.
  - a. True
  - b. False

7. Signs and symptoms of HIV infection include:
  - a. Persistent generalized lymphadenopathy
  - b. Fever lasting more than a month
  - c. Involuntary weight loss
  - d. All the above
  
8. Personal protective equipment includes:
  - a. Gowns
  - b. Gloves
  - c. Masks
  - d. All the above
  
9. Serum hepatitis includes type(s):
  - a. C, E
  - b. B
  - c. D
  - d. B and D
  
10. Alcohol can be used as a sterilizing agent.
  - a. True
  - b. False
  
11. Wearing gloves is the single most effective way to control infection.
  - a. True
  - b. False
  
12. Spilled blood should be cleaned with paper towels then disposed of after saturating with:
  - a. Iodophor solution
  - b. Bleach
  - c. Alcohol
  - d. Glutaraldehyde
  
13. Examples of disinfectants are:
  - a. Bleach
  - b. Glutaraldehyde
  - c. Phenol

- d. A and C
- e. All the above

14. After each patient, handpiece waterlines must be flushed for:

- a. 30 seconds
- b. 10 seconds
- c. 40 seconds
- d. 5 minutes

15. When close their lips around saliva ejector tips, it causes a suck back effect potentially exposing patients to pathogens.

- a. True
- b. False

16. To sterilize instruments in the autoclave, they must remain at 273°F for 20-30 minutes.

- a. True
- b. False

17. Spore testing services are available for steam, dry heat, unsaturated chemical vapor, and ethylene oxide gas sterilizers.

- a. True
- b. False

18. Spore testing must be performed:

- a. Daily
- b. Weekly
- c. Monthly
- d. Annually

19. Surfaces not protected by impervious barriers must be cleaned using an EPA registered disinfectant effective against HBV and HIV after each patient.

- a. True
- b. False

20. Glutaraldehyde sterilants are indicated for immersion use only and are not recommended for use as a surface disinfectant.

- a. True
- b. False

**21.** Sharps containers must be:

- a. Leak proof
- b. Puncture resistant
- c. A and B

**22.** Hepatitis B vaccinations need to be updated with a booster every:

- a. Ten years
- b. Five years
- c. Two years
- d. Not at all

**23.** Needles should be recapped:

- a. Using the scoop method
- b. Using the safety method
- c. By breaking the tip at the sharps container

**24.** Lister sterilized surgical instruments and wounds using:

- a. Bleach
- b. Phenol
- c. Glutaraldehyde
- d. Alcohol

**25.** If DHCP are exposed to HIV, it is recommended they receive treatment with antiretroviral drugs within:

- a. 2 days for one month
- b. 1 week for one month
- c. 24 hours for 4 weeks
- d. 12 hours for 2 weeks