

The Dental Learning Network



Infection Control: 6 Hours

6 Homestudy Credit Hours

Joseli Alves-Dunkerson, DDS, MS, MPH, MBA
Duane Dunkerson, MA

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Infection Control – 6 Hours

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Course Objectives

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

- List and define important terms in Infection Control.
- Describe diseases like Tuberculosis, Hepatitis B, and AIDS.
- Give the rationale for immunization against the Hepatitis B Virus.
- List the common forms of barrier techniques and the rationale for each.
- Describe correct aseptic technique for dental procedures.
- List the steps in correct instrument processing to achieve sterility.
- Describe an ideal chemical disinfectant.
- Describe the most commonly used sterilization methods, and list the pros and cons of each.
- Explain good sterile technique to be used in a dental laboratory.
- List the major components of a dental personnel health infection control program.
- Describe dental water quality concepts.
- Describe the chain of infection and detail the routes of transmission for disease causing microorganisms.

Course Introduction

Everyone recognizes the importance of preventing the spread of disease during routine dental care. Dental professionals live and work in a time that calls for competent, thorough, modern infection control procedures. Patients are concerned about the sterile procedures used in dental office. Dental Professionals need to understand recommended Infection Control measures to be confident in the routines of their daily practice.

About the Authors

Joseli Alves-Dunkerson, DDS, MS, MPH, MBA



Dr. Joseli Alves-Dunkerson is a public health dentist with extensive experience in both the private and public sectors. She completed her graduate studies in dentistry, public health and management at the University of Iowa. She also works as a dental public health consultant.

Duane Dunkerson, MA



Mr. Dunkerson is a freelance medical-technical writer and editor whose last position was with the Cancer Center of the University of Iowa. Previously he was a technical writer for the engineering department of an electronics manufacturer. While earning his MA in English from the University of Northern Iowa, he was a science writer for a laboratory publishing papers in microbiology, biochemistry, and cancer research.

Introduction

Fundamental infection control techniques date back to the mid-1800's. Dr. Lister used carbolic acid, (a phenolic) on instruments, in wounds, and as a handwash. Barrier products, aseptic techniques, and hospital-quality sterilization and disinfection are commonplace in dental offices today.

Included in this course are selections from a slide set prepared by the Centers for Disease Control and Prevention (CDC) to accompany the CDC "Guidelines for Infection Control in Dental Health-Care Settings – 2003" that are to give pictorial amplification to the course's text, tables, and figures.

CDC Recommendations

- Improve effectiveness and impact of public health interventions
- Inform clinicians, public health practitioners, and the public
- Developed by advisory committees, ad hoc groups, and CDC staff
- Based on a range of rationale, from systematic reviews to expert opinions

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 topic, available scientific data, urgency, resources, etc. and are based on a range of rationale, depending on the availability of scientific evidence.

The Guidelines for 2003 identifies infection control practices that 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.

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 the harmful bacteria, viruses, etc., in; 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 debris, dirt, or visible blood is removed from the surface. Cleaning alone does not remove all the microorganisms, but it is an important first step in correct sterile procedure.
- 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.

The following terms will be used throughout this course ^{i,ii}:

Standard Precautions: is a set of combined precautions that include the 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). Similar to universal precautions, standard precautions are 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 also
 - Body fluids, secretions, and excretions except sweat, whether or not they contain blood
 - Non-intact (broken) skin
 - Mucous membranes

Elements of Standard Precautions

- Handwashing
- Use of gloves, masks, eye protection, and gowns
- Patient care equipment
- Environmental surfaces
- Injury prevention

Universal Precautions: The infection control procedures and barrier techniques are determined by the 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 bloodborne pathogens in health care settings.

Sterilization: Destruction or removal of all microbial forms of life, 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.

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.

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

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 transmission of disease are:

- direct contact with an infectious lesion, blood, or saliva;
- indirect transmission from a contaminated object (gloves, dirty instruments)
- aerosolization of infected blood, saliva, and/or nasopharyngeal secretion droplets.

Modes of Transmission

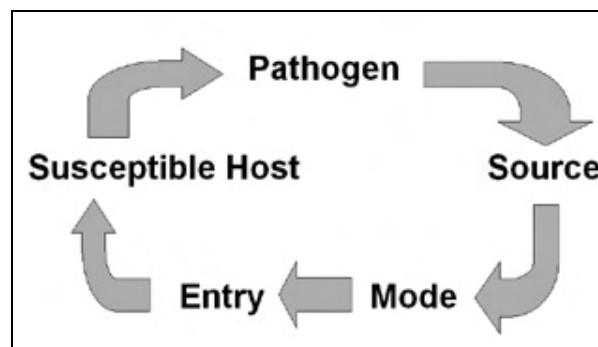
- Direct contact with blood or body fluids
- Indirect contact with a contaminated instrument or surface
- Contact of mucosa of the eyes, nose, or mouth with droplets or spatter
- Inhalation of airborne microorganisms

Dental patients and Dental Health Care 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 (e.g., instruments, operatory equipment, or environmental surfaces).
- Contact of mucous membranes of the eyes, nose, or mouth with droplets (e.g., spatter) containing microorganisms generated (e.g., coughing, sneezing, talking) 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.
- A reservoir or source that allows the pathogen to survive and multiply (e.g., blood).
- A mode of transmission from the source to the host.
- An entrance through which the pathogen may enter the host.
- A susceptible host (i.e., one who is not immune).

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

Types of Microorganisms

The following list of microorganisms is organized from most difficult to kill on surfaces or instruments to easiest to kill on surfaces or instruments.

Bacterial spores (endospores): The most difficult to kill. Dormant forms of bacteria that are encapsulated in a tough shell.

Mycobacterium Tuberculosis: One of the most difficult organisms to kill, may be carried in aerosols.

Small non-lipid viruses: The AIDS virus is this type.

Fungi: Can cause a variety of diseases.

Medium sized lipid viruses: Hepatitis B virus is this type.

Vegetative bacteria: Causes diseases like syphilis and cholera. *Streptococcus pyogenes* causes more diseases than any other organism even though this type of bacteria is the easiest to kill.

Chemical Agents that Kill Microorganisms

Chemical sterilizer: Most effective method. Kills all microorganisms in a certain amount of time, usually 10 hours.

High-level disinfection: Kills microorganisms except spores, with prolonged contact may kill endospores. 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.

Low-level disinfection: is the least effective disinfection process. Kills some viruses,

vegetative bacteria and fungi, but not bacterial spores, *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: Anything that penetrates tissue or contacts bone, the bloodstream, other normally sterile tissues (of the mouth) or touches broken skin including: needles, hand instruments, surgical instruments, probes, burs, scalers, ultrasonic scaler tips, curettes, and endodontic instruments **must be sterile, and if reusable, sterilized after each use.**

Semi-critical instruments: Anything handled, such as mouth mirrors, amalgam condensers, and dental handpieces, that during a procedure contacts oral tissue but does not penetrate the mucous membrane, and anything within the range of droplets from the air/water syringe, high-speed drill, or the patient coughing **ideally should be sterilized and must be disinfected at a high level if they cannot be sterilized.**

Non-critical instruments and devices are instruments and devices that contact intact skin. Examples are X-ray heads, facebows, pulse oximeter, 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 (at least) a low to intermediate level of disinfectant.**

Personal Protective Equipment: includes items such as gloves, masks, protective eyewear and protective attire (gown/labcoats) which are intended to prevent exposure to blood and body fluids.

Other Potentially Infectious Materials (OPIM): means any one 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 unfixated tissue or organ (other than intact skin) from a human (living or dead);
- (C) HIV-containing cell or tissue cultures, organ culture and blood, or other tissues from experimental animals.

All dental health care workers shall comply with and enforce the following minimum precautions to minimize the transmission of pathogens in health care settings:

- (1) Standard precautions shall be practiced in the care of all patients.
- (2) A written protocol shall be developed for proper instrument processing, operatory cleanliness, and management of injuries.

1

Treatment Zone

Sterile or high level disinfectant used after every patient. Instruments, bracket table, ultrasonic scaler tips, impression trays, handpieces, suction and evacuation tips, air/water syringe tip, gloved hands of operator.

2

Treatment Fringe, Spatter Zone

High level disinfectant used after every patient. Chair, switches, handles, cuspidor, counters, amalgamator, bracket table supports, light, handpiece hoses, evacuation hoses, controls on ultrasonic scaler, cabinet facings, protective eyewear, x-ray viewer, sink.

3

Other Surfaces in the Room

Intermediate to low level disinfectant, clean regularly. Walls, floors, door handles, drawers, pictures, chair base, rheostat, pens, inside cabinets, bathrooms.

Etiology and Transmission of TB, HIV, CJD, and Hepatitis B,C

Introduction

Preventing Transmission of Bloodborne Pathogens

Bloodborne viruses such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV):

- Are transmissible in health care settings
- Can produce chronic infection
- Are often carried by persons unaware of their infection

Average Risk of Bloodborne Virus Transmission after Needlestick

Source	Risk
HBV	
HBsAg+ and HBeAg+	22.0%-31.0% clinical hepatitis; 37%-62% serological evidence of HBV infection
HBsAg+ and HBeAg-	1.0%-6.0% clinical hepatitis; 23%-37% serological evidence of HBV infection
HCV	1.8% (0%-7% range)
HIV	0.3% (0.2%-0.5% range)

The average risk of transmission after a single needlestick from an infected patient by type of bloodborne virus is shown. Risk varies greatly by type of virus.

For instance, the risk of HBV transmission after a percutaneous exposure (e.g., needlestick) to HBV-infected blood varies from 1% – 62%, depending on the hepatitis B e-antigen (HBeAg) status of the source patient. If the source patient's blood is positive for HBeAg (a marker of increased infectivity), the risk of transmission can be as high as 62%. If the patient's blood is hepatitis B surface antigen (HBsAg) positive but HBeAg negative, the risk varies from 1% – 37%.

The average risk of HCV transmission after a percutaneous exposure to HCV-infected blood is 1.8%.

The average risk of HIV infection after a percutaneous exposure to HIV-infected blood is 0.3%. To put this in perspective, 1 in 3 needlesticks from an HBeAg+ source patient would result in infection compared to only 1 in 300 needlesticks from an HIV-infected patient.

Tuberculosis

Tuberculosis is an infection of the lungs 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)

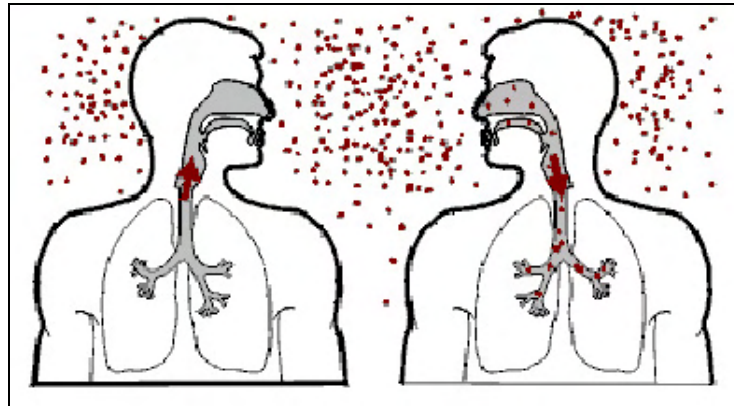


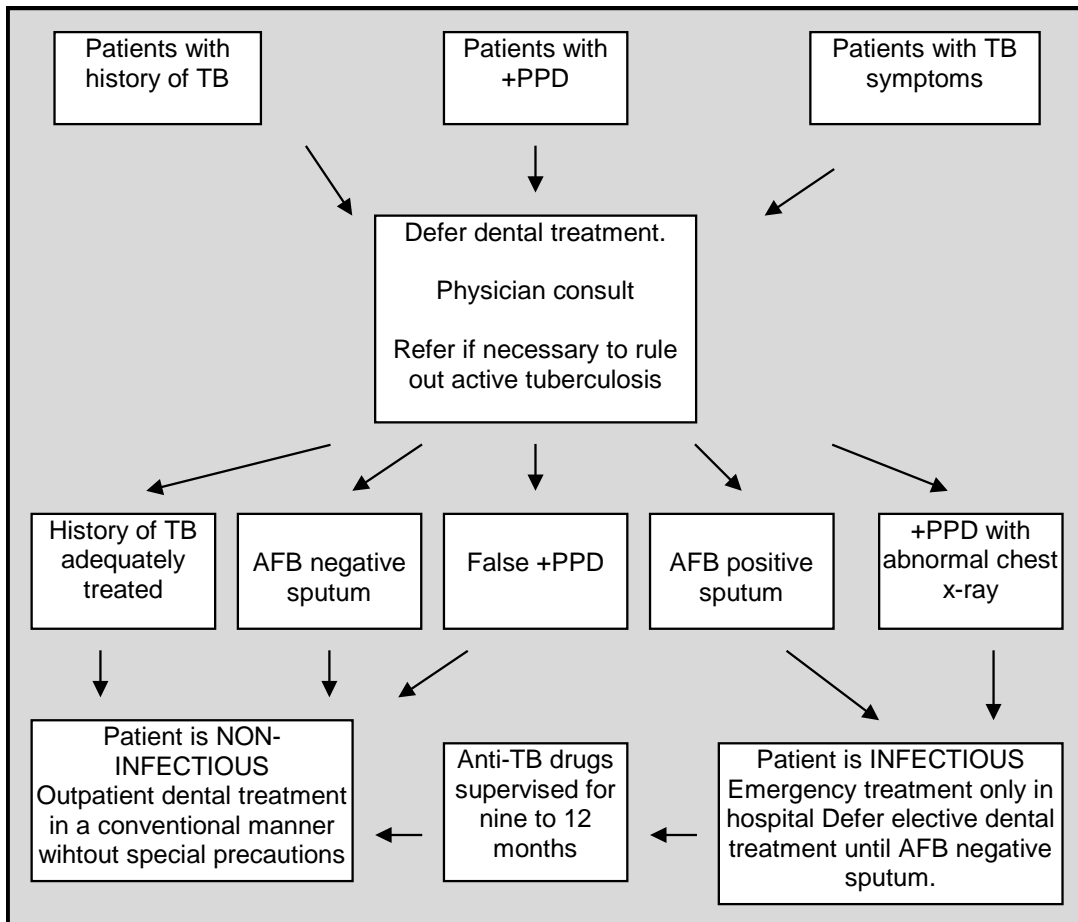
Photo credit: Centers for Disease Control and Prevention, Atlanta, GA.

The dental team's relatively brief interaction reduces the risk of transmission during treatment. Nevertheless, dental health care personnel who have contact with patients can also be exposed to persons with infectious TB, and should have a baseline tuberculin skin test, preferably by using a two-step test, at the beginning of employment. Some strains of the disease are resistant to the standard drug treatment regimens.

High-risk groups for tuberculosis include patients:

- who have had close contact with someone with active tuberculosis,
- with HIV or AIDS infection,
- with lymphoma,
- who are using immunosuppressive drugs,
- who have diabetes,
- who are older and have multiple medically compromising conditions,
- who are immigrants from areas with high TB prevalence,
- who are residents or employees at long-term care facilities like nursing homes or correctional institutions,
- who are living in high population, low economic, and medically underserved areas,
- who are alcoholic,
- who have had recent tuberculin skin test conversion,
- with any history of intravenous drug abuse, or
- have a history of silicosis, gastrectomy, or jejunioileal bypass.

Decision Tree for Dental Management of TB Patients



Signs and symptoms of Pulmonary TB include productive cough, rales, fever, malaise, night sweats, and weight loss. The patient will show a positive tuberculin skin test (+PPD) within 6 to 12 weeks. Chest radiographs will reveal infiltrates or cavitation of the apical-posterior segments of the upper lobes of the lung.

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 tuberculosisⁱⁱⁱ:

- (1) Ask patients about TB symptoms and history of TB.
- (2) Refer patients with symptoms of active TB to a physician for evaluation.
- (3) Postpone elective dental treatment until diagnostic tests rule out active tuberculosis.
- (4) 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.
- (5) 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. ^{iv} It is caused by a retrovirus, called human immunodeficiency virus (HIV). This virus suppresses human T-cells that are critical 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 with 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,' he said. 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. The cells die off very slowly. Based on data from his Baltimore patients, Siliciano estimated that it would take 73 years for the cells to die off-and he can imagine no way to speed the process. Scientists now say this latently infected reservoir is the single biggest obstacle to curing AIDS."^v

Signs and symptoms of HIV infection include: persistent generalized lymphadenopathy, fever of more than one month, involuntary weight loss more than 10% of baseline body weight, diarrhea lasting more than one 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.

Dentists should be aware of lesions present in the mouth that may indicate that the patient be tested for HIV. These include:

Fungal infections

Pseudomembranous Candidiasis	Erythematous Candidiasis
Hyperplastic Candidiasis	Angular cheilitis
Histoplasmosis	Cryptococcosis
Geotrichosis	

Bacterial infection

HIV-necrotizing gingivitis	HIV-gingivitis
HIV-periodontitis	<i>Mycobacterium avium</i>
Klebsiella pneumoniae	Enterobacter cloacae
Exacerbation of apical periodontitis	Submandibular cellulitis
Focal epithelial hyperplasia	

Viral infections

Herpes simplex virus	Cytomegalovirus
Epstein-Barr virus	Herpes zoster
Varicella	Human papillomavirus
Verruca vulgaris	Codyloma acuminatum

Neoplasms

Kaposi's sarcoma	Squamous cell carcinoma
Non-Hodgkin's lymphoma	

Unknown etiology

Recurrent aphthous ulceration	Toxic epidermolysis
Idiopathic thrombocytopenia	Xerostomia
Progressive necrotizing ulceration	Salivary gland enlargement
Melanotic hyperpigmentation	Toxic epidermolysis
Delayed wound healing	

Most of the initial adult AIDS cases were homosexual or bisexual men or intravenous drug users. Today, everyone is at equal risk for contraction of the disease regardless of sexuality. It is estimated that over 1 million people are infected in the U.S. alone. Lifestyle choices such as number of sexual partners, IV drug use, and failure to practice safe sex dramatically increase the risk of contraction.

HIV is transmitted through sexual contact, direct exposure to infected blood or blood components, and perinatally from mother to neonate. Blood, semen, vaginal secretions, and possibly breast milk have been linked to the disease transmission. HIV has been isolated from saliva, but the CDC has removed it from the list of body fluids requiring universal precautions, except in the dental setting where saliva is usually contaminated with blood.

There is no cure or vaccine for AIDS. Therapies include drugs used to inhibit the multiplication of the virus, drugs that boost the immune system, and drugs to combat the opportunistic diseases that usually are the causes of death in AIDS patients.

Current data from the CDC indicates that the average risk of acquiring HIV from a needlestick contaminated with HIV infected blood is .3% or 1 in 300.

Risk Factors for HIV Transmission after Percutaneous Exposure to HIV-Infected Blood CDC Case-Control Study

- Deep injury
- Visible blood on device
- Needle placed in artery or vein
- Terminal illness in source patient

Source: Cardo, et al., *N England J Medicine* 1997;337:1485-90.

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

CDC Database as of December 2002

	Documented	Possible
Dental Worker	0	6 *
Nurse	24	35
Lab Tech, clinical	16	17
Physician, nonsurgical	6	12
Lab Tech, nonclinical	3	—
Other	8	69
Total	57	139
* 3 dentists, 1 oral surgeon, 2 dental assistants		

Transmission of HIV from Infected Dentists to Patients

- Only one documented case of HIV transmission from an infected dentist to patients
- No transmissions documented in the investigation of 63 HIV-infected HCP (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.

AIDS statistics are continuously updated on the CDC website www.cdc.gov.

Creutzfeldt-Jakob Disease (CJD)

Creutzfeldt-Jakob Disease (CJD) and other Prion Diseases

- A type of a fatal degenerative disease of central nervous system
- Caused by abnormal “prion” protein
- Human and animal forms
- Long incubation period
- One case per million population worldwide

New Variant CJD (vCJD)

- Variant CJD (vCJD) is the human version of Bovine Spongiform Encephalopathy (BSE)
- Case reports in the UK, Italy, France, Ireland, Hong Kong, Canada
- One case report in the United States – former UK resident

Infection Control for Known CJD or vCJD Dental Patients

- Use single-use disposable items and equipment
- Consider items difficult to clean (e.g., endodontic files, broaches) as single-use disposable
- Keep instruments moist until cleaned
- Clean and autoclave at 134°C for 18 minutes
- Do not use flash sterilization

Hepatitis

Viral Hepatitis is categorized in three types:

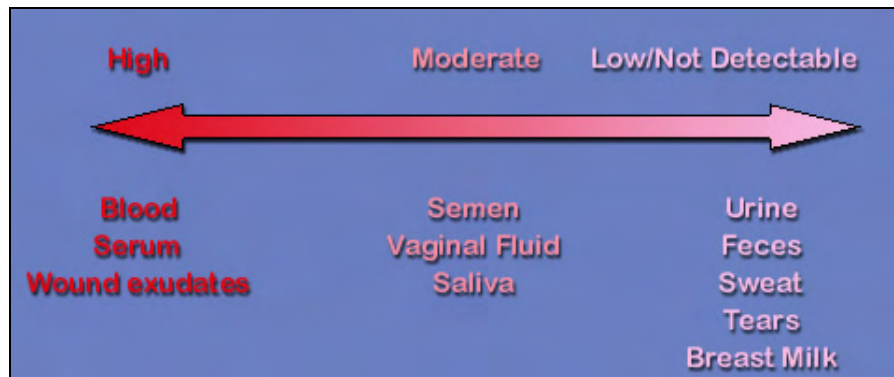
- Infectious: A;
- Serum: B and D;
- Non-A, Non-B: C, E

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.

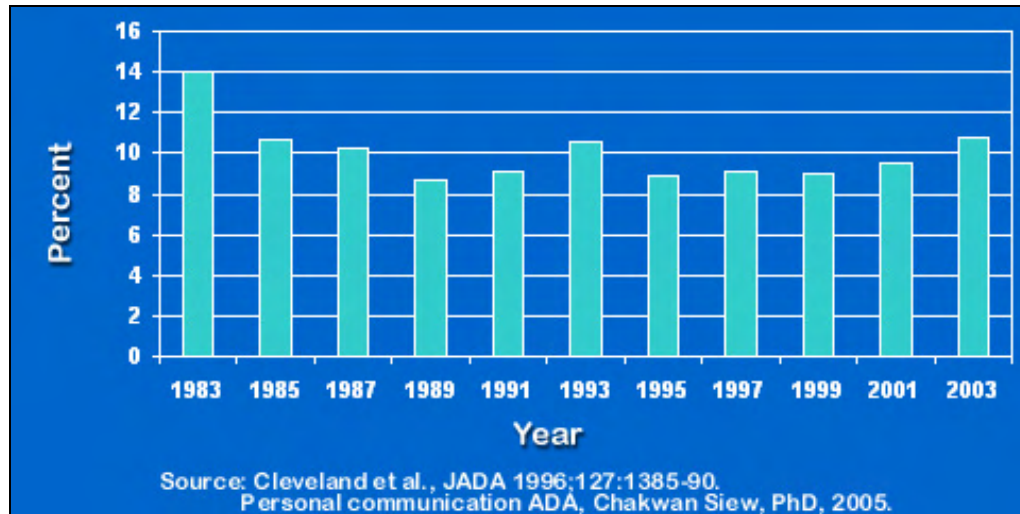
The hepatitis B virus (HBV) is transmitted either through percutaneous modes (IV drug abuse or prick wounds), by sexual contact, from mother to fetus or infant, and nonpercutaneous modes (transfer of infectious body secretions like saliva, blood, and crevicular fluid to mucous membranes or open wounds 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. The 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, 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 in this area 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.

Concentration of HBV in Body Fluids



HBV Infection Among U.S. Dentists



Among U.S. dentists, evidence of past HBV infection decreased from prevaccine levels of 14% in 1972 to ~9% in 1989. Since then, levels have remained relatively unchanged. This is because the prevalence (proportion) of HBV infection among all dentists should gradually decrease as older dentists (who are more likely to be infected and unvaccinated than younger dentists) retire.

Hepatitis C is a bloodborne disease transmitted through intravenous drug abuse, blood transfusion, from mother to child at birth, or occupational exposure. 80% of infected individuals have no signs or symptoms. Symptoms include jaundice, fatigue, dark urine, abdominal pain, loss of appetite, and nausea. The cause of infection is unknown in as many as 50% of hepatitis C cases. Approximately 50% of those infected become chronic carriers.

Occupational Risk of HCV Transmission among HCP

- Inefficiently transmitted by occupational exposures
- Three reports of transmission from blood splash to the eye
- Report of simultaneous transmission of HIV and HCV after non-intact skin exposure

HCV appears not to be efficiently transmitted through occupational exposures. Transmission of HCV generally has been associated with hollow-bore needles and not other sharp instruments.

Although studies have not documented transmission associated with mucous membrane or non-intact skin exposure, at least two cases of transmission of HCV from a blood splash to the conjunctiva of the eye have been reported.

In 2003, there was a report of simultaneous transmission of HIV and HCV from a nursing home patient to a health care worker. This transmission is thought to have occurred through a non-intact skin exposure. The investigation concluded that consistent use of barrier precautions might have prevented this transmission.

HCV Infection in Dental Health Care Settings

- Prevalence of HCV infection among dentists similar to that of general population (~ 1%-2%)
- No reports of HCV transmission from infected DHCP to patients or from patient to patient
- Risk of HCV transmission appears very low

The hepatitis D virus needs part of the hepatitis B virus to complete its life cycle. The infection can only be present in someone who was infected with hepatitis B, so it is considered a complication of hepatitis B. It is also a bloodborne disease with routes of transmission similar to hepatitis B.

Hepatitis A and E are not an occupational risk to dental workers because transmission is primarily via the fecal-oral route.

Hepatitis B Vaccine

Dental personnel are at a high risk of contracting hepatitis B from their patients.

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

The American Dental Association and The Centers for Disease Control recommend that dental professionals be vaccinated 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. 96% of young, 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 & 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 6 months later. Test for anti-HBs at 1 to 2 months after 3rd 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 of the normal 3 doses of vaccine within 7 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 is exposed to HBV should have his or her blood tested. If they have a low antibody response, they 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.

Personnel and Personal Protective Attire

Introduction

Personnel Health Elements of an Infection Control Program

- Education and training
- Immunizations
- Exposure prevention and postexposure management
- Medical condition management and work-related illnesses and restrictions
- Health record maintenance

Each dental office should have a written plan for an infection control program that includes elements to protect personnel.

These elements include:

- Education programs for staff members.
- Immunization plan for vaccine preventable diseases.
- Exposure prevention and postexposure management, with follow-up of staff exposed to infectious organisms or potentially harmful materials.
- Medical condition management and work-related illnesses and restrictions.
- Maintenance of health records in accordance with all applicable state and federal laws.

The infection control program should have an infection-control coordinator (a dentist or other dental health care professional) knowledgeable or willing to be trained who is assigned responsibility for coordinating the program. The effectiveness of the infection-control program should be evaluated on a day-to-day basis and over time to help ensure that policies, procedures, and practices are useful, efficient, and successful.

The majority of dental practices are in ambulatory, private settings that do not have licensed medical staff and facilities to provide complete on-site health service programs. In such settings, the infection-control coordinator should establish programs that arrange for site-specific infection-control services from external health care facilities and providers before dental health care personnel are placed at risk for exposure.

Dental care personnel are exposed to bacteria, viruses, fungi, and other disease-producing microbes during the normal course of their day. Universal precautions dictate that personal protective attire choices are based on the procedure rather than the patient's health history. If the patient is an infectious disease carrier and spatter is expected, gown, booties, and head covering should be worn. HIV is not considered highly infectious, so barrier protection that might be considered out of the ordinary could be considered discriminatory.

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

personal protective equipment.

Handwashing

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 antimicrobial resistance. Such hygiene is considered the single most critical measure for 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 between patients. That is, before and after patient treatment (before glove placement and after glove removal).


Wash after removing gloves and before touching anything. Health care workers shall also 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 based hand rub may be used as an alternative to soap and water. Alcohol hand rubs are rapidly germicidal when applied to the skin but should include such antiseptics as chlorhexidine, quaternary ammonium compounds, octenidine, or triclosan to achieve persistent activity.

Alcohol-based hand rubs should contain 60%-95% ethanol or isopropanol and should not be used in the presence of visible soiled or organic material. If using an alcohol-based hand rub, apply adequate amount to palm of one hand and rub hands together, covering all surfaces of the hands and fingers, until hands are dry. Follow manufacturer's recommendations regarding the volume of product to use. If hands feel dry after rubbing them together for 10-15 seconds, an insufficient volume of product likely was applied. The drying effect of alcohol can be reduced or eliminated by adding 1%-3% glycerol or other skin-conditioning agents.

Efficacy of Hand Hygiene Preparations in Reduction of Bacteria



Alcohol-based Preparations

<u>Benefits</u>	<u>Limitations</u>
<ul style="list-style-type: none">• Rapid and effective antimicrobial action• Improved skin condition• More accessible than sinks 	<ul style="list-style-type: none">• Cannot be used if hands are visibly soiled• Store away from high temperatures or flames• Hand softeners and glove powders may “build-up”

Special Hand Hygiene Considerations

- Use hand lotions to prevent skin dryness
- Consider compatibility of hand care products with gloves (e.g., mineral oils and petroleum bases may cause early glove failure)
- Keep fingernails short
- Avoid artificial nails
- Avoid hand jewelry that may tear gloves

Spend plenty of time when washing hands. Make sure to work a liquid soap between the webs of the fingers, cleaning the tips of the fingers around fingernails, and rubbing the backs

of the hands and the thumbs. Bars of soap can become contaminated so liquid soap in a dispenser is recommended. Do not use scrubbing brushes on hands because they can cause abrasions to the skin. For injuries to the skin, no evidence exists that using antiseptics for wound care or expressing fluid by squeezing the wound further reduces the risk of bloodborne pathogen transmission, however use of antiseptics is not contraindicated. The application of caustic agents like bleach or the injection of antiseptics or disinfectants into the wound is not recommended.

Remember to use disinfectant on the handles of the sink and the pump of the soap container after every patient.

Handwashing products, including plain (non-antimicrobial) soap and antiseptic products, can become contaminated or support the growth of microorganisms. Liquid products should be stored in closed containers and dispensed from either disposable containers or containers that are washed and dried thoroughly before refilling. Soap should not be added to a partially empty dispenser, because this practice of topping off might lead to bacterial contamination.

Dampness under gloves can cause irritation. Dry hands thoroughly with disposable paper towels.

Any member of the dental team who has an exudative lesion or weeping dermatitis shall refrain from all direct patient care and from handling patient care equipment until the condition resolves.

Gloves

Gloves are not a substitute for handwashing!

Washing hands thoroughly with antimicrobial soaps can disinfect the hands, but will not make them sterile. Medical exam gloves shall be worn whenever there is a potential for 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 activities. Wear a new pair of gloves for each patient. Healthcare workers shall perform hand hygiene procedures after removing and discarding gloves. Wash hands after each use. Gloves that are washed may develop small holes and are not suitable to be reused on patients. Gloves shall not be washed before or after use. 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. Also, since the FDA more strictly regulates the production of these gloves, they may offer increased piece of mind to the practitioner.

The chemicals in disinfectants can cause defects in the material of 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 it can damage the gloves and reduce their effectiveness. Using lotions to reduce dryness of the hands should only be used at the end

of the work day. Store gloves according to manufacturer's directions to assure the longest shelf life.

If gloves are torn, cut, or punctured they must be changed as soon as it is safely possible. Wash hands thoroughly and replace the gloves before continuing with the procedure. Sharp nail edges or broken nails are likely to increase glove failure. Long artificial or natural nails can make donning gloves more difficult and can cause gloves to tear more readily. Hand carriage of gram-negative organisms has been determined to be greater among wearers of artificial nails than among nonwearers, both before and after handwashing.

Any cuts should be covered with a Band-Aid. Use an antibacterial ointment underneath if indicated. Slip one layer of gauze between the Band-Aid the glove to help keep the Band-Aid from becoming moist from the gloves, or being contaminated by the powder inside the gloves.

Inexpensive plastic gloves used for handling food can be put over the gloves during treatment to enter data in charts or to retrieve an item out of a drawer. These gloves may not be used alone as a hand barrier or for intraoral patient care.^{vi}

Gloves are available as ambidextrous or right-left-specific. The ambidextrous gloves are less expensive, but right-left-specific gloves are more comfortable on hands and wrists.^{viii}

For oral surgery, the effectiveness of wearing two pairs of gloves to prevent disease transmission has not been demonstrated, but the majority of studies among health care personnel and dental health care personnel have demonstrated a lower frequency of inner glove perforation and visible blood on the surgeon's hands. Double gloving does not appear to substantially reduce either manual dexterity or tactile sensitivity.

Some health care workers have reported allergies to the 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



Photo credit: Arto Lahti, MD, Department of Dermatology, University of Oulu, Finland.

Contact Dermatitis

- Irritant contact dermatitis
 - Not an allergy
 - Dry, itchy, irritated areas
- Allergic contact dermatitis
 - Type IV delayed hypersensitivity
 - May result from allergy to chemicals used in glove manufacturing

General Recommendations Contact Dermatitis and Latex Allergy

- Educate DHCP about reactions associated with frequent hand hygiene and glove use
- Get a medical diagnosis
- Screen patients for latex allergy
- Ensure a latex-safe environment
- Have latex-free kits available (dental and emergency)

Three types of skin reactions to latex are: irritation contact dermatitis, delayed contact dermatitis (rash), and immediate allergic urticaria (hives). Repeated exposure to latex increases chances of an allergic episode. Most dental professionals wear gloves 8 to 10 hours daily, 4 to 5 days a week. Histories of allergies, asthma, and eczema have been linked to latex glove reactions. A physician should treat any dermatitis and the dental professional should not be exposed to the latex until the condition is completely healed. Some dermatitis problems may result from moisture accumulating under gloves. Cotton glove liners are available to provide a barrier between the skin and the latex. Dental professionals who exhibit skin rash, itching, or wheezing should seek the care of a physician for diagnosis.

Patients with spina bifida are particularly vulnerable to life-threatening latex reactions. Patients who have undergone repeated surgery with prolonged contact with rubber tubes or post-surgical drains, and those with history of other allergies are most likely to have reactions to rubber gloves or the rubber dam. For these patients it would be advisable to wear a non-latex glove (vinyl or other non-synthetic polymer).

Wear heavy utility gloves when cleaning, disinfecting, handling contaminated instruments or trash, mixing chemicals, and changing ultrasonic solutions. Spray utility gloves with a disinfectant and leave to dry after every use. If the glove is punctured or damaged, it should be discarded.

Gowns

Health care workers shall wear reusable or disposable protective attire when their clothing or skin is likely to be soiled with blood or OPIM. The garment should be fluid-resistant, high-necked, and provide coverage to the knees. Change gowns between patients when they are visibly soiled or moist or at least daily. Protective attire must be removed when leaving laboratories or areas of patient care activities and placed in laundry or disposal bags after

use. These protective garments should not be worn outside the office. Wash uniforms in hot soapy water and bleach. Reusable gowns shall be laundered in accordance with Cal-DOSH Bloodborne Pathogens Standards, Title 8, Cal. Code of Regs. section 5193.^{vii} Machine dry at least at 100°F. An easy cost analysis will reveal the most economical protective apparel choice for the office. Compare the costs of bulk purchases of disposable gowns and disposal requirements with the purchase and installation of a washer and dryer or medical laundry service.

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 spatter of blood or OPIM or when splashing of blood or OPIM and other body fluids is expected. Masks should be well constructed. The pleated, soft type of mask has a higher filtration than the cup style. A tight seal at the bridge of the nose will minimize eyewear fogging. Use a mask with at least a filtration of 95% of particles 3 to 5 microns in diameter.^{vi} After each patient, and during patient treatment if applicable, masks shall be changed. Microbes pass more easily through moisture, so change the mask if it becomes wet or visibly soiled. Some professionals change masks after an hour of use. Be careful not to touch the mask with soiled gloves if it is to be reused. After each patient, face shields and protective eyewear shall be cleaned; and if visibly soiled, cleaned and 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 spatter of contaminated material. Goggle-type wrap around styles or face shields are recommended. Face shields used during air-abrasion deflects aluminum oxide particles from the lenses of magnifying eyewear.^{viii} Protective eyewear also reminds the health care worker not to touch their eyes during procedures and when mixing chemicals. After each patient, face shields and protective eyewear shall be cleaned; and if visibly soiled, cleaned and disinfected.

The patient can wear protective eyewear. Some offices use sunglasses to reduce the glare of the overhead light and to protect the patient's eyes from spatter. Disinfect patient eyewear after each use.

Surfaces and Waste Disposal

Surface Covers

Many surfaces in the dental operatory become contaminated, but they are too difficult to clean or cannot be autoclaved. Cover items like chair buttons, control buttons on the air/water syringe, switches on the unit, light handles, hoses, and handpiece and air/water syringe holders with plastic wrap, aluminum foil, or other disposable material impervious to water. Replace with fresh covers after each patient. It is faster and easier to remove and throw away these coverings after dismissing the patient than to clean and disinfect the area. Make sure not to contaminate the underlying surface by touching it or carelessly removing the covers.

Surface Cleaning

Some surfaces like countertops are disinfected after each patient. Surface barriers can be used and changed between patients **OR** clean and disinfect all clinical contact surfaces that are not protected by impervious barriers using an EPA registered, hospital grade low- to intermediate-level disinfectant after each patient. The low-level hospital disinfectants used shall be labeled effective against HBV and HIV; the intermediate-level hospital disinfectants have a tuberculocidal claim. Use disinfectants in accordance with the manufacturer's instructions.

Routinely clean all housekeeping surfaces (e.g. floors, walls, sinks) with a detergent and water or an EPA registered, hospital grade disinfectant. Pre-clean surfaces before disinfection with a detergent cleaner. Disinfectants that have detergent properties can be used for this step and for disinfecting. This minimizes the amount of overall product necessary. Prepare fresh cleaning and disinfecting solutions daily and carefully follow the manufacturer's directions on the disinfectant product label. Use water to dilute concentrates, not alcohol or any other chemical. Wear utility gloves, a mask, protective eyewear, and protective clothing during surface cleaning and disinfection to reduce chances of direct contamination of the skin, mucous membranes, or eyes. Generously spray the cleaner onto the surface and wipe or scrub with paper towels or a brush. If possible, rinse over a sink. After pre-cleaning, spray enough disinfectant to stay moist and leave undisturbed for 10 minutes, or the time specified in the directions. (Spray - Wipe - Spray) Clean mops and cloths and allow to dry thoroughly before re-using.

Spilled Blood

Absorb any spilled blood with paper toweling, saturate with bleach and place in appropriate containers. Always wear utility gloves when cleaning up spilled blood.

Disposal of Contaminated Wastes

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

Regulated Medical Waste Management

- Properly labeled containment 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



Photo credit: NIOSH Web site.

Any disposable items (masks, gloves, paper covers, paper towels, gauze, surface covers, gowns, etc.) that are contaminated with blood or body fluids should be carefully handled with utility gloves and placed in a sturdy plastic red bag. In some states, liquid wastes (like blood and suctioned fluids) can be carefully poured down a drain that is connected to a sanitary sewer system. Put sharps (like needles and scalpel blades) in a puncture-resistant container and dispose of according to local regulations. Anesthetic cartridges may contain aspirated blood or fluids, so they should be disposed of in the sharps container. There are special regulations regarding the disposal of infectious medical wastes like tissues and culture media. In several states, regulated wastes must be transported by a waste hauler, and a log must be kept for 3 years with the receipts from each pick up. As opposed to **regulated** medical waste, (ordinary) medical waste is not considered infectious, and thus can be discarded in regular trash.

Extracted Teeth

- Considered regulated medical waste
 - Do not incinerate extracted teeth containing amalgam
 - Clean and disinfect before sending to lab for shade comparison
- Can be given back to patient



Handling Biopsy Specimens

- Place biopsy in sturdy, leakproof container
- Avoid contaminating the outside of the container
- Label with a biohazard symbol



Photo credit: Lt. Col. Jennifer Harte, U.S.A.F. Dental Investigation Service, Great Lakes, IL.

Needles

Strict guidelines are needed for handling and disposing of sharps in the dental setting. Clearly outline steps to be taken should an exposure occur. Use a new, sterile disposable needle and fresh carpule of anesthetic for every patient requiring local anesthesia. Handle needles and sharp instruments like scalpels and scalers very carefully because they easily puncture gloves and injure skin. Recap needles using a safe method or place them uncapped in a "sterile field" away from the bracket table until the procedure is complete. If recapping, do not hold the cap with your hand, use only a recapping protective device or "scoop up" the cap without touching it. One safe recapping method uses forceps to steady the cap. Whatever technique is used, do not direct the point of a needle toward any part of the body. Contaminated needles, disposable needles, syringes, scalpel blades or other sharp items and instruments shall be placed into sharps containers for disposal according to all applicable 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.

Introduction

Decision Factors: Surface Cleaning and Disinfection

James A. Cottone, DMD, MS

University of Texas Health Science Center at San Antonio Dental School

I. Efficacy:

A. Assumptions:

1. EPA registered
 - a) Hospital-level disinfectant: *Staphylococcus aureus*
Salmonella choleraesuis
Pseudomonas aeruginosa

B. Tuberculocidal:

1. 10 minutes or less

C. Virucidal:

1. Lipophilic virus (HIV)
2. Hydrophilic virus (Polio, Coxsackie, Rhinovirus, Rotavirus)
3. 10 minutes or less

D. Efficacy verified:

1. Multiple: studies, different investigators, agency recommendations

II. Choices:

A. **Cleaning ability:** Water-based (good) vs. alcohol-based (usually poorer)

B. **Application method:** Pump spray (preferable) vs. aerosol spray (less preferable)

C. Minimize disadvantages:

1. Chlorines-Corrosive; damages clothes, plastics, rubber; usually prepared daily
2. Iodophors- removable stains, prepare daily
3. Synthetic phenols- film accumulation, damages plastics and rubber

III. Available Products:

A. Water-based:

a) **Pump Spray**

- (1) **Concentrate:** Chlorines (*Bleach, Exspor*)
(dilute before use) Iodophors (*Iodofive*)
Synthetic phenols (*Omnill, ProPhene, Vital Defense-D, Top-Cide, Asepti-phene 128*)
- (2) **Pre-diluted:** Chlorines (*Dispatch*)
Synthetic phenols (*ProSpray*)

b) **Aerosol Spray:** none

B. Alcohol-based

a) **Pump Spray:** (*Coe Spray-The Pump, Novospray*)

b) **Aerosol Spray:**

- (1) Accusol Aerosol (*Lysol IC Disinfectant Spray*)
- (2) Standard aerosol (*Citrace, Lysol IC Disinfectant Spray, Asepti-Stery*)

October 4, 1995

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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 the surface. Liquid glutaraldehydes (at concentration levels for immersion sterilization) are not acceptable as surface disinfectants because of dangerous vapors and odors. 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 fast acting;
- be effective in the presence of bioburden and debris;
- compatible with soaps and other chemicals;
- non-corrosive, non-staining, non-toxic;
- have a residual effect;
- be odorless, economical, and easy to use.ⁱ
- 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 the 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, remember to take into account shelf life and mixing time.^{viii}

Iodophor Solutions

Iodophors are probably the most commonly used surface disinfectants. They have a 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. Other manufacturers recommend their formula for both precleaning and disinfecting. The residual effect is cumulative with each treatment. A more effective, longer lasting disinfection action will result if allowed to dry completely. Follow the manufacturer's directions for mixing and contact time.

Pros

- EPA licensed
- broad spectrum, tuberculocidal
- economical
- few side effects
- disinfection in 3 to 30 minutes, depending on the bioburden (number of microorganisms)
- surfactant carrier keeps area moist during action
- residual biocidal action even after dry

Cons

- not a sterilant
- may be corrosive to some metals
- inactivated by hard water and alcohol

- unstable at high temperatures
- loses activity with age
- requires prolonged exposure to be sporicidal
- may discolor light colored surfaces

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.

Pros

- EPA licensed
- broad spectrum, tuberculocidal
- good detergent for precleaning
- economical
- residual biocidal action even after dry

Cons

- not a sterilant
- disinfection in 10 minutes
- must be mixed weekly
- follow dilution directions carefully

Alcohol-Quaternary Ammonium Compounds

Alcohol combined with quaternary ammonium compounds enhances the antimicrobial spectrum. Alcohol-quats are appropriate disinfectants.^{ix}

Pros

- EPA licensed
- broad spectrum, tuberculocidal

Cons

- not a sterilant
- sensitive to organic material and anionic detergents.

Sodium Hypochlorite (Bleach)

Bleach should be mixed with water in a dilution of 1 to 10 or 1:100 of a 5.25% solution. Use a 1:100 solution (approximately ¼ cup of 5.25% household chlorine bleach to 1 gallon of water) when blood and debris are present. Make a fresh solution every day and wear heavy utility gloves. 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 a detergent/disinfectant.

Pros

- effective as a hard surface disinfectant
- low cost
- easily purchased
- broad spectrum, tuberculocidal

Cons

- corrosive to many metals
- toxic if swallowed
- irritating to eyes and hands
- odor

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, irregular 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.

Sterilants and High Level Disinfectants

The FDA has approved the following products with General Claims for Processing Reusable Medical and Dental Devices. ^x

- Advanced Sterilization Products:
 - Cidex® OPA Solution High Level Disinfectant, (0.55% ortho-phthaldehyde) K991487 High Level Disinfection Claim - 12 minutes at 20° C, maximum reuse of 14 days
- Sporidicin International:
 - Sporidicin Sterilizing and Disinfecting Solution (0.95% glut and 1.64% phenol/phenate), K983194 Sterilant Claim - 12 hours at 25 ° C, maximum reuse of 7 days High Level Disinfection Claim - 20 minutes at 25 ° C, maximum reuse of 7 days
- Johnson & Johnson Medical Products, Inc:
 - Cidex™ Activated Dialdehyde Solution (2.4% glut), K924434 Sterilant claim - 10 hours immersion at 25 ° C, maximum of 14 days reuse High Level Disinfection claim - 45 minutes at 25 ° C, maximum of 14 days reuse
 - Cidex Formula 7™ Long-Life Activated Dialdehyde solution (2.5% glut),

- K924334 sterilant claim - 10 hours at 20 - 25 ° C, maximum reuse of 28 days
 High Level Disinfection claim - 90 minutes at 25 ° C, maximum reuse of 28 days
- Cidex Plus™ 28 Day Solution (3.4% glut), K923744 Sterilant claim - 10 hours at 20 - 25 ° C, maximum reuse of 28 days High Level Disinfection claim - 20 minutes at 25 ° C , maximum reuse of 28 days
 - Metrex Research, Inc.
 - Metricide® Activated Dialdehyde Solution (2.6% Glut), K930284 Sterilant Claim - 10 hours at 25 ° C, maximum reuse of 14 days High Level Disinfection Claim - 45 minutes at 25 ° C, maximum reuse of 14 days
 - Metricide Plus 30® Long-Life Activated Dialdehyde Solution (3.4% Glut), K931592 Sterilant Claim - 10 hours at 25 ° C, maximum reuse of 28 days High Level Disinfection Claim - 90 minutes at 25 ° C, maximum reuse of 28 days
 - Metricide® 28 day Long-Life Activated Dialdehyde Solution (2.5% glut), K931052 Sterilant Claim - 10 hours at 25 ° C, maximum reuse of 28 days High Level Disinfection Claim - 90 minutes at 25 ° C, maximum reuse of 28 days
 - Cottrell Limited
 - Procide® 14 N.S. (2.4% glut), K932922 Sterilant Claim - 10 hours at 20 ° C, maximum reuse of 14 days High Level Disinfection Claim - 45 minutes at 20 ° C, maximum reuse of 14 days
 - Omnicide™ Long Life Activated Dialdehyde Solution (2.4% glut), K932922 Sterilant Claim - 10 hours at 20 ° C, maximum reuse of 28 days High Level Disinfection Claim - 45 minutes at 20 ° C, maximum reuse of 28 days
 - Omnicide™ Plus (3.4% glut), K932922 Sterilant Claim - 10 hours at 20 ° C, maximum reuse of 28 days High Level Disinfection Claim 45 minutes at 20 ° C, maximum reuse of 28 days
 - EndoSpor™ plus Sterilizing and Disinfecting Solution (7.35% hydrogen peroxide and 0.23% peracetic acid), K972708 Sterilant Claim: 180 minutes at 20° C, maximum reuse life of 14 days High Level Disinfection Claim: 15 minutes at 20° C, maximum reuse life of 14 days Note: Due to the lack of test strips for monitoring the concentrations of the active ingredients, the reuse period is limited to 14 days.
 - Wave Energy Systems
 - Wavicide® - 01 (2.5% glut), K914749 Sterilant Claim - 10 hours at 22 ° C, maximum reuse of 30 days High Level Disinfection Claim - 45 minutes at 22 ° C, maximum reuse of 30 days
 - STERIS ®Corporation
 - STERIS 20™ Sterilant (0.2% peracetic acid), K875280 Sterilant Claim - 12 minutes between 50-56 °C, single use only. Only cleared for use with the STERIS System 1™ Processor.
 - Minntech Corporation
 - Peract™ 20 Liquid Sterilant/Disinfectant (0.08% peroxyacetic acid and 1.0% hydrogen peroxide) K960513 Sterilant Claim - 8 hours at 20 °C, maximum reuse of 14 days High level Disinfection Claim - 25 minutes at 20 °C, maximum reuse of 14 days.
 - Reckitt & Colman Inc.
 - Sporox™ Sterilizing & Disinfection Solution (7.5% hydrogen peroxide), K970230 Sterilant Claim - 6 hours at 20 ° C, maximum reuse life of 21 days High Level Disinfection Claim - 30 minutes at 20 ° C, maximum reuse life of 21 days

- MedSci, Inc.
 - MedSci 3% Glutaraldehyde (3% glut), K974062 Sterilant Claim - 10 hours at 25 ° C, maximum reuse of 28 days High Level Disinfection Claim - 25 minutes at 25 ° C, maximum reuse of 28 days
- Cetylite Industries, Inc.
 - Cetylcode-G® Concentrate and Diluent Concentrate (3.2% glut), K974188 Sterilant Claim - 10 hours at 20 ° C, maximum reuse of 28 days High Level Disinfection Claim - 40 minutes at 20 ° C, maximum reuse of 28 days
- MediVators, Incorporated
 - Rapicide™ High Level Disinfectant and Sterilant, (2.5% glutaraldehyde) K993042 For use in a legally marketed automated endoscope reprocessor only. Sterilant Claim - 7 hours 40 minutes at 35° C, maximum reuse life of 28 days High Level Disinfection Claim – 5.0 minutes at 35° C, maximum reuse life of 28 days

Manufacturer's Material Safety Data Sheets (MSDS) should be consulted regarding correct procedures for handling or working with hazardous chemicals. Manufacturers must update the MSDS within three months of learning that new hazard data is available for the MSDS.

Preprocedural Mouthrinsing

It is an excellent idea to use a pre-procedural mouth rinse with residual activity to reduce the microbial levels in the patient's mouth.

There is no mouthwash currently available that would make a perfect preprocedural mouthrinse. There is no evidence that infections are prevented. Chlorhexidine gluconate seems to be the best currently available wide spectrum mouthrinse.

Studies show a 0.12 percent chlorhexidine gluconate (CHG) preoperative rinse clinically reduces the incidence of alveolar osteitis in extraction patients by 60%. The American Heart Association recommends chlorhexidine rinses as an adjunct to antibiotic prophylaxis, especially if the patient is of high risk or has poor oral hygiene.

The 0.12 % CHG has a wide spectrum of antimicrobial effects including reductions of:

- 65 to 85% of aerobes,
- 42 to 80% of anaerobes,
- 44 to 78% streptococci, and
- 85 to 97% actinomyces.

Repeated rinsing will not shift the normal oral flora. Opportunistic microbial species do not tend to grow. It has a significant and sustained effect on the salivary bacterial load. It also has a virucidal effect on herpes simplex virus, cytomegalovirus, influenza A., parainfluenza, and hepatitis B viruses. Much of the research for CHG shows that it reduces the patient's chances of developing an infection during the procedure rather than reducing cross-infection to health care workers. CHG helps to control the onset of opportunistic infections in compromised patients who have bone marrow transplants, cancer, or HIV infection.^{xi}

Chemical Agents for Surface Disinfection Reference Chart

CHEMICAL CLASSIFICATION												PRODUCTS											
	Advantages	Disadvantages	Example of Active Ingredient as listed on product label	Name	EPA Reg #	Dilution	TB Time	TB Temperature	Hydrophilic Virus Kill**	Total Time for Surface Disinfection	For more information Contact												
Alcohols	Do not use for environmental Surface disinfection. Rapid evaporation rate. Diminished activity with bioburden																						
Chlorines	Rapid acting; Broad Spectrum; Economical (Bleach)	Discard diluted solutions daily; Diminished activity by organic matter; Corrosive	Sodium hypochlorite; chlorine dioxide	Bleach (5.25%) Clorox Dipatch (0.55%)	N/A 5813-1 56392-7	1:100 1:100 None	10 min 10 min 2 min	20° C 20° C 20-25° C	Yes Yes Yes	10 min 10 min 2 min	Clorox Caltech												
Iodophors	Broad Spectrum; Few Reactions; Residual biocidal activity	Unstable at high temperatures; Dilution & contact time critical; Discard daily; Discoloration of some surfaces; Inactivated by hard water.	Butoxypolypropoxy-polyethoxyethanol iodine complex	IodoFive Biocide Iodophor Disinfect Asepti-IDC	4959-16 4959-16 4959-16 303-63	1:213 1:213 1:213 1:256	10 min 10 min 10 min 10 min	20° C 20° C 20° C 20° C	Yes Yes Yes Yes	10 min 10 min 10 min 10 min	Cottrell, Ltd Biotrol Smart Practice Huntington												
Continues on next page																							

IMPORTANT INFORMATION

All products to be used as disinfectants on precleaned surfaces must be EPA-registered. Listing does not imply endorsement, recommendation or warranty. Other products available. Purchasers are legally required to consult the package insert for changes in formulation and recommended product uses. Check compatibility of material before use on dental/medical equipment. This chart is a publication of the Organization for Safety & Asepsis Procedures (OSAP). OSAP assumes no liability for actions taken based on the information herein.

Continued from previous page

CHEMICAL CLASSIFICATION			PRODUCTS										
	Advantages	Disadvantages	Example of Active Ingredient as listed on product label	Name	EPA Reg #	Dilution	TB Time	TB Temperature	Hydrophilic Virus Kill**	Total Time for Surface Disinfection	For more information Contact		
Synthetic Phenolics	Broad spectrum; Residual biocidal activity	Discard daily for most diluted solutions; Degrades certain plastic over time; Difficult to rinse; Film accumulation	WATER-BASED <u>Dual Phenolics</u> Phenylphenol and benzylchlorophenol or tertiary amyphenol	Omni II	46851-1	1:32	10 min	20° C	Yes	10 min	Cottrell		
				ProPhene	46851-1	1:32	10 min	20° C	Yes	10 min	Cottrell		
				Vital Defense-D	46851-1	1:32	10 min	20° C	Yes	10 min	Block		
				ProSpray	46851-5	none	10 min	20° C	Yes	10 min	Cottrell, Ltd		
				Birex ^{se}	1043-92	1:256	10 min	20° C	No***	10 min	Biotrol		
				Lysol IC Disinfect Cleaner	675-46	1:128	10 min	20° C	No***	10 min	Reckitt Colman		
				Lysol IC Disinfect.	675-43	1:200	10 min	20° C	No***	10 min	Reckitt Colman		
				Dual Phenol Germicidal Cleaner	67813-3	1:256	10 min	20° C	No***	10 min	Smart Practice		
				BiArrest-2	67813-1	1:256	10 min	20° C	No	10 min	Infection Control		
			Tri-Phenolics Phenylphelol Benzylchlorophenol Tertiary amyphenol	Tri-Cide	11725-7	1:256	10 min	20° C	Yes	10 min	Technology		
				Dencide	63281-4	1:256	10 min	20° C	Yes	10 min	Health-Sonics		
				Asepti-phene128	303-223	1:128	10 min	20° C	Yes	10 min	Dentsply Huntington		
			ALCOHOL-BASED Tertiary amyphenol And/or phenylphenol plus ethyl alcohol or isopropyl alcohol	PUMP									
				CoeSpray	334-417	none	10 min	20° C	Yes	10 min	GC America		
				Asepti-phene RTU	334-417	none	10 min	20° C	Yes	10 min	Huntington		
AEROSOL													
Lysol IC Disinfect.	777-53	none		10 min	20° C	Yes	10 min	Reckitt Colman					
Asepti-Steryl	706-69	none		10 min	25° C	Yes	10 min	Huntigton					
Dual or Synergized Quarternaries (do not use older generations of quats a s surface disinfectants)	Broad Spectrum; Contains detergent for cleaning; Few reactions	Easily inactivated by anionic detergents and organic matter; Deleterious to some materials	Diisobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride; isopropanol	Cavicide	46781-6	None	10 min	20° C	Yes	10 min	Kerr		
				DisCide TB	1839-83	None	10 min	20° C	Yes	10 min	Palmero		
				Precise QTB	1839-83	None	10 min	20° C	Yes	10 min	Caltech		
				GC Spray-Cide	1130-15	None	6 min	20° C	Yes	10 min	GC America		
				SaniTex Plus	1130-15	None	6 min	20° C	Yes	10 min	CrossTex		
Asepticare TB	1130-13	None	10 min	20° C	Yes	10 min	Huntington						
Sodium Bromide and Chlorine	Broad spectrum; Reduced storage (tablets)	May not be used for immersion (hard surfaces only); Chlorine smell	Sodium bromide; sodium dichloroisocyanurate dihydrate	Microstat 2	70369-1	2 tablets per quart	5 min	20° C	Yes	5 min	Septodont		

*Temperature: 20° C = 68°F; 25° C = 77°F

**Studies by Klein and DeForest suggest that hydrophilic are more resistant than lipophilic viruses and therefore represent a better gauge of a disinfectant's virucidal efficacy. Hydrophilic viruses include various strains of Polio, Cocksackie, Thinovirus and Rotavirus.

***Demonstrates activity toward Adeno virus (resistance level between hydrophilic and lipophilic.)

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Steps in Instrument Processing

Introduction

Correct processing will sterilize instruments with minimal risk of injury to the staff and the least amount of damage to the instruments.

Instrument Processing Area

- Use a designated processing area to control quality and ensure safety
- Divide processing area into work areas
 - Receiving, cleaning, and decontamination
 - Preparation and packaging
 - Sterilization
 - Storage

More on 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, re-clean, re-wrap, and re-sterilize
- Store clean items in dry, closed, or covered containment

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 (for example, 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 the ultrasonic cleaner basket set in a pan of presoak, so the instruments can be directly immersed in the 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 submerged 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 the health care worker. Arrange the cleaning area so the ultrasonic cleaner is on one side, a sink in the middle, and sterilizer 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 still contaminated. Match the cleaning activity with the type of instruments being cleaned (e.g., 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 directions for 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. Then 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 types. 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 the high-speed handpiece or the air/water syringe. Risk of aspiration is nearly impossible because the instruments are not immersed in the oral fluids. Any incident would be precipitated by a pause in the water flow, which would signal the dental professional to discontinue the procedure.^{xii}

High-Speed Handpiece Asepsis

The American Dental Association, the Food and Drug Administration, and the Center for Disease Control recommend heat sterilization, indeed, there must be 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. They also stress running the handpiece waterline after use for 20 to 30 seconds to flush the internal lines. The Food and Drug Administration also recommends and it is required that air/water syringes, and ultrasonic scaler tips be sterilized between each patient. Most States now have laws that require heat sterilization of all reusable hand instruments, handpieces, and prophylaxis angles.

If you do not have the 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, after, or before and after sterilization. Some do not need lubrication at all.

HANDPIECE STERILIZATION/ASEPSIS MANUFACTURER RECOMMENDED PROCEDURES					
Brand	Ultrasonic Cleaning	Cleaning/ Lubrication Type	Lubrication Time	Max Temp	Dry Heat
Adec (Adec brand) Adec (W&H) 503-538-7478 800-884-3507	yes# No	Spray Assistina Syst.	B&A* B	250 F/121C 250F/132 C	NO NO
Bien Air 718-263-7866	NO Air Bearing	Grease Byro/cleaner	B&A B (cleaner only)	270 F/132C	NO##
Dabi-Atlante 800-884-3507	NO	Cleaner/Lube	B&A	275 F/135C	NO
Luckman Corp. Encore 215-659-1664	NO	Encore cleaner	B&A	260 F/127C	Yes‡
KaVo/all 312-885-3855 800-347-3289	No	KaVo spray only	B	275F/135 C	NO
Kinetics/all 203-743-0080	Yes¥	Spray	B	250 F/121C	NO
Lares 916-345-1767 800-347-3289	NO	Spray	B&A§	275 F/135C	Yes~
Midwest 708-640-4800 800-800-7202	YES+	HS=pump LS= drop oil	B&A++	275 F/135C	NO
NSK/all 708-843-7664	NO	NSK oil	B&A	275 F/135C	NO
Star 800-275-3320	NO	HS=spray LS=drop oil	B B	275 F/135C	NO
<p>NOTE: * B&A=Before and After Sterilization # Non-chlorine containing solution or solution corrosive to aluminum ## Also, do not sterilize in "alcohol autoclaves" ‡ "Rapid Dry Heat" sterilization only ¥ Use distilled water only. Kinetics has their own proprietary high level disinfection system § clean fiberoptic surfaces w/ isopropyl alcohol immediately after cooling from sterilizer ~ Later Lares can be rapid dry heat sterilized. PLEASE CHECK WITH LARES (WILL discolor HP & dim fiberoptics) + Ultrasonic air turbines and low speed attachments for "Lifecycle" cleaner only. ++ Before="Lifecycle" cleaner. After="Spray-A-Day" lube ^ Star "LS" (Lube Free) turbines require no lubrication (cleaner OK for troubleshooting) LUBE Star & attachments. Dr. Young UTHSCSA (210) 567-3450 From OSAP October 3, 1995 Reprinted by permission of OSAP</p>					

Slow Speed Handpieces, Contra Angles, and Prophy Angles

As with High Speed Handpieces, Low Speed Handpieces and their components, if used intraorally, must be heat sterilized between each patient. Follow manufacturer's directions for cleaning, lubricating and sterilizing.

Use heat sterilizable or disposable prophy 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 prophy angle.

Air/Water Syringes and Ultrasonic Scaler

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 the 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 by-products
- Infectious materials (HSV, HPV) may contact mucous membranes of nose
- No evidence of HIV/HBV transmission
- Need further studies

Disposable Items

Throw away all items (such as prophylaxis angles, prophylaxis cups and brushes, 3 tips for high-speed evacuators, saliva ejectors, 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 prophy angles, saliva ejector tips, prophy cups or brushes and paper products.

Saliva Ejector and High Speed Evacuation System

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^{xiii} clearly demonstrated this phenomenon. They thoroughly disinfected suction lines with a bleach/water solution, and then added 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 the 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 the film is inserted into the patient's mouth it is considered contaminated. Use disposable gloves in the darkroom to open the packets. Remove the 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, and the darkroom equipment will not be contaminated. The film packets could also be decontaminated by wiping them with bleach before taking them into the darkroom.

Impression Materials

There is a deficit in the general knowledge regarding disinfection of impressions in the dental office. Due to the 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 in regard to disinfection of impressions. This is an area that needs to be addressed. The CDC recommends that when an impression is sent to the lab, information should be included pertaining to the manner of impression disinfection (e.g., type of disinfectant used and time of exposure). Cleaning and disinfecting of an impression should be done as soon as possible after removal 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 (i.e., 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(1).”

Studies have shown that when submersing elastomer impression materials (polyether, polysulfide, addition silicone and condensation silicone) in either 5.25% NaOCl for 10 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 10 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

Introduction

METHOD	STANDARD STERILIZING CONDITIONS*	ADVANTAGES	PRECAUTIONS	SPORE-TESTING
Steam autoclave	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 stearotherophilus</i> strips, vials, or ampules.
Unsaturated chemical vapor	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; cannot sterilize liquids.	<i>Bacillus stearotherophilus</i> strips
Dry heat oven Dry heat	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
Rapid Heat Transfer	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 shall be cleaned and sterilized before use by using steam under pressure (autoclaving), dry heat, or unsaturated chemical vapor. FDA cleared chemical sterilants/disinfectants shall be used for sterilization of heat-sensitive critical items and for high level disinfection of heat-sensitive semi-critical items.

Liquid Chemical Sterilant/Disinfectants

- Only for heat-sensitive critical and semi-critical devices
- Powerful, toxic chemicals raise safety concerns
- Heat tolerant or disposable alternatives are available



Photo credit: Col. Shannon Mills, United States Air Force.

Critical and semi-critical instruments or containers of critical and semi-critical instruments sterilized by a heat or vapor method shall be packaged or wrapped before sterilization if they are not to be used immediately after being sterilized. These packages or containers shall remain sealed unless the instruments within them are placed onto a setup tray and covered with a moisture impervious barrier on the day the instruments will be used and shall be stored in a manner so as to prevent contamination.

Critical instruments sterilized unwrapped should be transferred immediately by using aseptic technique, from the sterilizer to the actual point of use. Critical instruments should not be stored unwrapped. Semicritical instruments that are sterilized unwrapped on a tray or in a container system should be used immediately or within a short time. When sterile items are open to the air, they will eventually become contaminated.

An adequate sterilization procedure must kill all microorganisms present on the item being sterilized. A process cannot be called “sterilization” unless it kills all bacterial spores, the most difficult of microorganisms to kill. The four main sterilizing methods used in dentistry today are steam heat autoclave, unsaturated chemical vapor, dry heat, and rapid heat transfer. The effectiveness of these types of sterilizers can be tested with commercial spore testing and by other means.

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 2.0 percent or 3.2 percent concentration for 10 hours will also 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: usually a steam autoclave and glutaraldehyde chemical sterilization.

The best and safest approach to preventing disease transmission from patient to patient via the instruments is to sterilize all reusable instruments that are contaminated with blood or saliva instead of sterilizing some and disinfecting others. Many states have laws that 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 of 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 and/or temperature;
- dry heat sterilizer door opened to add more items without starting sterilization time over;
- sterilizer timer malfunction;
- sterilizer malfunction; and
- improper cleaning of items to be sterilized.ⁱ

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

A two-part system of sterilization monitoring using both biological and chemical indicators helps 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. At least 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 that mail delays have no substantial effect on final test results. They call immediately for failures, and send written reports for each test.

Different companies may also have special advice on how to correct malfunctions, newsletters, and certificates for participation. Incubator and test units can be purchased for in-office testing of steam sterilizers. The results must be carefully analyzed and recorded. Keep reports of spore tests. Test results must be maintained for 12 months. Records of negative results (complete inactivation of spores) establish a pattern of compliance and successful sterile procedures on a consistent basis.^{xiv}

The records should include:

- the sterilizer identification number,
- date,
- duration and temperature of sterilization cycle,
- description of the general contents of the load,
- operator's name,
- results of biologic monitoring,
- repair and preventive maintenance measures, and
- a space for notes.^{xiv}

Along with weekly spore testing, tests should be performed when any new variable is introduced into the sterilization process; For example, if a new packaging material is used, if a new sterilizer is purchased, after a sterilizer has been repaired or after any change in sterilizer loading procedure. After purchase of a new sterilizer, it should be immediately tested and the results used as a baseline test.

Chemical monitoring using special sterilizing bags, tapes, or strips offers an immediate indicator that the packages have been exposed to heat, steam, or chemical vapor.

Two types of chemical indicators are:

- rapid-change (like tape that changes color immediately when exposed to temperatures of 250F) and
- slow-change or integrator (usually a strip or tab that changes color with a combination of physical conditions like heat and time).

Every package or cassette of instruments should have a visible chemical indicator so with a quick glance everyone will know if the instruments are ready to use. It is important to note that this is not a replacement for weekly spore tests.

Sterilization Failure

If monitoring indicates a failure in the sterilization process, you should:

- Take the sterilizer out of service,
- Repackage and sterilize all unused instruments in a properly operating sterilizer.
- Review sterilization procedures to identify operator error.
- If operator error is identified, retest the sterilizer.
- If the spore test indicates failure, replace or send the sterilizer in for repair. If the spore test is negative (indicating successful sterilization) put the sterilizer back into use.
- Spore test the replacement or repaired sterilizer before using it for the first time.^{xiv}

A conservative approach has been recommended in which any positive spore test is assumed to represent sterilizer malfunction and requires that all materials processed in that sterilizer, dating from the sterilization cycle having the first negative biologic indication to the next cycle indicating satisfactory biologic indicator results, should be considered nonsterile and retrieved, if possible, and reprocessed or held in quarantine until the results of the repeat biologic indicator tests are known.

This more conservative approach should always be used for sterilization methods other than steam (e.g., dry heat, unsaturated chemical vapor, ETO, or hydrogen peroxide gas plasma).

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 the container 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 date of expiration. Monitors are available commercially to test the concentration of glutaraldehyde, but do not assure sterility of instruments. Preclean, rinse, and dry instruments to prevent dilution of the sterilant. Completely submerge the instruments for proper contact time, usually 10 hours for sterilization. All glutaraldehyde solutions should be discarded and replaced with fresh solution when indicated. After correct processing time, thoroughly rinse the instruments with water. Use sterile water if the item may penetrate tissue during use. The instruments must be handled aseptically to prevent contamination from hands, aerosols, and dust before placement 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.

OPA

Due to the toxic nature of glutaraldehyde, there has been a recent shift in use to a product called orthophthalaldehyde or OPA. Orthophthalaldehyde 0.55% received FDA approval in 1999 as a chemical sterilant. It is superior to glutaraldehyde in several ways. First off, it is non-irritating to the eyes and nose, which is a very important distinction. It is also stable over a larger range of pHs than glutaraldehyde and therefore does not require activation. A drawback of this product is that it will stain clothing and the skin so personal protective equipment should be used at all times when handling OPA.

Bead Sterilizers

Bead sterilizers have been used in dentistry to sterilize small metallic instruments (e.g., endodontic files). The FDA has determined that a risk of infection exists with these devices because of their potential failure to sterilize dental instruments and has required their commercial distribution cease unless the manufacturer files a premarket approval application. If a bead sterilizer is employed, dental health care personnel assume the risk of employing a dental device the FDA has deemed neither safe nor effective.

Introduction

Even though the patient never sets foot in the dental laboratory, the cases, if not properly disinfected, carry microorganisms that can contaminate the lab. The lab should set up a receiving area separate from the production area for all incoming cases. The countertop should be disinfected daily with an acceptable disinfectant according to the directions on the bottle.

Unless the technicians are certain that the case has been disinfected properly, they should disinfect each case as it is received. An EPA-registered hospital disinfectant (low to intermediate) should be used, written documentation of the disinfection method provided, and the item placed in a tamper-evident container before returning it to the dental office. If such documentation is not provided, the dental office is responsible for final disinfection procedures. Case containers should be disinfected also. Anyone receiving cases before their disinfection should wear a uniform or laboratory coat, a mask, protective eyewear, and disposable gloves. Utility gloves and other standard protective attire should be used when working with disinfectant chemicals.

All equipment and surfaces in the production area should be disinfected daily. Splash shields and equipment guards shall be used on dental laboratory lathes. Fresh pumice and a disinfected, sterilized, or new ragwheel shall be used for each patient. Ragwheels should be cleaned and autoclaved after each case. Dispense pumice in small individual amounts for each case, and discard all excess. Mix 5 parts sodium hypochlorite (bleach) with 100 parts distilled water and three parts soap with the pumice to provide a disinfectant effect. Devices used to polish, trim or adjust contaminated intraoral devices shall be disinfected or sterilized.

Instruments, attachments, and materials used on new prostheses should be kept separate from the ones used on an appliance that has contacted a patient's mouth. Intraoral items such as impressions, bite registrations, prosthetic and orthodontic appliances shall be cleaned and disinfected with an intermediate-level disinfectant before manipulation in the laboratory and before placement in the patient's mouth. Such items shall be thoroughly rinsed prior to placement in the patient's mouth. Clean and heat sterilize heat-tolerant items used in the mouth.

Disinfect cases before returning to the dental office. The dentist and laboratory should communicate with each other about proper infection control regarding all lab cases.

Introduction

Water from dental unit water lines (DUWL) usually contains higher levels of bacteria than municipal water supplies, which are the primary sources of microorganisms for the DUWLs. But no widespread health problems have been associated with this water. Concern over DUWL contamination has been fueled by an increase in awareness of infection control issues, media reports of contaminated water from dental units, and case reports associating illness with dental water contamination.

Water from dental handpieces, sonic and ultrasonic scalers, and air water syringes continues to be the target of a program to reduce pathogens delivered to the patient during treatment.

Dental Handpieces and Other Devices Attached to Air and Waterlines

- Clean and heat sterilize intraoral devices that can be removed from air and waterlines
- Follow manufacturer's instructions for cleaning, lubrication, and sterilization
- Do not use liquid germicides or ethylene oxide

Dental unit water contains approximately the same types of bacteria found in drinking water, but in a higher concentration. Municipal water is normally maintained with below 500 colony forming units of heterotrophic (uses complex organic compounds) bacteria per milliliter of water (CFU/mL). Several studies show water from dental handpieces and air-water syringes contaminated at levels exceeding 100,000 CFU/mLs.^{xv} For routine dental treatment, meet the regulatory standards for drinking water, which is less than 500 CFU/ml of heterotrophic water bacteria. The ADA has recommended a goal of 200 CFU/mL.

The microorganisms in DUWL are bacteria, protozoa, and fungi. These microorganisms are found in the water as well as attached to the inside walls (biofilm) of the small bore tubing of waterlines. Microbes enter the tubing from incoming water and a very small proportion from dental patients during treatment. These microbes adhere to the walls of the tubing and begin to multiply. The biofilms serve as a microbial reservoir. The microbes produce a slime layer and more microbes from the water attach to the slime. The flow of the water can dislodge the microbes from the slime layer and release them into the flowing water. The tubing is constantly replenished with more microbes, stagnation of the water facilitates growth of the slime layer, and the small diameter of the tubing results in a large surface-area-to-volume ratio.^{xvi}

Water heating systems in dental units are designed to heat the water to human body temperature. This may increase the numbers of microorganisms adapted to growth in human hosts and encourage bacterial growth in the waterlines.^{xvii} Water heating systems should not be used.

Dental unit water lines shall be anti-retractable. Waterlines should be flushed after each patient for a minimum of twenty (20) to thirty (30) seconds.

Components of Devices Permanently Attached to Air and Waterlines

- Do not enter patient's mouth but may become contaminated
- Use barriers and change between uses
- Clean and intermediate-level disinfect the surface of devices if visibly contaminated

Sterile coolant and irrigating solutions should be used for surgical dental procedures involving bone and incision of mucosa. Sterile coolants/irrigants must be delivered using a sterile delivery system. Conventional dental units cannot reliably deliver sterile water even when equipped with independent water reservoirs because the water-bearing pathway cannot be reliably sterilized. Oral surgery and implant handpieces, as well as ultrasonic scalers, are commercially available that bypass the dental unit to deliver sterile water or other solutions by using single-use disposable or sterilizable tubing.

Water with less than 200 CFU/mL of heterotrophic mesophilic (grows between 10 to 45° C) bacteria is acceptable for non-surgical procedures including those involving the sulcus or initial access into dental pulp.^{xviii}

The US Food and Drug Administration (as specified in Section 510(k) of the Federal Food, Drug, and Cosmetic Act) classify dental water treatment and delivery systems as medical devices. They are subject to pre-market standards and must have a 510(k) clearance.

Any chemical germicides used must be EPA registered and produce water that must:

- be compatible with dental restorative materials,
- not exceed 200 CFU/mL of heterotrophic mesophilic bacteria, and
- not contain toxic or carcinogenic chemicals.^{xviii}

In the past, the CDC recommended that dental waterlines be flushed at the beginning of the clinic day to reduce the microbial load. However, studies have demonstrated this practice does not affect the biofilm in the waterlines or reliably improve the quality of water used during dental treatment. Because the recommended value of ≤ 500 CFU/mL cannot be achieved by using this method, other strategies should be employed.

Separate water reservoir systems in cooperation with chemical treatment are safe and effective.^{xviii} Technologies for waterline treatment include: independent reservoirs, chemical treatment (either continuous or intermittent), filtration, sterile water delivery systems, and combined approaches. A universal treatment protocol has not been published because dental units and water systems vary. Practitioners should consult their dental unit manufacturer for safe, acceptable methods of providing treatment water with fewer than 200 CFU/mL of heterotrophic mesophilic bacteria.

As for filtration, membrane filters are used to trap microorganisms suspended in water. Filters are usually installed on dental unit waterlines as a retrofit device. Microfiltration commonly occurs at a filter pore size of 0.03-10 µm. Sediment filters commonly found in dental unit water regulators have pore sizes of 20-90 µm and do not function as microbiological filters.

Monitoring Options

- Water testing laboratory
- In-office testing with self-contained kits
- Follow recommendations provided by the manufacturer of the dental unit or waterline treatment product for monitoring water quality

Dental professionals should:

1. Review scientific literature to understand the nature and risks of DUWL contamination as well as learn recent discoveries in technology,
2. Contact the manufacturer of their current dental units and devices that use water to receive recommendations on maintaining the quality of water delivered during dental treatment, and
3. When purchasing new equipment or retrofitting devices, select dental units and products that economically and reliably maintain water quality.

^{xviii}

Water unfit to drink (or swim in) is unfit for therapeutic use in dentistry. ADA's 200 CFU/mL goal is achievable now. Prudence dictates reasonable action to protect dental professionals and dental patients.^{xix}

Boil-Water Advisories^{xx}

OSAP (based on CDC recommendations) suggests the following procedures for dental offices during boil-water advisories. Use these instructions along with specific instructions issued by state or local health departments during these advisories.

While a boil-water advisory is in effect:

- Do not deliver water from the public water system through the dental unit, ultrasonic scaler, or other dental equipment that uses the public water system until the boil-water advisory is canceled.
- Do not allow patients to use water from the public water system for rinsing. Use water from alternative sources, such as bottled or distilled water.
- Dental workers should not use water from the public water supply for hand washing. Instead, use antimicrobial-containing products that do not require water for use, such as alcohol-based hand rubs, until the boil-water notice is canceled. Alcohol hand rubs are rapidly germicidal when applied to the skin but should include such antiseptics as chlorhexidine, quaternary ammonium compounds, octenidine, or triclosan to achieve persistent activity. Use products that have been reviewed and cleared for marketing by the U.S. Food and Drug Administration (FDA).

When the boil-water advisory is canceled:

- Flush incoming public water system water lines. All faucets in the dental setting should be turned on completely for at least 30 minutes, including water lines to dental equipment that uses the public water system.
- After the incoming public water system water lines are flushed, disinfect dental unit water lines according to manufacturer recommendations.

Alternative water sources, such as separate water reservoirs that have been cleared for marketing by the FDA, can be used during a boil-water advisory. However, if the alternative water source were to flow through a dental unit previously connected to the affected public water supply, first flush and disinfect the dental unit water lines according to the manufacturer's instructions.

Ethical and Legal Considerations Regarding AIDS and HIV

Introduction

All patients should be treated with compassion and dignity, regardless of their HIV status. There is little known risk of contacting AIDS through dental procedures if the recommended infection control procedures are followed carefully.

The ADA Council on Ethics, Bylaws and Judicial Affairs presented the following advisory opinion about patient selection:

"A dentist has the general 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, based solely on that fact, is unethical. Decisions with regard to the type of dental treatment provided or referrals made or suggested, in such instances, should be made on the same basis as they are made with other patients, that is, whether the individual dentist believes he or she has need of another's skills, knowledge, equipment or experience and whether the dentist believes, after consultation with the patient's physician if appropriate, the patient's health status would be significantly compromised by the provision of dental treatment."

Currently, it is illegal to refuse to treat a patient because they are HIV positive. If the individual is a patient of record, it is considered abandonment if the dentist refuses them treatment.

If a dentist or auxiliary is carrying an infectious disease, especially HIV or hepatitis B, he or she is obliged to take the precautions necessary to ensure that the disease is not transmitted to the patients. The laws are changing rapidly in this area, so the dentist or auxiliary who is a carrier of a disease should consult with their physician and lawyer to find out if there are any current laws that might restrict their practice or force them to advise patients of their disease state.

The Acer Case

In July of 1990, The Centers for Disease Control published the only documented cases of transmission of HIV from an infected health care worker to patients during invasive dental procedures. Five patients of Dr. Acer of Florida have been diagnosed as HIV positive. Each patient had undergone invasive dental procedures, and all reported that the dentist wore a mask and gloves. Epidemiological and molecular biological investigations confirmed that the infection was transmitted from the dentist. The precise mode of transmission is still a mystery. All the patients had dental care from the dentist after he was diagnosed HIV positive. Opportunities existed for needlestick injuries or cuts with other sharp instruments. Treatment records do not indicate any unusual circumstances involving any of the procedures, and the dentist denied any needlestick injuries since his HIV positive diagnosis. None of the patients had confirmed exposures to HIV other than the dental treatment by Dr. Acer.

The dentist's practice opened in 1981. His first reported positive HIV test was documented in 1986, but the date of onset of his HIV is unknown. The invasive procedures were performed between September of 1987 and July of 1989. Transmission occurred relatively late in the course of the dentist's infection. Cross-infection by dental instruments has been ruled out because none of the patients had appointments on the same day. Intentional transmission of HIV may be another theory, but no evidence exists to support this, through interviews with family, staff, and others. The virus was passed through direct patient exposure to the dentist's blood, but the exact route of transmission remains unknown.

Sharpe vs. Breglio

The Hampshire County Superior Court in Massachusetts decided a landmark case regarding contraction of AIDS in the Dental Office. Mr. Sharpe contended that he contracted AIDS by unsterilized dental equipment at Dr. Breglio's office.

Dr. John Molinari, a recognized expert in Infection Control, testified that it was "remotely possible" that the virus was transmitted through the dental equipment. He added that the T-cell evidence suggests that the virus was contracted years earlier. A surprise witness testified that Mr. Sharpe frequented private membership sex clubs in New York and she witnessed him with several sexual partners.

The jury was not convinced that the high-speed hand piece was the mode of transmission for the virus.

The case (concluded February 16, 1996) confirms the necessity of heat sterilizing dental equipment (including dental hand pieces), and gives additional documentation that the virus is not spread by dental visits.^{xxi}

The Bragdon Case

Ms. Sidney Abbott sought dental care from Dr. Randon Bragdon on Sept 16, 1994. She indicated that she had AIDS on her medical information sheet. During the examination, Dr. Bragdon found a carious lesion on a mandibular molar. He informed her that he would need to fill the tooth in a hospital because of his infectious disease policy and she would be responsible for the additional costs. Ms. Abbott sued. A federal judge and then the 1st U.S. Circuit Court of Appeals found that Bragdon had violated federal law in refusing to treat her in his office. The 1st Circuit court said, "Had the patient required more invasive treatment or had the dentist proffered stronger evidence of a direct threat, the result may well have differed." Bragdon appealed to the nation's highest court.^{xxii}

The Supreme Court delivered a decision in June, 1998 that HIV infected individuals are protected under the Americans with Disabilities Act. The Americans With Disabilities Act requires that a "major life activity" be impaired in order to be covered. Sydney Abbott claimed that her HIV status forced her to decide not to have children, and the judges agreed that reproduction is a major life activity. This ruling does not necessarily mean every HIV-positive person is covered by the act, but they most likely will be able to demonstrate they are covered by the AWDA in some way. The AWDA bans discrimination against disabled people, but there is an exception whereby care providers are not required to treat an infected person if the condition poses a significant safety risk. The Supreme Court directed the U.S. Court of Appeals for the First Circuit (the court that found Dr. Bragdon had illegally discriminated against Ms. Abbott by refusing to treat her) to further investigate the question

of risk involved in the case. According to Justice Anthony M. Kennedy, the Supreme Court could not decide on the matter "since it should be limited to 'objective, scientific information.'"^{xxiii}

The American Dental Association released a statement on September 29, 1998 reaffirming that patients with HIV may be safely treated in a dental office. ADA policy based on current scientific information states: "Current scientific and epidemiological evidence indicates that there is little risk of transmission of infectious disease through dental treatment if recommended infection procedures are routinely followed. Patients with HIV infection may be safely treated in private dental offices when appropriate infection control procedures are employed." In addition, a decision not to provide treatment to an individual based solely on their AIDS or HIV seropositive status is unethical.^{xxiv}

Summary Checklists

Introduction

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 when in contact with body fluids or mucous membranes: gloves, mask, protective eyewear, and gowns, lab coats, or uniforms.
- 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 pre-clean 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.

Dental Laboratories

Incoming Cases

- Wear appropriate protective gear including lab coats or uniforms, masks, and appropriate gloves (utility type when working with chemicals, disposable type when handling infected cases).
- Have a specific receiving area where all cases are placed before being taken to the production area.
- Properly disinfect each case when it is received. (If impressions cannot be disinfected without distorting, pour up and then disinfect the model).
- Disinfect case containers.
- Disinfect countertops and work areas daily by precleaning and then spraying with a suitable disinfectant, following the manufacturer's directions.
- Any solid waste contaminated with blood or saliva should be placed in sturdy bags and disposed of according to local, state, and federal regulations.

Production Area


- Use appropriate protective wear, safety glasses and masks.
- Clean and disinfect work surfaces daily.
- Have different sets of instruments, attachments, and materials: one for new cases and others for cases that have already been in a patient's mouth.
- Use small, individual amounts of pumice for each case and discard any remaining.
- Clean and disinfect brushes and other equipment used on contaminated prostheses.
- Clean and autoclave ragwheels after each case.

Outgoing Cases


- Disinfect all outgoing cases.
- Communicate clearly with the dental office about infection control procedures the laboratory uses and what must be done to each case in the dental office.

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.

Supplies

- What are the product's claims? Do they fit well with the needs of the practice?
- Does the product meet or exceed regulatory requirements? Does it meet the current standards of care and guidelines for infection control?
- Is it easy to use? Are instructions clear, easy to follow and compatible with the conditions of use in the practice?
- Are any special precautions required when using the product, and if so, are they reasonable? Check the MSDSs.
- Is the product cost-effective?
- What are the disposal requirements?
- Are the product's components compatible with the materials found in the practice?
- Is the product acceptable to staff and patients? ^{viii}

Cleaning Materials

- Antibacterial Handwash
- Container with a lid for collecting, presoaking, and transporting instruments from the room to the sterilizing area
- Rigid container for sharps disposal
- Properly functioning heat sterilizer
- Glutaraldehyde for submersion sterilant
- Chemical detergent precleaner
- Chemical disinfectant (best if it is detergent like, then one product can be used for both precleaning and disinfecting)
- Wire instrument cleaning brush
- Ultrasonic cleaner
- Disposable, individual units of items like pumice
- Barrier Protection Supplies
- Disposable gloves: latex and vinyl
- Face masks or face shield
- Clean uniform
- Disposable or washable fluid-resistant gown
- Heavy utility gloves for clean up and mixing of chemicals
- Disposable covers for surfaces and switches
- Patient bibs
- Rubber dam
- Safety device for recapping needles

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 faceshield.
- 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.
- Package instruments correctly 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.

Please mark only one best answer to the following questions on the one page answer sheet. Return the answers by mailing or faxing the answer sheet or entering your answers on the form available on our website at www.fice.com.

This test contains 50 questions. Please mark your answers in spaces numbered 1 through 50 on your answer sheet.

1. In the dental environment, disinfection means:
 - a. To sterilize.
 - b. destruction of several forms of disease-producing microorganisms, but not bacterial spores.
 - c. destruction of all forms of life including viruses, bacteria, fungi, and spores.
 - d. none of the above.

2. "Universal precautions" means that the infection control procedures and barrier techniques are determined by the exposure to blood and blood-contaminated products, and are used on all patients, regardless of their disease state.
 - a. True
 - b. False

3. The greatest concentration of the hepatitis B virus in the mouth is in:
 - a. the tongue
 - b. the anterior palate
 - c. the gingival sulcus
 - d. the enamel structure

4. Which of the following can damage latex gloves?
 - a. oil or petroleum based hand cream
 - b. disinfecting chemicals
 - c. antimicrobial hand wash
 - d. a sharp instrument
 - e. all of the above

5. Which of the following is true regarding "standard precautions"?
 - a. Standard precautions should be used in caring for all patients, regardless of their infectious status.
 - b. Expanded or transmission-based precautions are used beyond standard precautions to interrupt the spread of certain pathogens.
 - c. Standard precautions apply to exposure to blood, all body fluids and secretions (except sweat), nonintact skin, and mucous membranes.
 - d. All of the above.

6. Protective eyewear or face shields should:
 - a. have openings at the sides to allow for ventilation.
 - b. be designed to shield the eyes from contaminated material.
 - c. be disposable.
 - d. be sterilizable.

7. Local ordinances for contaminated waste disposal:
 - a. are federally mandated by the FDA.
 - b. are the same as disposal for uncontaminated waste.
 - c. vary from area to area in regards to waste management so professionals must check with local authorities for specific regulations.
 - d. all of the above.

8. A preprocedural chlorhexidine gluconate rinse may be indicated:
 - a. prior to oral surgery to reduce the patient's chances of developing an infection.
 - b. as an adjunct to antibiotic prophylaxis if the patient has poor oral hygiene,
 - c. for patients who are compromised because of HIV infection or cancer.
 - d. all of the above

9. Properly diluted iodophor is rated by the EPA as a tuberculocidal disinfectant.
 - a. True
 - b. False

10. Sodium hypochlorite (bleach) is recommended:
 - a. as a surface disinfectant after every patient
 - b. as a surface disinfectant after a high-risk patient
 - c. as a sterilizing soak for metal instruments.
 - d. as a solution to apply to contaminated paper products before their disposal

11. Isopropyl alcohol (used alone) is unacceptable as a surface disinfectant because:
 - a. it has a residual effect.
 - b. it is approved by the EPA.
 - c. it is ineffective against bacterial spores.
 - d. it is effective against bacterial spores.

12. Older quaternary ammonium compounds are approved by The Council for Dental Therapeutics of The American Dental Association.
 - a. True
 - b. False

13. Presoaking contaminated instruments in a mild detergent is beneficial because:

- a. it will sterilize the instruments.
- b. presoaking will protect the instruments from damage.
- c. it is required by law.
- d. presoaking takes the place of hand scrubbing or using an ultrasonic.
- e. it will prevent blood, saliva, and debris from drying on the instruments.

14. When handling contaminated instruments, wear:

- a. heavy utility gloves.
- b. protective eyewear.
- c. a mask.
- d. protective clothing.
- e. all of the above

15. Ultrasonic cleaners are a safer way of precleaning instruments than hand scrubbing.

- a. True
- b. False

16. When packaging instruments:

- a. use the correct type of instrument packaging for the sterilizing system you use.
- b. make sure the packaging is strong enough to hold the sharp tips of instruments within the bag to avoid contamination and possible injury.
- c. use containers of some type because loose instruments will become easily contaminated after removal from the sterilizer.
- d. bag instruments in sets to be used on individual patients and open them in front of the patient.
- e. all of the above

17. Autoclavable handpieces should be sterilized after each use.

- a. True
- b. False

18. Disposable items should not be disinfected and reused; they should be thrown away after each use.

- a. True
- b. False

19. To disinfect high speed evacuation systems:
- flush after every patient with a 2% glutaraldehyde or any other non-foaming agent recommended by the manufacturer for disinfecting the 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.
 - clean the traps with a high-level disinfectant every day.
 - all of the above
20. Disinfect impressions by rinsing with hot tap water before casting with die stone or sending out to the laboratory.
- True
 - False
21. Common mistakes of sterilizer use include:
- use of ultrasonic cleaners to preclean the instruments.
 - using only one layer of wrap for good penetration.
 - overloading sterilizer chamber.
 - completely drying instruments before packaging.
22. The American Dental Association recommends sterilizers should be spore tested:
- daily.
 - weekly.
 - yearly.
 - when instruments start looking dirty after a cycle.
23. In addition to the date, operator name, description of the general contents of the load, and maintenance, spore test records should include:
- sterilizer identification number.
 - duration and temperature of sterilization cycle.
 - results of biologic monitoring.
 - all of the above.
24. The first step to take if a monitoring service indicates that the sterilizer failed the spore test is:
- repeat the spore test.
 - order a new unit and use a tuberculocidal disinfectant spray on all instruments until the new one arrives.
 - take the sterilizer out of service.
 - use the same unit but run all loads twice.
25. Glutaraldehyde is recommended for immersion use only and is not recommended for use as a surface disinfectant.
- True
 - False

26. If the Dental Laboratory technicians are not sure that an impression (or case) has been disinfected, they should:
- send it back to the dental office for disinfection.
 - disinfect it as it is received.
 - work with it as it is.
 - autoclave it.
27. The Dental Laboratory should disinfect outgoing cases before delivery.
- True
 - False
28. In some special circumstances you do not need to wash your hands before putting on gloves.
- True
 - False
29. Water with less than _ CFU/mL of heterotrophic mesophilic bacteria is acceptable for non-surgical procedures including those involving the sulcus or initial access into dental pulp:
- 2.
 - 20.
 - 200
 - 20,000.
30. The US Food and Drug Administration classifies dental water treatment and delivery systems as medical devices.
- True
 - False
31. Any chemical germicides used to treat dental unit waterlines must be EPA registered and produce water that must:
- be compatible with dental restorative materials.
 - not exceed 20,000 CFU/mL of heterotrophic mesophilic bacteria.
 - contain toxic or carcinogenic chemicals.
 - all of the above.
32. In case Sharpe vs. Breglio confirms:
- it is illegal to refuse to treat a patient because of their HIV status.
 - HIV was not transmitted from Dr. Acer to his patients.
 - the Supreme Court decision that HIV infected individuals are protected under the Americans with Disabilities Act.
 - the necessity of heat sterilizing dental equipment (including dental hand pieces), and gives additional documentation that the virus is not spread by dental visits.

33. Which of the following statements is true regarding dental unit waterlines?
- a. If municipal water is the source that enters the dental unit waterline, output will always meet dental water quality.
 - b. Flushing the waterlines at the beginning of the day sufficiently reduces the biofilm in the waterlines.
 - c. Filters commonly found in dental unit water regulators do not function as microbiological filters.
 - d. Dental unit waterlines can reliably deliver optimal water quality when used for irrigation during a surgical procedure.
34. Employers are required to have an unwritten verbal agreement with workers who are occupational exposed to blood and other potentially infectious materials.
- a. True
 - b. False
35. In using this course's dental infection terminology, you can say a clean dental instrument is one that is ready for use.
- a. True
 - b. False
36. A major component of infection control is:
- a. aseptic technique
 - b. patient screening and evaluation
 - c. instrument sterilization
 - d. all of the above
37. The employee is responsible for purchasing protective equipment if their jobs may expose them to blood, body tissue, or saliva.
- a. True
 - b. False
38. Sharps containers must be:
- a. blue, hidden from view of the patient, and centrally located.
 - b. labeled, easily accessible and as close as possible to work stations where sharps are used.
 - c. a fixed part of the dental syringe and will provide a barrier between the hands and the needle immediately after its use.
 - d. unmarked and easy to open.
39. Employers must offer the hepatitis B vaccine without charge to employees within 1 year of assignment to a position with occupational exposure.
- a. True
 - b. False

40. Workers may decline the vaccine by signing a form to that effect, but they retain the right to employer-provided vaccinations if they change their minds.
- a. True
 - b. False
41. Both critical and semicritical instruments must be sterile in a dental setting.
- a. True
 - b. False
42. OPIM (Other Potentially Infectious Materials), as the term is used in this course, refers to:
- a. appointment books
 - b. intact skin
 - c. body fluids in dental procedures
 - d. dental unit water
43. The threat of infection from TB caused by *Mycobacterium tuberculosis* lasts for a period of a few minutes.
- a. True
 - b. False
44. In a dental setting saliva does not put you at risk for AIDS.
- a. True
 - b. False
45. Employee medical records must be maintained for:
- a. according to all applicable state and federal regulations
 - b. the length of employment plus 40 years
 - c. 5 years
 - d. for the lifetime of the dental office
46. MSDS sheets should be available from the:
- a. American Dental Association.
 - b. U.S. Food and Drug Administration.
 - c. Centers for Disease Control.
 - d. manufacturer of the product.
47. Manufacturers must update the MSDS within three months of learning that new hazard data is available for the MSDS.
- a. True
 - b. False

48. The majority of microorganisms found on the hands are:

- a. on the thumbs
- b. under and around the nails
- c. at the fingertips
- d. in between the fingers

49. For preparing a bleach solution one should end up with a concentration of at least:

- a. 1 : 100
- b. 1 : 250
- c. 1 : 500
- d. 1 : 1000

50. Patients may be given the choice of closing their mouths around suction tips.

- a. True
- b. False

(end of test)

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CDC Guidelines for Reducing TB Transmission in Dental Care Settings

The CDC recommends the following for reducing the risk of TB transmission in the dental office, depending on the facility's level of risk:

“In general, the symptoms for which patients seek treatment in a dental care setting are not likely to be caused by infectious TB. Unless a patient requiring dental care coincidentally has TB, it is unlikely that infections TB will be encountered in the dental setting. Furthermore, generation of droplet nuclei containing *M. tuberculosis* during dental procedures has not been demonstrated. Therefore, the risk for transmission of *M. tuberculosis* in most dental settings is probably quite low. Nevertheless, during dental procedures, patients and dental workers share the same air for varying periods of time. Coughing may be stimulated occasionally by oral manipulations, although no specific dental procedures have been classified as “cough inducing”. In some instances, the population served by a dental care facility, or the HCW's in the facility, may be at relatively high risk for TB. Because the potential exists for transmission of *M. tuberculosis* in dental settings, the following recommendations should be followed:

- A risk assessment [Section II.B] should be done periodically, and TB infection-control policies for each dental setting should be based on the risk assessment. The policies should include provisions for detection and referral of patients who may have undiagnosed active TB, management of patients with active TB relative to provision of urgent dental care; and employer-sponsored HCW education, counseling and screening.
- While taking patients' initial medical histories and at periodic updates, dental HCW's should routinely ask all patients whether they have a history of TB and symptoms suggestive of TB.
- Patients with a medical history or symptoms suggestive of undiagnosed active TB should be referred promptly for medical evaluation of possible infectiousness. Such patients should not remain in the dental care facility any longer than required to arrange a referral. While in the dental care facility, they should wear surgical masks and should be instructed to cover their mouths and noses when coughing or sneezing.
- Elective dental treatment should be deferred until a physician confirms that the patient does not have infectious TB. If the patient is diagnosed as having active TB, elective dental treatment should be deferred until the patient is no longer infectious.
- If urgent dental care must be provided for a patient who has, or is strongly suspected of having, infectious TB, such care should be provided in facilities that can provide TB isolation (Sections II.E and G) Dental HCWs should use respiratory protection while performing procedures on such patient.
- Any dental HCW who has a persistent cough (i.e., a cough lasting ≥ 3 weeks), especially in the presence of other signs or symptoms compatible with active TB e.g., weight loss, night sweats, bloody sputum, anorexia, and fever), should be evaluated promptly for TB. The HCW should not return to the workplace until a diagnosis of TB has been excluded or until the HCW is noninfectious.
- In dental-care facilities that provide care to populations at high risk for active TB, it may be appropriate to use engineering controls similar to those used in general-use areas (e.g., waiting rooms) of medical facilities that have a similar risk profile."

ADA Statement on Dental Unit Waterlines

Preface to ADA Statement on Dental Unit Waterlines

The issue of biofilm in dental unit waterlines has been actively addressed by the ADA Division of Science. In the past two years, workshops have been held that reviewed current research in this area -- in particular, methods to prevent or control biofilm formation in dental unit waterlines. Most recently, an expert panel was brought together to focus on what the goal should be for dental unit water quality and to identify critical research and development needs. The panel developed a statement addressing these areas, which was subsequently adopted by the ADA Council on Scientific Affairs. In turn, the Council recommended that the statement be adopted by the ADA Board of Trustees. The Board approved a resolution adopting the statement as the position of the Association on December 13, 1995. The complete statement follows.

American Dental Association Statement on Dental Unit Waterlines

Adopted by the American Dental Association Board of Trustees, December 13, 1995, and ADA Council on Scientific Affairs, September 28, 1995

Background: Organized dentistry has traditionally assumed responsibility for assessing and improving the quality of dental care provided to patients. The widespread adoption of enhanced infection control methodologies by dental practitioners is just one example of the profession's commitment to high quality patient care.

The Council is sensitive to heavy regulatory burden imposed on dentists in recent years by various federal, state and local government agencies. In some cases, the regulations have been based on limited science. The Council reaffirms its strong belief that both the profession and the public are served when recommendations affecting dental practice are based on sound science and take into account their cost in light of their expected benefit. The recommendations that follow are made in light of these considerations.

Through its continued monitoring of scientific literature, the Council has become aware that the microbiologic quality of water used in dental treatment could be improved. Although there is no evidence of a public health risk due to this phenomenon, steps should be taken to improve the quality of water used in patient care as soon as feasible. The profession, the dental industry, and the research community all have an important role to play in this process. Dental unit waterlines (the tubes that connect the high-speed handpiece, air/water syringe and ultrasonic scaler to the water supply) have been shown to harbor a wide variety of microorganisms including bacteria, fungi, and protozoans. These microorganisms colonize and replicate on the interior surfaces of the waterline tubing, inevitably resulting in adherent heterogeneous microbial accumulations termed "biofilms." Biofilms, once formed, serve as a reservoir significantly amplifying the numbers of free-floating microorganisms in the water exiting the waterlines. It has been suggested that heating dental unit water to increase patient comfort, as is the practice in some dental offices, may further augment biofilm formation. In unmaintained dental unit waterline systems, these microbial accumulations can contribute to occasional objectionable odors and visible particles of biofilm material exiting the system.

Water Quality Improvement: Dental unit water systems currently designed for general dental practice are incapable of delivering water of an optimal microbiologic quality. The Council

recommends an ambitious and aggressive course to encourage industry and the research community to improve the design of dental equipment so that by the year 2000, water delivered to patients during nonsurgical dental procedures consistently contains no more than 200 colony forming units per milliliter (cfu/ml) of aerobic mesophilic heterotrophic bacteria at any point in time in the unfiltered output of the dental unit; this is equivalent to an existing quality assurance standard for dialysate fluid that ensures the fluid delivery systems in hemodialysis units have not been colonized by indigenous waterborne organisms.

Manufacturers of dental equipment are encouraged to develop accessory components that can be retrofitted to dental units currently in use, whatever the water source (public or independent), to aid in achieving this goal. Further, the ADA should urge industry to ensure that all dental units manufactured and marketed in the U.S.A. in the future have the capability to be equipped with a separate water reservoir independent of the public water supply. In this way, dentists not only will have better control over the quality of the source water used in patient care, but also will be able to avoid interruptions in dental care when "boil water" notices are issued by local health authorities.

At the present time, commercially available options for improving dental unit water quality are limited and will involve some additional expense.

They include the use of:

- Independent water reservoirs
- Chemical treatment regimens
- Daily draining and air purging regimens
- Point-of-use filters

Preliminary data suggest that some combination of the above strategies will be necessary to control biofilm formation and to achieve the desired level of water quality. To date, however, there are insufficient data to establish the effectiveness of available methods. Industry and independent researchers should be strongly encouraged to explore as wide a range as possible of alternatives and adjuncts to the above listed options. Dental practitioners should always consult with the manufacturer of their dental units before initiating any waterline treatment protocol.

Water Quality Monitoring: Simple and inexpensive methods to estimate the number of free-floating heterotrophic bacteria in dental unit water need to be developed to test the effectiveness of control measures. A well-designed water quality indicator (WQI) should be self-contained and easy to use in-office; accurately detect a wide concentration range and type of aerobic mesophilic heterotrophic waterborne bacteria within a reasonable incubation time at room temperature; and be relatively inexpensive to use. The Council is aware that technology meeting these criteria is already available and could possibly be adapted for use in dentistry with minimal developmental cost.

Training and Education: The ADA should enhance its efforts to educate dental practitioners regarding microbial contamination and biofilm formation in dental unit waterlines, and the need for improvement in the quality of water delivered to patients. Additionally, manufacturers should maintain an active approach in training and educating the profession in the proper use and maintenance of their systems.

Critical Research and Development Needs Identified by the Council:

1. Research is needed to define the natural history of biofilms, specifically to more clearly determine the relationship of the numbers and types of microorganisms in the fixed population (sessile) to their free-floating (planktonic) counterparts.
2. Improved, research-based, methods need to be developed to effectively eliminate existing biofilm and prevent or control formation of new biofilm in dental unit waterlines.
3. Alternative devices for monitoring the microbial quality of water used during dental care should be developed that are simple, reliable, and cost-effective.

In summary, the Council recognizes that the scientific literature supports the need for improvement in dental unit water quality. The Council will continue to work with industry and the research community to address research and development needs that will allow the delivery of water of an optimal microbiological quality to the dental patient. The Council recommends dissemination of this information to dentists as part of the ADA's on-going service to the profession and the public.

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ADA Statement on Saliva Ejectors

A recent study published in the Journal of the American Dental Association raised the issue of possible cross contamination among dental patients as a result of backflow from the saliva ejector when, and if, the patient's lips form a seal around the ejector tip. The plastic tip suction excess saliva from the patient's mouth during dental procedures.

As part of the Association's ongoing commitment to monitoring infection control developments, its Council on Scientific Affairs is reviewing the issue at its scheduled meeting in February. If called for, the Council will recommend updated guidance to dentists on this issue.

Current infection control recommendations call for the disposal of saliva ejector tips after use on each patient. The dental profession has undertaken stringent infection control measures to help ensure patient safety.

While the ADA and Centers for Disease Control and Prevention are not aware of any adverse health effects associated with the saliva ejector, dentists may wish to remind patients not to close their lips around the saliva ejector tip during use.

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Internet Resources

ADA Infection Control Recommendations

<http://www.ada.org/prof/resources/topics/iconrol/index.asp>

ADA Statement on Dental Unit Waterlines

<http://www.ada.org/prof/resources/positions/statements/lines.asp>

ALERT: Allergy to Latex Education and Resource Team, Inc.

<http://www.latexallergyresources.org/>

Appendix - First-Line Drugs for HIV Postexposure Prophylaxis (PEP). Publication date 05/15/1998. www.cdc.gov/epo/mmwr/preview/mmwrhtml/00052801.htm

CDC Prevention Guidelines

<http://wonder.cdc.gov/wonder/prevguid/p0000018/P0000018.asp>

CDC Prevention Guidelines Database

<http://wonder.cdc.gov/wonder/prevguid/prevguid.html>

Provides access to the CDC Prevention Guidelines Database, which is a compilation of all of the official guidelines and recommendations published by the CDC for the prevention of diseases, disabilities, and injuries. Information on how to find a specific CDC Prevention Guideline.

CDC: Hoaxes - www.cdc.gov/hoax_rumors.htm

CDC: Infection Control in Dentistry - Airborne www.cdc.gov/nccdphp/oh/icair.htm

CDC: Infection Control in Dentistry - Bloodborne www.cdc.gov/nccdphp/oh/icbbp.htm

CDC: Infection Control in Dentistry - Waterborne www.cdc.gov/nccdphp/oh/icwater.htm

Center for Biofilm Engineering, Montana State University. Interdisciplinary glossary

www.erc.Montana.edu/Res-Lib99-SW/glossary/Gterms.html

Centers for Disease Control and Prevention www.cdc.gov/

OR: www.crawford.com/cgi-bin/kidofwais.pl

Centers for Disease Control and Prevention (CDC) www.cdc.gov/nip/vacsafe/

The National Immunization Program (NIP) of the CDC information on vaccine safety.

Centers for Disease Control Morbidity and Mortality Weekly Report: "Public Health Service Guidelines for the Management of Health-Care Worker Exposures to HIV and Recommendations for Postexposure Prophylaxis." May 15, 1998; Vol. 47, No. RR-7. The Adobe Acrobat pdf version contains the text of the report.

<ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4707.pdf>

OR www.cdc.gov/epo/mmwr/preview/mmwrhtml/00052722.htm

www.cdc.gov/epo/mmwr/preview/mmwrhtml/00052801.htm

Centers for Disease Control Morbidity and Mortality Weekly Report: "Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease." October 16, 1998/Vol.47/No. RR-19. The Adobe Acrobat pdf version contains

the text of the report. www.cdc.gov/epo/mmwr/preview/mmwrhtml/00055154.htm
or
<ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4719.pdf>

Centers for Disease Control Morbidity and Mortality Weekly Report: "Immunization of Health-Care Workers. Recommendations of the Advisory Committee on Immunization Practices (APIC) and the Hospital Infection Control Practices Advisory Committee (HICPAC)." December 26, 1997, Vol.46, No.RR-18.

www.cdc.gov/epo/mmwr/preview/ind97_rr.html

or

<ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4618.pdf>

CPL 2.103 Field Inspection Reference Manual

CPL 2.251 Scheduling System for Programme Inspections

CPL 2-0.124 Multi-Employer Citation Policy

Effective Engineering Controls ECRI designated as an Evidence-based Practice Center by the Agency for Health Care Policy and Research, is a nonprofit international health services research organization. This web site discusses the June 1998 issue of ECRI's Health Devices, which evaluated 19 needlestick-prevention devices, and provides information on how to obtain the document.

http://www.ecri.org/Products_and_Services/Products/Special_Reports/Sharps_Safety_and_Needlestick_Prevention.aspx/ssnp_press_release_111501.aspx ECRI,

Environmental Protection Agency www.epa.gov/

FDA Clearances: www.fda.gov/ode/germlab.html

Federal Register www.access.gpo.gov/su_docs/aces/aaces002.html/

Food and Drug Administration (FDA) information on how the FDA ensures vaccine safety. www.fda.gov/fdac/features/095_vacc.html. Information on the Vaccine Adverse Event Reporting System (VAERS), a cooperative program for vaccine safety of the FDA and CDC. www.fda.gov/cber/vaers/vaers.htm

Food and Drug Administration (FDA) Safety Alert: Needlestick and Other Risks from Hypodermic Needles on Secondary IV Administration Sets - Piggyback and Intermittent IV Warns of the risk of needlestick injuries from the use of hypodermic needles as a connection between two pieces of intravenous (IV) equipment. Describes characteristics of devices which have the potential to decrease the risk of needlestick injuries.

www.fda.gov/cdrh/safety.html

Glutaraldehyde Information: www.metrex.com/techinfo.html

Guideline for infection control in health care personnel, 1998.

www.cdc.gov/ncidod/hip/GUIDE/InfectControl98.pdf

Hazardous Waste Management www.metrokc.gov/lhwmp/cesgg/index.html

HIV Dent www.hivdent.org

Immunization Action Coalition (IAC) www.immunize.org/

The IAC is a nonprofit organization working to increase immunization rates and prevent

disease. Vaccine Information Statements, free print materials, and other hepatitis and immunization sites.

Immunization of Health-Care Workers: Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). Publication date 12/26/1997. Provides recommendations for Hepatitis B. www.cdc.gov/epo/mmwr/preview/mmwrhtml/00050577.htm

Infectious Diseases Society of America (IDSA) www.idsociety.org/vaccine/index.html
The Vaccine Initiative is a project of the IDSA and the Pediatric Infectious Diseases Society. information on vaccination and vaccination-related issues.

Institute for Vaccine Safety, Johns Hopkins School of Public Health
www.vaccinesafety.edu/

International Health Care Worker Safety Center at the University of Virginia
www.med.virginia.edu/~epinet

International Health Care Worker Safety Center, University of Virginia a list of safety devices with manufacturers and specific product names.
www.people.virginia.edu/~epinet/products.html

Latex Allergy:

www.latex.org/in_the_news.html
www.elastyren.com/info/question.html
allergy.mcg.edu/physicians/ltxhome.html
www.logicnet.com/alan.macleod/allergy.htm
www.latex.org/literature_library.html

Medscape Infectious Diseases www.medscape.com/

Morbidity and Mortality Weekly Report (MMWR) www2.cdc.gov/mmwr/mmwr.html
Provides access to the MMWR, a series which is prepared by the CDC. Contains comprehensive information on policy statements for prevention and treatment that are within the CDC's scope of responsibility, for example, recommendations from the Advisory Committee on Immunization Practices (ACIP).

National Institute for Occupational Safety and Health (NIOSH) Sharps Disposal Containers information on selecting, evaluating, and using sharps disposal containers. <http://www.cdc.gov/niosh/sharps1.html>

National Institute of Health www.nih.gov/
OR: www.fedworld.gov/
OR: golgi.harvard.edu/biopages/medicine.html
OR: www.cis.ohio-state.edu/hypertext/faq/usenet

National Institutes of Health (NIH) www.niaid.nih.gov/publications/vaccine/undvacc.htm a 40 page brochure "Understanding Vaccines."

National Library of Medicine www.nlm.nih.gov/ (National Institute of Health)
OR: www.med.harvard.edu/bwhrad/
OR: www.excite.com/subject/health-and-medicine/

OSAP (Office Safety & Asepsis Procedures Research Foundation): Home Page
www.osap.org

OSAP: Infection Control in Dentistry Guidelines www.osap.org/o-guide1.htm

OSAP: List of FDA-cleared products for Waterline Quality Improvement www.osap.org

Public Health Service Guidelines for the Management of Health-Care Worker Exposures to HIV and Recommendations for Postexposure Prophylaxis. Publication date 05/15/1998.
www.cdc.gov/epo/mmwr/preview/mmwrhtml/00052722.htm

Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease. Publication date 10/16/1998.
www.cdc.gov/epo/mmwr/preview/mmwrhtml/00055154.htm

Safety Sharp Device Contracts safety sharp devices on contract with the US Department of Veterans Affairs (VA).
www.va.gov/vasafety/osh-issues/needlesafety/safetysharpcontracts.htm

SHARPS Injury Control Program Established by Senate Bill 2005 to study sharps injuries in hospitals, skilled nursing facilities, and home health agencies in California. A Beta version of Safety Enhanced Device Database Listing by Manufacturer.
www.ohb.org/sharps.htm

Training for Development of Innovative Control Technologies (TDICT) Project "Safety Feature Evaluation Forms" for specific devices. www.tdict.org/criteria.html

United States Air Force Dental Investigation Service The Year 2000 USAF Dental Infection Control Guidelines www.brooks.af.mil/dis/icguidelines/index.htm

United States Food and Drug Administration www.fda.gov

World Health Organization www.who.org

World Health Organization vaccine safety home page which offers links to vaccine safety-related information. www.who.int/gpv-safety/

- ⁱ Miller, C.H.; Palenik, C.J. Infection Control and Management of Hazardous Materials for the Dental Team. Mosby 1994.
- ⁱⁱ Amendment of Section 1005 of Division 10 Title 16 of the California Code of Regulations. http://www.dbc.ca.gov/order_adopt1005.html
- ⁱⁱⁱ Centers for Disease Control and Prevention Guidelines for preventing the transmission of Mycobacterium tuberculosis in Health Care Facilities, 1994.
- ^{iv} <http://www.cdc.gov/hiv/pubs/mmwr/mmwr05jun81.pdf>
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