

The Dental Learning Network



Infection Control: 2 Hours

2 Homestudy Credit Hours

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

**The Dental Learning Network
is a recognized ADA CERP provider**

Infection Control – 2 Hours

(2 Credit Hours - \$30.00)

Please mark your answers to the course exam below, then fax this page to 703-935-2190 for scoring and certificate issuance. Or, if you wish to receive your certificate immediately, [click here](#) to take this exam online. Payment will be accepted at the time you submit the exam for scoring. If you've already paid for this course and wish to take the exam online, but you don't have a user name and password, send an email request to **CESupport@DentalLearning.Org**.

1. _____ 3. _____ 5. _____ 7. _____ 9. _____
2. _____ 4. _____ 6. _____ 8. _____ 10. _____

Name: _____
D.D.S. D.M.D. R.D.H. R.D.A. C.D.A. C.O.A. D.A. A.Q.P.

License State: _____ License Number: _____ Expiration Date _____ (MM/YY)

Address 1: _____

Address 2: _____

City: _____ State: _____ Zip Code: _____

Telephone Number: _____ Fax Number: _____

E-mail: _____

Please help us improve:

Ordering experience was convenient:	Yes	No
I received my workbook or file in a timely manner:	Yes	No
Course text and test clear and understandable:	Yes	No
I'll use the course information in my daily practice:	Yes	No
Overall, I would give this course a grade of _____.		

Fax your completed exam to 703-935-2190

If you have downloaded this course off the Internet and need to provide your credit card information for payment please do so here:

Card type _____ Card number _____

Exp. Date _____ Name as it appears on card _____

Instructions

Read the course material and enter your test answers on the one-page answer sheet included with this book.

You earn course credit for every test answer sheet with at least 70% correct answers. We notify failing students within 7 days and give them an opportunity to take a new test. To claim your credits, return your answers by:

- Taking the test online (only if you have not purchased the coursebook separately, you will need to provide credit card information at the time you submit your exam online for scoring).
- Writing your answers on the one-page answer sheet included with this book, then fax or mail them to:

The Dental Learning Network
1474 North Point Village Center - # 234
Reston, VA 20194
Phone: 800-522-1207
Fax: 703-935-2190

We grade all tests in a timely manner; so if you do not receive your certificate within five days, please send an email to CESupport@DentalLearning.org

There is no time limit for return of your answer sheet. Completion dates are taken from the test answer sheet envelope postmark or the finish date recorded in the computer when you do an online exam, and must be in the licensing cycle you wish to use the credits.

If you are dissatisfied with the course for any reason, please return the printed materials within 30 days of purchase and we will refund your full tuition. Shipping charges are nonrefundable.

If someone else would like to use this material after you are done, he or she may register with us and take advantage of the “sharing discount” workbook tuition charge. Courses downloaded from the Internet can be shared at the same tuition rate as currently available on our website. Please call us if you need an extra answer sheet or download one from our website. There is no “sharing discount” for online exams.

Keep in mind several States have specific requirements on subject matter as well as credits earned through different educational methods for license renewal. You are responsible to know of these limitations. The author and The Dental Learning Network have made every effort to include information in this course that is factual and conforms to accepted standards of care. This course is not to be used as a sole reference for treatment decisions. It is your responsibility to understand your legal obligations and license requirements when treating patients. The Dental Learning Network is not responsible for the misuse of information presented in this course. The material in this course cannot be reproduced or transmitted in any way without the written consent of The Dental Learning Network.

Table of Contents

Answer Sheet - Infection Control - 2 hrs	2
Instructions	3
Table of Contents	4
Course Objectives	6
Course Introduction	7
About the Authors	8
Joseli Alves-Dunkerson, DDS, MS, MPH, MBA	8
Duane Dunkerson, MA	8
Definitions	9
Introduction.....	9
Chemical Agents That Kill Microorganisms	11
Classification of Common Dental Items.....	12
TB / HIV / Hepatitis	13
Tuberculosis	13
AIDS	14
Hepatitis	15
First Lines of Defense	16
Hepatitis B Vaccine	16
Personal Protective Attire	17
Introduction.....	17
Handwashing.....	17
Gloves	17
Gowns	18
Masks.....	18
Protective Eyewear	19
Personal Hygiene	19
General Cleaning	20
Surface Covers.....	20
Surface Cleaning.....	20
Spilled Blood	20
Disposal of Contaminated Wastes	20
Aseptic Technique	21
Limiting Contamination	21
Preprocedural Mouthrinsing	21
Needles	21
Other Areas of the Practice	22
Suitable Disinfectants	22
Chemical Disinfectants	23
Introduction.....	23
Iodophor Solutions	23
Complex Phenolics.....	23
Alcohol-Quaternary Ammonium Compounds	23

Sodium Hypochlorite (Bleach)	23
Unacceptable Solutions.....	24
Steps in Instrument Processing	25
Introduction.....	25
Presoaking	25
Precogning	25
Corrosion Control and Lubrication.....	26
Packaging.....	26
High-Speed Handpiece Asepsis.....	26
Slow Speed Handpieces, Contra Angles, and Prophy Angles.....	27
Air/Water Syringes and Ultrasonic Scaler.....	28
Lasers, Curing Lights, Electrocautery Devices	28
Saliva Ejector and High Speed Evacuation System	28
Single Use	29
X-ray Equipment and Film	29
Impression Materials	29
Methods of Sterilization.....	30
Introduction.....	30
Sterilization Monitoring	31
Glutaraldehyde as a Sterilant	32
The Dental Laboratory	33
Introduction.....	33
Waterlines.....	34
Introduction.....	34
Ethical and Legal Considerations Regarding AIDS and HIV	36
Introduction.....	36
The Acer Case	36
Sharpe vs. Breglio	36
The Bragdon Case	37
Summary Checklists.....	38
Introduction.....	38
Dental Laboratories	40
Timetable Checklist	41
The Absolute “Bottom Line”	42
Test	43
Bibliography and Suggested Reading List	45
Appendices.....	59
CDC Guidelines for Dental Care Settings.....	59
ADA Statement on Dental Unit Waterlines	60
ADA Statement on Saliva Ejectors	62
Internet Resources	64
Endnotes.....	65

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 reasons for immunization against the Hepatitis B Virus.
- Describe correct aseptic technique for dental procedures.
- List the steps in correct instrument processing to achieve sterility.

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

It is important from the beginning of this course that everyone understands important terms.

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 an unacceptable definition of "disinfect." Disinfection is not the same as sterilization. For the precise needs of the dental and medical industry, 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 to the correct sterile procedure. True sterilization involves killing **all** microorganisms including hardy bacterial spores on a certain 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}:

Selections from a slide set prepared by the CDC to accompany the CDC "Guidelines for Infection Control in Dental Health-Care Settings – 2003" are included in this course. The slides are intended to give pictorial amplification for this course's text and table.

Universal Precautions: The same infection control procedures and barrier techniques are determined by the procedure, 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.

Standard Precautions: 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

Critical instruments: Surgical and other instruments used to penetrate soft tissue or bone.

Semi-critical instruments: Surgical and other instruments that are not used to penetrate soft tissue or bone, but contact oral tissue.

Non-critical instruments and devices: Contact intact skin.

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

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.

Other Potentially Infectious Material (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 unfixed tissue or organ (other than intact skin) from a human being (living or dead);
- (C) HIV-containing cell or tissue cultures, organ culture and blood, or other tissues from experimental animals.

All dental health personnel 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.

Low-level disinfection: The least effective disinfection process, kills some bacteria, viruses and fungi, but does not kill bacterial spores or *mycobacterium tuberculosis var bovis*, a laboratory test organism used to classify the strength of disinfectant chemicals.

Intermediate-level disinfection: Kills *mycobacterium tuberculosis var bovis* indicating that many human pathogens are also killed, but does not necessarily kill spores.

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

Sterilization: kills all forms of microbial life.

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

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 areas of infection control are:

- aseptic technique
- patient screening and evaluation
- personal protection
- instrument sterilization
- environmental surface disinfection
- equipment asepsis
- prevent exposure to blood and body fluids

Chemical Agents That Kill Microorganisms

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

High-level disinfectant: Kills microorganisms except spores, with prolonged contact may

kill endospores.

Intermediate disinfectants: Kills *M. Tuberculosis* and all other microorganisms but not endospores.

Low-level disinfectants: Kills certain viruses and vegetative bacteria, but not *M. Tuberculosis* 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

Must be Sterilized: All critical instruments. Anything that penetrates tissue or bone or touches broken skin including: hand instruments, surgical instruments, probes, burs, handpieces (high and low-speed) scalers, ultrasonic scaler tips, curettes, and endodontic instruments.

Must be Disinfected at a High Level (if they cannot be sterilized): All semi-critical instruments. Anything handled during a procedure 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.

Must be Disinfected at (least at) a Low Level: All non-critical instruments. Anything else in the operator's office that does not come in contact with the patient's mucosa, like walls, floor, cabinets.

Each office should have a written protocol on dealing with management of injuries, handling of contaminated instruments and disinfecting of the operator's office after completion of treatment. All new employees must be trained regarding this protocol.

A copy of all regulations and protocol should be placed in plain view in the dental office.

Tuberculosis

Tuberculosis is an infection of the lungs caused by *Mycobacterium tuberculosis*. Prolonged exposure to the disease is usually required for infection. The dental team's relatively brief interaction reduces the risk of transmission during treatment.

Signs and symptoms of active TB include productive cough, swelling in the neck (due to enlarged lymph nodes) and an increased heart rate. The patient will show a positive tuberculin skin test (+PPD) within 6 to 12 weeks. The definitive test for TB is a sputum culture.

If TB bacteria can grow from the sputum sample, the bacteria are tested to identify the type and to learn which medications will kill them (sensitivity testing).

Most adults with a properly functioning immune system are able to resist an active tuberculosis infection. The infection will be walled off in the lungs by the immune system and the individual will be asymptomatic. In the case of an active infection, the immune system can no longer contain the infection in the lungs. It may then spread via the bloodstream. 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. Limit treatment to relieve immediate pain. Dental care providers must use HEPA-filter masks during treatment.
- (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.

CDC Guidelines for Dental Care Settings can be found in the appendices.

AIDS

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		

Acquired immune deficiency syndrome (AIDS) was identified for the first time in 1981. It is caused by a retrovirus, called human immunodeficiency virus (HIV). This virus suppresses the T-cells that are critical in the human immune system. After infection, the patient may be completely asymptomatic for a prolonged period (even up to 7 years). However, during this time the infected person is still able to transmit the disease to others.

Signs and symptoms of the initial HIV infection mimic those of the flu – fever, headache, diarrhea, vomiting and sore throat. Many patients who test positive for HIV infection may have been carrying the disease undiagnosed for a long time. The dentist may notice some lesions present in the mouth that may indicate that the patient may be infected and should be tested for HIV. These include fungal infections, exacerbated forms of gingivitis and periodontitis, ulcerations and neoplasms.

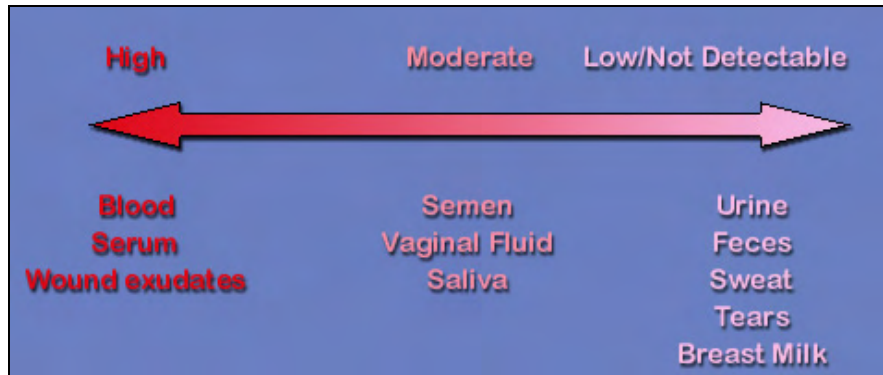
HIV is transmitted through sexual contact, direct exposure to infected blood or blood components, and perinatally from mother to neonate. Blood, semen and vaginal secretions have been shown to carry the virus. HIV has been isolated from saliva, but the CDC has removed it from the list of body fluids 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 (antiretrovirals), and drugs that boost the immune system. AIDS patients die from opportunistic diseases that their bodies are not able to fight.

Hepatitis

There are five main categories of hepatitis: A, B, C, D, and E. Hepatitis A and E are spread through contaminated food or water. Hepatitis B, C, and D are spread through direct contact with infected body fluids.

Concentration of HBV in Body Fluids



Of these viruses, Hepatitis B (HBV) is the greatest threat to dental professionals. Hepatitis B is spread by infected blood and other bodily fluids such as semen, vaginal secretions, saliva, open sores, and breast milk. It causes liver problems that can eventually lead to death. A vast majority of cases (90%) are limited meaning that the body is able to effectively fight off the disease.

The greatest concentration of HBV in an infected patient's mouth is at 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, as is the assistant or dentist packing cord for crown impressions or during oral surgery. Other occupational risks for exposure include needle sticks and injuries from other contaminated sharps, blood and saliva contamination of cuts and cracks on the skin, and spraying of blood and saliva onto mucous membranes.

The hepatitis C virus is the cause of 30% of acute viral hepatitis cases in the U.S. It is a bloodborne disease known to be transmitted through intravenous drug abuse, blood transfusion, or occupational exposure.

The hepatitis D virus needs part of the hepatitis B virus to complete its life cycle.

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

Hepatitis B Vaccine

Dentists and their staff are at a high risk of contracting hepatitis B from their patients. The American Dental Association, and The Centers for Disease Control,^{iv} recommend that dental professionals be vaccinated against hepatitis B. The plasma-derived hepatitis B vaccine, "Heptavax-B" was introduced in the United States in 1982. 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 then the third 6 months later. 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, and every 5 years to determine if a booster is needed.

Personal Protective Attire

Introduction

HIV is not considered highly infectious, so barrier protection, which might be considered out of the ordinary, could be considered discriminatory.

Handwashing

Dental care workers should wash their hands for a minimum of 15 seconds with an antimicrobial handwash at the beginning of the day, between every patient and at the end of the treatment day. Contaminated or visibly soiled hands shall be washed with soap and water and new gloves shall be put on 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 rubs that contain between 60%-95% ethanol or isopropanol are acceptable according to CDC guidelines (2003). Any member of the dental team who has an exudative lesion or weeping dermatitis shall refrain from direct patient contact and refrain from handling patient equipment until the wound is completely healed.

Gloves

Washing hands thoroughly with antimicrobial soaps can disinfect the hands, but will not make them sterile. For most dental procedures, single-use non-sterile rubber gloves are acceptable. Use sterile surgical gloves for surgical extractions and more invasive procedures. Medical exam gloves shall be worn whenever there is a potential for contact with mucous membranes, blood or OPIM. Gloves must be discarded upon completion of treatment and before leaving laboratories or areas of patient care activities. Dental care workers shall perform hand hygiene procedures after removing and discarding gloves. Gloves shall not be washed before or after use. Properly fitting gloves should be snug but not restrictive, and should cover the cuffs of a long sleeved gown.

The chemicals in disinfectants can cause defects in the material of the glove, 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.

Care should be taken to avoid injury during procedures. If gloves are torn, cut, or punctured they must be changed as soon as it is safely possible. Wash hands thoroughly and replace gloves before continuing with the procedure.

Inexpensive plastic foodhandler's gloves used for handling food can be put over the gloves during treatment to write 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.^y

Some health care workers have reported allergies to the latex or the powder used in gloves. The 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 dermatitis should be treated by a physician and the worker should not be exposed to the latex until the condition is completely healed. Some dermatitis problems may result from moisture accumulating under gloves. Be sure to dry hands thoroughly before putting on 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.

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)

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 a 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) over the latex gloves.

Wear heavy utility gloves when cleaning, disinfecting, handling contaminated instruments or trash, mixing chemicals, and changing ultrasonic solutions.

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. Gowns must be changed daily or between patients if they should become moist or visibly soiled. Protective attire must be removed when leaving laboratories or areas of patient care activities. Reusable gowns shall be laundered in accordance with Cal-DOSH Bloodborne Pathogens Standards, (Title 8, Cal. Code of Regs., section 5193).^{vi} Protective attire should be removed and placed in laundry or disposal bags after use.

Masks

Health care workers shall wear surgical facemasks in combination with either chin length plastic face shields or protective eyewear when treating patients whenever there is potential for splashing or spattering of blood or OPIM. The pleated, soft type of mask has a higher filtration than the cup style. Use a mask with at least a filtration of 95% of 3.5 micron in diameter sized particles.^v Microbes pass more easily through moisture, so change the mask if it becomes wet or visibly soiled. After each patient, and during patient treatment if applicable, masks shall be changed if moist or contaminated. After each patient, face shields and protective eyewear shall be cleaned and disinfected, if contaminated. Some personnel change masks after an hour of use.

Protective Eyewear

Wear protective eyewear to shield your eyes from spatter of contaminated material. Debris can be irritating to the eye, and microorganisms can enter the body through this route. If prescription glasses are worn, use sideshields for better protection. Goggle-type wrap around styles and face shields are recommended.

The patient should also be given the option of wearing 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.

Personal Hygiene

Wear a long sleeved fluid resistant lab coat (or a disposable gown) over your uniform when any spatter is possible (even during cleaning). Do not wear the lab coat or uniform out of the office. Wash uniforms in hot soapy water and bleach. Machine dry at least at 100°F. Cleaning of the uniforms should be done on site or by a third party.

False fingernails can lift at the edge, creating an area for fungi and microorganisms to breed. Keep fingernails trimmed so they do not stress or puncture gloves.

Surface Covers

Many surfaces in the dental operatory become contaminated, but they are too difficult to clean and disinfect or cannot be autoclaved. Cover chair buttons, control buttons on the air/water syringe, switches on the unit, light handles, hoses, handpiece and air/water syringe holders) with plastic wrap, aluminum foil, or other material impervious to water. Replace with fresh covers after each patient.

Surface Cleaning

Clean and disinfect all clinical contact surfaces that are not protected by impervious barriers using a Cal-EPA registered, hospital grade low- to intermediate-level disinfectant after each patient. The low-level disinfectants used shall be labeled effective against HBV and HIV. Use disinfectants in accordance with the manufacturer's instructions. Clean all housekeeping surface (e.g. floors, walls, sinks) with a detergent and water or a Cal-EPA registered, hospital grade disinfectant. Some surfaces like countertops can be disinfected after each patient. Preclean surfaces before disinfection with a detergent cleaner. 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 precleaning, spray enough disinfectant to stay moist and leave undisturbed for 10 minutes, or the time specified in the directions. (Spray - Wipe - Spray)

Spilled Blood

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

Disposal of Contaminated Wastes

Local, state, and federal environmental standards vary from area to area in regards to contaminated solid waste management. Check with authorities to clarify specific regulations. 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. Anesthetic cartridges may contain aspirated blood or fluids, so they should be disposed of in the sharps container.

Limiting Contamination

Perform dental procedures by conscientiously limiting the amount of droplet nuclei, spatter, and aerosols. Use high-speed evacuation, proper patient positioning, and a rubber dam if appropriate. Use overgloves if it is necessary to make a chart entry during treatment.

Anything used in the patient's mouth must be sterile. Put all instruments for a single patient on a sterile tray with a sterile cover, and place all instruments back onto this tray after use. Wipe down the area where the tray rests with disinfectant after each patient. Use of any irrigating solution should be delivered using a sterile delivery system.

Preprocedural 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. Chlorhexidine gluconate seems to be the best currently available wide spectrum mouthrinse.

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.

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. 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.^{vii}

Needles

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 only a safe method. If recapping, do not hold the cap with your hand, use a recapping protective device or "scoop up" the cap without touching it. Needles shall not be bent or broken for the purpose of disposal. Never leave an uncapped needle on the treatment tray, because it is more likely to cause injury. Place it in a "sterile field" away from the bracket table until the procedure is complete. ***Treat an unsheathed needle as if it were a loaded gun.*** Disposable needles, syringes, scalpel blades or other sharp items and instruments shall be placed into sharps containers for disposal according to all applicable regulations. Use hemostats or pliers to remove the needle from the syringe and place directly into the container.

Other Areas of the Practice

Disinfect the other areas of the office regularly, including pens, countertops, bathroom surfaces, waiting room hard surfaces, doorknobs, computer keyboards, phones, desks, and chairs.

Suitable Disinfectants

All products to be used as disinfectants on precleaned surfaces must be EPA-registered as effective against HIV, HBV, Mycobacterium ssp and TB. Check compatibility of material before use on dental/medical equipment.

For a list of EPA approved disinfectants, visit the following website:

<http://www.epa.gov/oppad001/chemregindex.htm>

Chemical Disinfectants

Introduction

Disinfection will kill disease-producing microorganisms, but not bacterial spores. Office disinfection procedures employ a liquid chemical at room temperature to kill microorganisms on instruments or operatory surfaces. The best solution to use is one that has a precleaning ability so fewer products need to be used after every patient. Properly diluted iodophor, sodium hypochlorite, and complex phenol preparations have been shown to be superior in comparison with other disinfectants for initial precleaning.

Read the labels and ask your product representative for information regarding the product. It is important to consider all the above qualities and make sure it is registered with the EPA.

Iodophor Solutions

Iodophors are probably the most commonly used surface disinfectants. They have a low toxicity, no offensive odor, and are not irritating to skin. There is a residual effect on the treated surface. Iodophors are rated by the EPA as a tuberculocidal hospital disinfectant. Other manufacturers recommend their formula for both precleaning and disinfecting. Check the instructions on the bottle. The residual effect is cumulative with each treatment.

Complex Phenolics

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

Alcohol-Quaternary Ammonium Compounds

Alcohol combined with quaternary ammonium compounds (quats) enhances the antimicrobial spectrum.^{viii}

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 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.

For a full list of FDA approved sterilants and high-level disinfectants visit the following site:
<http://www.fda.gov/cdrh/ode/germlab.html>

Unacceptable Solutions

Quaternary Ammonium Compounds (Quats)

All older quaternary ammonium compounds have been declared unacceptable for use in dentistry by The Council for Dental Therapeutics of The American Dental Association. Do not use any compound that contains benzalkonium chloride, dibenzalkonium chloride, cetylpyridinium chloride or alkyldimethylbenzylammonium chloride. 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.

Steps in Instrument Processing

Introduction

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

Presoaking

Soak contaminated instruments in a mild detergent or an instrument disinfectant/sterilant until a more convenient time for processing. This will prevent blood, saliva, and debris from drying on the instruments. Presoaking for longer than a few hours may cause corrosion of some instruments. 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. Risks of injury and cross-contamination increase dramatically with hand cleaning of instruments because of the close contact with sharp edges and spatter of contaminated fluids.

If hand scrubbing is the only option, wear heavy utility gloves, a mask, protective eyewear, and protective clothing. Be especially careful of spatter during handscrubbing, and keep sterile instruments away from the scrubbing area. If safe, try to scrub instruments while submersed in a sink of water and use careful, light motions. Always rinse and dry instruments.

Ultrasonic cleaners are very effective and greatly reduce the risk of puncture injury to 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 very 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, some cannot be cleaned ultrasonically.

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 will still be 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 small holes in the foil from the ultrasonic action. Keep the foil pieces for comparison.

Burs and drills can be carefully scrubbed with a wire brush before autoclaving. Remember to heat sterilize the wire brush and disinfect other brushes after use.

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

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.

High-Speed Handpiece Asepsis

All high-speed dental hand pieces, low-speed hand piece components used intraorally, and other dental unit attachments such as reusable air/water syringe tips and ultrasonic scaler tips, shall be heat-sterilized between patients. The ADA especially stresses flushing

the handpiece waterline after use for 20 to 30 seconds to wash the internal lines.

Anti-retraction valves are common on units manufactured after the mid-1980's. Any unit without these valves should be retrofitted with them. Check retraction by watching the end of the water line opening when the water is turned on, then off. Check units for water retraction monthly. Replace anti-retraction valves when indicated. Operate high-speed handpieces and air/water syringes for 30 seconds after each patient to flush the lines. To avoid spraying aerosols into the environment, operate the handpiece over a vacuum line to suction excess lubricant.

Always follow the handpiece manufacturer's directions for proper maintenance, cleaning, sterilization, disinfection, and compatibility with chemical agents. Each handpiece is different. Most handpieces that can be heat sterilized should be prepared for sterilization in the following way: (If manufacturer's directions are different do what they recommend)

When finished with the patient's treatment, wipe debris from the exterior with a piece of gauze and run the air/water system to flush the water and air lines into the evacuation system or a sink for 20 to 30 seconds.

Do not soak or submerge handpieces in an ultrasonic unless the manufacturer specifically recommends it. If the manufacturer approves ultrasonic cleaning, remember to drain the handpiece well and attach it to a hose to operate and dispel any fluids and debris trapped inside.

Reattach the handpiece to a hose and operate for a few minutes to remove excess lubricant from the moving parts. This step is very important because excess lubricant exposed to high temperatures can "gunk up" the moving parts and ruin the handpiece. Check the manufacturer's directions before operating the handpiece without a bur or blank in the chuck (called "no load operation").

If the handpiece has a fiber optic, clean carefully with a cotton swab and isopropyl alcohol to remove any debris. Do not use strong solvents because they can damage the fiber optic. Excess dirt can become embedded in the fiber optic during heat processing and ruin it.

Flush the air/water lines for 20 to 30 seconds before attaching the handpiece.

Slow Speed Handpieces, Contra Angles, and Prophy Angles

Since slow speed handpieces do not contact the patient's mucosa, they do not need to be sterilized. Follow manufacturer's directions for cleaning and disinfection, using a hard surface disinfectant that will not corrode the exterior casing.

Use heat sterilizable or disposable prophy angles and contra angles.

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 ultrasonics should be removable and 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.

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

Use barrier protection when possible, and preclean removable tips before sterilization.

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^{ix} clearly demonstrated suck back. 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 with a high-level disinfectant every day.

Single Use

Single use disposable instruments (e.g. prophylaxis angles, prophylaxis cups and brushes, 3 tips for high-speed evacuators, saliva ejectors, air/water syringe tips) shall be use for one patient only and discarded.

X-ray Equipment and Film

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

Rinse impressions to remove debris, saliva, and blood. Disinfect before casting with die stone or sending out to the laboratory. Different impression materials require different disinfectants. Polysulfides and silicones can be disinfected by immersion in any EPA accepted tuberculocidal disinfectant without distorting the impression. Time of immersion for disinfection will vary with different chemicals, so consult the directions on the bottle. Polyether impressions may be distorted if immersed. These impressions should be disinfected using a chlorine compound spray that has a short disinfection time of 2 to 3 minutes. After this time, rinse the impressions thoroughly.

The current recommendation for disinfection of an alginate impression is submersion in a solution of 0.5% NaOCl (diluted bleach) for 10 minutes. The time should be closely monitored due to the dimensional instability of alginate. The casting should be done as soon as possible after disinfection.

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 stearothermophilus</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 stearothermophilus</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. An adequate sterilization procedure must kill all microorganisms present on the item being sterilized.

Heat stable critical and semi-critical instruments shall be cleaned and sterilized before use by using steam under pressure (autoclaving), dry heat, or 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.

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.

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. 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 steam autoclaves as a primary source of sterilization with glutaraldehyde as a secondary.

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. 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;
- wrong packaging material for method of sterilization;
- more than two layers of wrap, inhibiting penetration;
- closed container not penetrated by steam or chemical vapor;
- starting timing for sterilization before sterilizing temperature is reached;
- 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

Sterilization Monitoring

The best way to ensure correct use of heat sterilizers (including operation, packaging, loading and timing) is by using spore tests. Weekly testing through the use of a biological indicator (such as a spore test) is required. Documentation for this testing must be made and kept for 12 months.

The spore test should be specific for the type of sterilizer used. The time, temperature, and pressure are recorded. The test and another control sample that has not been processed are then returned to the laboratory for culturing. Spores should grow on the control but not on the test. The laboratory then notifies the office of the results. 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. They call immediately for failures, and send written reports for each test.

Special sterilizing bags, tapes, or strips are available to test if the packages have been exposed to heat, steam, or chemical vapor. These should always be used in addition to, not instead of, spore tests, because they do not indicate that all microbes have been eliminated, just exposure to the proper elements.

Routine spore testing is done weekly. Spore test when any new packaging material is used, during and after sterilizer training of staff members, when a new sterilizer is used, after a sterilizer has been repaired, after any change in sterilizer loading procedure, and with every implantable device. Do not proceed with implantation until test results are verified.

Glutaraldehyde as a Sterilant

Glutaraldehyde is no longer widely used as a sterilant in dental offices. This is due to several properties of both the material and the sterilization process which make it inconvenient as a sterilant.

Glutaraldehyde is highly corrosive and toxic. Since instruments sterilized in this manner are not wrapped in sterilization pouches, it is necessary to either immediately use them after sterilization or to transfer them to a sterilized container (per the ADA's infection control recommendations).

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. 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. Ragwheels shall be disinfected, sterilized for each patient or a new ragwheel used for each patient. Fresh pumice should be dispensed 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.

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.

Devices used to polish, trim or adjust contaminated intraoral devices shall be disinfected or sterilized.

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.

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, yet 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 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 per milliliter (CFU/mL) of heterotrophic bacteria per milliliter of water. Several studies show water from dental handpieces and air-water syringes contaminated at levels exceeding 100,000 CFU/mL.^x The ADA has recommended a goal of 200 CFU/mL.

Microbes enter the tubing from incoming water. These microbes adhere to the walls of the tubing and begin to multiply. The microbes produce a slime layer (biofilm) 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-to-volume ratio.^{xi} Water heating systems in dental units are designed to heat the water to human body temperature. This may increase the numbers of microorganisms and encourage bacterial growth in the waterlines.

Dental unit waterlines shall be anti-retractive. This means that the flow of water is one-way only. Dental unit lines shall be flushed at the start of the day prior to attaching handpieces, scalers and other devices. Waterlines shall be flushed at the beginning of each workday for at least 2 minutes or purged with air for 2 minutes; and after each patient for a minimum of 20 seconds. This will also dislodge some of the biofilm. However, flushing only, without chemical treatment, filtration, or other valid intervention should be used only as an interim measure until methods that are more effective are available to bring the water quality up to the ADA goal of 200 CFU/mL.

Sterile coolant and irrigating solutions must be used for surgical dental procedures involving bone and incision of mucosa. Sterile coolants/irrigants must be delivered using a sterile delivery system. Water with less than 200 CFU/mL of heterotrophic mesophilic bacteria is acceptable for non-surgical procedures including those involving the sulcus or initial access into dental pulp.

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 than 200 CFU/mL of heterotrophic mesophilic bacteria, and
- not contain toxic or carcinogenic chemicals.

Current options for maintaining adequate bacterial levels in waterlines include water filtration, water purification and chemical treatments.

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

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 an extremely minute 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 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. All the patients had dental care from the dentist after he was diagnosed HIV positive. None of the patients had confirmed exposures to HIV other than the dental treatment by Dr. Acer. Cross-infection by dental instruments has been ruled out because none of the patients had appointments on the same day. 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.

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

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.^{xiii}

The Supreme Court delivered a decision in June, 1998 that HIV infected individuals are protected under the Americans with Disabilities Act (AWDA). The AWDA 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. According to Justice Anthony M. Kennedy, the Supreme Court could not decide on the matter “since it should be limited to ‘objective, scientific information.’”^{xiv}

The federal court of appeals ruled against Dr. Bragdon on March 5, 1997 and found him guilty of violating federal and state laws by refusing to treat Ms. Abbott in his dental office.

The American Dental Association released a statement on September 29, 1998 reaffirming that patients with HIV may be safely treated in a dental office. A decision not to provide treatment to an individual based solely on their AIDS or HIV seropositive status is unethical.^{xv}

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. Update at each appointment and document.
- Prostheses and appliances to be delivered to the patients should be disinfected before fitting.
- Disposable coverings should be placed prior to seating 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.
- 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.
- Do not be interrupted to leave the room if at all possible.
- Use an overglove if answering the phone or going into a drawer.
- Do not touch your face or hair.
- At end of treatment: discard mask and gloves, wash hands, and remove gown.
- Make notes in chart and dismiss patient.

After the patient leaves:

- Wear heavy rubber gloves while disinfecting surfaces 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 odd 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; follow manufacturer's directions.
- Use caution when handling sharps, especially disposable needles and scalpels. Place them in a puncture-resistant container before disposal.
- Decontaminate all environmental surfaces. Use absorbent paper toweling and a detergent type disinfectant to preclean surface and remove debris. Dispose of towels appropriately. Spray area liberally with disinfectant and leave wet for the time indicated by the directions. Dispose of and replace any protective coverings on switches, light handles, x-ray unit head.
- Decontaminate all outgoing materials such as impressions, bite registrations, and appliances being sent to a laboratory.
- Use only small individual amounts of pumice in a disposable container for each patient, and discard any unused portion.
- Appropriately dispose of wastes. Any blood, suctioned fluids, or other liquid waste should be 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 environmental standards.
- 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 environmental standards.

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.

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

Weekly

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

Monthly

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

Annually

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

The Absolute “Bottom Line”

- Take a full medical history on each patient.
- 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.
- 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.

Please mark only one **best** answer to the following questions on the one page answer sheet. This test contains 10 questions. Please mark your answers in spaces numbered 1 through 10 on your answer sheet.

1. The definition of disinfection used in this course is:
 - a. to sterilize.
 - b. destruction of most forms of microorganisms, but not bacterial and mycotic spores, which are highly resistant.
 - c. destruction of all forms of life including viruses, bacteria, fungi, and spores
 - d. none of the above.

2. Bacterial spores are harder to kill than fungus.
 - a. True
 - b. False

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

4. Electrical switches on the dental unit and chair are best cleaned and disinfected by:
 - a. spraying with an iodophor.
 - b. wiping with alcohol.
 - c. keeping isolated from contamination by covering with a disposable cover like plastic wrap, foil, or another material impervious to water; replacing after every patient.
 - d. dismantling, put in ultrasonic cleaner, dried, and autoclaved.

5. An ideal disinfectant solution should:
 - a. have a wide spectrum of antibacterial ability
 - b. be fast acting
 - c. be tuberculocidal, effective against hepatitis B and HIV
 - d. be odorless, economical, and easy to use
 - e. all of the above

6. Disposable needles can be reused.
 - a. True
 - b. False

7. If there is no visible blood on used X-ray films, they can be handled with bare hands.
 - a. True
 - b. False

8. Heat sterilizers should be spore tested:
 - a. daily.
 - b. weekly.
 - c. yearly.
 - d. when instruments start looking dirty after a cycle.

9. It is illegal to refuse treatment to a patient because of his/her HIV status.
 - a. True
 - b. False

10. If you need to retrieve an item in a drawer during a procedure and your gloves are contaminated, you should:
 - a. use an overglove or take off the gloves, wash hands, retrieve the object, put on a new pair of gloves.
 - b. wash gloves with an antimicrobial soap and dry thoroughly.
 - c. Wipe gloves with a dry towel, retrieve the item, wipe gloves with a dry towel again.
 - d. use your pinkie fingers to get the object because they don't usually come in contact with the patient's mouth.

(end of test)

Bibliography and Suggested Reading List

- Martin MV; The significance of the bacterial contamination of dental unit water systems. *British Dental Journal* 1987;163:15204.
- Challacombe SJ, Fernandes LL; Detecting *Legionella pneumophila* in water systems: A comparison of various dental units. *Journal of the American Dental Association* 1995;126:603-608
- Schold RC, Rosen S, Beck FM; Reduction of CFUs in high-speed handpiece waterlines over time. *Clinical Preventive Dentistry* 1990;12(2):9-11
- Williams JF, Johnston AM, et al.; Microbial contamination of dental unit waterlines. *Journal of the American Dental Association* 1993;124:59-65.
- Atlas RM, Williams JF, et al.; *Legionella* contamination of dental unit waters. *Applied Environmental Microbiology* 1995;61;1208-1213.
- ADA "Biological indicators for verifying sterilization." *JADA* 1988; 117: 653-4.
- ADA Councils on Dental Materials, Instruments and Equipment; Dental Practice; Dental Research; and Dental Therapeutics. "Infection control recommendations for the dental office and dental laboratory." *JADA (Supplement)* 1992; S246.
- ADA Department of State Government Affairs. "Five states move quickly on handpiece sterilization." *JADA* 1992; 123(11): 19-20.
- ADA Research Institute, Department of Toxicology. "Infectious hazards for both dental personnel and patients in the operatory." *JADA* 1988; 117: 374.
- ADA. Dental unit waterlines: approaching the year 2000. ADA Council on Scientific Affairs. *J Am Dent Assoc.* 1999 Nov;130(11):1653-64. Review.
- Advisory Committee on Immunization Practices. "Prevention of perinatal transmission of hepatitis B virus; Prenatal screening of all pregnant women for hepatitis B surface antigen." *Centers for Disease Control MMWR* 1988; 37: 341.
- Amaechi BT, et al. The use of gamma irradiation for the sterilization of enamel for intra-oral cariogenicity tests. *J Oral Rehabil.* 1999 Oct;26(10):809-13.
- American Dental Association "TV shows to examine handpieces." *ADA News* 1992; May 4: 1,5.
- American Dental Association, Council on Dental Materials, Instruments and Equipment, Council on Dental Therapeutics, Council on Dental Research, Council on Dental Practice. "Infection control recommendations for the dental office and the dental laboratory." Chicago: American Dental Association; 1992.
- American Dental Association. "Infection control recommendations for the dental office and the dental laboratory" *JADA* 1992; Supplement: 1-8.
- American Dental Association. "Sterilizing dental handpieces; results of a workshop on handpieces and other instruments in dentistry." *JADA* 1992; 123(10): 44-7.
- Anders PL, et al. Infectious diseases and the dental office. *N Y State Dent J.* 1998 Apr;64(4):29-34.
- Andre, F. "Clinical experience with a recombinant DNA hepatitis B vaccine." *Southeast Asian J Trop Med Public Health* 1988; 19: 501-10.
- Angelini, E. "Influence of sterilization on the corrosion resistance of high-speed dental handpieces." *Quintessence International* 1992; 23(3): 215-22.
- APIC,SHEA. "Position paper; The HIV-infected healthcare worker." *Infect Control Hosp Epidemiol* 1990; 11: 647-56.
- Archibald, D.W.; Cole, G.A. "In vitro incubation of HIV-1 infectivity by human salivas." *AIDS Res Human Retroviruses* 1990; 6: 1425-31.
- Ascencio F, et al. Orthodontic marking pencils: a potential source of cross-contamination. *J Clin Orthod.* 1998 May;32(5):307-10.

- Association for Advancement of Medical Instrumentation. "Good hospital practice: Flash sterilization-steam sterilization of patient-care items for immediate use (AAMI ST37), proposed final document. Arlington, Va.: AAMI; 1991.
- Association for Advancement of Medical Instrumentation. "Seam sterilization and sterility assurance in office-based, ambulatory care, medical and dental offices(AAMI ST 42), proposed final document." Arlington, Va.: AAMI; 1992.
- Atkinson, J.C.; Yeh, C.; Oppenheim, F.G.; Bermundez, D.; Baum, B.J.; Fox, P.C. "Elevation of salivary antimicrobial proteins following HIV-1 infection." *J AIDS* 1990; 3: 41-8.
- Axelsson, J.G.K.; Johansson, S.G.O.; Wrangsjö, K. "IgE-mediated anaphylactoid reactions to rubber." *Allergy* 1987; 42: 46-50.
- Barbeau J, et al. Biofilms, infectious agents, and dental unit waterlines: a review. *Can J Microbiol.* 1998 Nov;44(11):1019-28. Review.
- Barbeau J, et al. Cross-contamination potential of saliva ejectors used in dentistry. *J Hosp Infect.* 1998 Dec;40(4):303-11.
- Barco, C.T. "Prevention of infective endocarditis: a review of the medical and dental literature." *J Periodontol* 1991; 62: 510-23.
- Barr, C.E.; Miller, L.K.; Lopez, M.R.; et al. "Recovery of infectious HIV-1 from whole saliva." *JADA* 1992; 123(2): 37-45.
- Bednarsh H Infectious disease and infection control timeline. *Compend Contin Educ Dent.* 1998 Jun;19(6):640-2, 644, 646 passim.
- Bednarsh H, et al. Tuberculosis. what dental health care workers need to know. *J Mass Dent Soc.* 1998 Fall;47(3):25, 28-30.
- Bednarsh, H.; Connolly, J. Infection control practices of Massachusetts dentists 1986-1988. Massachusetts Department of Public Health, 1988.
- Bednarsh, H. Eklund, K.; Mills, S. Check your dental unit water IQ. *Access Vol. 10, No.9,* 1997.
- Beekman, S., Henderson, D.K. "Managing occupational risks in the dental office: HIV and the dental professional" *JADA* 1994; 125: July 847-852.
- Berkely, Z.T.; Luciano, W.J.; James, W.D. "Latex glove allergy-a survey of the U.S. Army Dental Corps." *JAMA* 1992; 268: 2695-7.
- Bernstein, D. et al. "In vitro virucidal effectiveness of a 0.12 percent chlorhexidine gluconate mouthrinse." *J Dent Res* 1990; 69: 874-6.
- Bettner MD, et al. Effect of ultrasonic cleaning on microorganisms. *Am J Dent.* 1998 Aug;11(4):185-8.
- Black KM HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc.* 1999 Sep;65(8):428, 461.
- Black KM HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc.* 1999 Sep;65(8):428, 461.
- Briner, W.W.; et al "Effect of chlorhexidine gluconate mouthrinse on plaque bacteria." *J Perio Res (Suppl)* 1986; 21: 44-52.
- Buckner, C.; Leithiser, R.; Walker, C.; Allison, J. "The changing epidemiology of tuberculosis and other mycobacterial infections in the United States: implications for the radiologist." *Am J Roetgenol* 1991; 156(2): 255-64.
- Burke FJ, et al. Autoclave performance and practitioner knowledge of autoclave use: a survey of selected UK practices. *Quintessence Int.* 1998 Apr;29(4):231-8.
- Calder, R.A.; Duclos, P.; Wilder, M.H.; Pryor, V.L.; Scheel, W.J. "Mycobacterium tuberculosis transmission in a health clinic." *Bull Int Union Tuberc Lung Dis* 1991; 66(2-3): 103.
- Canter, J. Mackey, K.; Good, L.S.; et al. "Cross-contamination potential with dental equipment." *Lancet* 1992; 340: 1252-4.

- Canter, J.; Mackey, K.; Good, L.S.; et al. "An outbreak of hepatitis B associate with jet injections in a weight reduction clinic." *Arch Intern Med* 1990; 150: 1923-7.
- Capilouto, E.I.; Cotton, D.; Weinstein, M.C. et al. "What is the dentist's occupational risk of becoming infected with hepatitis or the human immunodeficiency virus? *Am J Public Health* 1992; 82: 33-8.
- Castro, K.G.; Lifson, A.R.; White, C.R.; et al. "Investigations of AIDS patients with no previously identified risk factors." *JAMA* 1988; 259: 1330-42.
- CDA. CDA information bulletin: dental unit waterlines. Canadian Dental Association, Board of Governors. *Probe*. 1998 May-Jun;32(3):108-10.
- CDA. Dental unit waterlines spark controversy. *Tex Dent J*. 1998 Jun;115(6):78.
- CDC "Human T-lymphotropic virus type I screening in volunteer blood donors-United States, 1989." *MMWR* 1990; 39: 915, 921-4.
- CDC "Recommended infection control practices for dentistry." *MMWR* 1986; 35: 237-42.
- CDC, "Preliminary analysis: HIV serosurvey of orthopedic surgeons, 1991." *MMWR* 1991; 309-12.
- CDC. "Acquired immune deficiency syndrome (AIDS); precautions for clinical and laboratory staffs." *MMWR* 1982; 31: 577-80.
- CDC. "Human immunodeficiency virus infection in the United States: a review of current knowledge." *MMWR* 1987; 36: (S-6).
- CDC. "Possible transmission of human immunodeficiency virus to a patient during an invasive dental procedure." *MMWR* 1990; 39: 489-93.
- CDC. "Trends in human immunodeficiency virus infection among civilian applicants for military service-United States, October 1985-March 1988." *MMWR* 1988; 37: 677-9.
- CDC. "Update: acquired immunodeficiency syndrome and human immunodeficiency virus infection among health-care workers." *MMWR* 1988; 37: 229-34, 239.
- CDC. "Update: transmission of HIV infection during an invasive dental procedure-Florida." *MMWR* 1991; 40: 377-81.
- Centers for Disease Control "Guidelines for prevention of transmission of HIV and HBV to health care and public safety workers." *MMWR* 1989; 38: 1-37.
- Centers for Disease Control "Recommendations for preventing transmission of the human immunodeficiency virus and the hepatitis B virus during exposure-prone invasive procedures." *MMWR* 1991; 40(RR-8):1-9.
- Centers for Disease Control "Update: investigations of patients who have been treated by HIV-infected health-care workers." *MMWR* 1992; 41: 344-6.
- Centers for Disease Control "Update: transmission of HIV infection during an invasive dental procedure-Florida." *MMWR* 1991; 40: 377-81.
- Centers for Disease Control. "Facts about HIV/AIDS and health-care workers." *HIV/AIDS Surveillance Report*. February 1993.
- Centers for Disease Control. "Noscomial transmission of multidrug-resistant tuberculosis among HIV-infected persons-Florida and New York, 1988-1991." *JAMA* 1991; 266(11): 1483-5.
- Centers for Disease Control. "Possible transmission of human immunodeficiency virus to a patient during an invasive dental procedure." *MMWR* 1990; 39: 489-93.
- Centers for Disease Control. "Possible transmission of human immunodeficiency virus to a patient during an invasive dental procedure." *MMWR* 1990; 39: 489-93.
- Centers for Disease Control. "Prevention and control of tuberculosis in facilities providing long-term care to the elderly: recommendations of the Advisory Committee for Elimination of Tuberculosis." *MMWR* 1990; 39(mo. RR-10): 7-21.
- Centers for Disease Control. "Recommendations for preventing transmission of human immunodeficiency virus and hepatitis B virus to patients during exposure-prone invasive procedures." *MMWR* 1991; 40(RR8).

- Centers for Disease Control. "Recommendations for preventing transmission of Human Immunodeficiency virus and Hepatitis b virus to patients during exposure-prone invasive procedures." MMWR 1991; 40(RR-8): 1-9.
- Centers for Disease Control. "Recommendations for prevention of HIV in health-care settings." MMWR 1987; 36 (Supplement no. 2S): 1S-1 8S.
- Centers for Disease Control. "Recommended infection-control practices for dentistry, 1993" MMWR 1993; 41(RR-8): 1-12.
- Centers for Disease Control. "Update: investigations of patients who have been treated by HIV-infected health-care workers." MMWR 1992; 41: 344-6.
- Centers for Disease Control. "Update: investigations of persons treated by HIV infected health-care workers-United States." MMWR 1993; 42: 329-37.
- Centers for Disease Control. "Update: transmission of HIV infection during an invasive dental procedure-Florida." MMWR 1991; 40: 21-33.
- Centers for Disease Control. "Update: transmission of HIV infection during an invasive dental procedure-Florida." MMWR 1991; 40: 377-81.
- Centers of Disease Control. "The use of preventive therapy for tuberculosis in the United States: recommendations of the Advisory committee for the Elimination of Tuberculosis." MMWR 1990; 39(no. RR-8): 9-12.
- Chan RW Integrating the surgical and prosthodontic stages of implant therapy with a sterile implant position registration. Aust Dent J. 1999 Sep;44(3):200-6.
- Chan, C.; Lai, K.; Leung, J.; Lai, C. "T-lymphocyte activation in persons with active tuberculosis." Am Rev Respir Dis 1991; 144(2): 458-60.
- Chenoweth, N.; Mayberry, W.; et al. "Barrier techniques to infection: a national survey of pediatric dentists." Pediatr Dent 1990; 12(3): 147-51.
- Chong SL, et al. Effect of various infection-control methods for light-cure units on the cure of composite resins. Oper Dent. 1998 Mar-Apr;23(3):150-4.
- Choo, Q.; Kuo, G.; Weiner, A.; Overby, L.; Bradley, D.; Houghton, M. "Isolation of a cDNA clone derived from a blood-borne non-A, non-B viral hepatitis genome." Science 1989; 244: 359-62.
- Christensen GJ The high-speed handpiece dilemma. J Am Dent Assoc. 1999 Oct;130(10):1494-6.
- Christensen, R.; Robison, R.; Robinson, D.; Ploeger, B.; Leavitt, R. "Efficiency of 42 Brands of face masks and 2 face shields in preventing inhalation of airborne debris." Gen Dent 1991; 39: 414-21.
- Ciesielski, C.; Marianos, D.; Ou Cy, et al. "Transmission of human immunodeficiency virus in a dental practice." Ann Intern Med 1992; 116: 798-805.
- Ciesielski, C.; Marianos, D; Chin-yih, O.U.; Dumbaugh, R.; Witte, J. et al. "Transmission of human immunodeficiency virus in a dental practice." Ann Intern Med 1992; 116: 798-805.
- Cohen, L.A.; Grace, E.G. "Infection control practices related to treatment of AIDS patients." J Dent Pract Admin 1990:
- Cohen, L.A.; Grace, E.G.; Ward, M.A.; "Changes in public concern about transmission of AIDS from dentist to patient after CDC report." Clin Prev Dent 1992; 14(2) : 6-9.
- Collins, F.M. "Antituberculous immunity: new solutions to an old problem." Rev Infect Dis 1991; 13: 940-50.
- Corah, N.L.; O'Shea, R.M.; et al. "The dentist-patient relationship: perceived dentist behaviors that reduce patient anxiety and increase satisfaction." JADA 1988; 116(1): 73-6.
- Costerton, J.W.; Lewandowski, Z.; Cladwell, D.; Korber, D.; Lapin Scott, H. Microbial biofilms. Ann Rev of Microbiol 1995; 49: 711-745.
- Cottone, J. "Delta hepatitis: another concern for dentistry." JADA 1986; 112: 47-9.

- Cottone, J. "Recent developments in hepatitis: new virus, vaccine, and dosage recommendations." JADA 1990; 120 (5) : 501-7.
- Cottone, J.A.; Molinari, J.A. "State-of-the-art infection control in dentistry." JADA 1991; 123: 33-40.
- Council on Dental Materials, Instruments, and Equipment; Council on Dental Therapeutics; Council on Dental Research "Reactions to latex in health care setting: dealing with patient/worker concerns." JADA 1993; 124(12) 91-92.
- Crawford, J.J.; Broderius, C. "Control of cross-infection risks in the dental operator: prevention of water retraction by bur cooling spray systems." JADA 1988; 116: 685-7.
- Crosser, D.; Chipping, J. "Cross Infection Control in General Dental Practice." Quintessence Pub Comp LTD. London, U.K.; 1989.
- Croxson, T.S.; Mathur-Wagh, U.; Handwerker, S.; et al. "Prognostic significance of quantitative levels of HIV p24 ending capacity in HIV infection." AIDS Res Human Retroviruses 1990; 6: 455-63.
- Daar, E.S.; Moudgil, T.; Meyer, R.D.; Ho, D.D. "Transient high levels of viremia in patients with primary human immunodeficiency virus type I infection." N Engl J Med 1991; 324: 961-4.
- Dajani, A.S. et al. "Prevention of bacterial endocarditis-recommendations by the American Heart Association." JAMA 1990; 264: 2919-22.
- Daniel SJ Compliance with infection-control procedures and attitudes of oral health care providers toward patients with HIV/AIDS: a synthesis of the literature. J Dent Hyg. 1998 Summer;72(3):33-45. Review.
- Davis D, et al. Compliance with infection-control procedures among Illinois orthodontists. Am J Orthod Dentofacial Orthop. 1998 Jun;113(6):647-54.
- Davis, R.; McKiben, D.H.; et al. "Child reaction to protective garb at the first dental visit." Pediatr Dent 1993; 15(2): 86-7.
- Department of Labor, Occupational Safety and Health Administration. 29 CFR Part 1910.1030, "Occupational exposure to bloodborne pathogens; final rule." Fed Reg 1991; 56: 64004-182.
- Department of Licensing and Regulation, "Maryland occupational exposure to bloodborne pathogens." Maryland Register 1992; 19(6): 682-4.
- Dickinson, G.M.; Morhart, R.E.; Kilmas, N.G.; Bandea, C.I.; Laracuate, J.M.; et al. "Absence of HIV transmission from an infected dentist to his patients." JAMA 1993; 269: 1802-6.
- Dillard, S.F.; MacCollum, M.A. "Reports to FDA: Allergic reactions to latex containing medical devices." International latex Conference: Sensitivity to Latex in Medical devices. Program and Proceedings 1992: 23.
- Dimitrakopoulos, I.; Zouloumis, L.; Lazaridis, N.; Karakasis, D.; Trigonidis, G.; Sichteidis, L. "Primary tuberculosis of the oral cavity." Oral Surg Oral Med Oral Pathol 1991; 72: 712-5.
- Dooley, S.W. Jr.; Castro, K.G.; Hutton, M.D.; Mullan, R.J.; Polder, J.A.; Snider, D.E. Jr. "Guidelines for preventing the transmission of tuberculosis in health-care settings, with special focus on HIV-related issues." MMWR 1990; 39 (no. RR-17): 1-29.
- Editorial."Risk of HIV transmission during dental treatment." Lancet 1992; 340: 1259-60.
- Ehrnst, A.; Sonnerborg, A.; Bergdahl, S.; Strannegard, O. "Efficient isolation of HIV from plasma during different stages of HIV infection." J Med Virol 1988; 26: 23-32.
- Eisenach, K.; Sifford, M.; Cave, D.; Bates, J.; Crawford, J. "Detection of Mycobacterium tuberculosis in sputum samples using a polymerase chain reaction." Am Rev Respir Dis 1991; 144: 1160-3.
- Epstein, J.; Rea, G.; Sibau, L.; Sherlock, C. "Rotary dental instruments and the potential risk of transmission of infection: herpes simplex virus." JADA 1993; 124(12):55-59.

- Epstein, J.B.; Rea, G.; Sibau, L.; Sherlock, C. "Rotary dental instruments and the potential risk of transmission of infection: herpes simplex virus." *JADA* 1993; 124(12): 55-59.
- Favero, M.S.; bond, W.W. "Sterilization, disinfection and antisepsis in the hospital." In: Balows, A.; Hausler, W.J.; Herman, K.D.; et al, eds. Manual of Clinical Microbiology. Washington D.C.: American Society for Microbiology; 1991: 183-200.
- Field, E.A.; King, C.M. "Skin problems associated with routine wearing of protective gloves in dental practice." *Br Dent J* 1990; 169: 281.
- Fisher, A.A. "Management of allergic contact dermatitis due to rubber gloves in health and hospital personnel." *Cutis* 1991; 47: 301-2.
- Fitzgibbon, E.J.; Barzokas, C.A.; Martin, M.V.; Gibson, M.F.; Graham, R. "The source, frequency and extent of bacterial contamination of dental unit water systems." *Br Dent J* 1984; 157: 98-101.
- Flynn, N.M.; Pollet, S.M.; Van Horne, J.R.; Elvebakk, R.; Harper, S.D.; Carlson, J.R. "Absence of HIV antibody among dental professionals exposed to infected patients." *West J Med* 1987; 146: 439-42.
- Food and Drug Administration, final rule (21 CFR Part 880). "Medical devices: patient examination gloves." *Fed Reg* 1989; 54: 1602-4.
- Foti, S. "Death shows need for infection control." *AGD Impact* 1989; 17: 12.
- Fox, P.C.; Wolff, A.; Yeh, C-K.; Atkinson, J.C.; Baum, B.J. "Saliva inhibits HIV-1 infectivity." *JADA* 1988; 116: 635-7.
- Fox, P.C.; Wolff, A.; Yeh, C-K.; Atkinson, J.C.; Baum, B.J. "Salivary inhibition of HIV-1 infectivity: functional properties and distribution in men, women, and children." *JADA* 1989; 118: 709-11.
- Friedland, G.; Kahl, P.; Saltzman, B.; et al. "Additional evidence for lack of transmission of HIV infection by close interpersonal (casual) contact." *AIDS* 1990; 4: 639-44.
- Gallo R.C.; Salahuddin, S.Z.; Popovic, M; Shearer, B.M.; Kaplan, M "Frequent isolation and characterization of cytopathic retroviruses (HTLV-III) from patients with AIDS and at risk for AIDS." *Science* 1984; 224: 506-8.
- Gelfand, D.W. "Barium enemas, latex balloons, and anaphylactic reactions." *Am J Roetgenol* 1991; 156(1): 1-2.
- Gerety, R.; Ellis, R. "Plasma-derived vs. recombinant hepatitis B vaccine." *JAMA* 1987; 258: 1474.
- Gerety, R.; Ellis, R.; Zajac, B.; West, D. "Two superb vaccines against hepatitis B in Mexican standoff." *JAMA* 1988; 259: 2403-4.
- Gershon, R.R.M.; Vlahov,D.; Melson, K.E. "The risk of transmission of HIV-1 through nonpercutaneous, non-sexual modes-a review." *AIDS* 1990; 4: 645-50.
- Gerver, A.C.; Jorg, W.; Zibinden, S.; Seger, R.A.; Dangel, P.H. "Severe intraoperative anaphylaxis to surgical gloves: latex allergy, an unfamiliar condition." *Anesthesiology* 1989; 71(5): 800-2.
- Gildersleeve, J.; Hardage, J.; Young, J. "Dental fiberoptic handpieces: recommendations for proper use." *JADA* 1987; 114(2): 200-3.
- Gooch, B.; Mariano, D.; Ciesielski, C. Dumbaugh, R.; Lasch, A.; Jaffe, G.; Bond, E.; Lockwood, S.; Cleveland, J. "Lack of evidence for patient to patient transmission of HIV in a dental practice." *JADA* 1993; 124 (1): 38-44.
- Goodman, R.A.; Solomon, S.L. "Transmission of infectious diseases in outpatient health care settings." *JAMA* 1991; 265: 2377-81.
- Goto, Y.; Yeh, C-K.; Notkins, A.L.; Prabhadar, B.S. "Detection of proviral sequences in saliva of patients infected with human immunodeficiency virus type 1." *AIDS Res Human Retroviruses* 1991; 7: 343-7.

- Grace, E.G.; Cohen, L.A.; Ward, M.A. "Patient's perceptions related to the use of infection control procedures." *Clin Prev Dent* 1991; 13(3): 30-3.
- Griedland, G.H.; Klein R.S. "Transmission of the human immunodeficiency virus." *N Engl J Med* 1987; 317: 1125-35.
- Gruninger, S.; Siew, C.; Chang, S-B.; Clayton, R.; Leete, J; Hojvat, S.; Verrusio, A.; Neidle, E. "Human immunodeficiency virus type I infection among dentists." *JADA* 1992; 123 (3): 57-64.
- Gruninger, S.E.; Siew, C.; Chang, S-B; et al. "Human immunodeficiency virus type 1 infection among dentists." *JADA* 1992; 123(3): 57-64.
- Gurgan S, et al. Effect of disinfectant application methods on the bond strength of composite to dentin. *J Oral Rehabil.* 1999 Oct;26(10):836-40.
- Hardie J HIV/AIDS and infection control practices in dentistry: a rebuttal. *J Can Dent Assoc.* 1999 Jun;65(6):337-40.
- Hardie J Infection control practices of oral specialists and general dental practitioners. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1998 Dec;86(6):631-2.
- Hardie J The infection control practices of general dental practitioners. *Infect Control Hosp Epidemiol.* 1998 Dec;19(12):888-9.
- Hart PD Regulatory requirements for effective management of the exposure incident. *Dent Assist.* 1998 Nov-Dec;67(6):12-4, 44.
- Hastreiter, R.J.; Molinari, J.; et al. "Effectiveness of Minnesota dental office sterilization procedures 1989-1990." *Minn. Dent. Health Dept;* 1991.
- Hastreiter, R.J.; Roesch, M.H.; et al. "Dental health care workers' response to the HIV epidemic." *Am J Dent* 1992; 5(3).
- Hill, A.; Somasundaram. P.; Brustein, S.; et al. "Disseminated tuberculosis in the Acquired Immunodeficiency Syndrome era." *Am Rev Respir Dis* 1991; 144: 1164-70.
- Ho, D.D.; Byington, R.E.; Schooley, R.T.; Flynn, T.; Rota, T.R.; Hirsch, M.S. "Infrequency of isolation of HTLV-III virus from saliva in AIDS." *N Engl J Med* 1985; 313: 1606.
- Ho, D.D.; Moudgil, I.; Alam, M. "Quantification of human immunodeficiency virus type I in the blood of infected persons." *N Engl J Med* 1989; 321: 1621-5.
- Hoff, D.A.; Sampieri, P.A.; et al. "Consumer's awareness of barrier protection in dentistry." *JDH* 1990; 64(9): 446-8.
- Hollinger, F. "Hepatitis B vaccines-to switch or not to switch." *JAMA* 1987; 257: 234-6.
- Hoofnagle, J. "Type B hepatitis. Virology, serology, and clinical course." *Semin Liver Dis* 1981; 1: 7-14.
- Howard, W.W. "Sterilize your handpieces." *AGD Impact* 1991; 19(11):3.
- Hughes C Are your instruments sterile? *Tex Dent J.* 1998 Oct;115(10):36-7.
- Hughes CA Investigating sterilizer test failures. *Tex Dent J.* 1998 Apr;115(4):40-1.
- Hutin YJ, et al. Injections given in healthcare settings as a major source of acute hepatitis B in Moldova. *Int J Epidemiol.* 1999 Aug;28(4):782-6.
- Hutton, M.D.; Stead, W.W.; Cauthen, G.M.; Bloch, A.B.; Ewing, W.M. "Noscomial transmission of tuberculosis associated with a draining abscess." *J Infect Dis* 1990; 16(2). 286-95.
- Indiana Public Law 123-1988. "Dental on-site compliance review checklist." Indiana State Board of Health, Dental Health Division. Indianapolis, Indiana: February 1, 1990.
- Jacob, J.A. "Latex shock triggers allergy alert." *ADA News* 1991; April 22:1.
- Jakush, J. "Questions to follow TV shows." *ADA News* 1992; June 22: 2.
- Jereb, J.A.; Kelly, G.D.; Dooley, S.W. Jr.; Cauthen, G.M.; Snider, D.E. Jr. "Tuberculosis morbidity in the United States: final data q990, MMWR CDC Surveill Summ 1991; 40(no.SS-3): 23-7.
- Johnson, G.K.; Robinson, W.S.; "Human immunodeficiency virus-1 (HIV-1) in the vapors of surgical power instruments." *J Med Virol* 1991; 33: 47-50.

- Johnson, M.; Chaisson, R. "Tuberculosis and HIV disease." *AIDS Clin Rev* 1991; 109-26.
- Jordan, W. Videotape: "Latex reactions: fact and fiction: a discussion with dermatologist Dr. William Jordon." Valencia, Calif.: Baxter Healthcare Corp.; 1991.
- Kantor, H.S.; Poblete, R.; Pusateri, S.L. "Noscomial transmission of tuberculosis from unsuspected disease." *Am J Med* 1988; 84(5): 833-8.
- Karon, J.M.; Dondero, T.J. "HIV prevalence estimates and AIDS case projections for the United States: report based upon a workshop." *MMWR* 1990; 39: (RR-16)
- Kearney P HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc.* 1999 Sep;65(8):461.
- Kearney P HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc.* 1999 Sep;65(8):461.
- Kelstrup, J. et al. Microbial aggregate contamination of water lines in dental equipment and its control. *Acta Path Microbiol Scand B.* 1996; 85: 177-183.
- Kennedy JE, et al. Exposures to blood and body fluids among dental school-based dental health care workers. *J Dent Educ.* 1999 Jun;63(6):464-9.
- Kent, G.P.; Brondum, J.; Keenlyside, R.A.; LaFazia, L.M.; Scott, H.D. "A large outbreak of acupuncture-associated hepatitis B." *Am J Epidemiol* 1988.
- Klein, R.C.; Party, E.; Gershey, E.L. "Research report: virus penetration of examination gloves." *biotechniques* 1990; 9(2) (AU: Pages.)
- Klein, R.S.; Phelan, J.A.; Freeman, K.; et al. "Low occupational risk of human immunodeficiency virus infection among dental professionals." *N Engl J Med* 1988; 318: 86-90.
- Kramer, G.; Modilevsky, T.; Waliandy, A.; Leedom, J.; Barnes, P. "Delayed diagnosis of tuberculosis in patients with human immunodeficiency virus infection." *Am J Med* 1990; 89: 451-6.
- Kuehne, J.C.; Cohen, M.E.; Monroe, S.B. "Performance and durability of autoclavable high-speed dental handpieces." *Naval Dental Research Institute PR* 1992 May; 92-103.
- Larsen, P.E. "The effect of a chlorhexidine rinse on the incidence of alveolar osteitis following the surgical removal of impacted mandibular third molars." *J Oral Maxillofac Surg* 1991; 49: 923-7.
- Laxenaire, M.C. "Spina bifida: a terrain favorable to allergy, to latex, and to ethylene oxide." (editorial)(Fre). *Cah Anesthesiol* 1990; 38(3): 147-8.
- Leonard DL, et al. Performance of high-speed dental handpieces subjected to simulated clinical use and sterilization. *J Am Dent Assoc.* 1999 Sep;130(9):1301-11.
- Leonard DL, et al. Performance of high-speed dental handpieces subjected to simulated clinical use and sterilization. *J Am Dent Assoc.* 1999 Sep;130(9):1301-11.
- Leontiou AP, et al. Disinfection of dental diamond burs contaminated with hepatitis B virus. *J Prosthet Dent.* 1999 Sep;82(3):332-5.
- Levy, J.A. Greenspan, D. "HIV in saliva." *Lancet* 1988; 2: 1248.
- Lewis, D.L.; Arens, M.; Appleton, S.S. et al. "Cross-contamination potential with dental equipment." *Lancet* 1992; 340: 1252-4.
- Lewis, D.L.; Boe, R.K. "Cross-infection risks associated with current procedures for using high-speed dental handpieces." *J Clin Microbiol* 1992; 30(2): 401-6.
- Lewis, D.L.; et al. "Cross-contamination potential with dental equipment." *Lancet* 1992; 340(11): 1252-4.
- Lifson, A.R. "Do alternate modes for transmission of human immunodeficiency virus exist?" *JAMA* 1988; 4: 164-70.
- Lin JJ, et al. Disinfection of denture base acrylic resin. *J Prosthet Dent.* 1999 Feb;81(2):202-6.
- Lister, J. "On the antiseptic principle of the practice of surgery." *Br Med J* (1867; Sept 21).

- Lodi G, et al. Hepatitis G virus: relevance to oral health care. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999 Nov;88(5):568-72. Review.
- Mahonen K, et al. The effect of prosthesis disinfection on salivary microbial levels. *J Oral Rehabil.* 1998 Apr;25(4):304-10.
- Malasky, C.; Jordan, T.; Potulski, F.; Reichman, L.B. "Occupational tuberculosis infections among pulmonary physicians in training." *Am Rev Respir Dis* 1990; 142(3): 505-.
- Mandel, I.D. "Chemotherapeutic agents for controlling plaque and gingivitis." *J Clin Periodontal* 1988; 15: 488-98.
- Mangura, B.; Mangura, C.; Reichman, L.; "Tuberculosis and the atypical pneumonia syndrome." *Clin Chest Med* 1991; 12(2): 349-62.
- Mapoli, V.M.; McGowan, J.E. "How much blood is in a needlestick?" *J Infect Dis* 1987; 55: 828.
- Marais JT, et al. Electro-chemically activated water in dental unit water lines. *Br Dent J.* 1999 Aug 14;187(3):154-8.
- March, P.J. "An allergic reaction to latex rubber gloves." *JADA* 1988; 117: 590-1.
- Martin, M.V.; "The significance of the bacterial contamination of dental unit water systems." *Br Kent J* 1987; 163: 152-4
- Maso, M.J.; Goldberg, D.J. "Contact dermatoses from disposable gloves use: a review." *J Am Acad Dermatol (part 1)* 1990; 23(4): 733-7.
- Mayo, J.A.; Oertling K.M.; Andrew, S.C. "Bacterial biofilm: a source of contamination in dental air-water syringes." *Clin Prevent Dent* 1990; 12(2): 13-20.
- McCarthy GM, et al. Compliance with recommended infection control procedures among Canadian dentists: results of a national survey. *Am J Infect Control.* 1999 Oct;27(5):377-84.
- McCarthy GM, et al. HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc.* 1999 Sep;65(8):427-8.
- McCarthy GM, et al. HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc.* 1999 Sep;65(8):426-7.
- McCarthy GM, et al. Infection control practices across Canada: do dentists follow the recommendations? *J Can Dent Assoc.* 1999 Oct;65(9):506-11.
- McCarthy GM, et al. The role of age- and population-based differences in the attitudes, knowledge and infection control practices of Canadian dentists. *Community Dent Oral Epidemiol.* 1999 Aug;27(4):298-304.
- McDonald, M.M.; Hamilton, J.D.; Durack, D.T.; "Hepatitis B surface antigen could harbor the infective agent of AIDS." *Lancet* 1983; 2:882-4.
- Meiller TF, et al. Dental unit waterlines: biofilms, disinfection and recurrence. *J Am Dent Assoc.* 1999 Jan;130(1):65-72.
- Merchant, V. A. "Herpesviruses and other microorganisms of concern in dentistry." *Dent Clin North Am* 1991; 35: 283-98.
- Michaelis, B.A.; Levy, J.A. "Recovery of human immunodeficiency virus from serum." *JAMA* 1987; 257: 1327.
- Michigan Department of Public Health. "Michigan recommendations on HBV-infected and/or HIV infected health care workers." September 1992.
- Michigan Department of Public Health. "Michigan recommendations on HIV-infected health care workers." October 1991.
- Miller, C.; Sheldrake, M. "Sterilizing the internal lines of high-speed dental handpieces." *Transmissions* 1992; 7(2):4.
- Miller, C.H. "Cleaning, Sterilization and disinfection: basics of microbial killing for infection control." *JADA* 1993; 124(1): 48-56.

- Miller, C.H. "Cleaning, sterilization and disinfection: basics of microbial killing for infection control." JADA 1993; 124(1): 48-56.
- Miller, C.H. "Sterilization and disinfection: what every dentist needs to know." JADA 1992; 123(3): 44-54.
- Miller, C.H. "Sterilization: disciplined microbial control." Dent Clin North Am 1991; 35: 335-9.
- Miller, C.H. "Water contamination: Scope, importance, and possible solutions for the problem." OSAP Conference Proceedings. Sixth Annual Conference, June 1991, Indianapolis.
- Miller, C.H.; Hardwick, L.M. "Ultrasonic cleaning of dental instruments in cassettes." Gen Dent 1988; 36: 31-6.
- Miller, C.H.; Palenik, C.J. "Sterilization, disinfection and asepsis in dentistry." In Disinfection, Sterilization and Preservation (SS Block, ed.) Philadelphia; Lea & Febiger; 1991: 676-94.
- Miller, C.H.; Palenik, C.J. Infection Control and Management of Hazardous Materials for the Dental Team. Mosby 1994.
- Mills, S.E.; Kuehne, J.C.; Bradley, D.V. "Bacteriological analysis of high-speed handpiece turbines." JADA 1993; 124(1): 59-62.
- Mills, S.E.; Lauderdale, P.W.; Mayhew, R.B. "Reduction of microbial contamination in dental units with povidone iodine 10 percent." JADA 1986; 113: 280-4.
- Mize SB, et al. Effect of sterilization on cyclic fatigue of rotary nickel-titanium endodontic instruments. J Endod. 1998 Dec;24(12):843-7.
- Molinari JA Dental infection control at the year 2000: accomplishment recognized. J Am Dent Assoc. 1999 Sep;130(9):1291-8. Review.
- Molinari, G.; Molinari, J. "Kids and infection control: reactions to personal protective equipment in the office." Dent Teamwork Jan-Feb 1994:17-19.
- Molinari, G.E. "Pediatric dental patients' perceptions of personal protective equipment." CDA J 1992; 20 (10): 39-42.
- Molinari, J. "Practical infection control for the 1990's: applying science to government regulations." JADA September 1994; 125: 1189-1197.
- Molinari, J.A.; Gleason, M.J.; Cottone, J.A.; et al. "Cleaning and disinfectant properties of dental surface disinfectants." JADA 1988; 117: 179-82.
- Molinari, J.A.; Molinari, G.E. "Is mouthrinsing before dental procedures worthwhile?" JADA 1992; 123(3): 75-80.
- Moneret, V.D.; Laxenaire, M.C.; Bavoux, F. "Allergic shock to latex and ethylene oxide during surgery for spina bifida." Anesthesiology 1990; 73(3): 556-8.
- Moneret, V.D.; Mata, E.; Gueant, J.L.; Turgeman, D.; Laxenaire, M.C. "High risk of anaphylactic shock during surgery for spina bifida (letter)." Lancet 1990; 335(8693): 865-6.
- Moore, B.E. "HIV recovery from saliva before and after dental treatment inhibitors may have critical role in viral activation." JADA Vol 124 Oct 93: 73
- Morales, C.; Bascomba, A.; Carreira, J.; Sastre, A. "Anaphylaxis produced by rubber glove contact. Case reports and immunological identification of the antigens involved." Clin Exp Allergy 1989; 19(4): 425-30.
- Mosciciki, R.A.; Sockin, S.M.; Corsello, M.D.; Ostro, M.G.; Bloch, K.J. "Anaphylaxis during induction of general anesthesia; subsequent evaluation and management." J Allergy Clin Immunol 1990; 86(3); 325-32.
- Murray, J.F.; Madel, J.A. Textbook of Respiratory Medicine. Philadelphia: Saunders; 1988; 860-99.
- Muzzin KB, et al. Assessing the clinical effectiveness of an aerosol reduction device for the air polisher. J Am Dent Assoc. 1999 Sep;130(9):1354-9.

- Nadler, J.; Berger, J.; Nord, J.; Cofsky, R.; Saxena, M. "Amoxicillin clavulanic acid or treating drug-resistant Mycobacterium tuberculosis." *Chest* 1991; 99(4): 1025-6.
- New York State Department of Health Policy Statement and Guidelines. "Healthcare facilities and HIV-infected medical personnel." January 1991.
- Noble, M.A.; Gibson, G.B.; Mathias, R.G.; Epstein, J.B. "Hepatitis B and HIV infections control procedures." *J Can Dent Assoc* 1991; 57: 55-8.
- Noro A, et al. The effectiveness of the "Clean-Area-System" for infection control in the dental clinic. *Bull Tokyo Dent Coll.* 1998 Feb;39(1):15-24.
- Nutt S, et al. The truth about HIV/AIDS and infection control practices in dentistry. *J Can Dent Assoc.* 1999 Jun;65(6):334-6.
- Office Sterilization and Asepsis Procedures Research Foundation. "Infection control guidelines." Denver: 1991.
- O'Keefe J Breaking down old barriers. *J Can Dent Assoc.* 1999 Oct;65(9):479.
- Okuda K, et al. The efficacy of antimicrobial mouth rinses in oral health care. *Bull Tokyo Dent Coll.* 1998 Feb;39(1):7-14. Review.
- OSAP. Infection control guidelines. Denver: Office Sterilization and Asepsis Procedures Research Foundation; 1992.
- Ou Cy, Ciesielski, C.A.; Myers, G. et al. "Molecular epidemiology of HIV transmission in a dental practice." *Science* 1992; 256: 1165-71.
- Ownby, D.R.; Tomlanovich, M.; Simmons, N.; McCullough, J. "Anaphylaxis associated with latex allergy during barium enema examinations." *Am J Roetgenol* 1991; 156(5): 903-8.
- Park, J.B.; Park, N.H. "Effect of chlorhexidine on the in vitro and in vivo herpes simplex virus infection." *Oral Surg Oral Med Oral Pathol* 1989; 67: 149-53.
- Pecquet, C.; Leynadier, F.; Dry, J. "Contact urticaria and anaphylaxis to natural latex." *J Am Acad Dermatol* 1990; 22(4): 631-3.
- Peri, T.M.; Haugen, T.H.; Pfaller, A.D.; et al. "Transmission of the Herpes simplex virus type 1 infection in an intensive care unit." *ann Intern Med* 1992; 117: 584-6.
- Perillo, LR. "Screening of health care workers before hepatitis B vaccination: More questions than answers." *An Intern Med* 1985; 103: 793-4.
- Polish, L.B.; Shapiro, C.N.; Bauer, F.; et al. "Noscomial transmission of hepatitis B virus associated with the use of a spring-loaded finger-stick device." *N Engl J Med* 1992; 36: 721-5.
- Puttaiah, R.; Mills, S.; Sherman, L.; Plamadon, T.; Thrash, J.; Cottone, J. A multi-group longitudinal study of dental unit waterline contamination. *J Dent Res* 1996; 75: 414.
- Rademaker, M.; Forsyth, A. "Allergic reactions to rubber condoms." *Genitourin Med* 1989; 65(3): 194-5.
- Rankin, K.V.; Jones, D.; Rees, T.D. "Latex glove reactions found in a dental school." *JADA* 1993;124: 67-71.
- Rapisarda E, et al. Effect of sterilization on the cutting efficiency of rotary nickel-titanium endodontic files. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999 Sep;88(3):343-7.
- Reingold, A.L.; Kane, M.A.; et al. "Protective devices to prevent transmission of hepatitis B virus to oral surgeons." *JAM A* 1988; 259 (17).
- Renson T Infectious diseases: their impact on dentistry. *Prim Dent Care.* 1998 Apr;5(2):45.
- Rivera-Hidalgo F, et al. Aerosol and splatter production by focused spray and standard ultrasonic inserts. *J Periodontol.* 1999 May;70(5):473-7.
- Rogers, A.S.; Frogatt, J.W. III; Townsend, T.; Gordon, T.; Leigh Brown A.J.; et al. "Investigation of potential HIV transmission to the patients of an HIV-infected surgeon." *JAMA* 1993; 269: 1795-801.

- Rogers, A.S.; Frogatt, J.W. III; Townsend, T.; Gordon, T.; Leigh Brown A.J.; et al. "Investigation of potential HIV transmission to the patients of an HIV-infected surgeon." *JAMA* 1993; 269: 1795-801.
- Rogers, D.E.; Gellin, B.F. "The bright spot about AIDS: it is very tough to catch." *AIDS* 1990; 4: 695-6.
- Rowe, M. "Glove use in dentistry part 1: preventing glove damage to hands." *J Mich Dent Assoc* 1990; 72: 147.
- Runnells. R.R. "Handpiece sterilization ????" (Editorial). *Control* 1992; 7(6):1.
- Russo, G; La Croix. S.J. "A second look at the cost of mandatory human immunodeficiency virus and hepatitis B virus testing for healthcare workers performing invasive procedures." *Infect Control Hosp Epidemiol* 1992; 13: 107-10.
- Scheid, R.C.; Kim, C.K.; Bright, J.S.; Whitely, M.S.; Rosen, S. "Reduction of microbes in handpieces by flushing before use." *JADA* 1982; 105: 658-60.
- Schiff, E.R.; de Medina, M.D.; Kline, S.N.; et al. "Veterans Administration cooperative study on hepatitis and dentistry." *JADA* 1986; 113: 390-96.
- Schwartz, E.E.; Glick, S.N.; Foggs, M.B.; Silverstein, G.S. "Hypersensitivity reactions after barium enema examination." *Am J Roentgenol* 1984; 104: 103-4.
- Shafer, R.; Chirgwin, K.; Glatt, A.; Dahdouh, M.; Landesman, S.; Suster, B. "HIV prevalence, immunosuppression, and drug resistance in patients with tuberculosis in an area endemic for AIDS." *AIDS* 1991; 5: 399-405.
- Shaw, F.E.; Barrett, C.L.; Hamm, R. et al. "Lethal outbreak of hepatitis B in a dental practice." *JAMA* 1986; 255: 3260-4.
- Shearer, B. Biofilm in the dental office. *JADA* 1996; 127: 181-189.
- Shields JW Infection control practices of general dental practitioners. *Infect Control Hosp Epidemiol*. 1999 Jun;20(6):389.
- Siew, C.; Gruninger, S.; Mitchell, E.; Burrell, K. "Survey of hepatitis B exposure and vaccination in volunteer dentist." *JADA* 1987; 114: 457.
- Siffork, M.; Bates, J. "Host determinants of susceptibility to *Mycobacterium tuberculosis*." *Semin Respir Infect* 1991; 6(1): 44-50.
- Simonsen, K.F.; Schachtele, C.F.; Joos, R.W. "An evaluation of sterilization by autoclaves in dental offices (Abstract 1236)." *J Dent Res* 1979; 58: 400.
- Skaug N, et al. Biological monitoring of sterilizers and sterilization failures in Norwegian dental offices in 1985 and 1996. *Acta Odontol Scand*. 1999 Aug;57(4):175-80.
- Slater, J.E.; Mostello, L.A.; Shaer, C.; Honsinger, R.W. "Type I hypersensitivity to rubber." *Ann Allergy* 1990; 65(5): 411-4.
- Smart, E.R.; Macleod, R.I.; Lawrence, C.M. "Allergic reactions to rubber gloves in dental patients: report of three cases." *Br Dent J* 1992; 172: 445-7.
- Smith AJ, et al. Water, water everywhere but not a drop to drink? *Br Dent J*. 1999 Jan 9;186(1):12-4. Review.
- Smith, J.L.; Maynard, J.E.; Berquist, K.R.; Doto, I.; Webster, H.; Sheller, Sondheimer, J.M.; Pearlman, D.S.; Bailey, W.C. "Systemic anaphylaxis during rectal manometry with a latex balloon." *Am J Gastroenterol* 1989; 84(8): 97a5-7.
- Snyder, S.,Settle, S. "The rise in latex allergy: implications for the dentist" *JADA* August 1994: 125:1089-1097.
- Spaner, D.; Dolovich, J.; Tario, S. Sussman, G.; Buttoo, K. "Hypersensitivity to natural latex." *J Allergy Clin Immunol* 1989; 83(6): 1135-7.
- Stead, W.; Senner, J.; Reddick, W.; Lofgren, J. "Racial differences in susceptibility to infection by *Mycobacterium tuberculosis*." *N Engl J Med* 1990; 322: 422-7.
- Stewart R HIV/AIDS and infection control: the debate continues. *J Can Dent Assoc*. 1999 Sep;65(8):427.

- Stewart, J. "Glove use in dentistry part III: professional management of allergic hypersensitivity reactions to gloves." *J Mich Dent Assoc* 1990; 72: 149-50.
- Summers, C. et al "Practical infection control in oral health surveys and screenings" *JADA* September 1994; 125: 1213-1217
- Suzuki T, et al. Influence of ozone on oxidation of dental alloys. *Int J Prosthodont.* 1999 Mar-Apr;12(2):179-83.
- Swartz, J.; Braude, B.M.; Gilmour, R.F.; Shandling, B.; Gold, M. "Intraoperative anaphylaxis to latex." *Canadian J Anaesth* 1990; 37(5): 589-92.
- Swenson, P.D. "Hepatitis viruses. In: Balows, A.; Hausler, W.J.; Herrman, K.D.; et al. eds. Manual of Clinical Microbiology. Washington, D.C.: American Society for Microbiology; 1991: 959-83.
- Takla GS, et al. The effectiveness of an elastomeric module dispenser in cross-infection control. *J Clin Orthod.* 1998 Dec;32(12):721-6.
- Taylor, J.S.; Fisher A. "Contact dermatitis." 3rd. ed. Philadelphia; Lea & Febiger; 1986: 604-30.
- Terezhalmay GT, et al. Today's minimal requirements for a practical dental office infection control and exposure control program. *Dent Clin North Am.* 1998 Oct;42(4):629-42.
- Turjanmaa, K "Incidence of immediate allergy to latex gloves in hospital personnel." *Contact Dermatitis* 1987; 17: 270-5.
- Turjanmaa, K.; Laurila, K.; Malden-Kilyuned, S.; Reyunala, T. "Rubber contact urticaria." *Contact Dermatitis* 1988
- Turjanmaa, K.; Reunala, T. "Condoms as a source of latex allergen and cause of contact urticaria." *Contact Dermatitis* 1989; 20(5): 360-4.
- Turnock, B.J.; Kelly, C.J. "Mandatory premarital testing for human immunodeficiency virus: the Illinois experience." *JAMA* 1989; 261: 3415-8.
- U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Food and Drug Administration. "Infection control file: practical infection in the dental office." Atlanta/Rockville; 1989.
- U.S. Food and Drug Administration. "Allergic reactions to latex-containing medical devices." FDA Medical Alert 1991. MDA91-1, March 29.
- Van der Meeren, H.L.M.; Van Erp, P.kE.J. "Life-threatening contact from glove powder." *Contact Dermatitis* 1986; 14: 190-1.
- Veksler, A.E.; Kayrouz, G.A.; Newman, M.G. "Reduction of salivary bacteria by preprocedural rinses with chlorhexidine 0.12%." *J Periodontol* 1991; 62: 649-51.
- Verhagen C Environmental surface disinfectants. *J Mich Dent Assoc.* 1998 Apr-May;80(4):2-6.
- Verhagen C Hand asepsis--it's important. *J Mich Dent Assoc.* 1998 Sep;80(7):20-1, 53.
- von Reyn, C.F.; Gilbert, T.T.; Shaw, F.E. Jr; Parsonnet, K.C.; Abramson, J.E.; et al. "Absence of HIV transmission from an infected orthopedic surgeon." *JAMA* 1993; 269: 1807-11.
- Walker DR, et al. Disinfection/sterilization in U.S. dental practices--practice behavior and attitudes. *Gen Dent.* 1998 May-Jun;46(3):290-3.
- Watson, C.M.; Whitehouse, R.L.S. "Possibility of cross-contamination between dental patients by means of the saliva ejector." *JADA* 1993; 124(4): 77-80.
- Webb BC, et al. Effectiveness of two methods of denture sterilization. *J Oral Rehabil.* 1998 Jun;25(6):416-23.
- Weeks, C.; Briner, W.; Rebitski, G.; Vick, V.; Feller, M. "Immediate and prolonged effect of 0.12 percent chlorhexidine on salivary bacteria." *J Dent Res* 1988; 67:326.
- Wentzell, J.M.; Robinson, J.K.; Wentzell, J.M. Jr.; Schwartz, D.E.; Carlson, S.E. "Physical properties of aerosols produced by dermabrasion." *Arch Dermatol* 1989; 125: 1637-43.

- Williams, H. et al "Assessing microbial contamination in clean water dental units and compliance with disinfection protocol." JADA September 1994; 125:1205-1211.
- Williams, J.F.; Johnston, A.M.; Johnson, B.; Huntigton, M.K.; and Mackenzie, C.D. "Microbial contamination of dental unit waterlines: prevalence, intensity and microbiological characteristics." JADA Vol 124, Oct 93: 59-65.
- Yared GM, et al. Cyclic fatigue of Profile rotary instruments after simulated clinical use. Int Endod J. 1999 Mar;32(2):115-9.
- Yoshikawa, T. "Tuberculosis in aging adults." J Am Geriat Soc 1992; 40: 178-87.
- Young JM Aerosol and vapor control in the dental treatment room. Pract Periodontics Aesthet Dent. 1999 Apr;11(3):343-5.
- Young, J. "Dental air-powered handpieces: selection, use and sterilization." Compend Contin Educ Dent 1993; 14(3): 358-68.
- Young, J. "Dental handpieces and the clinician choosing, caring for high- and low-speed systems." Dental Teamwork 1994; 7(2): 33-36.
- Zinman, E.J. "Dentists and the law." Dent Manage 1991; 1: 46-7.

CDC Guidelines for 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 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 \geq 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 ongoing service to the profession and the public.

Copyright © 1995 American Dental Association. Reprinted by permission of ADA Publishing Co., Inc.

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.

Copyright © 1996 American Dental Association. Reprinted by permission of ADA Publishing Co., Inc.

Internet Resources

- ALERT: Allergy to Latex Education and Resource Team, Inc. <http://www.latexallergyresources.org/>
- Centers for Disease Control and Prevention <http://www.cdc.gov/>
- Environmental Protection Agency <http://www.epa.gov/>
- United States Food and Drug Administration <http://www.fda.gov>
- HIV Dent <http://www.hivdent.org>
- International Health Care Worker Safety Center at the University of Virginia <http://www.healthsystem.virginia.edu/internet/epinet/>
- Medscape Infectious Diseases <http://www.medscape.com/>
- National Institute of Health <http://www.nih.gov/>
OR: <http://www.fedworld.gov/>
- National Library of Medicine <http://www.nlm.nih.gov/> (National Institute of Health)
- OSAP (Office Safety & Asepsis Procedures Research Foundation): Home Page <http://www.osap.org/>
- World Health Organization <http://www.who.org>

- 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_adapt1005.html
- ⁱⁱⁱ Centers for Disease Control and Prevention Guidelines for preventing the transmission of Mycobacterium tuberculosis in Health Care Facilities, 1994.
- ^{iv} ADA, CDC.
- ^v OSAP Dental Infection Control and Office Safety Resource Guide 1999.
- ^{vi} <http://www.dir.ca.gov/title8/5193.html>
- ^{vii} Molinari, J.A.; Molinari, G.E. "Is mouthrinsing before dental procedures worthwhile?" JADA 1992; 123(3): 75-80.
- ^{viii} OSAP Monthly Focus #6, 1998
- ^{ix} Watson, C.M.; Whitehouse, R.L.S. "Possibility of cross-contamination between dental patients by means of the saliva ejector." JADA 1993; 124(4): 77-80.
- ^x Santiago, J et al Microbial contamination of dental unit waterlines: Short and long term effects of flushing. Gen Dent 1994. 42(6): 528-544.
- ^{xi} Bednarsh, H. et al Check your dental unit water IQ. Access Vol. 10, No.9, 1997
- ^{xii} Donn, J. Jury rejects man's claim he contracted AIDS from dentist. Feb. 17, 1996. Patriot Ledger
- ^{xiii} Associated Press "High Court to hear HIV bias case" New York Times 11/25/97
- ^{xiv} Greenhouse, Linda "Justices, 6-3, Bar Veto of Line Items in Bills; See H.I.V. as Disability" New York Times 6/26/98 P. A1.
- ^{xv} ADA Statement on Bragdon Case Brief. www.ada.org