Go Green, Go Online to take your course

This course has been made possible through an unrestricted educational grant. The cost of this CE course is $59.00 for 4 CE credits.

Cancellation/Refund Policy: Any participant who is not 100% satisfied with this course can request a full refund by contacting PennWell in writing.

Earn 4 CE credits
This course was written for dentists, dental hygienists, and assistants.

Instrument Sterilization in Dentistry
A Peer-Reviewed Publication
Written by Eve Cuny, RDA, MS and Helene Bednarsh, RDH, MPH

PennWell is an ADA CERP recognized provider
ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.
Concerns or complaints about a CE provider may be directed to the provider or to ADA CERP at www.ada.org/goto/cerp.
Educational Objectives
Upon completion of this course, the clinician will be able to do the following:
1. Follow an appropriate process for the segregation, cleaning and sterilization of re-usable items, and for the appropriate disposal of single-use items.
2. Understand the various cleaning and sterilization devices available in the United States, as well as the various methods by which they sterilize and clean instruments.
3. Select the correct materials used in preparing instruments prior to sterilization, package instruments appropriately for sterilization and ensure correct storage of sterile instruments.
4. Understand the various tests that are available to ensure the sterility of instruments, and what these tests can be used for and will show.

Abstract
Effective and efficient infection control in the dental office is essential for the safety of patients and to ensure that productivity does not suffer. Infection control programs all include the cleaning and sterilization of reusable dental instruments and devices. Care must be taken by the dental healthcare professional to ensure that all instruments are cleaned prior to sterilization, and that this is carried out in a safe manner to avoid injury and puncture wounds. Use of closed-system cassettes reduces the risk to dental healthcare professionals when executing infection control programs. When using ultrasonic cleaners, washers and sterilizers, it is important to always follow the manufacturer’s instructions. It is also important to consult with the manufacturer of dental instruments and devices as needed to ensure complete sterilization and to avoid damage to these items. Assurance of sterility of instruments and devices can be obtained through the use of one of several tests, and these tests must be performed regularly to ensure that the sterilizer is sterilizing all instruments and devices and that these are safe for use on patients.

Introduction
Today’s busy dental practices face a serious challenge: to maintain or increase productivity while ensuring that patient safety remains a top priority. At times, these may seem like incompatible goals. Advances in dental processing equipment, however, have empowered practices to develop safer processes while realizing efficiencies and ultimately, saving money.

A cleaning and sterilization process that meets ADA and CDC guidelines is vital to an effective infection control program. Streamlining of this process requires an understanding of proper methods, materials, and devices. Many methods of instrument reprocessing are available. Use of a complete system that encompasses and fulfills all elements that are critical maximizes efficiency and minimizes risks. Closed cassette systems provide a more efficient and safer way to process, sterilize and organize instruments in a dental office (Figure 1) — these eliminate manual steps during instrument reprocessing such as hand scrubbing and time-consuming sorting of instruments, thereby improving safety and increasing efficiency.
To prevent accidental injury with the contaminated instruments, special handling should be used to transport the instruments to the cleaning and sterilization area. The Centers for Disease Control and Prevention (CDC) states that, “Contaminated instruments should be handled carefully to prevent exposure to sharp instruments that can cause percutaneous injury. Instruments should be placed in an appropriate container at the point of use to prevent percutaneous injuries during transport to the instrument processing area.” In addition, the Occupational Safety and Health Administration (OSHA) says, “The person handling the instruments through removal, cleaning, packaging and sterilization needs to use heavy-duty gloves to help prevent injury with sharp contaminated instruments.” Although heavy-duty gloves (utility gloves) may feel more awkward than examination gloves, they provide extra protection while handling instruments during the cleaning, rinsing, drying, packaging and sorting procedures that take place during instrument reprocessing. The fine tactile sensitivity needed during dental procedures is not necessary during instrument cleaning and sterilization; therefore, heavy-duty gloves pose no problem in this regard. Additionally, nitrile utility gloves are available in a variety of sizes, allowing a more secure fit.

Cleaning
Using mechanical means of instrument cleaning rather than hand scrubbing should minimize handling of instruments. If procedures are used whereby hand scrubbing is necessary, heavy-duty (utility) gloves, mask, eyewear and gown should always be worn while cleaning. Minimize the risk of puncture injury by scrubbing only one instrument at a time while holding it low in the sink.

Use of a system utilizing locked cassettes eliminates the need to sort, handle and hand scrub individual instruments — reducing the risk of infection from contaminated instruments — and results in savings of, on average, five minutes during instrument reprocessing, as well as fewer damaged instruments, since the instruments are locked in position during reprocessing (Figure 3). As with any standardized procedure, a standardized instrument reprocessing protocol also results in easy staff training and cross-training.

In general, three classifications of mechanical cleaning devices are available for the dental office. They are the ultrasonic cleaner, instrument washer and instrument washer/disinfector.

Ultrasonic cleaning devices
An ultrasonic cleaner uses sound waves, that are outside the human hearing range to form oscillating bubbles, a process called cavitation. These bubbles act on debris to remove it from the instruments. Some manufacturers also use intermittent or sweeping sound waves to help improve the device’s cleaning ability and to decrease the potential for hot spots in the ultrasonic bath. Specialized detergent formulations are available for the solutions in ultrasonic machines. When selecting a cleaning agent to use in the ultrasonic cleaner, always consider the effect on materials and instruments. Household products are inappropriate because they cause pitting, corrosion, rust or other damage to instruments, and potentially to the ultrasonic chamber. Therefore, it is best to follow the manufacturer’s instructions, thereby choosing a solution that is compatible with the unit and the instruments. The procedure for cleaning the instruments in the ultrasonic cleaner is as follows:

- Suspend instruments in the ultrasonic bath using a rack or basket fitted to the unit.
- Do not lay instruments directly on the bottom of the ultrasonic cleaner, as this can interfere with cleaning and cause damage to instruments and the ultrasonic machine.
- Avoid overloading the ultrasonic device, since that could inhibit its cleaning ability.

It is important to follow the manufacturer’s instructions for the ultrasonic cleaning cycle.

In general, the timer is activated for three to six minutes for loose instruments and ten to twenty minutes for instrument cassettes, and the timing is adjusted as necessary. While the ultrasonic device is running, the lid or cover should be kept on to reduce the release of aerosol and spatter into the area from the ultrasonic cleaner. Routinely replacing the cleaning solution in the ultrasonic machine is important, and is necessary at least once a day, more often with heavy usage.

Instrument washers
Instrument washers use high-velocity hot water and a detergent to clean instruments. Widely used for decades in hospitals and large facilities as part of the central sterilization process, these devices have recently become available for the dental office. These devices require personnel to
either place instruments in a basket or to use instrument cassettes during the cleaning and drying cycles. Instrument washers for dental offices come in two different designs. One is a counter-top model. This type does not require professional installation. The other type is built-in and resembles a kitchen dishwasher (Figure 4). It functions much the same as the counter-top model, but it has a larger capacity and requires professional installation. Some models have the ability to dry the instruments after washing, some do not.

**Figure 4**

*Instrument washers/thermal disinfectors*

These devices may look like the instrument washers described above; however, there is one important difference. The high temperature of the water and chemical additives in these devices cleans and disinfects the instruments. The significance of this lies in how personnel can handle the instruments after the process. Upon removal from a thermal disinfector, instruments can be more safely handled, and if the dental healthcare professional were to sustain a puncture injury, it would not require the follow-up that a contaminated exposure requires.

All instrument washers and thermal disinfectors use either a detergent or a water-softening agent. It is possible for the pH of some of these chemicals to be incompatible with certain metals in dental instruments. For specific recommendations, the manufacturer of the dental instruments and the manufacturer of the instrument washer should be consulted.

Instrument washers and thermal disinfectors are approved medical devices that have been rigorously tested to meet Food and Drug Administration (FDA) requirements for safety and efficacy of medical devices; household dishwashers are not appropriate for use in a dental office.

**Instrument examination and care**

Cleaning instruments, provides a good opportunity to examine, replace or remove damaged instruments; lubricate items such as handpieces; and otherwise prepare instruments for sterilization. Instruments must be dry before packaging — if drying was not part of the cleaning process, time must be taken to dry the instruments completely. High-quality metal dental cassettes specially designed to withstand high temperatures are preferred for use with steam and chemical vapor sterilizers. Most sterilizers on the market today offer a cassette rack, which helps to prevent over-loading in the sterilizer, thereby reducing the risk of ineffective sterilization and ultimately of infection and cross-infection.

**Packaging**

Packaging used for instruments and cassettes prior to sterilization includes wrap, paper pouches, plastic pouches, combination paper/plastic pouches and nylon tubing. Sterilization packaging is specifically designed to allow penetration of heat, steam or vapor and then to seal the sterilized instruments inside the package for sterile storage (Figure 5). After sterilization, instruments should remain in packages until use. Different materials are appropriate for different types of sterilizers. Unless otherwise specified, all packaging is single use only. Using tape to reseal previously used packaging material may inhibit its ability to continue to function as intended by the manufacturer.

**Sterilization**

Parameters such as time, pressure and temperature vary according to the type of sterilizer, materials being sterilized and individual models within sterilizer brands. General sterilization parameters for each type of sterilizer appear in Table 1. The first step in determining the settings for the sterilizer is to refer to the manufacturer’s instructions. Sterilizers are medical devices, requiring clearance by the Food and Drug Administration before manufacturers may offer them for sale. The FDA requires rigorous testing to ensure an adequate margin of safety in each cycle type described in the instructions. Failing to follow the instructions of the manufacturer is ill advised, since it may result in inadequate sterilization of the instruments or devices in the sterilizer. It is never appropriate to use a household device, such as a toaster oven, for sterilization of dental instruments, devices, or equipment.

**Steam autoclaves**

Steam autoclaves are the most commonly used type of heat sterilizer in dental practices. Two types of processes employ steam under pressure. The difference between the two is the manner in which the machine evacuates the air from the sterilization chamber and then introduces the steam.
**Chairside**
Clinicians can focus on their chairside time on patients. By systematically organizing instruments by type of procedure, clinicians will save time that would be spent looking for an instrument to complete a procedure, and can focus on their chairside time with patients. This results in efficiency gains.

**Storage**
After completion of the sterilization cycle, the cassettes can be safely stored. Set-up time for procedures is reduced as the cassettes are labeled by the type of procedure that the instruments in the cassette are used for (such as composites, or examination, or scaling and root planing). Depending upon the type of procedure, the appropriately labeled cassette can simply be taken from the storage area and placed in the treatment area.

**Transportation and Cleaning**
Cassettes containing used instruments are transported to the sterilization area. The instruments remain in the cassettes during cleaning, rinsing and drying - this reduces the risk of sharps injuries and the potential for instrument damage or breakage during cleaning.

**Packaging and Sterilization**
The cassettes are then packaged using either wrap or self-sealing sterilization pouches for cassettes, with external and internal indicators. The packaged cassette is now ready to be placed in the autoclave unit for proper sterilization.

Gravity displacement sterilizers rely on the forces of gravity to force air out of the chamber through air escape vents. The steam entering the chamber from the water reservoir displaces the air as it leaves the chamber. The combination of pressurization of the chamber, steam and a high temperature for a prolonged period has the ability to kill virtually all microorganisms. This is the most common type of autoclave found in dental offices in the United States. A typical cycle for wrapped instruments includes heat-up and pressurization time, followed by a 15-to-30-minute cycle during which sterilization is taking place (121°C at 15 psi). The sterilization cycle time decreases as the temperature is increased. It is important to use cycle times and temperatures described in the owner’s manual, and never to interrupt the sterilization cycle to remove or add items, or for any other reason. Interruption of the cycle will result in instruments that are not sterile and therefore not safe for use on patients. After the sterilization cycle, the sterilizer must depressurize and the packs remain in the sterilizer for drying. The drying phase may take anywhere from 20–45 minutes. The unit must only be opened after completion of the drying cycle. Upon removal from the sterilizer, sterile packs must be stored in a clean, dry area. Packs that become wet, torn, contaminated, or otherwise compromised require resterilization.

Prevacuum autoclaves (also called Class B or Type B sterilizers) use a variety of technologies to remove air from the chamber before the steam enters, thus creating a vacuum. Most use a pulse vacuum to ensure elimination of air from the chamber. This is generally a more efficient means of pressurizing the chamber; therefore, the operator may notice some minor time saving in the start-up of the prevacuum sterilizers. Most prevacuum sterilizers use a temperature of 132°C–135°C for 3–10 minutes to achieve sterilization. This higher temperature may be unacceptable for some items, such as Teflon-coated instruments. Total time for pressurization, sterilization, venting and drying is generally considerably shorter than that for gravity sterilizers — about 45 minutes.
use of a proprietary chemical that contains formaldehyde, 

Unsaturated chemical vapor sterilization relies upon the

unsaturated chemical vapor sterilization

for sterilization itself.

handpiece manufacturer’s instructions should be followed

instruments, devices, and materials with the unit and the

instructions should be checked for compatibility of in-

struments that contain turbines and bearings are susceptible

mechanically driven hand-

Most handpieces will not tolerate the higher tempera-

packaging material is available for dry-heat sterilizers.

paper will scorch and plastic will melt. Specialized

chamber. Most commercially available dry-heat sterilizers

air to maintain a uniform temperature throughout the

convection, which helps to ensure that the heat circulates

chamber during the process.

Mechanical convection is more effective; the sterilizer con-

convection, which helps to ensure that the heat circulates

method of heat circulation in dry-heat sterilizers is usually

(10–30 min at 250°F)

• Time efficient

• Good penetration

• Can be used with packaged items

• Ability to process wide range of materials without destruction

• Corrosion of nonstainless steel metal items

• May not use closed containers

• Possible deposits from using hard water

• May leave instruments wet at end of cycle

• May damage heat-sensitive plastics and rubber items

• May dull certain sharp items

• Special solutions required

• Solutions may result in hazardous waste

• Adequate ventilation required

• Items must be thoroughly dried before processing

• May damage heat-sensitive plastics

• Do not use closed containers

• May not be appropriate for handpieces

• May damage heat-sensitive plastic and rubber items

• Items must be thoroughly dried before processing

• Long cycle time

• May not be appropriate for handpieces

• May damage plastic and rubber items

• Items must be thoroughly dried before processing

• May damage heat-sensitive items

• May not be appropriate for handpieces

• May leave instruments wet at end of cycle

• Possible deposits from using hard water

• May leave instruments wet at end of cycle

• May damage heat-sensitive plastics and rubber items

• May dull certain sharp items

Adapted from: Miller CH, Palenik CJ. Sterilization, disinfection, and asepsis in

Table 1. Methods of Heat Sterilization

<table>
<thead>
<tr>
<th>METHOD</th>
<th>STERILIZING CONDITIONS(^a)</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES/ PRECAUTIONS</th>
<th>BIOLOGICAL MONITORING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam:</td>
<td>15–30 min at 250°F</td>
<td>• Time efficient</td>
<td>• Corrosion of nonstainless steel metal items</td>
<td>Geobacillus stearothermophilus (formerly known as Bacillus stearothermophilus)</td>
</tr>
<tr>
<td>Gravity displacement</td>
<td></td>
<td></td>
<td>• May not use closed containers</td>
<td></td>
</tr>
<tr>
<td>Pre-vacuum</td>
<td>3.5–10 min at 270°F</td>
<td>• Time efficient</td>
<td>• Possible deposits from using hard water</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• May leave instruments wet at end of cycle</td>
<td></td>
</tr>
<tr>
<td>Unsaturated Chemical Vapor</td>
<td>20 min at 270°F</td>
<td>• Time efficient</td>
<td>• May damage heat-sensitive plastics</td>
<td>Geobacillus stearothermophilus (formerly known as Bacillus stearothermophilus)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No corrosion or rust</td>
<td>• Do not use closed containers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Items dry after cycle</td>
<td>• May not be appropriate for handpieces</td>
<td></td>
</tr>
<tr>
<td>Dry Heat</td>
<td></td>
<td></td>
<td>• May damage heat-sensitive plastic and rubber items</td>
<td>Bacillus atrophaeus (formerly known as Bacillus subtilis)</td>
</tr>
<tr>
<td>Static Air</td>
<td>60–120 min at 320°F</td>
<td>• No corrosion or rust</td>
<td>• Items must be thoroughly dried before processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Does not dull cutting edges</td>
<td>• Long cycle time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Items dry after cycle</td>
<td>• May not be appropriate for handpieces</td>
<td></td>
</tr>
<tr>
<td>Forced Air (convection)</td>
<td>12 min at 375°F</td>
<td>• Time efficient</td>
<td>• May damage plastic and rubber items</td>
<td>Bacillus atrophaeus (formerly known as Bacillus subtilis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No corrosion or rust</td>
<td>• Items must be thoroughly dried before processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Does not dull cutting edges</td>
<td>• May damage heat-sensitive items</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Items dry after cycle</td>
<td>• May not be appropriate for handpieces</td>
<td></td>
</tr>
</tbody>
</table>

Dry heat sterilization
(convection and static air)

Dry-heat sterilization employs high temperatures for ex-
tended periods to achieve sterilization of instruments. The

method of heat circulation in dry-heat sterilizers is usually

convection, which helps to ensure that the heat circulates

throughout the sterilization chamber during the process.

Mechanical convection is more effective; the sterilizer con-

tains a fan or blower that continually circulates the heated

air to maintain a uniform temperature throughout the

chamber. Most commercially available dry-heat sterilizers

on the market today are of this type.

The higher temperature of a dry-heat sterilizer means

that paper will scorch and plastic will melt. Specialized

packaging material is available for dry-heat sterilizers.

Most handpieces will not tolerate the higher tempera-
tures of a dry-heat sterilizer. Mechanically driven hand-

pieces that contain turbines and bearings are susceptible
to damage at higher temperatures. The manufacturer’s

instructions should be checked for compatibility of in-

struments, devices, and materials with the unit and the

handpiece manufacturer’s instructions should be followed

for preparation of the handpiece prior to sterilization and

for sterilization itself.

Unsaturated chemical vapor sterilization

Unsaturated chemical vapor sterilization relies upon the

use of a proprietary chemical that contains formaldehyde,
alcohol and other inert ingredients, instead of water, to

produce a vapor to promote the sterilization. Use of this

proprietary chemical also results in the vapor having less

humidity and therefore being less corrosive to sensitive

instruments than if water were used.

Sterility assurance

All the efforts that go into the preparation of instruments

are futile if the sterilization process itself is not successful.

There is no way of seeing that instruments are sterile by

simply observing the sterilizers and packs, even though a

chemical or mechanical indicator may have changed. An

indicator such as autoclave tape may change color when

exposed to heat, but there is a possibility that the heat was

not present for the proper length of time or that there was

inadequate pressure. Indicators that go on the outside of

the packs are useful for identifying processed and unprocessed

packs. Failure of sterilization can occur due to mechanical

malfuction of the sterilizer or due to operator error. There

are several methods to provide assurance of sterility.

Operator error

It is common to rely upon the automated functions of the

sterilizer to tell the DHCP if there is a problem with the

sterilization process. Most sterilizers have a system to

notify the operator of mechanical malfunction, but steril-

izers cannot notify the operator whether the contents of the

instrument packs or cassettes are sterile or not. Operator
error in loading the sterilizer could result in failure to ster-
ilize all the packs in spite of the proper time, temperature
and/or pressure. It is important to avoid overloading the
sterilizer or loading packs and cassettes on top of one
another; use of a cassette system helps to reduce operator
error due to overloading. The heat and/or steam must be
able to circulate throughout the chamber and between the
packs or cassettes for successful sterilization.

Chemical indicators
Chemical indicators indicate the presence of certain condi-
tions during the sterilization cycle, such as the presence of
heat and steam. There are five classifications of indicators
recognized by the FDA, and it is important to note that
it is now recommended that all packs or cassettes include
internal and external indicators.

Class 1 — Process Indicators. These are placed on the
outside of packs and are useful in determining which packs
have been properly processed versus those that have not.
Class 1 process indicators include autoclave tape and the
color change indicators embedded on the outside of steril-
ization packaging materials.

Class 2 — Bowie-Dick Indicators. These show the
pass/fail in prevacuum sterilizers. This test is conducted
daily with the chamber empty, during the first cycle of the
sterilizer, and is available as a kit from commercial steril-
ization monitoring companies.

Class 3 — Temperature-Specific Indicators. These
react to one of the critical parameters of sterilization and
indicate exposure to a specific value such as temperature
or psi.

Class 4 — Multi-parameter Indicators. These react to
two or more of the critical parameters in the same manner
as Class 3 indicators.

Class 5 — Integrating indicators. These are designed to
react to all critical parameters of sterilization cycles. When
used properly, integrating indicators may serve as the basis
for the release of processed items, excluding implants. It
is important to follow the manufacturer’s specific instruc-
tions for use regarding a test challenge pack.

Biological monitoring
The use of biological monitors (spore tests) is the most
reliable method to validate that the sterilizer is functioning
and that the sterilization of instruments is effective (Figure
6). These monitors consist of paper strips or vials impreg-
nated with bacterial spores that are specifically resistant
to the sterilization process. New spore tests have been
developed that enable completion of biological monitoring
in-office and yield results in as little as 24 hours. These
tests allow quick remediation and validate proper infection
control procedures without a long lag time during which
the sterilization procedure may have become ineffective
but is not known. It is recommended that biological moni-
toring be conducted at least weekly and with every load
that includes an implantable device.

Resources
U.S. Department of Labor, Occupational Safety and Health
Administration. 29 CFR Part 1910.1030. Occupational
exposure to bloodborne pathogens; needlesticks and other
5325. As amended from and includes 29 CFR Part
1910.1030. Occupational exposure to bloodborne patho-
Available at: http://www.osha.gov/SLTC/dentistry/index.html.CDC. Guidelines for Infection Control in Den-
tal Health-Care Settings — 2003.

References
3. Greene VW. Microbiological contamination control in hospitals.
4. CDC. Guidelines for environmental infection control in
   health-care facilities: recommendations of CDC and the
   Healthcare Infection Control Practices Advisory Committee
   (HICPAC). MMWR 2003;52(No. RR-10). Oper Dent. 2005
   2006.
   in general dental practice. Compend Contin Educ Dent. 2004;25(1
7. Association for the Advancement of Medical Instrumentation,
   American National Standards Institute. Good hospital practice:
   steam sterilization and sterility assurance. ANSI/AAMI ST46-
   1993. Arlington, VA: Association for the Advancement of Medical
   Instrumentation, 1993.
8. Rutala WA, Weber DJ. Choosing a sterilization wrap for surgical
9. Rosa AC et al. Effects of handling and storage on sterile dental
10. Association for the Advancement of Medical Instrumentation.
    Chemical indicators—guidance for the selection, use, and
    25. Arlington, VA: Association for the Advancement of Medical
    Instrumentation, 1999.
11. www.cdc.gov/mmwr/preview/mmwrhtm/rr5217a1.htm
AUTHOR PROFILES:

Eve Cuny, MS
Eve Cuny is the Director of Environmental Health and Safety and Assistant Professor in the Department of Pathology and Medicine at the University of the Pacific School of Dentistry. She has consulted with the Centers for Disease Control and Prevention, American Dental Association, California OSHA, California Dental Board and other agencies on issues related to safety and infection control in dentistry. She has presented over 100 continuing education programs throughout the world and published numerous articles and textbooks. Ms. Cuny is also founder and managing partner of Eve Cuny Consultants, LLC, a consulting group specializing in product evaluation, professional writing and other services to the dental profession and industry.

Helene Bednarsh, RDH, MPH
Ms. Bednarsh is the Director of HIV Dental for the Boston Public Health Commission and has participated in local, regional, national and international programs on infection control and HIV/AIDS. She is a member of the American Public Health Association and served on the Oral Health Section Council, the American Association of Public Health Dentistry. She served on the Editorial Board of the American Dental Hygienists Association and the Massachusetts Dental Hygienists Association. Ms. Bednarsh was active with the Massachusetts Public Health Association, serving on the planning committee for dentistry and as secretary. She is a member of OSAP and has served on the Board. She was a member of the ADA/DAAC special workgroup on the Management of Occupational Exposure to Bloodborne Pathogens and Evaluation of Occupational Exposure to TB. She is a member of the ADA Wellness Committee/Peers Network for issues related to HIV/AIDS. Ms. Bednarsh co-chairs the Dental Workgroup of the Boston AIDS Consortium.

Disclaimer
The authors of this course have no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course.

Reader Feedback
We encourage your comments on this or any PennWell course. For your convenience, an online feedback form is available at www.ineedce.com.
Questions

1. Cleaning, sterilizing and storing instruments in the room where the delivery of patient care is provided ______:  
   a. Is ideal  
   b. Saves time  
   c. Increases the risk of cross-contamination  
   d. a and b

2. Removal and disposal of single-use sharps must be done:  
   a. Daily  
   b. Twice daily  
   c. In the sterilization area  
   d. At the point of use

3. Heavy-duty (utility) gloves should be used while:  
   a. Handling instruments during cleaning, rinsing, drying, packaging and sorting procedures  
   b. Treating patients  
   c. Disposing of sharps  
   d. All of the above

4. The risk of puncture injury while scrubbing instruments can be minimized by:  
   a. Scrubbing instruments low in the sink  
   b. Scrubbing quickly  
   c. Scrubbing only one instrument at a time  
   d. a and c

5. Hand scrubbing of instruments can be avoided by:  
   a. Using a locked cassette system  
   b. Using a regular dishwasher  
   c. Sending out instruments to a specialized cleaning service  
   d. None of the above

6. Types of mechanical cleaning devices available for the dental office include:  
   a. Ultrasonic scalers  
   b. Ultrasonic cleaners  
   c. Instrument washers/disinfectors  
   d. b and c

7. Ultrasonic cleaners form ______ that act(s) on debris:  
   a. Froth  
   b. Oscillating bubbles  
   c. Emulsions  
   d. None of the above

8. The sound waves used in various ultrasonic cleaners can be:  
   a. Continual  
   b. Sweeping  
   c. Intermittent  
   d. All of the above

9. The cleaning solution used in ultrasonic cleaners ______:  
   a. Is ideal  
   b. Saves time  
   c. Increases the risk of cross-contamination  
   d. a and b

10. Instrument washers for instruments use ______ to clean instruments:  
    a. Tepid water  
    b. High-velocity hot water  
    c. Detergent  
    d. b and c

11. Sterilization packaging is designed to allow the penetration of ______:  
    a. Air  
    b. Microbes  
    c. Heat, steam or vapor  
    d. Detergent

12. Using a standardized protocol including the use of cassettes enables ______:  
    a. Time savings  
    b. Easy staff training  
    c. Less damage of instruments  
    d. All of the above

13. The following vary by type of sterilizer:  
    a. Time  
    b. Pressure  
    c. Temperature  
    d. All of the above

14. Prior to clearing a sterilizer, the FDA requires rigorous testing to ensure:  
    a. An adequate margin of safety  
    b. Manufacturers are spending as much money as possible on testing  
    c. Patients are never late  
    d. a and b

15. Interrupting the autoclave cycle will:  
    a. Speed up sterilization  
    b. Result in instruments not being sterile  
    c. Make no difference  
    d. a and c

16. The two types of steam autoclaves available are:  
    a. Gravity displacement autoclaves and prevacuum autoclaves  
    b. Gravity displacement cleaners and presterilized autoclaves  
    c. Autoclave autoclaves and ultrasonic devices  
    d. a and c

17. The most common type of autoclave found in the United States is the:  
    a. Gravity displacement autoclave  
    b. Prevacuum autoclave  
    c. Disinfector autoclave  
    d. None of the above

18. Instruments in packs that become wet, torn or contaminated after sterilization require:  
    a. Sterile gauze over the damaged area of the pack  
    b. Resterilization  
    c. Make no difference  
    d. None of the above

19. Use of convection in dry-heat sterilizers helps ensure that:  
    a. The heat circulates throughout the sterilization chamber  
    b. Energy is not wasted  
    c. Double packaging is possible  
    d. All of the above

20. Most prevacuum autoclaves use temperatures of:  
    a. 99 °C  
    b. 120 °C – 130 °C  
    c. 132 °C – 135 °C  
    d. Any of the above

21. Compatibility of instruments, devices and materials with dry-heat sterilization should be checked by:  
    a. Trying out one instrument first to see if it is OK  
    b. Checking the manufacturer’s instructions  
    c. a and b  
    d. None of the above

22. The proprietary chemical used in unsaturated chemical vapor sterilization contains:  
    a. Alcohol  
    b. Formaldehyde  
    c. Inert ingredients  
    d. All of the above

23. Failure of sterilization can occur due to:  
    a. Mechanical malfunction of the sterilizer  
    b. Operator error  
    c. Poor judgment  
    d. a and/or b

24. Most sterilizers have a system to:  
    a. Notify the operator of a malfunction  
    b. Notify the operator that instruments are not sterile  
    c. Ensure that the time cycle gets longer the more instruments are loaded in  
    d. None of the above

25. There are ______ classifications of chemical indicators recognized by the FDA:  
    a. Three  
    b. Five  
    c. Six  
    d. No

26. Class 1 process indicators ______:  
    a. Are useful to determine which instruments to place in the sterilizer  
    b. Are useful to determine which packs have been properly processed  
    c. Are placed on the outside of packs  
    d. b and c

27. It is now recommended that both ______ and ______ indicators be used:  
    a. Integral and digital  
    b. External and internal  
    c. At least two of the indicators be used each time  
    d. None of the above

28. Class 3 indicators are ______:  
    a. Temperature-specific indicators  
    b. Chemically-deficient indicators  
    c. Alcohol indicators  
    d. None of the above

29. Class 5 integrating indicators are designed to:  
    a. React to only one critical parameter  
    b. React to all critical parameters  
    c. Serve as the basis for sterilization  
    d. a and c

30. Biological monitors are also known as ______:  
    a. Spore tests  
    b. Probiotic tests  
    c. Biomechanical tests  
    d. All of the above
Requirements for successful completion of the course and to obtain dental continuing education credits: 1) Read the entire course. 2) Complete all information above. 3) Complete answer sheets in either pen or pencil. 4) Mark only one answer for each question. 5) A score of 70% on this test will earn you 4 CE credits. 6) Complete the Course Evaluation below. 7) Make check payable to PennWell Corp.

Postal Address: Machele Galloway, 1421 S. Sheridan Rd., Tulsa, OK 74112 or macheleg@pennwell.com.

Please direct all questions pertaining to PennWell or the administration of this course to www.ineedce.com.

We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course. Please e-mail all questions to: macheleg@pennwell.com.

All content has been derived from references listed, and or the opinions of clinicians. No manufacturer or third party has had any input into the development of course content.

This course was made possible through an unrestricted educational grant. No interested party has had any input into the development of course content.

Mail completed answer sheet to:

Academy of Dental Therapeutics and Stomatomy,
A Division of PennWell Corp.
P.O. Box 116, Chesterland, OH 44026
or fax to: (440) 845-3447

For IMMEDIATE results, go to www.ineedce.com and click on the button “Take Tests Online.” Answer sheets can be faxed with credit card payment to (440) 845-3447, (216) 398-7922, or (216) 255-6619.

Payment of $59.00 is enclosed. (Checks and credit cards are accepted.)

If paying by credit card, please complete the following:

□ MC □ Visa □ AmEx □ Discover

Acct. Number: _______________________________

Exp. Date: ________________________________

Charges on your statement will show up as PennWell.

**Course Evaluation**

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?
   - Objective #1: Yes No
   - Objective #2: Yes No
   - Objective #3: Yes No
   - Objective #4: Yes No

2. To what extent were the course objectives accomplished overall?
   - 5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives.
   - 5 4 3 2 1 0

4. How would you rate the objectives and educational methods?
   - 5 4 3 2 1 0

5. How do you rate the author’s grasp of the topic?
   - 5 4 3 2 1 0

6. Please rate the instructor’s effectiveness.
   - 5 4 3 2 1 0

7. Was the overall administration of the course effective?
   - 5 4 3 2 1 0

8. Do you feel that the references were adequate?
   - Yes No

9. Would you participate in a similar program on a different topic?
   - Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.

11. Was there any subject matter you found confusing? Please describe.

12. What additional continuing dental education topics would you like to see?

Please photocopy answer sheet for additional participants.

AGD Code 148

Please return this evaluation survey to:

Mail completed answer sheet to:

Academy of Dental Therapeutics and Stomatomy,
A Division of PennWell Corp.
P.O. Box 116, Chesterland, OH 44026
or fax to: (440) 845-3447

For IMMEDIATE results, go to www.ineedce.com and click on the button “Take Tests Online.” Answer sheets can be faxed with credit card payment to (440) 845-3447, (216) 398-7922, or (216) 255-6619.

Payment of $59.00 is enclosed. (Checks and credit cards are accepted.)

If paying by credit card, please complete the following:

□ MC □ Visa □ AmEx □ Discover

Acct. Number: _______________________________

Exp. Date: ________________________________

Charges on your statement will show up as PennWell.

**Course Evaluation**

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?
   - Objective #1: Yes No
   - Objective #2: Yes No
   - Objective #3: Yes No
   - Objective #4: Yes No

2. To what extent were the course objectives accomplished overall?
   - 5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives.
   - 5 4 3 2 1 0

4. How would you rate the objectives and educational methods?
   - 5 4 3 2 1 0

5. How do you rate the author’s grasp of the topic?
   - 5 4 3 2 1 0

6. Please rate the instructor’s effectiveness.
   - 5 4 3 2 1 0

7. Was the overall administration of the course effective?
   - 5 4 3 2 1 0

8. Do you feel that the references were adequate?
   - Yes No

9. Would you participate in a similar program on a different topic?
   - Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.

11. Was there any subject matter you found confusing? Please describe.

12. What additional continuing dental education topics would you like to see?

Please photocopy answer sheet for additional participants.

AGD Code 148

Please return this evaluation survey to:

Mail completed answer sheet to:

Academy of Dental Therapeutics and Stomatomy,
A Division of PennWell Corp.
P.O. Box 116, Chesterland, OH 44026
or fax to: (440) 845-3447

For IMMEDIATE results, go to www.ineedce.com and click on the button “Take Tests Online.” Answer sheets can be faxed with credit card payment to (440) 845-3447, (216) 398-7922, or (216) 255-6619.

Payment of $59.00 is enclosed. (Checks and credit cards are accepted.)

If paying by credit card, please complete the following:

□ MC □ Visa □ AmEx □ Discover

Acct. Number: _______________________________

Exp. Date: ________________________________

Charges on your statement will show up as PennWell.

**Course Evaluation**

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?
   - Objective #1: Yes No
   - Objective #2: Yes No
   - Objective #3: Yes No
   - Objective #4: Yes No

2. To what extent were the course objectives accomplished overall?
   - 5 4 3 2 1 0

3. Please rate your personal mastery of the course objectives.
   - 5 4 3 2 1 0

4. How would you rate the objectives and educational methods?
   - 5 4 3 2 1 0

5. How do you rate the author’s grasp of the topic?
   - 5 4 3 2 1 0

6. Please rate the instructor’s effectiveness.
   - 5 4 3 2 1 0

7. Was the overall administration of the course effective?
   - 5 4 3 2 1 0

8. Do you feel that the references were adequate?
   - Yes No

9. Would you participate in a similar program on a different topic?
   - Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.

11. Was there any subject matter you found confusing? Please describe.

12. What additional continuing dental education topics would you like to see?

Please photocopy answer sheet for additional participants.

AGD Code 148