Disinfection and Sterilization: A Primer

by Dr. Margaret Scarlett
President, Scarlett Consulting International
Atlanta, Georgia

Educational objectives
Upon completion of this course, participants should be able to achieve the following:
• Discuss the basic principles of sterilization and disinfection, including the importance of cleaning each item before a process is used.
• Highlight methods of sterilization.
• Detail the types of chemical sterilants/disinfectants and appropriate selection for patient care items.
• Highlight key principles for special considerations for disinfection and sterilization issues, such as laboratory items, dental unit water lines, amalgam separators and evacuation systems.
• Review some of the regulatory compliance issues regarding disinfectants.

Sterilization and disinfection are important for both personnel safety and patient safety. Rather than a cookbook approach, these should be viewed as processes that are utilized based on a philosophy. The philosophy of how an item is used, stored, contaminated and reused or disposed determines the optimal method of sterilization and disinfection.

Sterilization and disinfection are important to prevent the chain of infection in the dental office. The chain of infection is a complex series of events that
continuing education

requires that all of the following conditions be present. Being vigilant about the pathways is important when you set up, perform, monitor and evaluate your disinfection and sterilization practices. The chain of infection is something that you think about when you are choosing disinfection and sterilization of items that are used in patient care or in the area around which patient care is provided.

The chain of infection is:
- An entrance through which the pathogen may enter the host.
- A susceptible host is one who is not immune or has compromised immunity.
- A sufficient number of pathogens, or infection-causing organisms, must be present to produce infection. This is called the infectious dose. This varies for different infections or diseases. There must be a reservoir or source that allows the infectious agent to survive and multiply (e.g., blood).
- There is a mode of transmission from the source to the host.

A mode of transmission is the method of transmission of infectious agents. Different infections are transmitted in different ways more efficiently by different modes. Specifically, some modes are more efficient at transmission of infection than others. For example, with bloodborne infections, percutaneous or beneath-the-skin entry, is a highly efficient way to transmit infections. Intact skin is a fairly good barrier for infection control and is not a very efficient way to transmit infection.

When all the above events happen together, this is considered the “chain” of infection. Effective infection control strategies prevent infection or disease transmission by interrupting one or more links in the chain of infection. Effective infection control strategies prevent disease transmission by interrupting one or more links in the chain of infection.

Cleaning is the most important step in all decontamination processes. Cleaning involves the physical removal of debris and reduces the number of microorganisms on an instrument or device. If visible debris or organic matter is not removed, it can interfere with the disinfection or sterilization process. Use appropriate protective barriers such as heavy-duty utility gloves, masks, and protective eyewear when cleaning and disinfecting surfaces. Examples of cleaners include ultrasonic cleaners, instrument washers and washer disinfectors.

Spaulding's Classification

The following categories are based on the how the items are categorized, how an item is used, the type of contamination and the conditions necessary for transmission of infection.

There are three categories of patient-care items, depending on their intended use and the potential risk of disease transmission for dental instruments and devices.

• **Critical items** touch sterile areas of the body, such as those in an incision or in deep tissues. Dental equipment which touch sterile areas of the body, such as bone and blood vessels or penetrates the mucous membrane of the mouth is classified as critical. The latter includes tongue or gingival tissues. Examples of critical items include surgical instruments, scalpel blades, periodontal scalers and surgical dental burs. Sharps injury with contaminated needles or scalpels carry the greatest risk of infection of bloodborne pathogens for oral care personnel.

• **Semi-critical items** are contact-only mucous membranes and do not penetrate soft tissues. As such, they have a lower risk of transmission. Because most items in this category are heat-tolerant, they should be heat sterilized between patient uses. For heat-sensitive instruments, high-level disinfection

Categorize Dental Items By:

**Critical items** touch sterile areas of the body, such as those in an incision or in deep tissues.

**Semi-critical items** are contact-only mucous membranes and do not penetrate soft tissues.

**Non-critical items** contact intact skin.

continued on page 54
is appropriate. Examples of semi-critical instruments include dental mouth mirrors, amalgam condensers and impression trays.

- **Non-critical items** contact intact skin. These include, among other things, blood-pressure cuffs and X-ray heads. Special cases are those clinical surfaces or frequently touched environmental surfaces. Most instrument cleaning, disinfecting and sterilization should occur in a designated central processing area to control both quality and personnel safety. Non-critical items pose the least risk for transmission of infection.

Dental handpieces are a special case. Even though they do not penetrate soft tissue, it is difficult for chemical germicides to reach the internal parts of handpieces. For this reason, they should be heat sterilized using a steam autoclave or chemical vapor sterilizer.

**Instrument Processing**

Most instrument cleaning, disinfecting, and sterilization should occur in a designated central processing area to control both quality and personnel safety. After thorough cleaning and drying of instruments, especially critical and semi-critical instruments that will be stored before use, should be wrapped or placed into container systems prior to heat sterilization. This step protects items from contamination after the sterilization cycle and during storage.

Ultrasonic cleaners, instrument washers and washer disinfectors are all examples of automated (or mechanical) cleaning equipment.

**Sterilization Tips:**

**Before sterilization**
- Open or unlock hinged instruments so that all surfaces are exposed.
- Place a chemical indicator inside each wrapped package. If the indicator cannot be seen from the outside, place another indicator on the outside of the package.
- Place the date of sterilization and identify the sterilizer used if multiple sterilizers are utilized in the office.

**After sterilization**
- Examine each package. If it is damaged in any way, items should be re-cleaned, re-wrapped, and re-sterilized.
- Store all sterile and clean items and supplies in dry, closed or covered cabinets.

Read the manufacturer's directions and follow them to assure sterility. Liquid chemical sterilants and low temperature processes are indicated for heat labile instruments devices. These are less reliable because temperature and expo-
sure time after cleaning vary. Use liquid chemical sterilants or low temperature sterilization processes intended for the reprocessing of heat sensitive devices. This is usually not necessary because the vast majority of instruments in dentistry are heat-stable.

Sterilization Monitoring

Monitoring is a key component of sterilization and a log for monitoring is recommended. Monitoring for time and temperature is necessary with each sterilization cycle to assure sterility. At least once a week, you should perform spore tests to assess the sterilization process. Having a log book to document results close to the sterilization area is helpful. There are a variety of types of indicators, and these include mechanical or physical monitors. These monitors measure the time, temperature and pressure. Chemical monitors which show a change in color when a physical parameter is reached. Biological monitors or spore tests measure the effectiveness of the sterilization process.

Biological indicators

Biological spore tests use biological spores to assess the sterilization process directly. Biological indicators measure the ability to determine if the sterilization method is effective and if sterilization conditions have been met. This is a standardized preparation of bacterial spores on or in a carrier. They must be placed in the most difficult site for sterilant penetration, and a positive indicator is a process failure. The use of a biological indicator spore test should be done in the office or by using a testing service (check with state or local regulations) once a week and should be recorded in your office infection control manual.

Chemical indicators

- Measure key parameters of the sterilization process
- Visual change when the desired parameter has been achieved (e.g. color change)
- Single parameter indicators, multi-parameter indicators
  This includes colored tapes and other symbols that change color when exposure to sterilization occurs.

Physical indicators

Equipment monitors that are engineered to detect any of these parameters:
- Time, temperature
- Pressure, gas concentration
- Relative humidity
- Steam purity
- Delivered dose of sterilant

Disinfection

Disinfection is different from sterilization in that sterilization kills all life forms, including spores. Disinfection is a less effective process than sterilization.

Three Levels of Disinfection:
- High
- Intermediate
- Low

How to choose a disinfectant?

Once the product(s) is/are selected, a routine can be easily established. Begin by cleaning the surface. If disinfection is necessary,
apply an EPA-registered tuberculocidal, virucidal product to the surface in accordance with the label instructions [The Food and Drug Administration (FDA) and Environmental Protection Agency (EPA) are the regulatory agencies that registers liquid chemical germicides with clear label claims for intended use and instructions for use]. Most disinfectants specify that surfaces should be kept wet for 10 minutes. Excess solution can be wiped away with a paper towel or gauze.

Hierarchy of resistance to organisms for liquid chemical sterilants/disinfectants (high to low):

- Spores
- *Mycobacterium tuberculosis* var. *bovis*
- Non-lipid or small viruses
- Fungi
- Vegetative bacteria
- Lipid or medium sized virus

Types of Disinfectants

- **High-level disinfectant** – Utilizes a liquid chemical sterilant and a process that kills all life forms including bacterial spores and inactivates *Mycobacterium tuberculosis* var. *bovis*

- **Intermediate-level disinfectant** – Utilizes a liquid chemical sterilant and a process that kills all life forms but not bacterial spores and inactivates *Mycobacterium tuberculosis* var. *bovis*

- **Low-level disinfectant** – Inactivates vegetative bacteria, some fungi, medium-large viruses, viruses with lipid-containing envelopes. These include quaternary ammonium compounds, some phenolics, some iodophors.

Hospital disinfectants are an EPA category for disinfectants. Hospital disinfectants are those that have demonstrated potency against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Salmonella choleraesuis*. A tuberculocidal disinfectant is one that uses *Mycobacterium tuberculosis* var. *bovis* as a test organism and is a measure of potency because Mycobacteria have the highest intrinsic level of resistance among the vegetative bacteria, viruses, and fungi. This test does not utilize the infectious agent, *Mycobacterium tuberculosis*, the organism that causes tuberculosis among humans. The FDA provides regulatory support for certain kinds of claims for disinfectants and sterilants. Heat labile instruments should be treated with a sterilant/disinfectant that states that it is tuberculocidal.

In general, cleaning and removal of microorganisms is as important as the disinfection process itself for surfaces. Blood or other patient materials left on surfaces can interfere with the disinfecting process. Follow the manufacturer’s instructions for proper storage, dilution, and use of hospital disinfectants. Because of their toxic nature, the use of sterilants or high-level disinfectants on environmental surfaces is not recommended. Clinical contact surfaces, including a light handle, countertop, bracket tray, dental chair, and door handles are example of clinical contact surfaces. Examples of housekeeping surfaces are walls, sinks, and floors.

**To conclude, keep up to date by review, assessment and evaluation**

Remember that disinfection and sterilization is not a one-time process. Be sure to review all your procedures at least monthly with all staff members, and utilize cross training. As you purchase new items, review with staff members how these items will be disinfected and sterilized. Remember that sterilization and disinfection is an ongoing process that is constantly being reviewed and renewed to make it better all the time.
Post-test

Answer the Post-Test Questions Online – for FREE

You have two options to claim your CE credits: 1) Go online and answer the test for free OR 2) answer the test on the Continuing Education Answer Sheet and submit it by mail or fax with a processing fee of $35.

To take the test online: After reading the preceding article, type the following link into your browser and click the button TAKE EXAM: http://www.docere.com/Dentaltown/OnlineCE.aspx?action=PRINT&cid=40

You can also view the course online in a Web cast format by clicking the above link and then the button REVIEW COURSE.

If you choose that latter option, you can take the test by scrolling down and clicking “I wish to claim my CE credits.”

Please note: If you are not already registered on www.dentaltown.com, you will be prompted to do so. Registration is fast, easy and of course, free.

1. The most important step in any sterilization or disinfection process is:
   a) cleaning
   b) using spore monitoring systems
   c) sterilizing for the correct amount of time
   d) choosing the right disinfectant

2. Patient care items are categorized as critical, semi-critical or non-critical and this is important to know because:
   a) this is correlated with the potential risk of infection associated with their intended use.
   b) this is important to make it easier to figure out when to use barrier protection.
   c) this makes it easier to know what to do with items when the manufacturer does not specify how to clean and disinfect.
   d) none of the above.

3. The regulatory agency that clears and registers liquid chemical germicides with clear label claims for intended use and instructions for use is:
   a) CDC
   b) FDA
   c) EPA
   d) A and C
   e) B and C

4. Items that pose the least risk for transmission of infection are:
   a) items such as surgical instruments or scalpels.
   b) dental mouth mirrors.
   c) blood pressure cuffs, or x-ray head or other non-critical items.

5. For oral care personnel, the greatest risk of infection of blood borne pathogens occurs with:
   a) hand hygiene.
   b) sharps injury with contaminated needles or scalpels.
   c) patients with diabetes.
   d) patients with any known disease.

6. The use of a biological indicator spore test will
   a) determine if the sterilization method is effective and sterilization conditions have been met.
   b) should be done in office or by using a testing service (check with state regulations) at least once a week.
   c) should be recorded in your office infection control manual.
   d) all of the above.

7. If a packaged item has been sterilized and stored properly, but the package is torn then, you would
   a) use the item anyway.
   b) re-wrap and re-sterilize.
   c) re-clean, re-wrap and re-sterilize.
   d) none of the above.

8. The gold standard for sterilization is
   a) use of a sterilant/disinfectant because it is cheap and easy to use.
   b) use of steam sterilization because it is dependable and economical.
   c) use of boiling water because this can be done almost anywhere.

9. The sterilant/disinfectant of choice for heat labile instruments (instruments that cannot withstand heat) should be:
   a) a label that states that the product is spermicidal.
   b) a label that states that the product is tuberculocidal.
   c) a label that states that the product is a germicide.
   d) a label that states that the product is a good cleaner.

10. The following is an example of automated or mechanical cleaning equipment:
    a) Ultrasonic cleaners
    b) Instrument washers
    c) Washer disinfectors
    d) All of the above
Continuing Education Answer Sheet

Fill out this sheet ONLY if you wish to submit your test by mail or fax. A $35 processing fee applies.

Instructions: To receive credit, complete the answer sheet and mail it, along with a check or credit card payment to: Dentaltown.com, Inc., 10850 S. 48th Street, Phoenix, AZ 85044. You may also fax this form to 480-598-3450. You will need a minimum score of 70% to receive your credits.

Please print clearly. Deadline for submission of answers is 24 months after the publication date.

Disinfection and Sterilization: A Primer by Dr. Margaret Scarlett

License Number ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

AGD# ____________________________________________________________

Name ___________________________________________________________

Address __________________________________________________________

City ___________________________ State __________ Zip ______________________

Daytime phone ____________________________________________________

☐ Check (payable to Dentaltown.com, Inc.)

☐ Credit Card (please complete the information below and sign)

Card Number ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Expiration Date – Month / Year ____ ____ / ____ ____ ____ __________

Signature ________________________________________________________ Date __________________

CE Post-test
Please circle your answers.

1. a b c d
2. a b c d
3. a b c d e
4. a b c
d

Program Evaluation
Please evaluate this program by circling the corresponding numbers: (3 = Excellent to 1 = Poor)

1. Course objectives were consistent with the course as advertised 3 2 1
2. Course material was up-to-date, well-organized and presented in sufficient depth 3 2 1
3. Instructor demonstrated a comprehensive knowledge of the subject 3 2 1
4. Overall, I would rate this course 3 2 1
5. Overall, I would rate this instructor 3 2 1

For any questions, please contact Rita Zakher, DMD, MBA, director of continuing education at rita@dentaltown.com