Globalization has reached the dental office. New technologies delivering greater effectiveness and efficiencies have been introduced in Europe and are now making an entrance in the United States. This issue of ICIP explores available new instrument processing technologies to assist the dental professional.

Ultrasonic Cleaners
In dentistry, ultrasonic cleaners have long been used to clean instruments in preparation for the sterilization process. They employ sound waves above human audibility that result in the formation of oscillating bubbles (cavitation) that then collapse and implode.

More recently, some ultrasonic manufacturers have employed new technology that uses a variable frequency as opposed to a fixed frequency. The purpose of this is to deliver consistent cavitation to all areas of the solution and reduce the potential for hot spots that may cause weakening of the cleaning ability. Additionally, some manufacturers are using materials with antimicrobial activity in the manufacture of the interior chamber of the ultrasonic.

Instrument Washers
Instrument washers are a class of device more efficient and effective than hand scrubbing for cleaning dental instruments. Although traditionally used in central sterilization services, such as in hospitals, these devices are still new to the dental profession. Two major categories of instrument washers are available to the dental market:

1. Instrument washer/disinfectors. Food and Drug Administration (FDA)-cleared medical devices that wash, disinfect and dry instruments. These devices incorporate a high-level disinfection cycle that decreases the risks associated with percutaneous injuries. However, this feature does not preclude the need for proper personal protective equipment (PPE).

2. Instrument washers. Devices that are not cleared by the FDA to make a disinfection claim, but perform a cleaning process. Some also will dry instruments.

Sterilizers
Dental offices rely on sterilization technologies to ensure reusable instruments and devices are safe for use on patients each time they are used. Equipment that has not been cleared by the FDA for sterilization, such as household ovens and experimental devices, should not be used. Traditionally, dental offices have employed one of three heat processes for sterilization: steam under pressure, unsaturated chemical vapor or dry heat.

Steam under pressure
A steam sterilizer contains a sealed fixed or removable chamber in which steam is generated or introduced from an outside source to create high pressure and temperature. Steam is introduced into both the outside jacket and the inside chamber which is designed to withstand...
New Instrument Reprocessing Technologies

continued from front cover

OSAP
Dentistry’s Resource for Infection Control & Safety

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Unsaturated chemical vapor

Unsaturated chemical vapor also uses steam under pressure to sterilize dental instruments and heat stable devices. Rather than using water steam alone, these devices use a proprietary formula that includes formaldehyde and alcohol to generate a chemical vapor. The lower humidity produced by the chemical vapor results in less corrosion to sensitive instruments, such as those manufactured of carbon steel. No major change to this technology has been introduced in recent years.

Dry heat

Dry heat sterilizers use temperatures higher than those used in other heat sterilization processes. Sterilizing by dry heat is accomplished by conduction. The heat is absorbed by the outside surface of the item, and then passes towards the center of the item, layer by layer. There are two mechanisms used for dry heat sterilizers.

In sterilizers without mechanical convection air is heated and rises. The cooler air falls as it is displaced by the rising heated air. Due to this rising and falling of heated and cool air the temperature tends to be uneven in the chamber. This temperature variation results in difficulty in monitoring a gravity convection device, which for many years was the only option offered to dental practices.

Mechanical convection is the more effective type. The sterilizer contains a fan or blower which continually circulates the heated air to maintain a uniform temperature throughout the chamber. Most commercially available dry heat sterilizers in the market today are of this type.

Sterilization Monitoring

Biological monitoring through the use of a spore test is the gold standard for verifying sterilization. The CDC recommends weekly biological monitoring of all sterilizers used in dental practices. Although in-office spore tests are available, most dental offices choose to use a mail-in service that provides third party verification. These services are available through major dental suppliers and many university dental schools.

A major advance made in the past two years has been the approval of a 24-hour incubation test for steam sterilizers. Previously, all services provided 7-day incubation, which could delay notification of sterilizer failure to the dental office affected by the failed spore test.
FDA

When you’re using steam sterilizers for medical instruments, physical, chemical and biological monitors help assure that sterilization has taken place. In a recent article, FDA cites several reports of problems with these monitors.

In one case, the liquid growth media in the self-contained biological monitor had dried out. In another case, one chemical indicator failed to change color, even though another one in the same sterilizer cycle did change. And in a third case, a physical monitor showed that the required temperature wasn’t reached, and yet the sterilizer didn’t warn that this had happened.

The article suggests several ways to address these kinds of events. For example, for self-contained biological indicators, always check the level of the growth media before and after sterilization, and don’t use indicators with low levels of media.

If a biological or chemical indicator gives unexpected results, this could be because the sterilizer was overloaded or improperly loaded, so that steam couldn’t penetrate or circulate to reach the indicator. Or it could be that the sterilizer isn’t delivering good quality steam.

The article also cautions that if you program your sterilizer to operate at other than the manufacturer’s settings for time and temperature, you should develop a system to be sure that these are set properly by the staff. For example, you might require that a second person verify the settings before the sterilizer is returned to service.

CDC

Heat-tolerant dental instruments usually are sterilized by 1) steam under pressure (autoclaving), 2) dry heat, or 3) unsaturated chemical vapor. All sterilization should be performed using medical sterilization equipment cleared by FDA. The sterilization times, temperatures, and other operating parameters recommended by the manufacturer of the equipment used, as well as instructions for correct use of containers, wraps, and chemical or biological indicators, should always be followed.

CDC. Guidelines for Infection Control in Dental Health-Care Settings - 2003

Cavitation

The formation of partial vacuums in a liquid by a swiftly moving solid body (as a propeller) or by high-intensity sound waves.

Conduction

The transmission of heat, electricity or sound.

Convection

The circulation of hot air within a chamber through the use of a fan.

Lumen

The bore of a tube (as of a hollow needle or catheter).

Washer-disinfector

Automatic unit that cleans and thermally disinfects instruments, by using a high-temperature cycle rather than a chemical bath.

Ultrasonic cleaner

Device that removes debris by a process called cavitation, to disrupt the bonds that hold debris to surfaces.

Infection Control In Practice is a resource prepared for clinicians by the Organization for Safety & Asepsis Procedures with the assistance and expertise of its member-contributors. OSAP is a nonprofit, independent organization providing information and education on infection control and occupational health and safety to dental care settings worldwide.

Information in this issue has been brought to you with the help of the following individuals:

Contributor

Lt Col Jennifer Harte, DDS, MS is the chief military consultant for dental infection control to the Air Force surgeon general, U.S. Air Force Dental Investigation Service, Great Lakes, IL.

The opinions expressed in this text are those of the author and do not reflect the official policy of the U.S. Department of Defense or other departments of the U.S. government.

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Putting It All Together

Selection of new devices for the dental practice can be daunting. To ensure you get the most for your equipment investment, ask some key questions to assist in your decisions. Below is a sample of questions to help guide your decision-making. Factor in the specific needs of your practice setting for a complete list.

**Ultrasonic Cleaners**
1. Is it easy to use?  
   - Yes  
   - No
2. Will it process an adequate number of instruments?  
   - Yes  
   - No
3. Does it accommodate cassettes?  
   - Yes  
   - No
4. Are instructions clear and easy to follow?  
   - Yes  
   - No
5. Is the product cost-effective?  
   - Yes  
   - No
6. Is the cleaning product compatible with instruments?  
   - Yes  
   - No
7. What precautions are needed to use the product safely?
8. What personal protective equipment needs to be used?

**Washer/Disinfectors**
1. Is the device cleared by the FDA?  
   - Yes  
   - No
2. Does it have a drying cycle?  
   - Yes  
   - No
3. Is there adequate space in the sterilization room?  
   - Yes  
   - No
4. Does it accommodate cassettes?  
   - Yes  
   - No
5. Are racks and accessories an extra cost?  
   - Yes  
   - No
6. Does it disinfect in addition to cleaning?  
   - Yes  
   - No
7. What precautions are needed to use the product safely?
8. What personal protective equipment needs to be used?

**Heat Sterilizers**
1. Is the device cleared by the FDA?  
   - Yes  
   - No
2. Does it generate a regulated waste requiring special disposal?  
   - Yes  
   - No
3. Does it accommodate cassettes?  
   - Yes  
   - No
4. How long is total cycle time, including drying?
5. Is the process compatible with instrument materials?  
   - Yes  
   - No
6. Can the process be validated?  
   - Yes  
   - No
7. Is chemical exposure monitoring required?  
   - Yes  
   - No
8. What precautions are needed to use the product safely?

**Ask OSAP**

**Q:** If instruments are disinfected and dry after removal from a washer/disinfector, is it still necessary to heat sterilize them?

**A:** Yes. Heat sterilization processes kill all viable microorganisms. Further, they allow for packaging of instruments before sterilization, which provides protection from contamination of the instruments during storage provided the packages are stored in a clean, dry place. Additionally, these processes have quality assurance monitoring methods such as chemical indicators and biological monitors to ensure the instruments are rendered safe for reuse.  

— OSAP

**Q:** Should we be performing a “Bowie-Dick” test on our autoclave?

**A:** Bowie-Dick tests are intended to ensure that there has been complete air removal in a pre-vacuum steam autoclave before steam is injected into the chamber. The test does not apply to gravity steam sterilizers or other types of sterilizers such as dry heat and chemical vapor. The Association for the Advancement of Medical Instrumentation (AAMI) recommends daily air removal tests for all pre-vacuum (Class B) sterilizers. The Bowie-Dick test and other equivalent air removal tests are commercially available through dental supply companies providing sterility assurance products.  

— OSAP

**Q:** I notice that household automatic dishwashers are less expensive than washer/disinfectors. Wouldn't it be just as good to use a household dishwasher since we have to sterilize the instruments afterwards?

**A:** Household dishwashers are not intended for use with dental instruments and devices. The washer/disinfectors use higher temperature water and specialized chemical agents to clean and disinfect your dental instruments safely. Chemical agents used for cleaning in a household setting may cause corrosion or other damage to dental instruments and will not have been tested for safety and compatibility as a process for dental instruments.  

— OSAP
## OSAP Chart & Checklist
### Comparison of Heat-Sterilization Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Sterilizing Conditions&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Advantages</th>
<th>Disadvantages/Precautions</th>
<th>Biological Monitoring</th>
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</thead>
<tbody>
<tr>
<td>Steam</td>
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<tr>
<td>Gravity displacement</td>
<td>3-10 min at 270°F/132°C</td>
<td>Time efficient</td>
<td>Corrosion of nonstainless steel and metal items</td>
<td>Geobacillus stearothermophilus (formerly known as Bacillus stearothermophilus)</td>
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<td></td>
<td>15-30 min at 250°F/121°C</td>
<td>Good penetration</td>
<td>Do not use closed containers</td>
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<tr>
<td>Pre-vacuum</td>
<td>3.5-10 min 270°F/132°C</td>
<td>Can be used with packaged items</td>
<td>Possible deposits from using hard water</td>
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<td></td>
<td></td>
<td>Ability to process wide range of materials without destruction</td>
<td>May leave instruments wet at end of cycle</td>
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<td></td>
<td>May damage heat-sensitive plastics &amp; rubber items</td>
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<tr>
<td>Unsaturated Chemical Vapor</td>
<td>20 min at 270°F/132°C</td>
<td>Time efficient</td>
<td>Special solutions required</td>
<td>Geobacillus stearothermophilus (formerly known as Bacillus stearothermophilus)</td>
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<td></td>
<td></td>
<td>Less corrosion or rust</td>
<td>Ventilation must be adequate</td>
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<td>Items dry after cycle</td>
<td>Items must be thoroughly dried before processing</td>
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<td>May damage heat-sensitive plastics</td>
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<td></td>
<td>May not be appropriate for handpieces&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Dry Heat</td>
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<tr>
<td>Static Air</td>
<td>60-120 min at 320°F/160°C</td>
<td>No corrosion or rust</td>
<td>May damage heat-sensitive plastic &amp; rubber items</td>
<td>Bacillus atrophaeus (formerly known as Bacillus subtilis)</td>
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<td></td>
<td></td>
<td>Does not dull cutting edges</td>
<td>Items must be thoroughly dried before processing</td>
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<td>Items dry after cycle</td>
<td>Long cycle time</td>
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<td>Closed containers may be used if spore test is used to confirm appropriate kill</td>
<td>May not be appropriate for handpieces&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Forced Air</td>
<td>12 min at 375°F/190°C</td>
<td>Time efficient</td>
<td>May damage plastic &amp; rubber items</td>
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<td>No corrosion or rust</td>
<td>Items must be thoroughly dried before processing</td>
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<td>Items dry after cycle</td>
<td>May not be appropriate for handpieces&lt;sup&gt;b&lt;/sup&gt;</td>
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<sup>a</sup> Cycle times do not include warm-up times and may vary with the brand of sterilizer; follow the manufacturer instructions for sterilizing conditions.

<sup>b</sup> Check with handpiece manufacturer.

**Adapted from:** Miller CH, Palenik CJ. Sterilization, disinfection, and asepsis in dentistry. In: Block SS, ed. Disinfection, sterilization, and preservation, 5th ed. Philadelphia; Lippincott Williams & Wilkins, 2001:1053.

Calendar

To help practices stay on track, OSAP provides this calendar listing typical schedules for periodic maintenance, record-keeping, and infection control activities. This schedule is intended only to serve as a guide. Proper practices, procedures, and maintenance schedules can vary according to the kinds of products used, the practice type, and patient volume. Always follow the device or equipment manufacturer’s instructions for maintenance and infection control.

For a monthly dental office calendar you can customize to best meet the needs and schedules in your practice, visit osap.org/calendars/index.htm. (Adobe Acrobat Reader required.)

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<tr>
<th>SUNDAY</th>
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<td>Weekly: clean evacuation traps</td>
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<td>Weekly: waterline monitoring</td>
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FEBRUARY 2005

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1. Which cleaning method best describes the system used by ultrasonic cleaners?
   a) agitation  
   b) cavitation  
   c) soil extraction  
   d) automation

2. Which of the following statements is not true of washer/disinfectors?
   a) they must receive FDA clearance  
   b) high temp. water & chemical agents are used  
   c) they eliminate the need for a heat sterilization process  
   d) they are considered medical devices

3. Which of the following is not an appropriate technology for sterilization of dental instruments?
   a) steam under pressure (autoclave)  
   b) dry heat  
   c) washer/disinfector  
   d) unsaturated chemical vapor

4. Gravity displacement autoclaves:
   a) are the most rapid method of heat sterilization  
   b) may produce wet pouches of instruments  
   c) evacuate air from chamber before injecting steam for sterilization process  
   d) do not require monitoring

5. Pre-vacuum autoclaves:
   a) provide a more efficient means of sterilization than traditional dental office sterilizers  
   b) may produce wet pouches of instruments  
   c) are not available to the dental profession  
   d) require more space than traditional office sterilizers

6. Dry heat sterilization is achieved using what method of heat transfer?
   a) absorption  
   b) reduction  
   c) abduction  
   d) conduction

7. Which statement is true of mechanical convection dry heat ovens? These sterilizers:
   a) are more effective than dry heat sterilizers  
   b) have uneven heat distribution in chamber during cycle  
   c) can be substituted by household convection ovens  
   d) are rarely found in dental offices that use dry heat sterilizers

8. Dry heat sterilizers that do not have convection may have which disadvantage?
   a) cannot be monitored using biological (spore) test  
   b) heat may escape through ventilation holes in chamber  
   c) rise and fall of heated and cooled air results in uneven distribution of heat  
   d) approved for disinfection only/end process for sterilization must still be used

9. Unsaturated chemical vapor sterilizers:
   a) are not available in the dental market  
   b) require the use of specialized respiratory protection  
   c) use a proprietary formula containing alcohol and formaldehyde  
   d) tend to promote corrosion and rusting of dental instruments

10. The Centers for Disease Control and Prevention (CDC) recommend at least ________ biological monitoring (spore test) for all heat sterilizers.
    a) quarterly  
    b) monthly  
    c) bi-weekly  
    d) weekly

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An eyewash station is an important safety element in a dental office. In spite of the use of protective eyewear there is potential for contamination or injury to the eyes of dental workers during the course of delivering dental treatment. Some of the potential hazards include restorative materials that are being removed from teeth; spray from air/water syringes, water-cooled handpieces or ultrasonic scalers; tooth and bone fragments during surgical extractions; and chemical exposures. It may seem like an area that does not require training, however picture yourself with your eyes stinging and burning, your hands held over your eyes, while you try to run to the sink and activate the eyewash station. It may not be as easy as it sounds.

Kathy Eklund, RDH, MHP, Associate Professor at The Forsyth Institute in Boston, MA, shared two training tips that work. "I blindfold my students, or otherwise obstruct their vision and then have them find and activate the eyewash station under this 'impaired vision.' I would suggest that every person in the office practice this during a safety training session until they are able to flush their eyes within 10 seconds. In the event that a real injury was to occur, knowing how to get to and activate the eyewash quickly could make all the difference in the world. During this type of situation, it may also be difficult to see the telephone keypad to dial the emergency 9-1-1 number for outside help. Other situations that might make that difficult would be a room full of smoke or a power failure. Simply placing raised dots on the '9' and '1' keys on the telephones could speed emergency assistance when the telephone keypad is not visible."

Kathy Eklund, RDH, MHP is an Associate Professor, Director of Infection Control and Occupational Health, and Research Subject Advocate at The Forsyth Institute in Boston, MA. She also is a long-time OSAP member and currently serves on the Foundation Board of Directors.

Do you have a practice tip you’d like to share with other OSAP members and subscribers? Send your suggestions for enhancing dental infection control and safety in practice to editor@OSAP.org. Be sure to include contact information, a photo, and a brief bio. Thanks!