One of the most important duties of the Infection Control Coordinator (ICC) is to maintain procedures that ensure the instruments used to provide patient treatment have been adequately processed. The main goal of these procedures is to prevent the spread of potentially pathogenic microbes from contaminated instruments to patients and dental healthcare personnel. The “Chain of Instrument Processing” (Figure 1) is similar to the “Chain of Infection”. When one (or more) link is broken the overall desired result is challenged. The storage and handling link is a key step in the process to ensure the sterility of the instruments is maintained until they are needed at chairside.

**LEARNING OBJECTIVES**

After reading this publication, the reader should be able to:

- describe how to store sterile packages to maintain their sterility.
- describe how to handle sterile packages to maintain their sterility.
SCENARIO: The Incident

Oscar was a fourth year dental student and had just started his externship at Dr. Dee’s general dentistry practice. The dental assistant (Burrell) had stored wrapped, sterilized, instrument cassettes and supplies packages on the operatory countertop because they were in protective packaging and were readily accessible. Replacement instruments for quick retrieval were sterilized unpackaged and stored on the grooved glass slabs in a drawer next to chairside.

While Oscar was preparing the operatory for the first patient of the day (Mrs. Wilk), Burrell washed her hands, donned exam gloves, and retrieved a sterilization bag containing some disposables and a wrapped instrument cassette stored on the operatory countertop. She placed them on the bracket table and told Oscar that the instruments and supplies were safe to use since the indicators on the outside of the packages (autoclave tape on the wrapped cassette and marking on the paper bag) had changed color.

Oscar escorted Mrs. Wilk into the operatory, and after she was seated Burrell opened the cassette and supplies package. She handed the packaging material to Oscar for discarding. He noticed that there was no indicator inside the cassette or paper package and that there was a small tear in the paper bag. He was uncomfortable pointing out the lack of internal indicators, and he assumed that the tear occurred when Burrell opened the package. Dr. Dee came in, greeted Mrs. Wilk, and he and Burrell began the treatment with no indication of contamination. However, the external indicator can still be read even though it may have been damaged. The external indicator can be read even though it may have been damaged.

Potential Consequences

Packaging instruments and supplies prior to sterilization protects the contents from recontamination until opened at chairside. However, it’s important to remember that the outside of sterilized packages are exposed to the environment, to anything on the hands/gloves when handled, and to any surface they contact. The outside of the wrapped cassettes and packages stored uncovered in Dr. Dee’s operatory were not only subject to contamination from environmental microbes on dust particles but also to microbes that settle from dental aerosols and spatter generated during patient treatment.

When Burrell donned gloves and retrieved the previously sterilized cassette and package from the countertop, her gloves became contaminated with whatever was on the outside of the packages. She did not change her gloves prior to assisting with Mrs. Wilk’s intraoral treatment. So she unnecessarily spread microbes from her “dirty”gloves to Mrs. Wilk and anything else she touched. She also contaminated the uncovered replacement instruments with Mrs. Wilk’s microbes when opening the drawer and touching the probes with contaminated gloves. Just opening the drawer allowed airborne microbes to enter, and “rummaging” through the instruments to pick the right one spread the contaminants.

Also the process indicators on the outside of packages are to be used to simply identify packages that have been subjected to certain conditions during sterilization. The internal chemical indicators (not used in Dr. Dee’s office) show if the sterilizing agent has penetrated the packaging material and contacted the instruments. For example, packages could be loaded so tightly in the sterilizer that the sterilizing agent isn’t able to penetrate to the inside of each package.

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**Prevention**

Storage of sterile packages for more than a few days at the most is rare in dentistry because most facilities maintain a relatively small inventory of instruments. However, protection of sterile items from damage and recontamination is a must regardless of the time between sterilization and use at chairside. Improper storage or handling of sterile packages causes recontamination of the instruments, and this negates all of the previous instrument processing procedures.

- Store sterilized packages in low-dust or dust-free areas away from moisture and potential dental aerosols and spatter - preferably in a closed cabinet.
- Handle the sterilized packages with care so as not to challenge the integrity of the packaging material.
- Follow the manufacturer’s instructions for drying the steam-sterilized packages inside the sterilizer to reduce the chances of wicking and of tearing wet sterilization paper when handling.
- Make sure packages used for patient care have indeed been processed through a sterilizer and the internal chemical indicator has changed color or form to show penetration of the sterilizing agent.
- Check the integrity of sterile packaging material before distributing to chairside.

**Some Related CDC Recommendations**

- Assign responsibilities for reprocessing of dental equipment to dental healthcare personnel with appropriate training on instrument processing.
- Have manufacturers’ instructions for reprocessing reusable dental instruments/equipment readily available, ideally in or near the reprocessing area.
- Use mechanical, chemical, and biological monitors according to the manufacturer’s instructions.
- Monitor each sterilizer load with mechanical (e.g., time, temperature, pressure) and chemical indicators.
- Place a chemical indicator on the inside of each package. If the internal indicator is not visible from the outside, also place an exterior chemical indicator on the package.
- Place items/packages correctly and loosely into the sterilizer so as not to impede penetration of the sterilant.
- Do not use instrument packs if mechanical read-outs or chemical or biological indicators indicate inadequate processing.
- Allow packages to dry inside the sterilizer before they are handled to avoid contamination.
- Implement practices on the basis of date- or event-related shelf-life for storage of wrapped, sterilized instruments and devices.
- Even for event-related packaging, at a minimum, place the date of sterilization, and if multiple sterilizers are used in the facility, the sterilizer used, on the outside of the packaging material to facilitate the retrieval of processed items in the event of a sterilization failure. Write on the plastic side of paper/plastic pouches using an approved permanent soft-tipped marker. For example the Industrial Sharpie® permanent marker #13601 has been validated for use in the steam sterilization process and is stable up to 500°F. Do not use regular pens or pencils, and use labels on other types of packaging materials.
- Examine wrapped packages of sterilized instruments before opening them to ensure the barrier wrap has not been compromised during storage.
- Reclean, repack and resterilize any instrument package that has been compromised.
- Store sterile items and dental supplies in covered or closed cabinets, if possible.
The overall goal of instrument processing is to ensure that contaminated instruments will be made safe for use on a subsequent patient. Each step in the process (Figure 1, Page 1) must be performed precisely or the desired end result will not be achieved. Some strategies for the handling and storage of sterilized packages are given here with further details provided elsewhere.4,6

**INFECTION CONTROL IN PRACTICE Team Huddle™**

**Storage and Handling of Sterilized Packages**

- Shelf-life of sterile packages is not just a function of time but of the conditions of storage, transport, the amount of handling, and general inventory control to maintain the integrity of the packaging material. Packaging materials cleared by the Food and Drug Administration (FDA) have been validated to maintain sterility if not compromised.

- Store sterile packages in closed cabinets. If open shelves are used protect the packs with a dust cover. Consider storing instruments in one central area to facilitate retrieval and inventory.

- Store sterile packages in dry, low dust, low traffic areas away from sinks, exposed sewer and water pipes, and a few inches away from outside walls, ceilings, and floors. This reduces the chances of the packs becoming wet from water splashes, floor cleaning products, and condensation on pipes and walls.

- Store and handle sterile packages in a manner to prevent crushing, bending, compression, sliding, tearing, or puncturing. For example do not:
  - handle wet packages;
  - squeeze pouches and bags;
  - stack wrapped instrument cassettes or pouches/bags;
  - slide wrapped cassettes onto a shelf or other surface;
  - use instruments if the packaging material is torn or punctured.

- Retrieve and use stored sterile packages on a “first in, first out” system of stock rotation.

- The success of event-related storage of sterilized packages is based upon carefully inspecting the integrity of the packaging material (i.e., wraps, pouches, bags, plastic tubing) before they are opened for use.

- Instruments that are sterilized unpackaged have a zero shelf-life, for they become contaminated as soon as they are removed from the sterilizer.

- When checking packaging integrity before distributing to chairside watch out for protruding instruments.

- If carts are used to transport sterile packages, routinely decontaminate the carts and cover the packages.

- To open sterile packages wash hands or use an alcohol hand-rub, and open the package without contaminating the contents. Then perform hand hygiene and don gloves before intraoral contact with the patient. If the sterile instruments or other items then need to be further manipulated such as arranging on a sterile tray, use fresh gloves or sterilized forceps/tongs and avoid contact with the external surface of the packaging material.

- Arranging instruments on packaged trays or in instrument cassettes prior to sterilization prevents extra manipulation after sterilization.

- Drawers or mobile carts used at chairside are fraught with great potential for contamination of patient care items from airborne and direct contact modes, and shouldn’t be used. If used, a strict protocol must be in place to avoid contamination of patient care items.

- A written protocol for the storage and handling of sterile packages is important in maintaining patient safety and should be an integral part of the facility’s infection prevention and control manual.

**Instrument Storage and Handling Checklist**

Infection prevention during storage and handling of sterile packages should include the following.

- Proper packaging materials and procedures are used
- Packages are identified with the sterilizer used, the cycle or load number, and the date of sterilization
- An internal sterilization indicator is used in every package to be sterilized, and if it can’t be seen from the outside, an external indicator is also used
- Packages are dry before removing from the sterilizer
- Packages are handled carefully to avoid contamination of the contents and injury to the hands
- Packages are stored properly
- Storage of sterilized packages is based on date- or event-related shelf-life
- Packages are transported to the point of use in an aseptic manner
- All sterile packages are carefully inspected for integrity before opening
- When packages have been compromised the instruments are recleaned, repackaged and resterilized
- If internal or external chemical indicators or biological indicators or any mechanical indicators indicate failure, the instruments are withheld from patient treatment
- Packages are opened without contaminating the contents
- Placement of sterile instruments on sterile trays or covered bracket tables is performed aseptically
What’s Wrong With This Picture?

Can you identify the breach(es) in infection prevent and safety procedures in this photo taken of dental instruments stored after sterilization?

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The Scenario: “Patient greeting”

TEAM HUDDLE DISCUSSION GUIDE

1. How should Oscar have handled the situation of the torn packaging material?
2. How should Burrell have opened the sterile packages?
3. Are there any problems with how sterile instrument packages are handled in your facility?

GLOSSARY

Event-related storage: A practice of storing sterilized packages. It recognizes that packages remain sterile until something (an event) happens that compromises the integrity of the packaging material.

Links to Resources


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QUESTIONS FOR ONLINE QUIZ

1. What criterion should be used for stock rotation of sterilized instrument packages?
   a. Use the newest package first
   b. Use the smallest package first
   c. Use the largest package first
   d. Use the oldest package first

2. What should be done with the instruments from a sterilized paper/plastic peel pouch that was torn during transport to chairside?
   a. Repackage and resterilize
   b. Tape over the tear and resterilize
   c. Reclean, repackage and resterilize
   d. Wipe down the instruments with a high level disinfectant and repackage

3. Autoclave tape on the outside of a sterilization bag containing cotton rolls has dark stripes. What does this signify?
   a. The cotton rolls are sterile
   b. The cotton rolls should be discarded and not used
   c. The cotton rolls should be repackaged and resterilized
   d. The cotton rolls have been processed through a sterilizer

4. Why should paper/plastic peel pouches of instruments be allowed to dry inside a steam sterilizer before being removed from the sterilizer?
   a. So the instruments will not show whitish water spots
   b. So the chemical indicators will have time to change color
   c. So the paper on the pouch will be less susceptible to tearing when handled
   d. So the plastic part of the pouch will close its pores to maintain sterility after removal from the sterilizer

5. What’s the first thing that should be done after unwrapping a sterilized instrument cassette?
   a. Wipe down the outside of the cassette with a low-level disinfectant
   b. Check the status of the internal chemical indicator
   c. Make sure the wrapping material is dry
   d. Begin using the instruments

6. What is event-related storage?
   a. It indicates that a sterilized package remains sterile until something happens that compromises the integrity of the packaging material
   b. A storage practice that considers sterilized packages remain sterile for a specified predetermined time
   c. Storing only sterilized packages that have the date of sterilization marked on the outside of the package
   d. Sterilized packages remain sterile forever regardless of any events that occur during storage

7. What is the best way to reduce the chances of contamination of packaged, sterile instruments before being used on patients?
   a. Store on countertops in the operatory
   b. Store in a mobile cart at chairside
   c. Store in drawers at chairside
   d. Store in closed cabinets

8. What do internal chemical indicators monitor?
   a. The penetration of the sterilizing agent through the packaging material
   b. The amount of moisture left in the packaging material after autoclaving
   c. The hardness of the water used in steam sterilizers
   d. The death of resistant bacterial spores

9. What is the shelf-life of sterilized unpackaged instruments?
   a. One month
   b. One week
   c. One day
   d. Zero

10. How should a hygienist open a sterilized package of instruments at chairside?
    a. Wash hands, open the package, wash hands, and begin patient treatment
    b. Wash hands, open the package, wash hands, and begin patient treatment
    c. Wash hands, don gloves, open the package, wash gloves, and begin patient treatment
    d. Don gloves, open the package, and begin patient treatment

KEY TAKEAWAYS

1. Improper storage and handling of sterile instrument packages can undermine entire instrument processing procedures.
2. Sterile packages must be stored under conditions that do not cause crushing, bending, compression, sliding, tearing, or puncturing of the packaging material.
3. Sterile packages must be carefully inspected before being used for patient treatment.
4. Sterilized instruments must remain sterile between sterilization and use on a patient.
TEAM HUDDLE HIGHLIGHTS

1. When did you last evaluate your instrument processing procedures?

2. Are you confident that the instruments used on your patients are safe?

3. Does your infection control protocol include procedures for storage and handling sterile packages?

4. Are your sterilized instrument packages becoming compromised before the packages are distributed to chairside?

Read on!