





# Instrumentation Assembly, Inspection & Protection

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#### LEARNING OBJECTIVES

1. Understand how to assemble instruments in a manner that will facilitate the sterilization process
2. Review basic aspects of instrument inspection
3. Understand how to protect instruments from potential damage that may occur during sterilization, storage and transport
4. Learn to assemble instrument trays in a manner that will simplify their selection and use

The success of any surgical procedure largely depends on Sterile Processing (SP) professionals' ability to clean, disinfect, sterilize and inspect instrumentation to keep the devices functioning properly and reduce infection risks to patients. After the decontamination process, instruments are transferred to the assembly area in the SP department (SPD); this area is also commonly known as the preparation and packaging area. It is in the assembly area that the Certified Instrument Specialist (CIS) must assemble instrumentation in a manner that will facilitate the sterilization process and protect instruments from damage – and determine how best to assemble instruments for use in the Operating Room (OR). Instrument assembly is a critical step in the process because it is the last point in which the instrumentation will be handled prior to its use in the OR.

#### Objective 1: Understand how to assemble instruments in a manner that will facilitate the sterilization process

Every SPD's main goal is to provide instrumentation that is safe for patient use. One consideration CIS technicians must determine is how best to contain instruments throughout the sterilization process. Instrument containment devices come in all shapes, sizes and configurations. Some instrument containers have graphic inserts in which every instrument has a specific location for placement within the tray. Instruments are placed in each designated position, usually identified by an instrument serial number or outline of the instrument (this is pre-determined by the instrument manufacturer). Instruments in these types of containers must be placed in the correct location and not modified, unless permitted by the manufacturer; this is because the manufacturer has validated the inserts based on the specific placement of each instrument in the tray.

Other containers provide customizable



baskets or tray inserts that have nesting capabilities that allow multiple tray inserts to be stacked on top of one another, thereby, providing users with different options for separating instruments. Customizable accessories can also facilitate sterilization by physically separating instrumentation and holding instruments in place. Like the graphic inserts, customizable trays allow users to designate placement of instrumentation to facilitate sterilization and provide ease of assembly for technicians by removing any guesswork of where instruments should be placed.

Most healthcare facilities use baskets in conjunction with a rigid container system or basket/container that is subsequently wrapped prior to sterilization. These types of instrument containment systems are open to configuration by the instrument specialist. This allows technicians to organize each tray by arranging instrumentation within the tray to maximize space, while also creating a layout that will facilitate the sterilization process.

Several aspects of instrumentation assembly can result in a breach of sterilization, if performed incorrectly. One common assembly error is failure to disassemble multi-part instruments. Prior to cleaning, assembly and sterilization of any instrument, technicians should read and understand the instrumentation's instructions for use (IFU). The instructions describe how the instrument should be processed and will include any special instructions, such as disassembly of multi-part instruments prior to sterilization. Failure to disassemble a multi-part instrument can prevent the sterilant from reaching all surfaces of the instrument and, thereby, prevent sterilization of the item; however, some instrument manufacturers do not require disassembly of multi-part instruments and their instructions will

depend upon how the instrument was validated for sterilization.

When configuring instrumentation such as ringed instruments or instruments with a ratchet, instruments should be sterilized in the unlatched position (more commonly referred to as the "open position"). ANSI/AAMI ST79:2017, *Comprehensive guide to steam sterilization and sterility assurance in health care facilities*, states that "ratcheted instruments should be unlatched. Racks, pins, stringers, or other specifically designed devices can be used to hold the instrument in the unlatched position." Unlatching instruments in the open position allows the sterilant to easily reach all surfaces. Note: The ST79 recommendation does not state that instruments must be fully extended during sterilization, but rather held in the unlatched position.

It is also important to place all instruments in trays in a manner that prevents air entrapment and water pooling or condensation during the sterilization process. Concave instruments and long, wide and flat instruments, such as malleable retractors, should be placed on edge (not lying flat) to prevent pooling and retained water. Medicine cups should not be positioned upright, but in a manner that allows for drainage, while also allowing the sterilant to come in contact with all surfaces.

One common myth is that instruments cannot touch each other or have metal-on-metal contact. There currently is no standard, guideline or recommendation that states that metal-on-metal contact will impede sterilization. For example, ringed instruments unlatched on a stringer and touching each other is an acceptable practice. (See Figure 1)

Although there are no recommendations to prevent metal-on-metal contact, that does not mean it is acceptable to place a major instrument set into the smallest



Figure 1

available instrument tray. Instruments should be positioned in a tray large enough to permit equal distribution of weight and metal mass, and to allow circulation of the sterilant.

Sterilization and drying can also be impacted by excessive tray weight or density. When configuring trays, it is important to ensure the weight does not exceed the recommendations of 25 pounds or 11 kilograms. The instrument specialist should also re-weigh trays any time the tray is modified.

## Objective 2: Review basic aspects of instrument inspection

The instrument specialist must always be aware of the important role instrument inspection plays in positive patient outcomes. A complete and thorough inspection of instrumentation can prevent potentially serious complications before they have an opportunity to occur. The following is a review of basic instrument inspection principles:

- Check all items for cleanliness;
- Check cutting edges for sharpness (Figure 2 shows an example of an osteotome with a damaged cutting edge);
- Check to ensure tips are properly aligned;
- Check box locks for signs of wear;
- Check ratchets;
- Check for missing or loose screws;
- Check for worn serrations or



**Figure 2:** Osteotome with damage to the cutting edge and excessive scratching

- missing teeth;
- Check sockets, wrenches and screwdriver tips;
- Check for distorted or bent shanks and tips;
- Check cannulations and lumens for blockage;
- Check multi-part instruments to ensure all parts are present and working;
- Check plated instruments for flaking;
- Check for excessive scratches on the surface of the instruments (Figure 2 shows an example of an osteotome with excessive scratches);
- Check for missing or broken parts;
- Check working (moving) parts to ensure smooth, easy motion;
- Check the instrument for pitting or corrosion;
- Check for peeling and flaking tape;
- Check for stains;
- Check for signs of surface deterioration;
- Check insulation integrity; and
- Check power instruments.

*Note: Always refer to the IFU for inspection guidelines for each instrument.*

### **Objective 3: Understand how to protect instruments from potential damage that may occur during sterilization, storage and transport**

Instruments are essential tools that perform specific tasks during surgical procedures. Instrument technicians should carefully handle each instrument because even minor

damage to instrumentation can render an instrument unusable. A slight nick or bend to an ocular or middle ear instrument, for example, can appear significant under a microscope and render the instrument unusable.

The instrument specialist is responsible for protecting instruments from damage. Even though some instruments look like they could be useful tools for other tasks in the department, instruments should only be used for their intended use. For example, mayo scissors should not be used to cut peel pouches. Several precautions should be taken to ensure instrument damage does not occur after leaving the assembly area. A simple practice to avoid damaging instrumentation is to remove instruments from the basket one at a time instead of dropping or dumping the instruments onto the assembly table. When instruments are dumped from the instrument basket onto the assembly table, they can be damaged by impact with the table or other instruments. This impact can cause instrumentation nicks that, over time, can lead to further deterioration. Sharp items such as skin hooks can have damaged or bent tips after impact. Delicate forceps can inadvertently become lodged in the instrument basket and bend, which can force the tips out of alignment.

As each instrument is inspected and placed in the tray, the instrument technician should evaluate its vulnerability to damage – and then take steps to mitigate damage and protect the instrument. Many devices are available that provide instrument protection. Before utilizing any protection device, it is important to review the device's IFU for proper use and sterilization. All devices that enter the tray must have IFU with sterilization instructions. If a device or item does not have sterilization instructions, it should not be used.

Devices such as instrument stringers not only keep ringed instruments open, which facilitates effective sterilization, but they also keep ringed and ratcheted instruments organized together and prevent movement inside the tray. Instruments with sharp, pointed tips (such as those found on scissors) may require instrument tip protectors. Instrument tip protectors should fit loosely to allow sterilant penetration, but not fit so loosely that the device slips off inadvertently. Tip protectors should be colored (not clear) to simplify identification and help ensure they are removed prior to the instrument's use (this helps prevent tip protectors from accidentally falling into the surgical site and becoming a retained surgical item). Silicone finger mats, foam pouch protectors and medical-grade paper pouch devices are other examples of devices used to hold, organize and protect instruments from damage.

Technicians should be aware of tray contents that may impact sterilization. Items that impact or impede sterilization should not be used in a surgical tray. For example, latex or silicone tubing should not be used as tip protectors, unless stated in the IFU, because the use of latex or silicone may prevent the sterilant from making direct contact with the instrument. Plastic-paper sterilization pouches intended to sterilize individual instrumentation should not be used to organize and protect instruments within a tray. The plastic side of the pouch prevents the sterilant from passing through the pouch and could obstruct or prevent the sterilant from reaching all items within the tray. Gauze should never be used as an instrument protection device or as a wicking material to reduce moisture. Gauze used in an instrument tray is not radiopaque (impenetrable to various forms of radiation and, therefore, not x-ray detectable) and has



the potential to be confused with other gauze used on the surgical field. Using radiopaque surgical sponges would also be potentially harmful because adding sponges to the sterile field may lead to errors in the surgical sponge count. Prepackaged sterile towels purchased from an outside vendor or sterilized in house should not be opened and used in trays because the towels may super heat during sterilization. Super heating occurs when dry steam becomes too hot compared to saturated steam. Dry steam rises to a temperature higher than the boiling point of saturated steam. This can occur when dehydrated linen is processed in a steam sterilizer. Due to the lack of moisture, dry steam is not an effective sterilant and can char or burn items in the sterilizer. If super heating occurs, the tray can potentially be rendered unsterile.

### Objective 4: Learn to assemble instrument trays in a manner that will simplify their selection and use

Standardization of instruments within trays is important. Instrument trays should look the same every time the surgical scrub technician or nurse opens the tray, regardless of which instrument technician assembled it. An effective arrangement can save set-up time and stress during a procedure. For example, an emergency tracheotomy tray may require that a knife handle, trach hook and tracheal dilator sit on top of other instruments, so when the tray is opened, the scrub person can identify the instruments and start the procedure immediately. If the items are not in the predetermined position when the tray is opened, the scrub person may assume the tray is incomplete and ask for another tray. In this example, searching for instrumentation could delay the procedure and possibly cause a negative patient outcome.

The order and arrangement of instrumentation in a tray should

be determined by the SP manager, instrument specialist and a representative from the OR. Each individual is responsible for collaboratively working on the tray arrangement in order to provide the assembly technician with the instructions for assembly and give the surgical scrub an idea of what to expect each time the tray is opened.

When assembling instrumentation, heavier items like retractors and mallets should be placed on the bottom of the tray. Heavier items can damage more delicate items like thumb forceps. Ringed or hinged instruments should be placed on a stringer in the unlatched position and grouped together with similar instruments, from smaller to larger sizes. For example, smaller clamps such as mosquito forceps would be grouped together with other hemostats like Crile, Kelly and Peon forceps. The curvature of the instruments should be facing in the same direction. Other straight ratcheting forceps like the Kocher, Allis, Babcock and sponge forceps can be grouped together, followed by needle drivers and scissors (with the same principles of smaller to larger sizes). Knife handles, thumb forceps and Frazier-type suction tubes should also be separated and protected because of the delicate nature of these instruments. Figure 3 provides a good example of a well-organized tray.

Instrument technicians should never attempt to assemble instrument trays by memory. The contents of the tray can change, technicians can become distracted, or a technician can simply forget an item. An instrument count sheet or recipe card should always be used, regardless of whether the count sheet is used with a tracking system or provided on paper. The count sheet should include detailed instructions and list the required instruments and placement for each tray. Each instrument should be identified, inspected and verified



Figure 3

against the count sheet and placed in the proper location within the tray.

### Conclusion

Instrument assembly can be challenging. Instrument technicians must be vigilant to ensure that instruments are assembled in a manner that will facilitate the sterilization process, protect the instruments from potential damage and facilitate their safe, proper use. Applying these principles will help the instrument assembly technician produce safe, functional and sterile instrumentation. 

### RESOURCES

Association for the Advancement of Medical Instrumentation. *ANSI/AAMI ST79: 2017, Comprehensive Guide to Steam Sterilization and Sterility Assurance in Health Care Facilities*.

Association of periOperative Registered Nurses. *AORN Guideline for Sterilization Packaging Systems*. 2019.

International Association of Healthcare Central Service Materiel Management. *Instrument Resource Manual. Chapter 8, Preparing Medical Devices for Use*. 2018.

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International Association of Healthcare Central Service Materiel Management. *CSSD Dictionary and Reference Guide*. 2010.