Maintaining Proper Function and Repair of Surgical Instruments

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LEARNING OBJECTIVES

1. Identify the function tests appropriate for specific types of surgical instruments
2. Describe how to determine when instrument repair is needed
3. Understand the available types of instrument repair and maintenance programs

A key factor in providing safe care for surgical patients is ensuring that instruments used for every procedure are in good working order. Operating Room (OR) and Sterile Processing department (SPD) personnel should understand that instruments that do not function properly can adversely affect patient care and safety, the facility's investment, and surgeon satisfaction.

Improperly functioning instruments should never reach the OR; they should be discovered in the SPD, if not earlier, and withheld from any sets for patient use. During reprocessing, as part of the instrument use cycle (see Figure 1), the structural and functional features of any instrument should be inspected for integrity and cleanliness, as well as function tested after every cleaning. Only instruments that are in proper working order should be used for patient procedures.

Objective 1. Identify the function tests appropriate for specific types of surgical instruments

Function testing must be performed consistently, so instruments exhibiting excessive wear or damage are removed from service. Following manufacturers' instructions for use (IFU) on the proper function testing methods and materials is key. Improper maintenance may void the instrument's warranty and can pose a risk of injury to the patient. The following function tests can provide savings in both time and cost of replacement to the facility, while helping to ensure patient safety.

Figure 1 – Instrument Use Cycle

Scissors

Scissors blades should cut on the edges and glide over each other smoothly.

Sharpness: To test for sharpness, open the scissors approximately two-thirds and close on the test material (either latex-type test material or test cloth/bandage). See Figure 2. The cut should be smooth and extend to the tip of the scissors. You should see the clean-cut edge and not feel any catch, snag or drag when removing the scissors following testing. Always close rings without applying lateral force or movement and perform two to three consecutive cuts.

Closure tension: To test for correct tension, open the scissors and then gently let go of the top handle. The scissors should close and stop with approximately two-thirds the length of the blades still opened. If it closes all the way, it is too loose; if it stays up high and is tight to close, it is too tight.

Figure 2– Function Test for Sharpness of Scissors

Needle Holders

Many needle holders have tungsten carbide (TC) inserts. Those without TC inserts are usually cross-serrated, with or without a longitudinal groove.

Jaws: Jaws should close with spring action at least two-thirds the length of the jaw. To test the inserts, close the jaw one ratchet on the test material (aluminum foil or test paper) to see the outline of the jaw. The grooves/serrations or pyramid tips of the TC inserts should engage when the instrument is being closed and must fully engage when the instrument is closed completely. The jaw should not pierce through the test material.

To test jaw approximation, close to one ratchet. The jaws of the needle holder should come together at the tips, without having to apply closing pressure. With increasing pressure, the jaws should close without leaving any gap throughout the gripping area. The ratchets must cover each other when the instrument is closed completely.

Closure tension: For ring-handled needle holders, open the shafts and release the ring of the upper handle/shaft. The handles should close smoothly and stop when the tip of the distal end of the instrument touches and the ratchet touches without engaging. The box lock/joint should not wobble.

Clamps

Clamp handles should be even and align properly; ratchets should close and lock easily and hold firmly. The jaws should be aligned so any teeth mesh together without overlapping; if they overlap, they are out of alignment.

Jaws: Jaws should close with spring action at least two-thirds the length of the jaw. Inspect any serrations for consistency and for wear/cracks. Close the jaw on the test material (aluminum foil or test paper) to see the outline of the jaw. The clamp should hold securely. If the jaws are serrated, inspect the test paper for consistency of the serrated pattern.

- Jaws with transverse serrations should close two-thirds of the functional surface.
- Jaws with longitudinal or cross serrations close over the entire surface.
- Any teeth should engage when closed.
- For sharp tip towel clamps, tips come into lateral contact before or at the moment of engaging the first catch.
- For some towel clamps with "ball and socket" or non-perforating jaws, the clamp must be closed beyond the first catch to test the clamping function.
- For atraumatic clamps, grip undamaged testing paper with the clamp, completely closing the jaws for two seconds. The entire longitudinal profile must be visible on the testing paper without punctures or holes

Closure tension: For ring-handled clamps, open the shafts and release the ring of the upper handle/shaft. The handles should close smoothly and stop when the tip of the distal end of the instrument touches the ratchet without engaging. The box lock/joint should not wobble.

Curettes

When inspecting and testing a curette, look to ensure:

- Intact cup
- No nicks or burrs
- Sharp cutting edge

Sharpness: Using a plastic (acrylic) test rod, the curette should cut lightly without slipping (see Figure 3).

Figure 3 – Testing the Sharpness of a Curette Cutting Edge

Bone Rongeurs

Inspect rongeurs' surface, screws, jaws, and action of these instruments for proper function and signs of wear. Look to ensure:

- Edges of the cutting jaw surface are free from nicks.
- Jaws are of equal size and symmetry.
- Screws at the joint and spring areas are tight and don't come loose during use.
- Springs aren't damaged.

Cutting tests: Place card stock test material (such as a business card) two-thirds into the jaws and cut. Expected result: smooth cut image in the shape of the jaw that falls from the test material without tearing.

Objective 2. Describe how to determine when instrument repair is needed

Any instrument should be removed from service and sent for repair if it becomes corroded or cracked, or if closure tension is too tight or loose. Other repair indicators based on instrument type include:

Scissors

- Bent or broken tips
- Detached fragments, burrs or nicks in the blade or TC inserts
- Metal abrasion in joints

Needle Holders

- Worn gripping surfaces
- Cracks in TC inserts, gripping surface, joints
- Bent jaws, ratchets or shanks

Clamps

- Bent jaws, ratchets or shanks
- Damaged serrations

Curettes

- Cup not intact
- Cutting edge not sharp
- Nicks or burrs on surfaces
- Pitting, stress, or crevice corrosion

Rongeurs

- Notches in jaw region
- Blunt cutting edges
- Edges don't engage correctly
- Loose screws
- Defective joints
- Bent springs

Objective 3. Understand the available types of instrument repair and maintenance programs

With repeated use, instruments eventually wear. Components such as screws, inserts and springs may also need to be replaced. Over time, even with normal usage, the blades of scissors as well as the edges of other cutting instruments become dull.

Examples of routine repairs include:

- Sharpening: Scissors, rongeurs and curettes should be sharpened based on usage. Sharpening scissors recreates a properly functioning sharp blade cutting edge. For instruments with a cup or bowl-type of sharp end, such as curettes, sharpening should be performed from the inside out.
- Realignment: The jaws of forceps, clamps and scissors should meet and align correctly.
- Recoating and plating: Chipped plating can cause corrosion and rusting to surgical instruments. Repair of broken insulation is also critical to patient safety.
- Inspection, cleaning and lubrication to maintain proper operation.

Restoration/Refurbishment

With continued use, instruments may become stained, corroded, pitted or rusted. Severe buildup of deposits may impair the instrument's function, as well as its ability to be effectively sterilized.

The surface of some damaged instruments can be repolished and passivated by the manufacturer to restore the integrity of the finish. In addition, the SPD should maintain water quality and proper use of detergents to help minimize surface damage to the surgical instruments, thus reducing overall costs and volume of repairs.

Instruments that are severely damaged or broken must be replaced if they are beyond repair or restoration. Typically, instrument repair vendors will offer two options for general instrument maintenance programs:

1. Repair program: A basic service that repairs an instrument, so it is functional.
2. Repair and refurbishment program: A higher level of service that brings an instrument back to proper functioning condition. This service restores the functionality and surface finish of an instrument.

There are several options for instrument repair services. A facility may choose to:

- Send repairs to an outside contractor
- Send repairs to the manufacturer
- Use an independent service company on-site
- Use the original manufacturer for on-site repairs and preventive maintenance.

Any instrument repair vendor should be able to perform all types of repairs and return the instruments to proper functioning condition. Choosing a repair service is an important decision in the proper care and handling of surgical instruments and, ultimately, patient safety. When selecting a repair facility or service, the following factors should be considered:

- Company reputation
- Expertise of the repair technicians, repair equipment used, and services offered:
  - o Verifiable expertise with general and specialized surgical instruments
  - o Minimum of five years of experience or specialized training in preventative maintenance

- Availability of expert resources in addition to repair technician
- Ability to perform customized repairs
- References from other users/facilities
- Company liability and shipping insurance
- Costs
- Response time and turnaround time
- Quality control measures
- Availability of replacement parts
- Availability of mobile on-site repair services, or in-house (on-site) full-time maintenance and repair

Repair and preventative maintenance work should include sharpening, adjustments, polishing, cleaning, realignment, replacement of lost, worn or broken parts to ensure proper device functioning, inspection, and lubrication. Repair services may also include quality guarantee, demagnetizing, the potential for same-day turnaround time, and surgical instrument refurbishing.

Scheduled preventive maintenance combined with performing routine repairs are two of the best ways to prolong the life of surgical instruments and enhance the quality of care provided to all surgical patients. The benefits of periodic refurbishment and routine repairs of surgical instruments include maximizing instrument performance; prolonging the useful life of an instrument; maintaining proper functioning; lowering the costs associated with major repairs and/or frequent instrument replacement; minimizing downtime; reducing the risk of patient liability concerns; ensuring that all instruments will perform their intended tasks, thereby reducing complaints regarding nonfunctioning instruments; and increasing surgeon satisfaction.

Conclusion

Using a proactive approach to instrument maintenance and repair is cost effective and contributes to OR and surgeon satisfaction. The SPD's goal should be to provide correctly functioning instruments for every case. Preventive maintenance, along with careful handling and proper use, are the best ways to prevent equipment failure to minimize risk of patient injury and extend the useful life of surgical instruments.

RESOURCES

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