Instrument Surface and Functionality Changes: PART II

Inspection and functionality testing is a cornerstone in the instrument cycle of use, and all Central Service (CS) personnel who handle them impact the quality and future functionality of the devices. In this second of a two-part series, we will discuss methods for inspection and testing, types of changes in surgical instruments, and recommendations for managing recurrent instrument issues.
LEARNING OBJECTIVES

1. Review inspection and testing methods for various types of instrumentation
2. Discuss common surface and functionality changes in selected surgical instruments.
3. Explain inspection procedures for specific instruments
4. Define words in a brief glossary of instrument surface and functionality-related terms

Current best practices in surgery and sterile processing require that every patient receive the same high quality of instrumentation for every episode of care. Fortunately, there are commonly-used methods that Certified Instrument Specialist (CIS) technicians can employ to ensure the same quality of instruments is delivered to the operating room (OR) for every patient, every time.

FOCUS ON INSTRUMENT INSPECTION

Instrument inspection begins in the decontamination area, and CIS technicians must first determine whether all instruments are present. As well, instrumentation should be returned to the department in proper condition. It is a best practice for OR personnel to return instruments to their original containers (with used sharps segregated) for return to the CS department. More importantly, the Association of PeriOperative Registered Nurses (AORN) recommends keeping instruments as moist as possible during the case (examples: wiping and rinsing with sterile water) and keeping them moist or pre-treating them with an enzymatic spray before transport to the CS department. Prolonged exposure of surgical stainless steel to blood and saline leads to corrosion and eventual failure of stainless steel instruments. Frequent incidents of items received with dried organic material or soaking in saline or other solutions should be reported so corrective actions can be taken.

Those receiving instruments must determine if any items are broken or bent. Although the final inspection process will be performed more thoroughly on the preparation side, it is helpful for the decontamination personnel to discover where problems occur (CS or the OR). A simple log sheet can assist in data collection and make it easier to identify specific training and education topics helpful for those in specific positions.

SURFACE AND FUNCTIONALITY CHANGES

Common problems involve stains, friction damage, rust, corrosion, and fractures.

STAINS – Irregular stains that are erasable with a standard pencil eraser often indicate exposure to harmful chemicals or substances that affect the passivation layer that provides a corrosion-resistant finish on instruments. Surface staining can often be treated with an acid-based stain remover and re-washed to remove the offending substance or discoloration. Recurring stains may indicate early corrosion from chronic exposure to saline, blood, or other chlorides or suggest steam or water quality issues. Then end-users must be educated about keeping instruments as free of debris as possible during procedures and ensuring devices are kept moist or pre-treated with enzymatic sprays until they can be terminally cleaned in the decontamination area.

Ensuring adequate steam quality begins in the boiler plant. If facility employees cannot provide a steam quality assessment, commercial vendors can do so and recommend solutions to remediate water quality problems, improper steam traps (doglegs), or other issues affecting wet loads and instrument staining.

RUST, CORROSION, FRICTION DAMAGE, AND FRACTURES – Deep rust spots (pitting or corrosive changes), retained debris, and obvious dents or

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fractures may be identified during a general inspection. Rust/corrosion that cannot be removed with an acid-based stain remover and fractures in hinges and box locks are permanent changes, and affected instruments are ruined.

If instruments are placed in washers in closed positions, cleaning and lubricating agents cannot adequately reach the internal surfaces of the hinge and mated surfaces. Note: these are designed for automated and manual applications; follow the manufacturer’s IFU for dilution, if applicable. Then debris build-up in the hinges and metal-on-metal friction cause irreparable harm to the instrument.

To prevent these problems, ensure hinged instruments are in the open position when washed. In the absence of an automated lubrication cycle, instrument milk should be used on instruments with moving parts before each sterilization (unless IFU state otherwise).

Rarely, post-production etching can breach an instrument’s passive layer. If rusting is seen in these areas and nowhere else, discuss this with the vendor who performed the etching or engraving.

OTHER FUNCTIONAL CHANGES – In the normal use cycle, dulling of blades, wearing of working surfaces, and dents and dings in items such as mallets, probe and groove directors, and malleable retractors are expected. These issues usually do not indicate handling problems if they are appropriately managed but to be managed they must be discovered.

INSPECTION PROCEDURES FOR SPECIFIC INSTRUMENTS

Functional changes requiring intervention include normal wear and tear, breakage, “sprung” hinges, insulation damage, and magnetization.

SCISSORS – Special scissors should be used for specific functions. For example, tissue scissors should only be used for tissue and wire scissors for very heavy suture and surgical wire. The presence of burrs and fractures may indicate inappropriate use or exposure to corrosive substances.
Scissors tips are inspected for breakage and blades for burrs, debris, and staining. Retained blood or chloride solutions can cause gray or rusty discoloration inside the blade/hinge area and, if seen, the scissors should be returned to decontamination for additional cleaning. “Fretting” is a circular grooving in the hinge caused by friction from inadequate lubrication and is seen in scissors and clamp hinges. It can indicate inadequate lubrication, but if it cannot be repaired, the instrument must be replaced as must scissors with broken tips and fractured hinges.

Blade sharpness is tested, preferably using a piece of commercially available test fabric made specifically for regular and microblade scissors. Scissors that do not cut cleanly and smoothly through the fabric should be repaired and sharpened before reuse.

**NEEDLE HOLDERS** – Needle holders are generally durable when used appropriately and are available in varying sizes and shapes for different tasks, but their jaws eventually wear out. The jaws may have serrations or a “diamond jaw” (diamond dusted) finish commonly used for micro needle holders. Gold-handled needle holders are more expensive than stainless steel, but are longer wearing and can be re-fitted with new jaw inserts as needed.²

Jaw tips are inspected for worn serrations, cracked inserts, and retained debris. A suture tie can test the instrument’s grip. To do this, clamp the suture into the jaws of the needle holder and pick-up the needle holder by the suture. One should be able to lift the instrument without the suture sliding through the clamped jaws of the needle holder. When engaging the ratchets, the locking mechanism should click smoothly and without springing open under pressure.

Causes of needle holder damage include use for a non-intended function (example: as a pliers) and sterilizing with the ratchets engaged which cracks the box locks. If the needle holder springs open with engaged ratchets, it should be repaired.

**FORCEPS** – Like most useful devices, multiple variations of forceps are available to address specific uses in surgery. For example, they may be smooth, with teeth, serrated, or the distinctive DeBakey or Cooley jaw configuration for handling blood vessels and highly vascular tissues. Common forceps problems include cracks or rust in the weld, stretching (springing), burrs and missing teeth, and retained bioburden in irregular surfaces. Since they are used for virtually every stage of most surgical procedures, wear and tear is not uncommon; however a few precautions can extend their life. Since they are welded, they are prone to develop corrosive changes after prolonged exposure to blood and other caustic substances. Determine whether bioburden is habitually allowed to dry on the instruments and if they are soaked in saline in the OR. Recurrent issues with springing at the weld can indicate the forceps are being forced open by nesting them during the preparation process or, perhaps, in the OR.

**LAPAROSCOPIC INSTRUMENTS** – Laparoscopic instruments have revolutionized patient care, and smaller incisions and decreased trauma and healing times have made laparoscopy the method of choice for many common surgical procedures.

Laparoscopic instruments can be difficult to clean and maintain. Function and insulation testing should be done before each sterilization. Instruments should arrive in the preparation area disassembled, if applicable, and they must be re-assembled for testing. If they are disassembled when sterilizing, ensure all pieces are present for re-assembly at the surgical field. The IFU require many laparoscopic instruments to be disassembled for cleaning. If validated for sterilization in the assembled state, this should only be done in a pre-vacuum sterilizer with the ports open to permit steam penetration through the inner lumens.

**INSULATED INSTRUMENTS** – Insulation on many surgical instruments protects patients from burns during electrocautery. Cracks and holes in the insulation can result in electrical current leakage that can harm the patient, especially in laparoscopy where the burn may not be noticed.

Look for wearing, holes, cracks, or peeling of the insulated coating. Ideally, an electrical leakage tester is used to identify insulation imperfections that are not readily visible. Holes and breaks in insulation render the device unfit for patient use. For recurrent issues, check to ensure the items are being correctly transported and cleaned. Placing heavier items on top of the insulation in the washer or splash basin may damage the coating.

**MICRO-INSTRUMENTS** – Ultra-delicate instruments require ultra-special care but, because they are small and often specialized, inspection can be a challenge. In addition to routine inspection, micro instruments may be difficult to evaluate due to their size or specialized function. Some eye probes have what appear to be burrs on the tips; magnification may reveal a functional hook that is part of the instrument. When unsure whether an instrument is damaged, use a lighted magnifier. Refer to the instrument catalog to ensure damaged items are not sent to the OR and acceptable instruments are not tagged for repair. Micro scissors sharpness should be tested using specialized fabric; regular gauze or testing fabric may dull or damage the tiny blades. Some stainless steel instruments attract and
hold a magnetic charge, making them difficult or impossible to use in a micro-procedure. Demagnetizing (degauussing) of small micro and vascular instruments should be part of routine preparation. Degaussing of other instruments may be done on an as-needed basis.

GLOSSARY OF SURFACE AND FUNCTIONALITY TERMS

This lesson ends with a brief listing of terms important in understanding instrument surface and functionality issues.

ALLOY – A metallic material, such as steel or brass made from a mixture of two or more metals, or metallic elements with non-metallic elements. Alloys often have physical properties that differ from pure metals.

AUSTENITIC (300 SERIES) STAINLESS STEEL – An iron alloy usually containing at least 8% nickel and 18% chromium used when corrosion, heat or creep resistance, or nonmagnetic properties are required; commonly used for instruments that must be malleable (worked, hammered, or shaped without breaking).

CAVITATION – The process used by an ultrasonic cleaner in which low-pressure bubbles in a cleaning solution burst inward to dislodge soil from instruments.

CORROSION – The act of wearing away gradually by a chemical action.

DEGAUSS – The process of neutralizing or removing magnetic properties with a degauesser (magnetizer) that produces an opposing magnetic field.

FRETTING – A circular pattern etched into the surface of the hinge in hinged instruments caused by metal-on-metal contact.

MARTENSITIC (400 SERIES) STAINLESS STEEL – An iron alloy used to make most instruments that require hardened steel, such as scissors and osteotomes; it is magnetic and less resistant to corrosion than austenitic stainless steel.

OXIDIZATION – A chemical reaction with oxygen, such as rusting.

PASSIVATION – A chemical process applied during instrument manufacture that provides a corrosion-resistant finish by forming a thin and transparent oxide film.

IN CONCLUSION

This two-part part series has addressed methods to manage instrument appearance and functionality changes with the use of knowledge and preventive tactics. Attention to water and steam quality, correct use of automated cleaning technologies, and compliance with the manufacturer's IFU for cleaning are critical. Judicious and timely training of CIS technicians enable them to provide the inspection and troubleshooting procedures necessary for safe and effective reprocessing.

REFERENCES


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