



Protecting Your Optical Investment: Why Sterilization Method Matters More Than You Think

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After decades of working in Sterile Processing—across everything from small community hospitals to large, complex integrated delivery networks—there are a handful of topics that I find myself returning to again and again in conversations with peers, leadership, and frontline staff. The sterilization of optical components is one of those items. Not because it is particularly complicated science, but because the consequences of getting it wrong are both clinically significant and extraordinarily expensive, and yet the practice often goes unexamined for years at a time.

So let me share what I have learned, what the research tells us, and why I believe SPD leaders need to be far more assertive about how these decisions are made—including decisions that happen far outside the walls of our departments.

The Problem with steam and optical components

Let's start with the fundamentals. Rigid endoscopes, camera heads, and light cords are precision optical instruments. They contain glass lenses, fiber bundles, optical coatings, and adhesive assemblies that are engineered to extraordinarily tight tolerances. They

are also, in many facilities, routinely run through a steam autoclave—a process that subjects them to temperatures exceeding 270°F, saturated steam, and significant pressure—cycle after cycle after cycle.

The physics of what happens inside that autoclave cycle is not friendly to optical components. Steam sterilization causes rapid thermal expansion and contraction of the materials within the scope—metals, glass, adhesives, and polymer coatings all expand and contract at different rates. Over time, this differential stress leads to microcracks in lens coatings and glass elements, breakdown of the adhesive bonds holding optical assemblies together, degradation of fiber bundles, and compromised seals that allow moisture ingress. Published technical commentary from ICO Optics describes this plainly: *“Steam sterilization (autoclaving) causes expansion and contraction, which stresses adhesives and leads to microcracks in glass or polymer coatings.”*

The damage is rarely catastrophic in a single cycle. It is cumulative. And that is precisely why it is so easy to miss—or to rationalize.

A scope that goes into the autoclave this morning may look and function fine today. Three months from now,

a surgeon comments that the image “seems a little dim.” Six months from now, the scope goes out for repair. Your team sends it in, a repaired unit comes back, and the cycle starts over. Nobody connects the dots between sterilization method and repair frequency because the timeline is long and the causality is not obvious in the moment.

What the research tells us

The evidence base here is more robust than many Sterile Processing (SP) professionals realize. Several peer-reviewed and industry studies have examined the comparative impact of steam versus low-temperature sterilization on optical components, and the findings are consistent.

A study published via Taylor & Francis Online found that *“high temperature damage to lenses was reduced in the order of 80% when low-temperature hydrogen peroxide gas plasma was applied for sterilization instead of steam autoclaving.”*²² That is not a marginal improvement—that is an 80% reduction in a specific, measurable damage mechanism simply by changing the sterilization modality.

A multi-center evaluation published by Dove Medical Press looked at optical degradation patterns in rigid



endoscopes and found something that should give every SP director pause: *“repaired endoscopes have a median lifespan of 30% fewer usages and median light transmission that is 11% lower than new endoscopes.”*² Let that sink in. When you get a repaired scope back from your vendor, you are not getting back what you sent in. You are getting back a device that, statistically, will need to be repaired again sooner and will deliver a dimmer, degraded image in the interim.

Research published in the *American Journal of Infection Control* went further, conducting an economic analysis across a 10-year horizon. The findings: *“increased low-temperature sterilization costs are outweighed by the savings associated with less frequent repairs. Over a 10-year period, in large health care facilities, the probability of achieving an internal rate of return of at least 6% is 0.81.”*³ STERIS’s Healthcare Knowledge Center has similarly documented that *“hydrogen peroxide-based low-temperature sterilization does less damage to medical instruments than steam autoclaves, resulting in lower repair and replacement costs.”*⁴

The evidence is there. It has been there for years. The question is whether our organizations are acting on it.

Low-temperature sterilization: a better option for optics

Low-temperature sterilization modalities—most commonly hydrogen peroxide gas plasma systems—operate at temperatures that are dramatically less stressful to optical assemblies, typically below 50°C. There is no saturated steam. There is no aggressive thermal cycling. The sterilant itself is effective against the full spectrum of surgical pathogens, and cycle times are competitive with—and in many practical workflows, faster than—steam when you factor in the drying phases that steam cycles require.

The majority of rigid endoscopes, camera heads, and light cords used in surgical environments today are dual-validated by their manufacturers for both steam and low-temperature sterilization. This means the choice of method is not a clinical efficacy question—both methods achieve the same sterility assurance level. It is a question of what we do to the device in the process of sterilizing it, and what the long-term consequences of that choice are.

In my experience, when facilities use low-temperature sterilization for their optical components as the standard of practice—not as the exception—they see fewer repairs, longer device lifespans, better image quality over time, and a more predictable capital and operational budget for these expensive instruments. The science supports what the operational data shows.

The repair/exchange agreement: where sterilization method becomes a financial decision

Here is where I want to be direct with my colleagues in SP leadership, because this is something that I believe our profession has not been vocal enough about.

Most facilities that own surgical optical components have a repair/exchange agreement in place with a service vendor. These contracts provide a mechanism for repairing or exchanging damaged or degraded scopes, cameras, and light cords, typically at a negotiated price or within a bundled service structure. On the surface, this seems straightforward. In practice, the way these agreements are structured has enormous financial implications—and the sterilization method your department uses is one of the primary drivers of those costs.

Here is what every SP director

should understand: the pricing and terms of repair/exchange agreements are frequently benchmarked against the volume of repairs and exchanges that occurred under the previous agreement. Vendors look at how many items were sent in, how often, and what the utilization pattern looked like, and they price the next contract accordingly. If your department has been steam sterilizing optical components at high frequency, your repair volume is likely high, and your next contract will be priced to reflect that history.

The inverse is equally true and equally important. Facilities that have transitioned optical components to low-temperature sterilization and maintained that practice consistently often see substantially lower repair volumes over time. When it comes time to renegotiate the agreement, that lower utilization history translates directly into negotiating leverage—and often into lower contract costs.

I have seen this play out firsthand. The financial delta between a repair/exchange agreement negotiated off a high-steam-utilization baseline versus one negotiated off a low-temperature baseline can be significant. We are talking about a line item that, in a large integrated delivery network (IDN), can easily reach six or seven figures annually. The sterilization decisions your team makes every single day in the decontamination room and sterilization floor are not just clinical and operational decisions—they are financial decisions with a long tail.

SP leadership must have a seat at the negotiating table

This brings me to what I consider the most important point of this article, and one I will advocate for without reservation: **SP leadership must be involved in the negotiation and**



renewal of repair/exchange agreements for optical components.

In many organizations, these contracts are negotiated and managed by Biomed, Periop, etc., often without meaningful input from the SP professionals who actually control the variables that drive the cost of those agreements. That is a structural problem, and it has real financial consequences.

SP directors and managers have direct operational control over the practices that determine how many repairs and exchanges will be needed. They understand the relationship between sterilization method, device lifespan, and repair frequency. They can assess current drying practices, evaluate whether workflow changes are needed to support low-temperature sterilization, identify whether staff education gaps exist, and quantify the actual impact of process changes over time. No one in the building is better positioned to influence the inputs that determine what an optical component repair/exchange agreement should cost.

If you are not currently part of the conversation when these agreements come up for renewal, I would encourage you to make the case for your inclusion, and bring data. Pull your repair and exchange utilization history. Identify what percentage of optical items are currently being steam sterilized versus low-temperature sterilized. Assess whether there is an opportunity to standardize to low-temperature sterilization for all dual-validated optical components. Then, bring that analysis to supply chain and leadership with a clear narrative: our sterilization practices directly drive this contract's cost, and I can demonstrate how operational changes in my department will reduce that cost over the term of the next agreement.

That is the language that resonates with health system leadership. That is the kind of strategic contribution that elevates the SPD from a cost center to a value-generating partner in the organization's financial health.

A final thought

SP professionals are, at our best, trusted advisors to our surgical teams, to our leadership, and to the broader clinical enterprise. The question of how we sterilize optical components may seem like a narrow technical matter, but it touches patient outcomes (image quality, device reliability), operational efficiency (turnaround times, cancellation rates), financial performance (repair costs, contract terms), and the long-term stewardship of expensive surgical capital.

We know the evidence. We have the operational control. The next step is making sure we have the organizational influence to act on both, including at the negotiating table.

Note: The views expressed in this article reflect the author's professional experience and perspective. Facilities should consult their device manufacturers' IFU and sterilization equipment suppliers when making sterilization method decisions. 

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