Cleaning A Microscope's Optical Surfaces

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Recently there was an exchange on the Confocal Listserver about the proper method for cleaning objective lenses. Some suggestions were useful and were some fraught with danger. This article is adapted from my reply to the list.

There are only three hard and fast rules about lens cleaning:

1) **Never "dry" clean a lens.**
2) **Use a solvent or dispersant that is likely to remove whatever is on the lens.**
3) **Use the best quality lens tissue available.**

The most likely source of damage to glass surfaces and fine optical coatings is abrasion. The particles that cause the abrasion are the particles on the objective lens surface and the particles in whatever is used to wipe the lens. If the surface of an objective lens is simply wiped with lens tissue, no matter how fine it tissue's quality, particulates will be rubbed on the lens surface and wear or abrade away the coating. If the particle is large and hard enough, the glass itself may be scratched.

The best procedure for lens cleaning is to remove the objective lens from the microscope and stand it on its base. Put a small drop of cleaning solution on the front surface and let it dissolve and float off any contaminant. Before the cleaner dries, gently wipe it off with lens tissue. Fine particulate matter will be drawn up into the spaces between the fibers of the lens tissue, with the fluid used to disperse it acting as a lubricant. Try using a gentle, aqueous cleaning fluid first. Commercial microscope lens cleaners available from scientific supply houses and microscope dealers usually work well. Some prefer Sparkle™, a window cleaner available in the Midwest. At Nikon, we include blue liquid Windex™ in our show kits. Aqueous cleaners offer the advantage of being able to disperse not only immersion oil, but most biological contaminants as well. If the aqueous cleaner does not work, move the objective lens into a fume hood and try solvents such as xylene or alcohol/ether mixtures. Do not leave organic solvents in contact with the cements holding the objective lenses together for any longer than necessary. Wipe the lens carefully with a quality lens tissue. If the residue has not been removed, repeat the procedure. Some aqueous lens cleaners have a high detergent content. Any such residue can be cleaned off with a mixture of anhydrous ether and alcohol.

The purpose of lens tissue is to trap the particulate contaminants that got on the lens. Good lens paper has a tissue-like consistency with plenty of space between the fibers to trap particulates. If the tissue is not soft and absorbent, it will not do its job. Before using something other than a high quality lens tissue, look at a few sheets under a microscope with a 10X objective lens and decide if its a good idea to rub the particulates seen there over the surface of an expensive objective lens. From what I have seen, the lens tissue marketed by all of the major microscope manufacturers is of excellent quality, as is Kodak lens tissue. Some lens papers from other sources are not nearly so fine.

One more source of damage to objective lenses is seepage. I have seen too many oil immersion objective lenses ruined by immersion in immersion oil. This happens when oil seeps between

the lens barrel and the outer sleeve and gets into the lens, especially with inverted microscopes. Sometimes, if lenses are left sitting in oil without being cleaned regularly, oil seeps in through voids in the cements that hold the individual lens elements in place. This will never happen if the oil is simply wiped off the objective lens and a fresh, *small* drop of oil is used every time the specimen is changed. Wipe the oil off the lenses at the end of each work session, and clean the lenses regularly, even the non-immersion ones.

Another kind of seepage that plagues inverted microscopes is even more damaging than immersion oil. When saline and tissue culture media drip through or even around the objective lenses, brass and aluminium components of the microscope corrode. I have seen objective lenses corroded into the nosepiece, DIC nosepiece prisms frozen in place, and other even more costly damage. Any spills on a tissue culture microscope should be attended to immediately. Physiological workstations should be thoroughly cleaned after each use. The aqueous cleaner used on the objective lenses can also be used to safely clean the rest of the microscope.

Cotton tipped applicator sticks have been suggested as an alternative to lens tissue in some lens cleaning applications. In my experience, lens tissue works best on small surfaces like the front surface of microscope objective lenses, and applicator sticks are most effective when used over large surfaces. Before using an applicator stick on an optical surface, check it under the microscope to make sure that it is residue free. Moisten the cotton tip of the applicator stick with the dispersant of choice and work in a spiral pattern out to the edge of the lens. If a film of dispersant remains, remove it with a clean applicator stick. Using this method one can clean to the edge of the top lens of an eyepiece. The same method applies for cleaning DIC prisms. If the quality of the applicator stick is suspect, you can cover the cotton end with lens tissue, but be aware that when cleaning quartz prisms, it is the cotton on a high quality applicator stick that removes the last traces of residue giving the prism a polished look.

The cost of the materials necessary to properly clean the optical surfaces of a microscope is small, especially when compared with the cost of repairing or replacing optical components damaged by mishandling or neglect. The investment in time is small as well. I have never damaged an objective lens using these simple guidelines and, I do not know of anyone else following them ever damaging a lens. ■