Rigid Endoscopes

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Objectives:

Discuss the development of the endoscope

Describe the parts of an endoscope

Discuss troubleshooting issues

Endoscopic surgery as we know it today had it's precursor as early as the time of Hippocrates when a speculum was used to look into the rectum. In 1585 an endoscopic light was designed to look into the nasal cavity. It was ingenious the way it was designed by using solar rays through a small opening.

Scientists and physicians were not satisfied with just exploring the easy orifices. They wanted to look at the internal organs of the body. In 1805, in Frankfurt, Germany, Bozzani, an obstetrician, used a tube as an endoscope and used hand-held candles for the light source. He was then censored for being too nosey. About 20 years later, Segalas, a French physician refined the original endoscope by adding an obturator to assist in the insertion as well as a series of mirrors which were used to deflect the light into the urethra for better visualization.

The first true cystoscope and urethroscope was designed around 1835. The designer, a man by the name of Desmoreau, is considered to be the "Father of Endoscopy". Kerosene lamp light was used with a mirror system to illuminate the urethra. A lens system was designed by Nitze, a German physician, in 1877 by adding a lens system to the scope. After Edison invented the light bulb, advancements continued with small light bulbs being added to the end of the scope in order to get better illumination. From this start, scopes were designed for nasal surgery, laryngoscopic surgery, esophagoscopy and photocopy.

On into the 19th and 20th century, advancements continued to be made. These included, using a needle to allow air to be introduced into the abdomen to create a bag-like area in the abdomen to see the internal organs. Using instruments thru a scope to cut adhesions. Applying electrical current to an instrument to cauterize the fallopian tubes to provide sterilization. The development of a way to transmit light along a quartz tube allowed pictures to be taken of the internal organs for the first time. And finally the use of lasers thru a scope to treat endometriosis.

We've looked at the history but we need to look at the building of an endoscope in order to truly understand the complexity of the instrument and how we need to treat it. In a rigid scope, we have the body and shaft of the scope, the eye piece, the light guide connector and the distal end. The body of the scope houses the mechanism which consolidates the image. The lenses, spacers and spring mechanism (holds the lens and spacers together) are placed in an adjacent shaft but are not glued together.

The shaft extends from the eye piece to the distal tip. This outer tube of the shaft is generally made of stainless steel while the inner tube is the part that carries the optical system (objective lenses, rod lenses and spacers). Because of the size of the endoscope, some of the rod lenses are the size of a single strand of spaghetti. No wonder they are so delicate and can so easily be damaged. One problem that can be encountered with the rod lenses being so small is when surgeons bend them by trying to se around the knee for instance. Bone is not movable and as a consequence, the scope shaft can become bent. How many times have we heard, "I didn't do it", it must have been done in CS".

The light guide connector is the cabling that connects the rigid endoscope to the light source. The light cord as we call it, is interesting in it's own right. There are thousands of tiny glass fibers that conduct light energy. These fibers can be finer than human hair. As a general rule, we don't notice if a few fibers are broken since the rest take up the slack.

. . However, once about 25 % of the fibers are broken, it becomes more noticeable. It becomes more difficult to see the internal organs we are looking at. If the cord is not repaired and fibers continue to break, it becomes akin to looking down a hole with a flashlight. The light just doesn't get to the area we want to see. In order to check for broken fibers, the easiest thing to do is to hold one end of the light cord to the light and look at the other end. If the fibers are broken, they will show up as dark spots in a sea of bright. Another thing that will help prevent the fibers from breaking in the sterilization process is to curl the light cord loosely in the packaging. If the cord is curled too tightly or wrapped around something, the fibers will break much quicker.

The eye piece is the rounded somewhat flat piece at the end of the shaft or body. When a camera is connected to the eye piece, a picture can be viewed on a monitor so that all staff in the room are able to see and assist the surgeon. When a scope is inadvertently dropped, it is possible to crack the eye piece. If it is not identified as damaged before going into a decontamination cycle and is immersed, fluid can get inside the shaft and create damage to the rod lenses as well as the housing of the endoscope.

It is sometimes necessary to remind staff not to touch the lens of the eye piece in processing as this can cause blurring of the picture due to skin oils being deposited on the lenses.

In the cleaning of endoscopes, each manufacturer has their own directions for cleaning and handling. Because endoscopes are so expensive, it is important to handle the scopes delicately. First, transportation to decontam should be in a closed container, they should not be left dangling or stuck in a basin of water. Make sure water is drawn up thru any channel in the scope in order to prevent debris from drying inside. It is imperative that when brushed are used, they are of the right texture so the bristles don't damage the delicate lenses at the end of the scope. A low-sudsing detergent should be used in order to prevent detergent residue from drying on the scope.

After the manual or automated cleaning process, the scopes must be thoroughly rinsed including the internal lumens to remove detergent residue that could become baked on the equipment during the sterilization process.

Many of the rigid endoscopes available to us now are autoclavable. These scopes are treated in the same manner of cleaning and disinfection as well as making sure all detergent is rinsed off before being placed in the autoclave for sterilization.

Storage of endoscopes is also very important. They need to be protected in order to prevent scratches, being dropped or any pathogen growth. Rigid endoscopes should be stored in a place that secures the endoscopes so they cannot roll off the storage area. Rigid scopes must also be stored in any area that prevents other instruments from being stored on top of them.

Preventative maintenance is absolutely necessary to promote the continued working of the rigid endoscope. Some endoscope manufacturers will offer preventative maintenance contracts to assist in repairing minor damage before it becomes major. All preventative maintenance and any service work should be documented so that the life expectancy of the endoscope can be predicted by looking at the scope's repair history. This is helpful for the budgeting process when you are trying to figure out what needs to be replaced and the cost.

Troubleshooting should be part of the process when getting the scope ready to go back into service after use. The owner's manual will have a section on troubleshooting. For instance, if the image appears to be cloudy, the distal tip may need to be carefully cleaned to remove any smudges or debris.

A cloudy image can also be caused by anti-fogging agents left on the eye piece before sterilization.

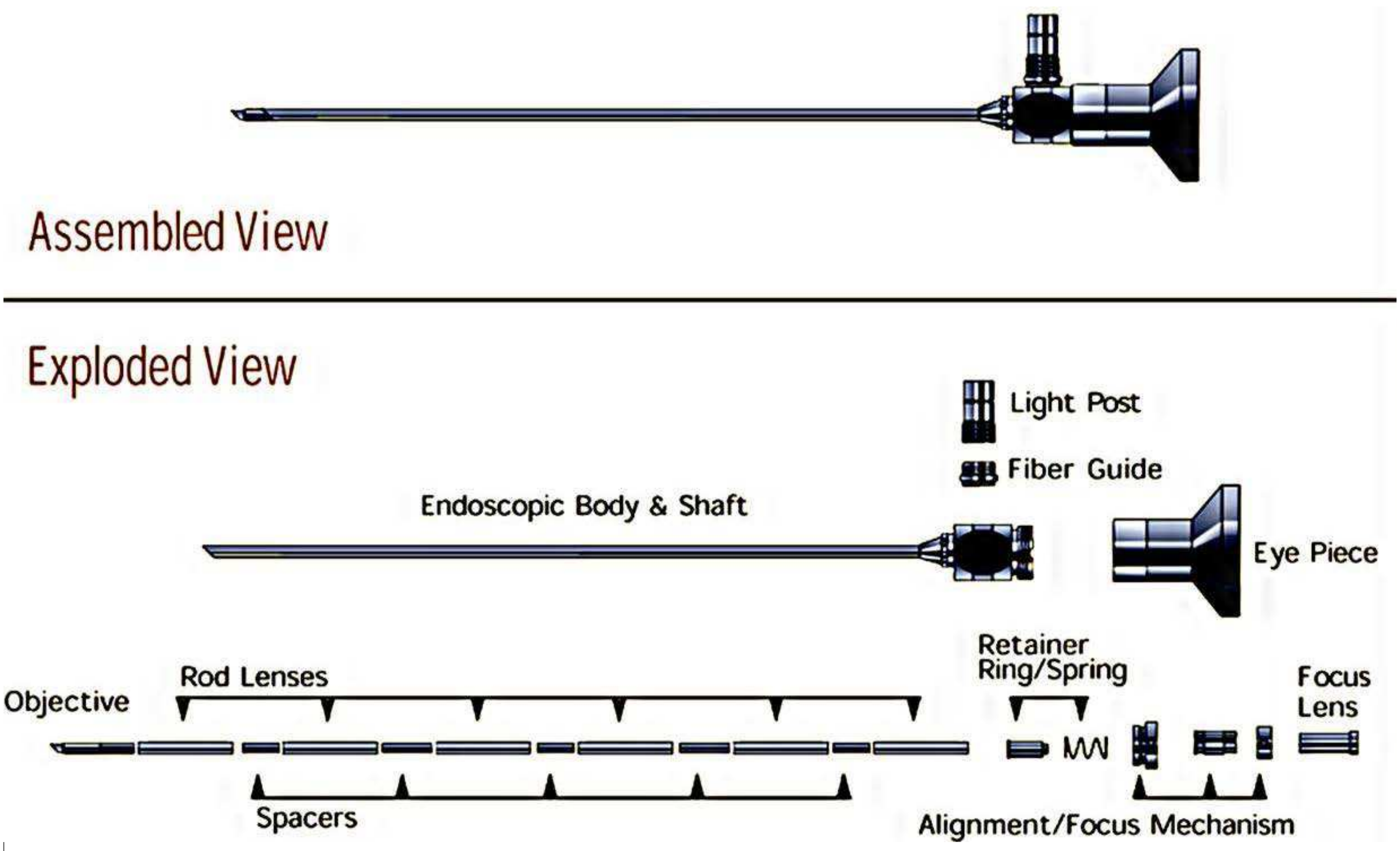
There are also some tips to be found in the owner's manual that could prevent damage to the scope. These include: holding the endoscope by the eye piece and the distal end to avoid bending the shaft; routinely inspecting the endoscope to insure it has not been damaged during use or while being processed; how to clean the lens surface to keep them free of debris & how to inspect the lenses for chips, cracks and scratches.

Although the use of endoscopes has grown exponentially based on the type of cases, it is still up to the Central Sterile Technician to provide the expertise to maintain the endoscopes properly. We are the guardians to the future by ensuring all parts of the rigid endoscope are checked on a regular basis. Because of the continued advancements in the field of Endoscopy, there will be a continued need for the work the CS tech does to ensure the performance of the scopes.

Resources:

AAMI. (2006) "Comprehensive Guide to Steam Sterilization and Sterility Assurance in Health Care Facilities," ANSI/ AAMI ST79, Arlington, VA, AAMI.

Reichert, M and Young, J, Sterilization Technology for the Health Care Facility, 1993, Gaithersburg, MD, Aspen Publishers, Inc.



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Post-Test

1. Bozzani, a German obstetrician, used a tube as an endoscope and candles for light sources.

   True False

2. Advancement in the development of endoscopes lead to using a needle to put air into the abdomen.

   True False

3. The 5 parts of the endoscope are: Eye piece, body, shaft, light guide connector, distal end.

   True False

4. The light cord is made of one glass fiber.

   True False

5. In the sterilization process, light cables must be coiled loosely to prevent damage.

   True False

6. The eye piece is the segment that the camera attaches to.

   True False

7. If anti-fog dries on the lens or eye piece, it will create a clearer image.

   True False

8. Any preventative maintenance or servicing should be documented to be able to blame the surgeon for damaging the scope.

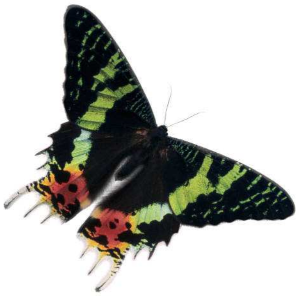
   True False

9. Trouble shooting tips can be found in the owner's manual.

   True False

10. The invention of the telephone by Thomas Edison assisted the continued advancement of the endoscope.

    True
    False



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