This lecture will discuss the handling and maintenance of all the equipment associated with arthroscopy. An arthroscope is a form of rigid endoscope that is used to visualize the inside of the joints of large and small animals. They allow the surgeon to examine the articular environment in a minimally invasive manner while the animal is under general anesthesia.

**Arthroscopes:**

There are many different components to an arthroscopy equipment system. The arthroscopes themselves are rigid endoscopes that generally range from 9cm to 15cm in length and 1.9mm to 6.0mm in diameter. Crudely, an arthroscope consists of a series of lenses and a fiber optic light wire housed in a metal tube. Most of the arthroscopes used today have a 30 degree “offset” and therefore do not look straight ahead at what they are pointed at but rather somewhat sideways. This allows the surgeon to visualize the articular environment with greater ease. The arthroscope is connected to a camera head and light source (discussed later) which allows the magnified image of the inside of the joint to be displayed on a monitor. These endoscopes are very fragile and, along with the camera, are the most problematic and difficult to maintain. The most common problems with arthroscope maintenance are bending and dropping. If the arthroscope is laid on its side and another instrument is then inadvertently laid on top of it, the tube can bend. Once the working tube of the arthroscope is even slightly bent, the instrument will not work as the image will not be able to be transferred to the camera head. To avoid bending the working tube of the arthroscope the instrument should never be laid on its side unless it is engaged within its associated cannula (discussed later). The cannula will provide additional protection against bending but keep in mind the instrument may still bend if heavy equipment is placed on top of it. The best way to avoid bending of the arthroscope is to always lay the instrument within its sterilization tray with sterile foam insert. These foam inserts usually have “cut outs” within them that perfectly match the arthroscope itself and will protect very well against inadvertent bending. Obviously, dropping of the instrument should be avoided at all times. Even if the arthroscope is dropped from a short distance (onto a countertop) the instrument should be checked to see if any of the lenses have been displaced or the tube has been slightly bent. Looking through the arthroscope with the naked eye is a crude method of checking the arthroscope but the preferred way is to connect it to a camera head and light source to evaluate the image that is displayed on a monitor.

Surgeons can also be guilty of damaging the arthroscope by applying too much force to the tube during the procedure or damaging the articular end with either a power shaver device or a radio-frequency ablation device. The articular end of the arthroscope should always be visualized during cleaning after every procedure to be sure neither of the above occurred.

All arthroscopes are passed into the joint via a cannula. The cannula is a tube that the arthroscope slides down and locks into when it is seated properly. It provides protection against bending and provides a conduit for fluids to flow into the joint. Each
arthroscope has its own specific cannula that it will fit into so care must be taken not to
switch cannulas between arthroscopes. In addition to the arthrosopic cannula there are
also instrument cannulas and outflow cannulas. These are also tubes that allow access
into the joint for instrumentation or a conduit for fluid to flow out of the joint after it is
pumped in. All cannulas have an associated trochar which is a metal rod that fits down
the middle of the tube. The end of the trochar is pointed and either sharp or blunt ended.
This trochar is used while the surgeon is introducing the cannula into the joint. After the
cannula is safely in the joint the trochar is removed and the procedure is performed. All
cannulas and trochars should be kept together with the arthroscopes and sterilized
together so that vital pieces of the arthroscopy kit are not lost or misplaced.

Most arthroscopes can be steam autoclaved but every effort should be made to
sterilize them either with ethylene oxide gas or hydrogen peroxide gas (Sterrad). The
extreme temperatures associated with a steam autoclave cause expansion and contraction
of the glue or weld that holds the lenses within the arthroscope which can cause
displacement or cracking of these lenses over time.

Cameras Heads:
The camera head is the “brains” of the arthroscopic equipment. This is a device
that attaches to the arthroscope itself and is responsible for producing the image on the
screen. Inside the camera head there are small computer chips that capture the actual
image into a digital image. The newest cameras have High Definition (HD) technology
and deliver crystal clear images for the surgeon. The camera head should be treated just
like a small computer. Although some companies claim that there camera heads can be
steam autoclaved, most companies recommend that the cameras be sterilized using
ethylene oxide gas or hydrogen peroxide gas. Camera heads and associated cables can be
used while not sterile by utilizing a sterile “sleeve” that slips over the camera head intra-
operatively.

Light Sources:
All endoscopes utilize a light source to illuminate the inside of the joint during the
procedure. The light source consists of a box that houses the bulb (usually xenon or
LED) that connects to the arthroscope via a sterile fiberoptic light cable. This cable
carries the light to the arthroscope and can be set at various light intensity levels. The
light cables should always be gas sterilized and carefully coiled loosely to avoid breaking
the fiberoptic wires within the cable bundle. The light cables come in various lengths and
are easily cleaned with a damp cloth. Xenon light bulbs need to be replaced
approximately every 1-2 years depending on hours of use. LED light sources do not need
to be replaced.

Image Capture Devices:
Image capture devices are commonly found on arthroscopy towers today. They
“capture” pictures or movies during the arthroscopic procedure and save them as either
jpegs or mpegs onto CDR’s or more commonly external hard drives. This allows the
practice to document the procedure digitally and to provide the owner with wonderful
pictures or movies of their dog’s arthroscopic procedure. Very little maintenance is
required for this piece of equipment.
"Shavers and Radiofrequency Ablation:

Most arthroscopic towers also have a device called a shaver. This usually consists of a power box that attaches to hand pieces held by the surgeon. The hand piece is the driver for various attachments (burrs, shavers, biters) that fit into the joint via the instrument portal. These power instruments are used to debride or ablate unwanted tissues within the joint. A radiofrequency ablation instrument may also be part of the tower. This instrument uses high frequency sound waves to generate heat at the tip of the instrument. This heat is used to ablate unwanted or damaged tissues within the joint. All of the attachments for the shaver and radiofrequency unit including the hand pieces should be gas sterilized.

"Monitor:

The monitor usually sits on top of the arthroscopic tower and is the device that projects the image created by the arthroscope and the camera head. Monitors are usually basic analog projection boxes but can be flat panel screens in the most evolved systems. Minimal maintenance is necessary for this part of the arthroscopic system. The monitor should be wiped with a disinfectant daily to prevent dust build up and keep the image clear for the surgeon.

"Arthroscopic Instruments:

There are various hand held instruments that are used during the arthroscopic procedures. Instruments used for grasping, cutting, and extracting tissue are most common and are usually kept in one large kit and sterilized together. These instruments are almost always made of stainless steel alloy and are usually safe to steam autoclave.

"Fluid Pump:

All arthroscopy requires fluid to be introduced into the joint to provide distention of the joint capsule and a clear environment to visualize the intra-articular structures. The fluid can either be introduced using gravity and a simple intravenous fluid bag (LRS) or via a specialized pump that forces fluid into the joint at a specific rate and pressure. These pumps are relatively intuitive to use and very little to no maintenance is required."