The Ultimate Guide For Surgical Instruments

Care, Cleaning & Identification

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BRIEF HISTORY OF SURGICAL INSTRUMENTS

Surgical instruments go as far back as 10,000 BC. Archaeological discoveries have unveiled cutting tools like a sharp flint used to sharpen animal teeth, grasping tools to extract arrows, saws, forceps and other ancient surgical instruments. Rubble amidst the volcanic ashes of the old Roman city of Pompeii unveiled an entire well-preserved arsenal of surgical instruments. The find is known as the *House of the Surgeon*, because of the nature of the collection found in the home.

Claude Moore Health Sciences Library by the University of Virginia received a reproduction of the Pompeii instruments in 1947. This library is one of the best preserved collections of this nature. Few changes have been made to surgical instruments' design and functionality since Hippocrates (5th century BC), who is called the father of medicine, and Galen (2nd century). Here are a few examples along with short description of how the instruments were used. The descriptions of the usage were provided by the medical writers of antiquity.

Hooks (Greek name: agkistron, Latin name: hamus, acutus) like the ones on the next page served the same purpose as today, to dissect blood vessels, manipulation or retracting. Both blunt and sharp were found.

Image courtesy of Historical Collections & Services, Claude Moore Health Sciences Library, University of Virginia.

Scissors (Greek: psalis, Latin: forfex) were used in ancient Rome for cutting hair, which was considered a medical procedure. Regular scissors where used. There are few references for surgical use of scissors, except for a few references to tissue cutting.

Image courtesy of Historical Collections & Services, Claude Moore Health Sciences Library, University of Virginia.

Forceps (Greek: tricholabis, Latin: vulsella) may not have been surgical instruments. There is little indication that the forceps were used for medical purpose, but rather articles mentioned them in cosmetic usage such hair removal and art.

Image courtesy of Historical Collections & Services, Claude Moore Health Sciences Library, University of Virginia.

WHAT IS STAINLESS STEEL?

Two main criteria to be considered when choosing the instruments are the quality of the steel and the manufacturing process itself. Manufacturing quality instruments involves standards for various aspects of the manufacturing process, including the basic requirements for quality steel, as well as vigorous inspection for every step on the process.

Stainless steel (Inox in Europe) is a mixture of metals, all playing different roles in the final alloy. Common elements found in steel composition includes:

- **Pure Iron** (Fe) is highly corrosive and soft, but when combined with other metals, it becomes by far one of the most commonly used industrial materials.
- **Carbon** added to the iron gives it hardness, adds consistency when the metal is welded and provides ductility. Ductility defines how a solid material stretches under tensile stress.
- **Chromium** adds resistance to corrosion, and in combination with the oxygen in the air, creates a more adherent surface film that resist further oxidation.
- **Nickel, magnesium, silicon, molybedum** and **sulfur** are called residual elements and are retained from the raw material. Unless the chemical composition of steel calls for a minimum or maximum of this elements, they may be present in the composition.

The degree to which the steel become "stainless" is determined by all these metals, by the heat treatment applied and by the final rinsing process. The additives increase the metal's capacity to resist highly corrosive environments such as blood, body fluids, salt solutions, cleaning solutions and sterilization methods.

Based on the mechanical properties and composition, the American Iron and Steel Institute (AISI) differentiate all steel, about 80 types, by using 3-digits numbers. The most used types of steel, when making surgical instruments, are the 300 and 400 series described below . This types of steel is rust and corrosion resistant, has good tensile strength and will provide a sharp edge for repetitive use. The 300 series steels are manufactured from the austenic steel class and cannot be hardened by heat treatment. 400 series steels are manufactured from the martensenic steel class series and can be hardened by heat treatment.

- **Stainless Steel 304** is the most popular variety of steel and is composed of 18% chromium and 8% nickel. This type cannot be hardened by heat treatments. Sometimes this steel is referred to as 18-8.
- **Stainless Steel 316** is the second most popular steel. For this type, the amount of chromium decreases to 16%, the nickel content goes up to 10% and molybedum is added in a concentration of 2%.This combination gives the steel an increased resistance to salt water corrosion.
- **Stainless Steel 410** is an alloy with a chromium composition of 11.5%. Because it has less chromium, it has better corrosion resistance.
- **Stainless Steel 409** has the lowest concentration of chromium, 10.5%.The corrosion resistance is similar to Stainless Steel 410.

Mechanical Property of Stainless Steel Grades

Stainless Grade	Hardness (Rb)[1]	Tensile Strength (1000 psi)[2]	Yield Strength (0.2% 1000 psi)[3]	Elongation (% in 2")[4]
304/316	78-83	80-85	30-42	50-60
430	80-85	70-75	40-50	30-35
410	80-82	70-75	34-45	25-35
409	75	65	35	25

[1]Rb is the abbreviation for Rockwell hardness measured in the B scale. The test is done by pressing a small indenter against a surface with a specific force.
[2]Tensile strength is the resistance of a material to a force tending to tear it apart. The unit of measure is PSI (pounds per square inch).
[3]The yield strength is the permanent deformation of a material when stress is applied.
[4]Elongation is a measure of the ductility of the steel, how far a material tested for tensile strength will elongate before a crack occurs.

Benefits of Stainless Steel

- Corrosion resistance (alkaline solution, chlorine, acids and water environments)
- High temperature resistance
- Easy to clean, making the best option in hospitals, clinics and laboratories
- Cost-effective
- 100% recyclable

Grades of Instruments

Surgical instruments come in three grades:

- Premium ore quality
- Intermediate ore quality
- Floor grade

Both premium and intermediate grade instruments are made out of corrosion resistant 300 and 400 steel and can withstand repetitive cutting or use, and repeated sterilization processes. They are manufactured to strict specifications and subjected to high quality control inspection at several points during the manufacturing process.

Floor grade instruments may look the same as the higher grades, but the specification for steel quality and manufacturing are less strict. Floor grade instruments are forged with recycled steel, and the finished product is plated to cover imperfections. These instruments can break more easily, and because they are plated, they can bend, and they rust relatively easily. This grade of instruments is designed for single use or as disposable instruments.

In order to avoid tissue damage, impaired healing or infection, good quality instrumentation should be used.

WHICH ALLOY IS BEST FOR MY INSTRUMENTS?

Inox, Titanium, Dumoxel®, Dumastar®, Antimagnetic... Have you ever looked at the variety of metal alloys for surgical instruments and laboratory tools and wondered which is best for your needs? Here's a brief rundown.

	Hardness (Rockwell)	Max. Temp. Resistance	Corrosion Resistance	Magnetic
Stainless Steel & Inox	55-56	350°C	Good	Yes
Dumoxel	36	350°C	Excellent	No
Dumostar	62	550°C	100% Non-corrosive	No
Titanium	37	550°C	100% Non-corrosive	No

Stainless Steel or Inox

Our standard line of instruments are manufactured of highest quality materials, they are made of austenitic 316 steel commonly known as "surgical steel" or "marine grade steel." The steel is highly corrosion-resistant, and it is a common choice of material for biomedical implants or body piercing jewelery. It is in compliance with ASTM F138. This WPI line is an excellent alternative to German surgical instruments. The high-quality, corrosion-resistant instruments are available at a fraction of the price of German surgical instruments.

Inox (stainless steel) is well suited for medical purposes, because this stainless steel, magnetic alloy has excellent corrosion resistance and good salt resistance. Temperature resistant up to 400°C, it can be autoclaved at 180°C. Almost as strong as carbon steel, Inox is an excellent general-purpose alloy for surgical instruments.

Titanium

100% anti-magnetic, corrosion-resistant, lightweight and strong, titanium alloy is ideal for biological and medical applications. Titanium has the tensile strength of carbon steel and is completely resistant to corrosion from nitric acid, chloride, saltwater, industrial chemicals and organic chemicals. Titanium is more flexible and 40% lighter than Inox. When heated or cooled, the dimensions of titanium alloy change less than half of what stainless steel alloys will, making titanium surgical instruments much more durable. Titanium is stain-free and temperature resistant up to 430°C. Titanium is the softest alloy for surgical instruments. Titanium tools are the premium choice for corrosive environments or MRI applications.

Dumoxel®

Developed by Dumont Tools, Dumoxel is highly resistant to sulphuric environments, hydrochloric acid, mineral and organic acids. Extremely flexible, Dumoxel is 95% antimagnetic and stain resistant. The high molybedum and chromium content increases its resistance to corrosion. It is more likely to bend than break. Temperature resistant up to 400°C, it can be autoclaved at 270°C. Dumoxel is the most popular Dumont alloy for tools.

Dumostar®

Patented by Dumont Tools, Dumostar is more elastic and more corrosion-resistant than the best stainless steel. It is resistant to minerals, organic acids and salt corrosion. Dumostar is 100% anti-magnetic and temperature resistant up to 500°C. It is highly resistant to metal fatigue, has great elasticity and is durable. It is more likely to bend than break. Dumostar is the most cost-effective and appropriate alloy for laboratory tools.

Antimagnetic

With good corrosion resistance, this alloy is 80% antimagnetic. Temperature resistant up to 400°C, it can be autoclaved at 270°C. Antimagnetic is not quite as hard as Inox.

Tungsten Carbide

As a general rule, surgical instruments with tungsten carbide inserts performing the same type of work will last up to five times longer than stainless steel instruments. The additional length of service makes tungsten carbide surgical instruments more cost-effective than cheaper models.

Black Titanium Coated

Our black instruments are coated with titanium nitride (TiN), an extremely hard ceramic material. The TiN coating hardens and protects the cutting edge. Ceramic coated anti-reflective instruments are perfect for microscopy and microsurgical applications. Coating surgical instruments with a black ceramic adds a thin layer to the metal instrument, making the instrument harder and giving you greater precision. This anti-glare surface minimizes reflections off the surface of your instruments. The incredibly smooth coating improves the instruments' resistance to corrosion and minimizes friction. The ceramic coating is virtually impenetrable, because the raw material is bonded to the instrument both physically and chemically. These instruments are much more resilient to the pressure of daily use and chemical processing. Coated instruments last considerably longer.

PERFORMANCE

Surgical instruments are designed to perform diagnostic, therapeutic, or investigative operations having specific functions such as to cut or incise, retract, grasp, hold or occlude, dilate or probe, suture or ligate.

The majority of surgical instruments are made of stainless steel or titanium (used where non-magnetic instruments are required). Stainless steel is an alloy that contains a minimum 12% chromium for corrosion resistance.

The instruments can vary in quality and price and often represent a large portion of a surgical budget. Caring for this investment is the responsibility of all who use them from technicians to surgeons.

Managing the instrument care process begins with understanding the many types and styles and using the correct one for your procedure. Most surgical instruments are made of surgical stainless steel and are quite robust and resilient, however, they are not indestructible. Stainless steel does stain. It just stains less than other types of steel.

Properly cleaning and caring for your surgical instruments is the single easiest way to prolong their use and improve the outcome of your surgical procedures.

Choosing the correct surgical instruments is imperative for assuring your success. This guide will help you to understand the importance of choosing the right material for your instruments and what it takes to get the instrument from raw material to finished product, as well the importance of routine cleaning and maintenance.

HOW ARE SURGICAL INSTRUMENTS MADE?

Surgical instruments can be made of a variety of materials. Series 300 surgical stainless steel is the most common. In metallurgy, stainless steel refers to a steel alloy, meaning raw steel is combined with other metals to improve various properties. A very small amount of carbon is added to increase the strength of the steel, and at least 11% chromium is added to increase the corrosion-resistance. The process by which surgical instruments are created includes **forging**, **grinding**, **milling**, **finishing** and **heat treating**.

Forging

Forging involves stamping an outline of the instrument on the steel. It is the basis for a quality instrument. Heated stainless steel is stamped using a die.

Heat Treating

The heating and cooling process must be done very carefully to result in a high quality forging and high quality surgical instruments.

Flashing

The edges of the forging, called flashing, are very rough and are removed by grinding and milling during the second phase of production.

Finishing

After the rough edges are removed from the open spaces such as in the ring handles, machinery is used to finish the instrument. Finishing includes honing the blades to the appropriate sharpness, creating the male and female halves of scissors, hemostats and other hinged instruments, creating serrations, etc.

Once the instruments are sharpened and assembled, they are heated and then cooled in a controlled process called annealing. Annealing the instruments conditions the metal to be strong and hard. Once cooled the instruments then go through polishing and passivation. Polishing ensures a smooth finish for the instrument and can result in either a shiny, mirror finish or a satin/matte finish. Both finishes are acceptable and have their own virtues. A mirror finish reflects light, which can be annoying under surgical lights, however, it discourages staining. A satin finish does not reflect light, however, it is more susceptible to staining.

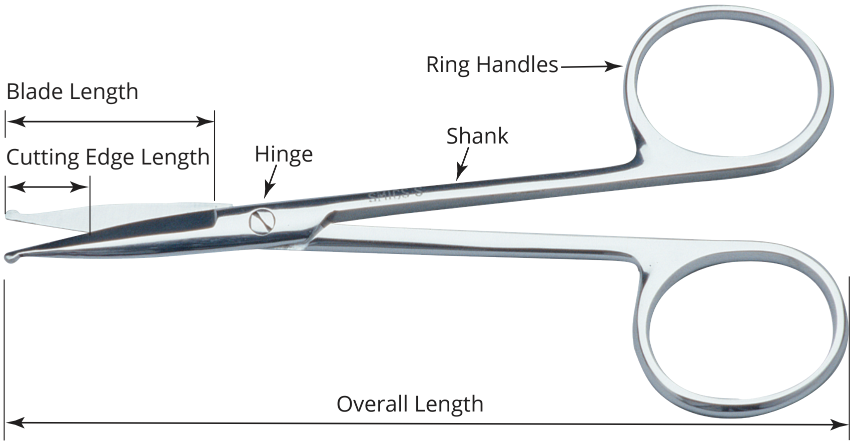
Passivation, the formation of a hard, non-reactive surface film that inhibits further corrosion, is achieved by submerging the instrument in nitric acid. The nitric acid removes the iron remnants from the outer layer of the instrument and increases the formation of a protective chromium layer.

Marking instruments, often with the instrument company's name or brand, is generally done by acid etching which does not affect the integrity of the instrument.

BE THE INSTRUMENT EXPERT

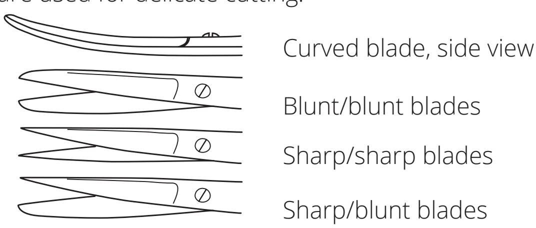
Scissors

Scissors are widely used in healthcare units, hospitals and laboratories. The smaller sized blades are used at the surface for small incisions and the longer blades go deeper into cavities. Curved blades provide a better visual of the working area and straight blades can be used for any type of incision.



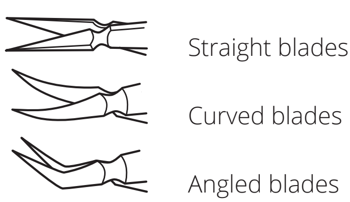
Standard Scissor Tips

Standard scissors are available in a variety of lengths and patterns with straight, curved or angled blades. Heavy duty patterns are for blunt dissection. Fine, thin blades are used for delicate cutting.



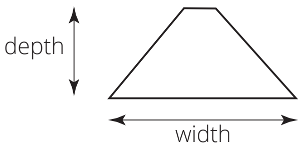
Micro Scissor Tips

Micro scissors are often called Vannas or spring scissors. They are excellent for left hand users.



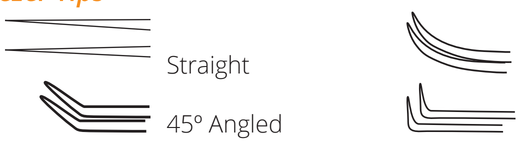
Tweezers

Tweezers are used for grasping tissue, cells and other materials, generally under a microscope. The tips are sharpened to a fine point. Tweezer tips are measured by examining a cross section of the tip and measuring the width and the depth. The width is the first number reported, and the depth is the second number.



0.1 x 0.06 mm tips

Tweezer Tips

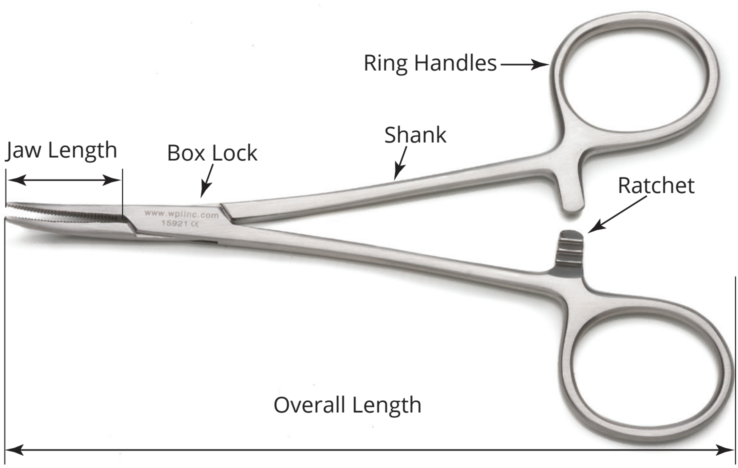


Hemostats

Ring forceps (also called hemostatic forceps) are hinged and look like ring scissors. Frequently, hemostatic forceps have a locking mechanism called a ratchet, which is used for clamping. The jaws of the locking forceps gradually come together as each increment of the ratchet is employed.

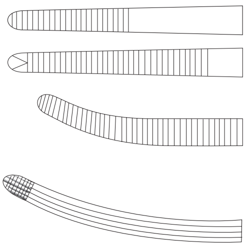
Ring forceps are used for grasping, holding firmly or exerting traction upon objects. For especially delicate operations, generally ring handles with a locking ratchet are preferred over thumb forceps.

Locking hemostatic forceps may be called clamps and are used to securely hold tissue. When they are used to control blood flow, they are called hemostats. Hemostats are typically used to compress blood vessels or other tubular structures to obstruct the flow of blood or fluids.



The jaws can be straight, curved or right angle. They come in a variety of sizes depending on your application. For example, Mosquito hemostats clamp small blood vessels, and Kelly hemostats can be used to clamp larger vessels or grasp tissue. Kelly hemostats and Rochester forceps look similar. However, Kelly hemostats have shorter serrations. Rochester hemostats can reach a little deeper.

Hemostat Tips



Crile hemostats, straight

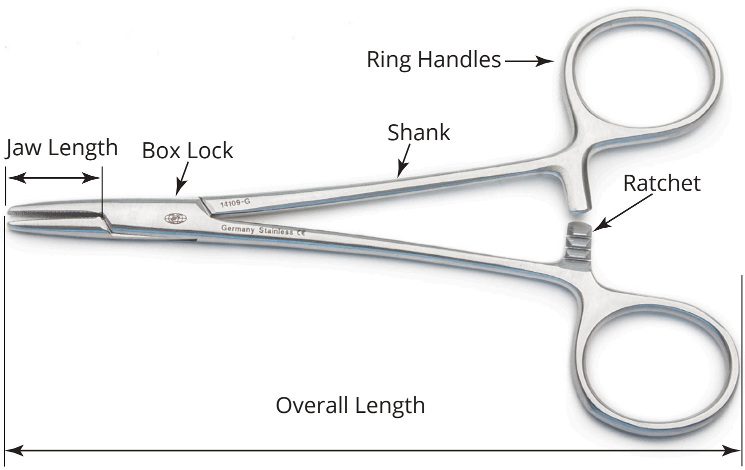
Rochester-Pean hemostats, straight

Kelly hemostats, curved

Rochester-Carmalt hemostats, curved

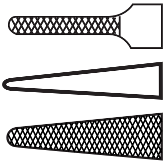
Needle Holders

Needle holders, also known as needle forceps or needle drivers, are used in suturing during a surgical procedure. Needle holders typically have a textured tip for a secure hold. Often they have a ratchet (or other mechanism for locking). Some have tungsten carbide inserts in the tips. Tungsten carbide inserts are more durable than stainless steel, last longer and typically offer a better grip. Tungsten carbide (TC) is harder than stainless steel. Look for the gold handles which designate tungsten carbide inserts. Titanium needle holders are lighter weight, which makes them easier to use during long procedures. Choose your needle holders based on the size of the needle you are using, so that they securely hold your needle. The smaller the needle, the smaller the needle holder.



Standard Needle Holder Tips

The ratchet locks the tips on the needle of standard needle holders. The tips can be straight or curved. Serrated tips work better for holding larger needles. Smooth tips are designed for the smallest needles. Some needle holders have built-in suture scissors.



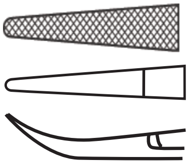
Ryder, serrated jaw

Smooth jaw

Standard, serrated jaw

Micro Needle Holder Tips

Micro needle holders have the spring (squeeze) handles for ambidextrous use. They come with or without a lock, smooth or serrated, and straight or curved.



Serrated jaw

Smooth jaw

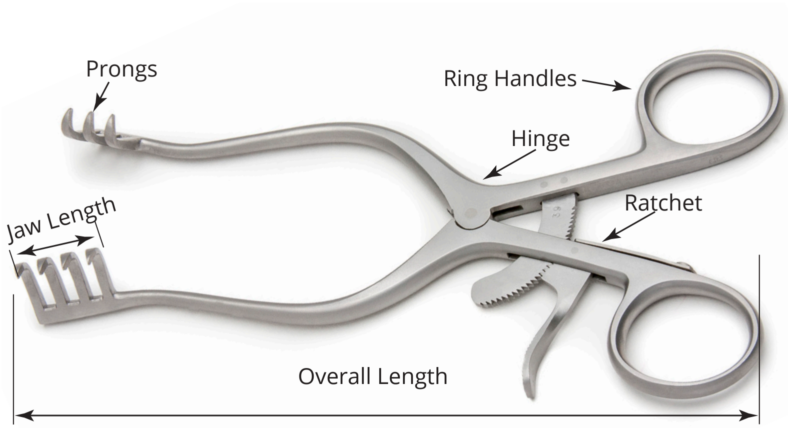
Curved jaw

Retractors

Retractors are used to hold an incision or a wound open, to hold an organ or tissue out of the way to expose what's underneath. Three broad categories of retractors include:

- **Hand Retractors** must be held by an assistant, a robot or the surgeon during a procedure.
- **Self-Retaining Retractors** have a mechanical device for holding tissue during surgery, allowing hands free operations. Self-retaining retractors have a screw, ratchet or some type of clamp to hold the tissue. These allow the surgeon to operate with two free hands.
- **Wire Retractors** are the simplest style of retractor. Usually the wire has some spring so that the surgeon can pinch it together, position it and release it. These also free up the surgeon's hands.

The most common retractors include the Belfour, Gelpi, Weitlaner, Barraquer, Wire and Stevenson retractors.



How Do I Select Appropriate Instruments for My Application?

There are literally thousands of different surgical instrument patterns and styles available in the world today for an infinite number of applications. The vast majority of these instruments have been developed for clinical use in human beings and are not specifically geared toward use in research on very small animals, embryos and cells. However, with a little thought and investigation, an appropriate instrument can be found for nearly every surgical research application.

Few instruments on the market are made for one specific application, and often instruments are re-purposed into tools that will work in many situations. For example, smooth jawed, curved micro needle holders are excellent for mouse laminectomies, but their original use is for driving suture needles.

When you are selecting surgical instruments for a procedure, here are a few key points to consider.

- What procedure are you performing? Published research papers usually indicate which instruments other researchers have used for similar procedures. The correct surgical instrument for a particular procedure makes a difference on the outcome of that technique.
- What is the size of your subject? An instrument that is perfect for a 200–300 g rat (about 22–25 cm long) may not be the best choice for a neo-natal mouse of about 15 g (about 1–2.5 cm long).
- How often will the instrument be used? If you perform more than 100 cuts per day, a pair of titanium scissors or a pair of scissors with tungsten carbide inserts would be worth considering. They stay sharp longer.

Let's consider some of these factors and offer a few tips for selecting an appropriate pair of scissors, tweezers and forceps.

When selecting instruments, it is helpful to understand the methods used to measure and communicate the various attributes of an instrument. Length is fairly obvious, but there may be some confusion about blade length, tip dimensions, retractor openings, tooth dimensions and more.

The overall length of an instrument is measured from the bottom of the handle or rings to the tip.

Micro Scissors

Cutting edge lengths are measured as the operational length of the cutting edge. For example, a micro scissor blade is measured by looking at the length when the scissor is lying on a surface in the natural open position. This is the maximum the jaws will open without reverse force, therefore, it is the operational blade length. It is most accurate to do the measurement under a microscope using a reticle.

Standard Scissors

The cutting edge length on standard scissors requires a little bit more subjectivity, but will still be an adequate measurement. They are measured by opening the scissors to a normal, natural opening and measuring the distance from the tip to where the two blades cross.

Cutting Instruments

Most surgical instruments can be used for general surgery in a research laboratory setting. Instruments may be roughly categorized by function. Cutting instruments include scissors, surgical blades, knives and scalpels.

Scissors

Fine tip scissors (like Vannas, Castroviejos and McPhersons) are ideal for use in very restricted spaces. They are perfect for right or left hand use, and are designed for ophthalmological procedures, which require a delicate incision of tissue. You can make quick, accurate cuts with minimal tissue damage using these sharp blades.

TIP: Curve tipped scissors are a good choice when you want to avoid cutting underlying tissues.

TIP: Scissors designed with a heavier construction (like Metzenbaum, Mayo and SuperCut scissors) are useful for cutting fur, thicker tissue, bone or muscle.

Metzenbaum Scissors with tungsten carbide inserts

TIP: The length of the scissor tips should match the depth of the incision you need to make.

Black Ceramic Scissors

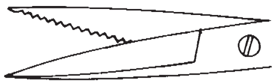
Our black instruments are coated with titanium nitride (TiN), an extremely hard ceramic material. The TiN coating hardens and protects the cutting edge. Ceramic coated anti-reflective instruments are perfect for microscopy and microsurgical applications. The ceramic coating is virtually impenetrable, because the raw material is bonded to the instrument both physically and chemically.

These instruments are much more resilient to the pressure of daily use and chemical processing. Coated instruments last considerably longer.

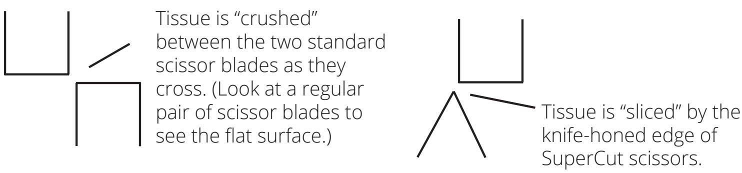
Corrosion resistant • Non-reflective • Low friction • Wear & tear resistant • Biocompatible

SuperCut Scissors

Our black handled surgical scissors designate our SuperCut scissors. These scissors have one razor sharp blade and one micro-serrate blade. The sharp edge gives a clean cut with minimal tissue damage, and the serrated edge actually holds the tissue to prevent it from slipping while you are making an incision.



Iris SuperCut Scissors



Side view comparison of standard scissor blades and knife-edge honed SuperCut blades.

Tungsten Carbide Scissors

Scissors with tungsten carbide inserts have golden handles. Tungsten carbide instruments are more durable, hold an edge longer and last longer than stainless steel instruments. Scissors with one black handle and one gold handle are both serrated and have tungsten carbide blade inserts, giving you the very best of both worlds.

Spring Scissors

Spring scissors are perfect for left or right hand use. They are designed for neurosurgical, vascular, microsurgical and ophthalmological uses. Vannas scissors are delicate spring scissors. They are used frequently in ophthalmic and neurosurgical applications. The fine scissor blades are sharp. Vannas scissors work well under a dissection microscope.

Sapphire Blade for a Knife

Sapphire blades may be used in microsurgery, dissection and related applications. They are not as hard as a diamond, but still hundreds of times harder then a razor blade. Sapphire blades can cut with minimum pressure, without tearing or damaging the specimen. The blades are corrosion-free and resistant to saline solution. They offer a super sharp cutting edge, and they work with stainless steel or titanium handles. These blades may be autoclaved up to 200°C.

Grasping Instruments

Grasping or holding instruments, including surgical forceps, may be broadly divided into two categories, ring forceps (also called hemostats, hemostatic forceps and locking forceps) and thumb forceps (frequently called tweezers or pinning forceps). Here are some tips to keep in mind when selecting an appropriate pair of forceps:

- Reverse forceps are self-closing. You squeeze them to open them. They provide uniform tension.

- Ceramic tipped forceps are non-porous, corrosion and heat resistant and insulated.

- Straight tips on forceps are used for general precision work, and slightly curved or fully curved tips provide more visibility

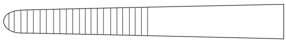
Hemostatic Forceps

Ring forceps, also called hemostats or locking forceps, are an instrument for grasping, holding firmly or exerting traction upon objects especially for delicate operations. They are hinged and look like ring scissors. Frequently, hemostatic forceps have a locking mechanism called a ratchet, which is used for clamping. The jaws of the locking forceps gradually come together as each increment of the ratchet is employed.

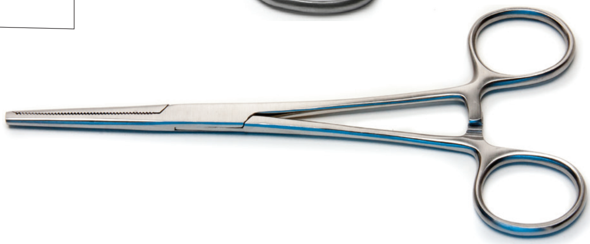
Locking hemostatic forceps may be called clamps and are used to securely hold tissue. When they are used to control blood flow, they are called hemostats. Hemostats are typically used to compress blood vessels or other tubular structures to obstruct the flow of blood or fluids.

Common Types of Ring Forceps

Kelly hemostats can be used to clamp larger vessels or grasp tissue. **Kelly** hemostats and **Rochester** forceps look similar. However, **Kelly** hemostats have shorter serrations. **Rochester** hemostats can reach a little deeper.



Kelly-Rankin Hemostats



Rochester Oschner Hemostats

Hartman Mosquito forceps have fine, short tips and a serrated jaw. **Hartman Mosquito** hemostats are used as hemostats for clamping small blood vessels and in fine tissue dissection when the incision is shallow. Use them to clamp small blood vessels or hold fine sutures. For a lighter and longer hemostat, try the **Halstead Mosquito** forceps.

(Left) Hartman Mosquito Forceps *(Right) Halsted Mosquito Forceps*

Allis tissue forceps have sharp teeth for gripping heavy tissue. Because they can cause damage, they typically hold tissue that is to be removed.

Crile hemostats are similar to **Halsted Mosquito** forceps, but they are a little larger

Rochester-Oschner forceps are heavy hemostats designed for clamping large vessels or grasping dense tissue. They are serrated for grasping and often have teeth at the tip, too.

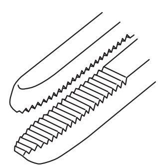
Rochester-Carmalt forceps, nicknamed the "stars and stripes hemostat," are characterized by the longitudinal serrations that run the length of the blade with cross-hatching at the tip. These large, crushing hemostatic forceps are a choice instrument for clamping blood vessels and large tissues or ligating pedicles.

Rochester-Pean hemostatic forceps are designed with full horizontal serrations for clamping larger tissue and vessels.

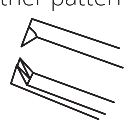
Thumb Forceps

Thumb forceps are spring forceps used by compression between your thumb and forefinger and are used for grasping, holding or manipulating body tissue. They have no ratchet in the handle. Two broad categories of thumb forceps are dressing forceps and tissue forceps.

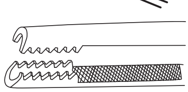
Dressing forceps are used when dressing wounds and removing dressings. Very fine dressing forceps are also used in eye surgery. Dressing forceps have serrated tips for grasping delicate tissue and dressings.



Tissue forceps generally have teeth, which offer a better grip on tissues while minimizing tissue damage. The most common pattern is 1x2 teeth, also known as rat tooth forceps. Other patterns include 2x3, 3x4, 4x5 and 9x9 (Adson-Brown).



1x2 Rat tooth forceps



9x9 Adson-Brown forceps

2x3 Rat tooth forceps

Common Types of Thumb Forceps

Adson tissue forceps are designed for grasping delicate tissues, and they have 1x2 teeth.

Bonn tissue forceps are designed for delicate work, and they include a tying platform to assist when you are tying sutures.

Foerster tissue forceps work well when handling delicate tissue. These serrated forceps have the unique octagonal keyhole in the handle, giving you tactile feedback and control. The keyhole also gives you a better grip, especially when you are wearing gloves. When you need a firm grip and minimal tissue trauma, the **Foerster** forceps are an excellent choice.

Iris forceps are designed for use in ophthalmologic work. The Iris dressing forceps are serrated and the **Iris** tissue forceps have 1x2 teeth.

Iris Dressing Forceps

Iris Tissue Forceps

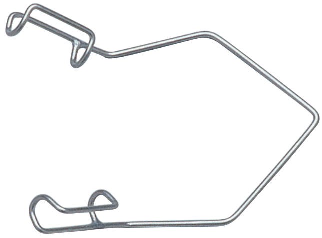
Graefe forceps have a horizontal row of 6 (or 8) small teeth for grasping tissue. They are most commonly use in ophthalmologic applications.

Retractors

Retractors are used to hold an incision or a wound open, to hold an organ or tissue out of the way to expose what is underneath. Common retractors include Gelpi, Weitlaner and US Army style instruments.

An assistant, a robot or the surgeon must hold hand retractors during a procedure. Self-retaining retractors have a mechanical device for holding tissue during surgery, allowing hands-free operations. Self-retaining retractors have a screw, ratchet or some type of clamp to hold the tissue by itself. These allow the surgeon to operate with two free hands. Wire retractors are the simplest style of retractor. Usually the wire has some spring so that the surgeon can pinch it together, position it and release it. These also free up the surgeon's hands.

Senn Hand Retractor



(Left) Baby Balfour Self-Retaining Retractor *(Right) Wire Retractor*

Cleaning Your Instruments

The proper care and handling of surgical instruments is the simplest way to protect your investment and add years to the life of your instruments.

Rinsing

The first step in properly cleaning your instruments is to rinse off all blood, bodily fluids, and tissue immediately after use. Dried soils may damage the instrument surface and make cleaning difficult. Use plain water, but do not use hot water, because proteinous substances will coagulate.

Manual Cleaning

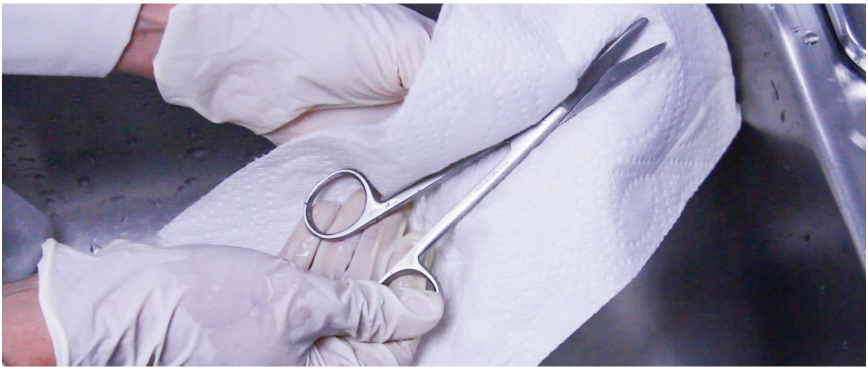
When you are cleaning instruments:

- Use stiff plastic cleaning brushes.
- Do not use steel wool or wire brushes.
- Use only neutral pH detergents.
- If not rinsed properly, low pH detergents may breakdown the stainless protective surface and cause black staining.

- High pH detergents may cause surface deposits of brown stains, which can interfere with the smooth operation of the instrument.

1. Mix a product such as Alconox (WPI # **13740**) according to the manufacturer's directions and use to it wash the instruments.
2. Use appropriate brushes to clean each surgical instrument.
   - Use a microbrush to remove debris from the hinged area of scissors, forceps, hemostats, ronguers, needle holders and retractors.
   - Use a microbrush to remove the debris from the box lock area and the ratchet of hemostats and needle holders.
   - Use a microbrush to clean the delicate tips of tweezers.
   - Use a microbrush to remove debris from all moving parts of retractors.
   - Use a stiff brush to clean the tip serrations and handle serrations of dressing forceps and needle holders.
   - Use a stiff brush to clean the teeth of tissue forceps.
   - Brush delicate instruments carefully and handle them separately from general instruments. Ultrasonic cleaning is recommended for delicate instruments like micro scissors (also known as Vannas scissors).

3. Inspect all instrument surfaces to ensure they are visibly clean and free of stains and tissue. Inspect each instrument for proper function and condition. See "Inspecting Your Instruments" on page 24.
4. Rinse instruments thoroughly under running water. While rinsing, open and close scissors, hemostats, needle holders and other hinged instruments to ensure that hinge areas are also rinsed.
5. Dry instruments thoroughly with a clean towel. This minimizes the risk of corrosion and formation of water spots. Use a spray lubricant (WPI #**500126**) in the hinges to improve the function of the instrument.



Ultrasonic Cleaning

Ultrasonic cleaning is the most effective cleaning method. Ultrasonic cleaning is the result of cavitation. The vibrating sound waves create micron-size bubbles in the solution that grow with the alternating pressure. When they reach a resonant size, the bubbles implode creating a force that dislodges dirt and particles, even in the smallest of crevices. The use of an ultrasonic detergent (instead of plain water) greatly improves the rate of cavitation. Ultrasonic cleaning is specifically recommended for micro scissors and small instruments.

WPI #**504216**

1. First, mix the enzymatic cleaner (like Enzol - WPI #**7363**), or other neutral pH or mild alkaline detergent (like Alconox - WPI #**13740**) according to the manufacturer recommendations. Use deionized water, if available.
2. Run the ultrasonic cleaner for several minutes to degas the solution and obtain the correct temperature.
3. Place the instruments in an open position into the ultrasonic cleaner. Do not allow instruments with sharp blades to touch other instruments. All instruments must be fully submerged.

CAUTION: Do not place dissimilar metals (stainless, copper, chrome plated, etc.) in the same cleaning cycle.

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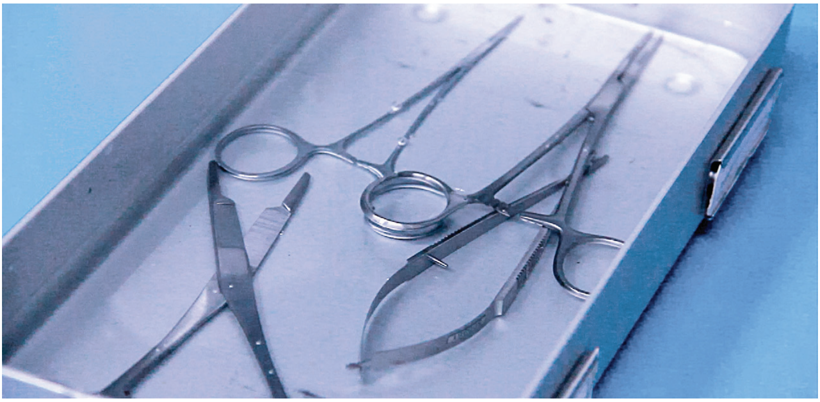
4. Process instruments in the cleaner for 5 to 10 minutes.
5. Rinse the instruments with water to remove the ultrasonic cleaning solution and any remaining soils.
6. Dry the instruments thoroughly with a clean towel. This minimizes the risk of corrosion and the formation of water spots.
7. Use a spray lubricant (WPI #**500126**) in the hinges to improve the function of the instrument.

Automatic Washer

Follow the manufacturer's recommendations. Lubricate instruments after the last rinse cycle and before the sterilization cycle.

Soaking

Large, non-delicate instruments may be soaked in a corrosion inhibiting detergent (like Alconox - WPI #**13740**) when other cleaning methods are not practical. Rinse and dry your instruments after soaking them.



Sterilizing Your Instruments

Autoclaving

1. Using a surgical instrument lubricant (WPI #**500126**), lubricate all instruments that have any metal-to-metal action such as scissors, hemostats, needle holders, self retaining retractors, etc.

CAUTION: Do not use WD-40, oil or other industrial lubricants.

CAUTION: Never lock an instrument during autoclaving. This will prevent the steam from reaching and sterilizing the metal-to-metal surfaces. Heat expansion during autoclaving could also cause cracks in hinge areas.

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2. Place a towel on bottom of the sterilization tray to absorb excess moisture during autoclaving. Arrange the instruments in the trays.
3. Load the autoclave chamber, but do not overload it. Overloading may hinder steam penetration.
4. Run your autoclave according to the manufacturer's directions. At the end of the autoclave cycle (before the drying cycle) unlock autoclave door and open it no more than a crack (about 3/4"). Run the drying cycle for the period recommended by the autoclave manufacturer. If the autoclave door is opened fully before the drying cycle, cold room air will rush into the chamber, causing condensation on the instruments. This will result in water stains on instruments and also cause wet packs.

Cold Sterilization

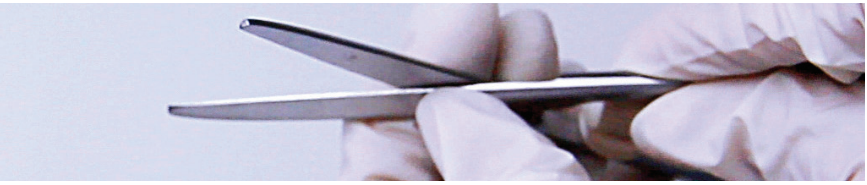
Most cold sterilization solutions require a 10-hour immersion to render instruments sterile, but this prolonged chemical action may be more detrimental to surgical instruments than the 20-minute autoclave cycle. If the instruments only need to be disinfected (clean and free of most microorganisms), cold sterilization is acceptable, since disinfection will take place in only 10 minutes. However, to render the instruments sterile (with absolutely no microorganisms surviving), autoclaving is recommended.

CAUTION: For instruments with tungsten carbide inserts (needle holders, scissors, tissue forceps), do not use solutions containing benzyl ammonium chloride which will destroy the tungsten carbide inserts.

Inspecting Your Instruments

Scissors

- ❏ Scissor blades should glide smoothly, and the blades must not be loose when they are in the closed position.
- ❏ Scissors must be sharp and smooth. They must cut easily. Use a latex material to test their cutting. Scissors should not snag the test material. The blades should cut smoothly without hesitation as the blades close.
- ❏ Examine cutting instruments and knives to be sure their blades are sharp and undamaged.
- ❏ Inspect the cutting edges for chips, nicks and dents. They should be burr-free.
- ❏ If the scissors have tungsten carbide inserts, the blades should not have any voids, and no soldering material should be visible



Forceps/Hemostats

- ❏ Check that forceps tips are properly aligned.
- ❏ Hemostats should lock and unlock easily, and the joints should not be too loose.
- ❏ Hold your closed forceps blades up to a light source. No substantial light should pass through the closed jaws.
- ❏ Clamp the forceps on a plastic surface. You should see a clear and consistent impression on the plastic when the forceps are removed.
- ❏ Close the jaws and examine the tip. The jaws should meet and be closely aligned.
- ❏ Ratchets should engage crisply and smoothly. When the ratchet is engaged, it should not open easily if the instrument is lightly tapped on the edge of a table.

Needle Holders

- ❏ Check needle holder jaws for wear. They should not show light through the jaws.
- ❏ The needle holders should firmly grasp suture material without slipping.
- ❏ Ratchets should engage crisply and smoothly. When the ratchet is engaged, it should not open easily if the instrument is lightly tapped on the edge of a table.

Retractors

- ❏ Check the tips to verify that they are sharp (or blunt or semi-sharp) as they should be.
- ❏ Make sure any mechanisms work smoothly.
- ❏ Check the holding power of the ratchet when it is engaged
- ❏ Check the teeth when the ratchet is engaged.

Cutting Forceps/Rongeurs

- ❏ Generally, cutting forceps should cut cleanly with the front half of the jaw
- ❏ Verify that the tips close properly from the top to the middle of the jaws.
- ❏ Verify that the cutting edge does not splay apart at the very tip when the jaws are closed.
- ❏ If necessary, perform a cutting test with latex material

Pin & Wire Cutters

- ❏ Test the cutting ability of the instrument using the appropriate pins or wires.

Tweezers

- ❏ Verify that the tips meet together. They should be aligned.
- ❏ Hold the closed tweezers tip up to a light source. No substantial light should pass through the closed tip.
- ❏ If your tweezers are serrated, the serrations, should fit together closely. Likewise, if your tweezers have teeth, the teeth should close together in proper alignment.

Storing Your Instruments

Fine surgical instruments are too valuable not to protect. WPI's sterilizing trays help reduce damage from everyday use.

With top quality structural integrity, these trays are ideal for the handling and storage of all standard microdissection and surgical instruments. Sterilization trays are typically used in an autoclave for sterilizing your fine surgical instruments.

Instruments should be stored in a clean and dry environment until use. Wire baskets are ideal for storing and for sterilizing surgical instruments.

Stain Guide for Stainless Steel

Although stainless steel is corrosion-resistant, it can still rust and stain if it is handled improperly. To determine if a discoloration is rust or just a stain, erase the discoloration with a pencil eraser. If there is pitting in the metal under the discoloration, it is corrosion. If the discoloration is removed, it was just a stain.

Stain color	Cause
Brown/Orange	High pH
Dark Brown	Low pH
Bluish/Black	Reverse plating due to mixed metals during cleaning process
Multicolor	Excessive heat
Light/Dark Spots	Water droplets drying on the surface
Black	Contact with ammonia
Gray	Excessive use of rust remover solution
Rust	Dried-on blood or bio-debris

Glossary

Angled on the side–Instrument that (when lying flat) is bent to one side.

Arthroplasty–Using surgical techniques to reconstruct a joint.

Arthroscopy–Using an arthroscope to examine the inside of a joint.

Aspirate–Using suction to remove fluid or gas from a joint area or cavity.

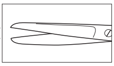
Atraumatic–Will not cause damage to tissue by crushing or biting.

Autoclave–Piece of equipment that uses heat and steam to sterilize surgical instruments.

Ball End Tip–The tip of a pair of scissors that is rounded off with a circular end. If the scissors have one ball tip and one pointed tip, they are called "sharp with a ball end."

Biopsy–To excise and analyze living tissue from an organism.

Blunt–Tip of a surgical instrument that has a rounded shape. (Opposite: Sharp)



Blunt/Blunt

Caliper–An instrument used to make measurements during implant procedures and when installing orthopedic screws.

Cavitation–The forming of tiny bubbles created by sound waves during the cleaning process in an ultrasonic cleaner.

Ceramic coating–Our black instruments have a thin titanium nitride (TiN) coating. TiN is an extremely hard ceramic material, which hardens and protects the cutting edge. Coating surgical instruments with a black ceramic offers several distinct advantages. They are non-reflective, corrosion resistant, low friction, wear and tear resistant and biocompatible.

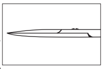
Corrosion–Gradual eroding of a surface on surgical instruments which may be caused by exposure to chemicals or failure to properly clean and store them.

Corrosive–Causes the gradual dissolving and deterioration of a substance, especially by chemicals.

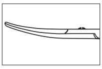
Cleaning detergents–Solutions manufactured to aid in the removal of dirt, protein and biological debris from surgical instruments. This is the first stage of caring for surgical instruments, but it does not disinfect or sterilize the instruments.

Curette–A small, sharp, ice cream scoop shaped instrument used to scrape, shape and remove bone material during a surgery.

Curved–Gentle bend in the tip of a pair of scissors or forceps.



Straight

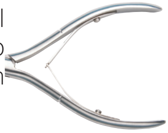


Curved

Dissect–To methodically take apart, cut up or separate tissue for the purpose of analysis. To study the minute details.

Dissector–Surgical instrument probe used during a dissection to separate tissues or tissue layers.

Double Spring Handle–A dual support structure on a surgical instrument like a pair on rongeurs that uses two supports to attaches the handles to each other and hold the instrument in an open position.



Fine, Sharp Tips–Scissor tips which are narrowed and the tip and taper to a point.

Hemostat–Ring forceps (also called hemostatic forceps) which are hinged and look like ring scissors and are used to control blood flow. Frequently, hemostats have a locking mechanism called a ratchet, that is used for clamping. Hemostats are used to compress blood vessels or other tubular structures to obstruct the flow of blood or fluids.

Hook End–A blunt pair of scissors with a crescent cut out of one of the blades.

Jaws–Business end of ring handled forceps or scissors that is used for grasping or cutting.

Lamina–A thin layer of organic material, from a bone, a membrane or something else.

Laminectomy–Excision, or cutting away, of the posterior arch of a vertebrae.

Ratchet–A locking closure on a handle that securely holds the position of a surgical instrument like a needle holder or a hemostat.

Retractor–Surgical instrument used to hold an incision or a wound open, or to hold an organ or tissue out of the way to expose what is underneath. Three broad categories of retractors include hand retractors, self-retaining retractors and wire retractors. Hand retractors must be held by an assistant, a robot or the surgeon during a procedure. Self-retaining retractors have a mechanical device for holding tissue during surgery, allowing hands-free operations. Self-retaining retractors have a screw, ratchet or some type of clamp to hold the tissue by itself. These allow the surgeon to operate with two free hands. Wire retractors are the simplest style of retractor. Usually the wire has some spring so that the surgeon can pinch it together, position it and release it. These also free up the surgeon's hands.

Rongeur–Surgical instrument like pliers with a heavy, pointed jaw. They are used for gnawing holes in bones during surgery. This could be neurosurgery where the surgeon must remove part of the skull to expose the brain, an orthopedic surgery or a cadaver dissection.

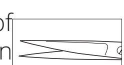
Scissors–Surgical instrument that has two blades joined together in the middle so that the sharp edges slide against each other, shearing what is between the blades. Two main styles exist. Standard scissors have ring handles to put your thumb and index finger in. Spring scissors fit in the palm of your hand and are held between your fingertips and thumb. They shear as you squeeze your thumb and fingers together. They may be used ambidextrously.

Self-retaining–A surgical instrument which can maintain a fixed position. A self-retaining retractor or clamp may have a screw to set the position when surgeon has it in the correct spot. The retractor will remain in position, leaving the surgeon a free hand.

Serrations–Small grooves on the edge or tips of a surgical instrument. They typically have a pattern which could be vertical grooves, horizontal grooves, diamond cuts or cross-hatching.

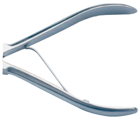
Shanks–The mid-section of ring handled surgical scissors or forceps where a ratchet mechanism may be located.

Sharp–Tip of a surgical instrument which has a pointed tip. A pair of scissors or a rake retractor can have pointed tips. Sharp is a common slang for any sharp surgical instrument. (Opposite: Blunt)



Sharp/Sharp

Single Spring Handle–An individual support on a surgical instrument like a pair on rongeurs that attaches one handle to the other and holds the instrument in an open position.



Smooth–Tip of a surgical instrument that has no teeth.

Soft tissue instruments–Basic surgical instruments which are required for making incisions, subcutaneous tissue dissection and wound closure.

Spotting–Discolorations and marks on a surgical instrument caused by non-adhesive surface contaminants.

Spring Closure–Commonly closure used with micro scissors and some needle holders where the halves of the instrument are linked together at the base to provide tension for the cutting/closing action.

Staining–Discolorations and marks on a surgical instrument caused by semi-adhesive surface contaminants. These are difficult to remove.

Stainless steel–An alloy of steels where the main metal is iron alloyed with chromium, carbon, manganese, silicon and other elements. Chromium helps with rust resistance, and the other elements can be added for specific characteristics. Most surgical instruments are manufactured from stainless steel.

Sterilization–Process that destroys all microbial life, including spores, on your surgical instruments to make them safe from contamination. Dry heat or autoclaving are the preferred method of sterilizing surgical instruments. Gas and chemical sterilization methods exist too.

Tungsten carbide inserts–Tungsten carbide metal plates are soldered or welded into the jaw of an instrument. Tungsten carbide instruments are more durable, hold an edge longer and last longer than stainless steel instrument Surgical instruments with gold handles have tungsten carbide inserts in the blades. NOTE: Inserts may also be replaced, extending the life of an instrument.

Teeth–Small, pointed notches or projections on the end of tissue forceps which are used to grasp tissue and prevent the instrument from slipping.

Tissue–A group of cells acting together that have a specialized purpose or perform a particular function.

Ultrasonic cleaner–Mechanical tank that used sound waves (known as cavitation) to clean surgical instruments. They are commonly used before lubrication and sterilization.

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