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## Chapter 1

# SUTURING: THE BASICS

### KEY FIGURES:

Curved needles: tapered and cutting  
Eversion of skin edges  
Instruments: needle holder  
Instruments: forceps with teeth  
Instruments: suture scissors  
Holding scissors and needle holder  
Needle in the needle holder  
Holding the forceps  
Face bites vs. body bites  
Needle entering tissues at 90° angle

Simple sutures  
Continuous vs. interrupted closure  
Mattress sutures  
Buried intradermal sutures  
Figure-of-eight sutures  
Instrument tie  
Skin stapler in position  
Staple remover: clamp removing the staple  
Adhesive strips

Suturing is the joining of tissues with needle and “thread,” so that the tissues bind together and heal. The “thread” is actually specialized suture material.

Health care providers frequently encounter wounds in need of suturing, and it is important to become proficient. You can practice your suturing skills on pigs’ feet, available at a butcher shop. This chapter gives you all the necessary information to perform basic suturing, including:

- Types of needles and suture material
- Selection of material for various wounds and situations
- Techniques

Information about the proper use of local anesthetics for pain control while placing sutures is discussed in chapter 3.

### ***Suture Needles***

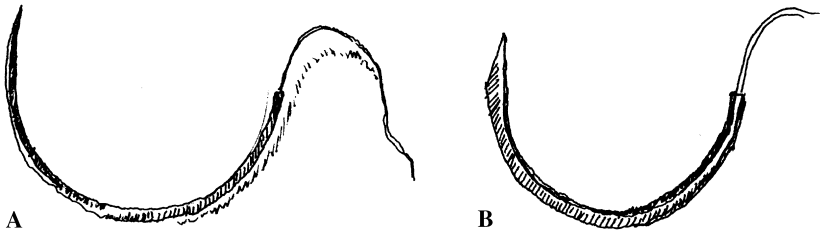
There are two broad classifications of needles: curved and straight. A straight needle can be used without instruments. A curved needle must be handled with forceps and a needle holder.

Although hand sewing with a straight needle does not require forceps, the technique is cumbersome and entails a much higher risk of accidentally sticking yourself. Hence, suturing with a straight needle is

uncommon and not recommended if curved needles are available. Generally, forceps and needle holders are available, and a curved needle is used for suturing. There are two types of curved needles.

**Cutting Needle.** A cutting needle is used primarily for suturing the skin. It has a very sharp tip with sharp edges, which are needed to pass through the skin. Since you will place primarily skin sutures, you generally will use a cutting needle.

**Tapered Needle.** Tapered needles, or “round-bodied” needles, have a sharp tip with smooth edges and are less traumatic to the surrounding tissues. They are used primarily on the deeper, subcutaneous tissues, blood vessels, and intestinal anastomoses. A tapered needle is not good for simple skin suturing because it is difficult to pass the tapered needle through the skin.



A, Tapered needle used for suturing subcutaneous tissue, fascia, and other deep structures. B, Cutting needle used for suturing skin. Note the difference specifically around the tip of each needle.

### ***Suture Sizes***

Sutures come in various sizes. The bigger the suture material, usually the bigger the needle. The sizing of sutures is similar to the sizing of needles for injection: the bigger the number, the smaller the size of the suture. Suture sizes range from 00 (very large, used to close the abdominal wall—about the size of large fishing line) to 10-0 (very tiny, used for microvascular anastomoses—as fine as a human hair). You generally will use sizes in the middle range: 3-0 to 5-0.

It is best to use small sutures on the face, such as 5-0 or 6-0. Smaller sutures are associated with decreased scarring, which is a concern with facial wounds. (See chapter 16, “Facial Lacerations,” for more specific details.) On areas where cosmetic concerns are less important, 3-0 or 4-0 sutures are best, because the larger size makes the technique easier and the thicker sutures are stronger. The tendency is to use smaller sutures on children because of their more delicate skin. Rarely do you need anything larger than a 4-0 suture.

## ***Suture Material***

Many different suture materials are available. The main classifications are absorbable or nonabsorbable. A more subtle subclassification is whether the suture material is braided or nonbraided.

Unless there is a dire emergency, *never* use regular thread for sutures because of the risk of infection.

### *Nonabsorbable Sutures*

Nonabsorbable sutures remain in place until they are removed. Because they are not dissolved by the body, they are less tissue-reactive and therefore leave less scarring as long as they are removed in a timely fashion. They are best used on the skin.

### *Absorbable Sutures*

Absorbable sutures are dissolved by the body's tissues. The great advantage is that the sutures do not need to be removed. However, absorbable sutures tend to leave a more pronounced scar when used as skin sutures. Absorbable sutures are primarily used under the skin, where they are well hidden.

It is sometimes difficult to get patients to return for suture removal. If this is a concern, use an absorbable suture for skin closure. You should warn the patient that absorbable sutures probably will result in a more noticeable scar than nonabsorbable sutures with later removal.

Because it is often difficult to remove stitches from children (because of their crying and difficulty in staying still), absorbable materials should be used when suturing their wounds.

### *Braided Sutures*

Braided sutures are made up of several thin strands of the suture material twisted together. Braided sutures are easier to tie than nonbraided sutures. However, braided sutures have little interstices in the suture material, which can be a place for bacteria to hide and grow, resulting in an increased risk of infection.

### *Nonbraided Sutures*

Nonbraided sutures are simply a monofilament, a single strand. They are not made up of the little subunits found in a braided suture. Nonbraided sutures are recommended for most skin closures, especially wounds that may be at risk for infection.

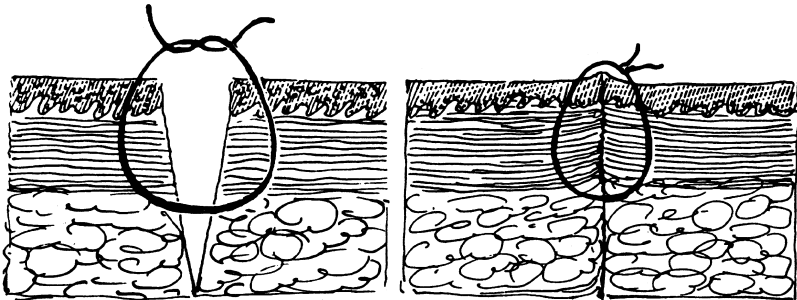
**Table 1. Characteristics of the Most Commonly Used Suture Materials**

Suture Material	Tissue Reaction	A or N	Braided	Non-Braided	Suture Strength	Primary Indication
Chromic catgut	+++	A	X		Lasts 3–4 wks at most	Facial wounds, lip/intraoral mucosa, children's wounds
Nylon	+	N		X	Loses 20% per year	Skin sutures
Polydioxanone (PDS)	+	A		X	Lasts 4–6 mo	Intradermal sutures
Polyglycolic acid (Dexon)	++	A	X		Lasts about 1 mo	Intradermal sutures, sutures for fascia, muscle, mucosa, or subcutaneous tissue
Prolene	0	N		X	Lasts a long time	Skin sutures
Silk	+++	N	X		Loses strength within 1 yr	Very clean skin wounds, especially on eyelids

A = absorbable, N = nonabsorbable, 0 = no tissue reaction, +++ = highly reactive.

## ***Suturing Techniques***

When suturing the edges of a wound together, it is important to evert the skin edges—that is, to get the underlying dermis from both sides of the wound to touch. For the wound to heal, the dermal elements must meet and heal together. If the edges are inverted (the epidermis turns in and touches the epidermis of the other side), the wound will not heal as quickly or as well as you would like. The suture technique that you choose is important to achieve optimal wound healing.



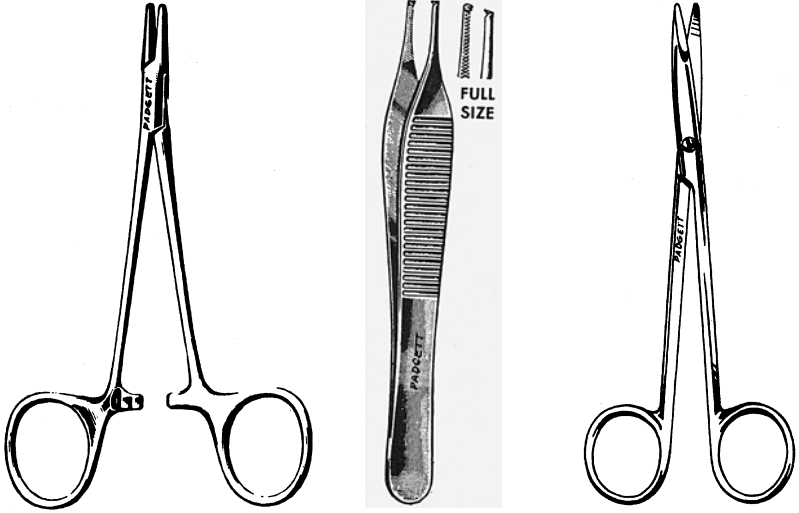
Sutures should be placed so that the skin edges are everted to ensure that the dermis is touching. This technique is important for proper healing. (From McCarthy JG (ed): *Plastic Surgery*. Philadelphia, W.B. Saunders, 1990, with permission.)

### *Instruments Needed*

**Needle holder:** used to grab onto the suture needle

**Forceps:** used to hold the tissues gently and to grab the needle

**Suture scissors:** used to cut the stitch from the rest of the suture material



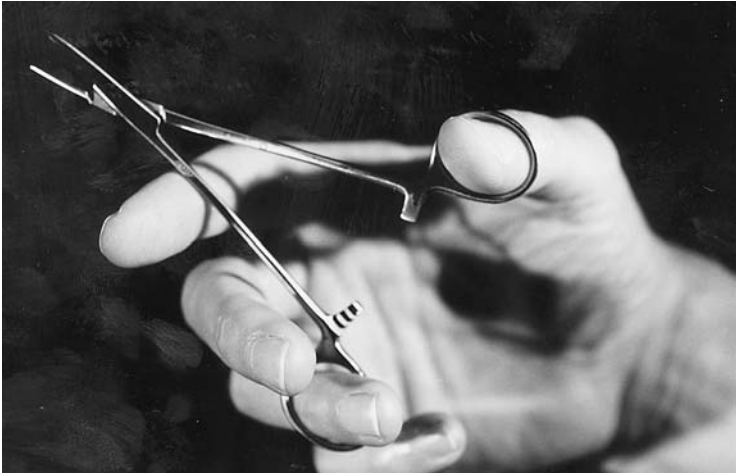
*Left, Needle holder. Center, Forceps with teeth. Right, Suture scissors.*  
(Courtesy of Padgett Instruments, Inc.)

### *How to Hold the Instruments*

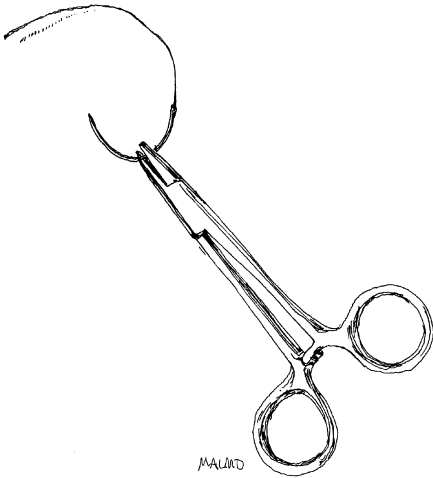
Whenever you use sharp instruments, you face the risk of accidentally sticking yourself. Needlesticks are especially hazardous because of the risk of serious infection (hepatitis, human immunodeficiency virus). To prevent needlesticks, get in the habit of using the instruments correctly. *Never handle the suture needle with your fingers.*

**Scissors.** Place your thumb and ring finger in the holes. It is best to cut with the tips of the scissors so that you do not accidentally injure any surrounding structures or tissue (which may happen if you cut with the center part of the scissors).

**Needle Holder.** Place your thumb and ring finger in the holes. When using the needle holder, be sure to grab the needle until you hear the clasp engage, ensuring that the needle is securely held. You grab the needle at its half-way point, with the tip pointing upward. Try not to grab the tip; it will become blunt if grabbed by the needle holder. Then it will be difficult to pass the tip through the skin.

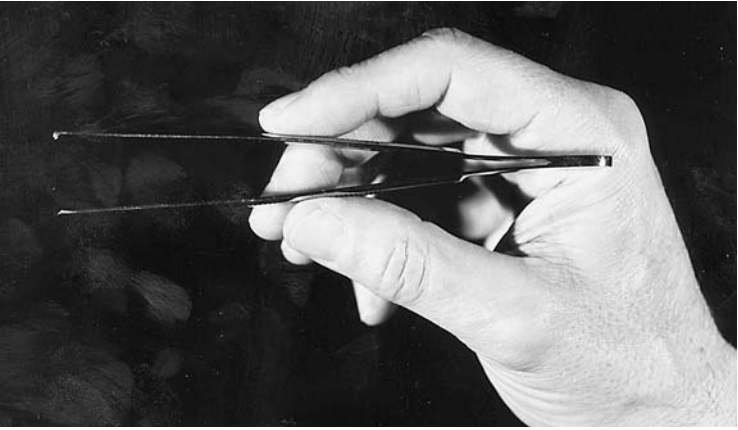


The needle holder and scissors are handled similarly. For maximal control, place the tips of your thumb and ring finger into the rings of the instrument. Your thumb does most of the work to open and close the instrument.



The needle should be held in the jaws of the needle holder at its midpoint (where the curve of the needle is relatively flat). This technique prevents you from bending the needle as it passes through the tissues.

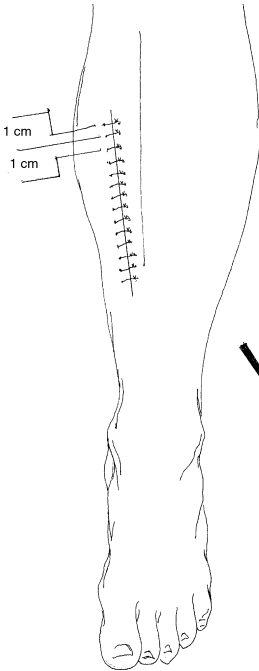
**Forceps.** Hold the forceps like a writing utensil. The forceps is used to support the skin edges when you place the sutures. Be careful not to grab the skin too hard, or you will leave marks that can lead to scarring. Ideally, you should grab the dermis or subcutaneous tissue—not the skin—with the forceps, but this technique takes practice. For suturing skin, try to use forceps with teeth, which are little pointed edges at the end of the forceps.



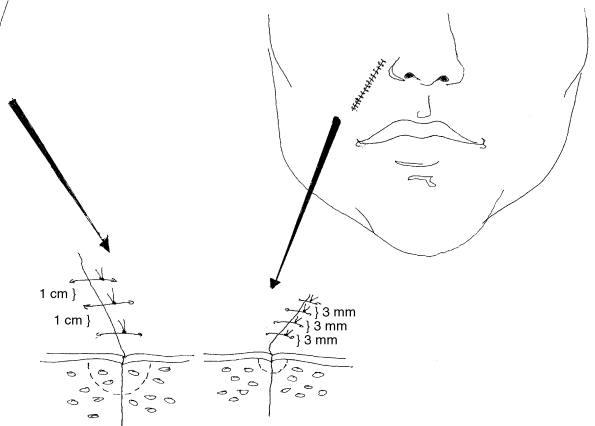
Hold the forceps as you would hold a writing instrument.

### *Placing the Sutures*

For most areas of the body, except the face (see chapter 16, “Facial Lacerations”), the sutures should be placed in the skin 3–4 mm from the wound edge and 5–10 mm apart.



Sutures placed on the face should be approximately 2–3 mm from the skin edge and 3–5 mm apart. Sutures placed elsewhere on the body should be approximately 3–4 mm from the skin edge and 5–10 mm apart.



Start on the side of the wound opposite and farthest from you to ensure that you are always sewing toward yourself. By sewing toward yourself, the suturing process is made easier from a biomechanical standpoint.

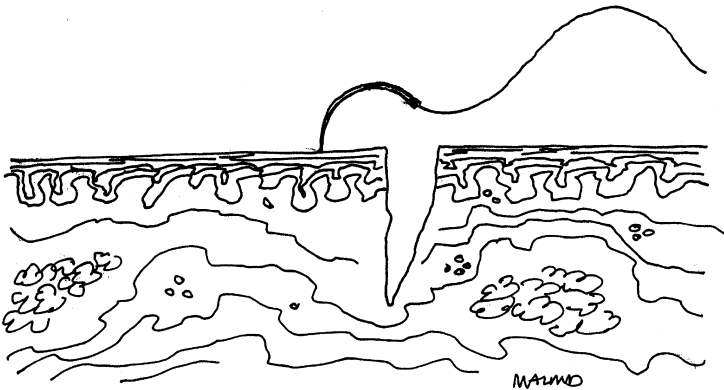
*Do not drive yourself crazy by placing too many sutures.*

### *Simple Sutures*

**Indication.** This technique is the easiest to perform. It is used for most skin suturing.

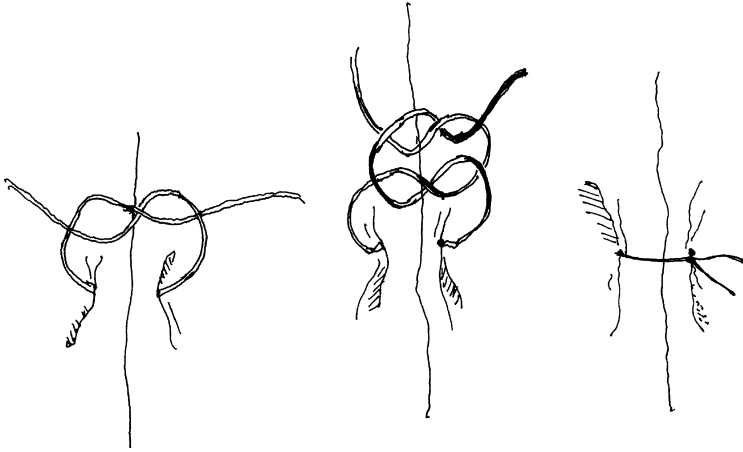
### **Technique**

1. Start from the outside of the skin, go through the epidermis into the subcutaneous tissue from one side, then enter the subcutaneous tissue on the opposite side, and come out the epidermis above.
2. To evert the edges, the needle tip should enter at a 90° angle to the skin. Then turn your wrist to get the needle through the tissues.
3. You can use simple sutures for a continuous or interrupted closure.



The needle tip should enter the tissues perpendicular to the skin. Once the needle tip has penetrated through the top layers of the skin, twist your wrist so that the needle passes through the subcutaneous tissue and then comes out into the wound. This technique helps to ensure that skin edges will evert.





A simple suture.

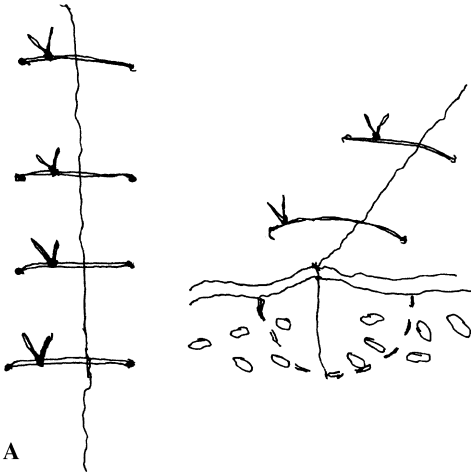
### *Interrupted or Continuous Closure*

#### **Interrupted Sutures**

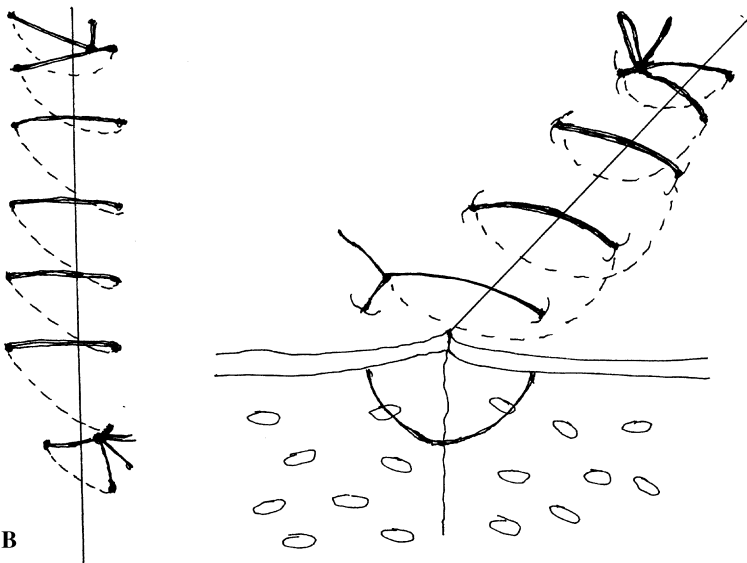
- Interrupted sutures are individually placed and tied.
- They are the technique of choice if you are worried about the cleanliness of the wound.
- If the wound looks like it is becoming infected, a few sutures can be removed easily without disrupting the entire closure.
- Interrupted sutures can be used in all areas but may take longer to place than a continuous suture.

#### **Continuous Closure**

- Place the sutures again and again without tying each individual suture.
- If the wound is very clean and it is easy to bring the edges together, a continuous closure is adequate and quicker to perform.
- Continuous closure is the technique of choice to help stop bleeding from the skin edges, which is important, for example, in a scalp laceration.

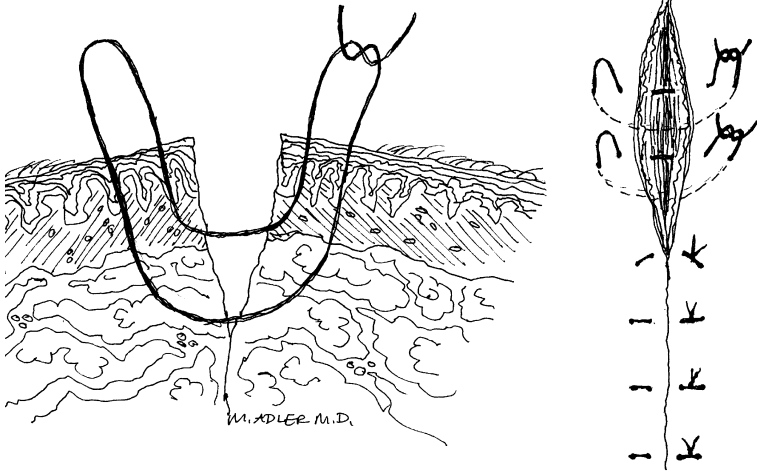


A, Interrupted sutures are individually placed and tied. B, A continuous suture is done by passing the needle from side to side (across the wound) multiple times before finally tying the suture.



### *Mattress Sutures*

**Indication.** Mattress sutures are a good choice when the skin edges are difficult to evert. Sometimes you may want to close a wound with a few scattered mattress sutures and place simple sutures between them. It is a bit more technically challenging to place mattress sutures, but it is often worth the effort because good dermis-to-dermis contact is achieved.



The vertical mattress suture.

### Technique

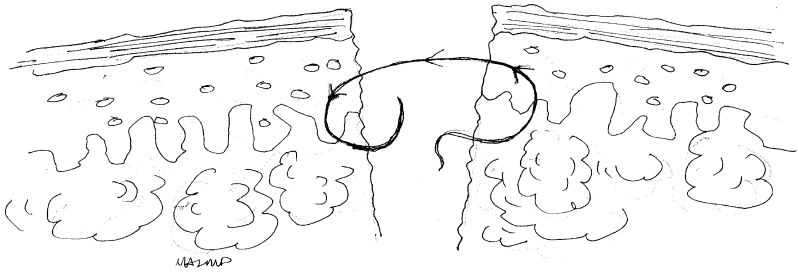
1. Start like a simple suture, go from the outside of the skin through the epidermis into the subcutaneous tissue from one side, then enter the subcutaneous tissue on the opposite side, and come out the epidermis above.
2. Turn the needle in the opposite direction and go from outside the skin on the side that you just exited and come out the dermis below. Then enter the dermis on the opposite side and come out of the epidermis above.
3. Your suture is now back on the side on which you started.

### *Buried Intradermal Sutures*

**Indication.** This technique is useful for wide, gaping wounds and when it is difficult to evert the skin edges. When buried intradermal sutures are placed properly, they make skin closure much easier. The purpose of this stitch is to line up the dermis and thus enhance healing. The knot needs to be as deep into the tissues as possible (hence the term *buried*) so that it does not come up through the epidermis and cause irritation and pain.

### Technique

1. Use a cutting needle and absorbable material.
2. Start just under the dermal layer and come out below the epidermis. You are going from deep to more superficial tissues.



Buried intradermal suture.

3. Now the technique becomes a bit challenging. You need to enter the skin on the opposite side at a depth similar to where you exited the skin on the first side, just below the epidermis. To do so, you should position the needle with the tip pointing down and pronate your wrist to get the correct angle. It will help to use the forceps (in the other hand) to hold up the skin. The needle should come out of the tissues below the dermis. Try to get as little fat in the stitch as possible; it does not contribute to the suture.
4. Tie the suture.

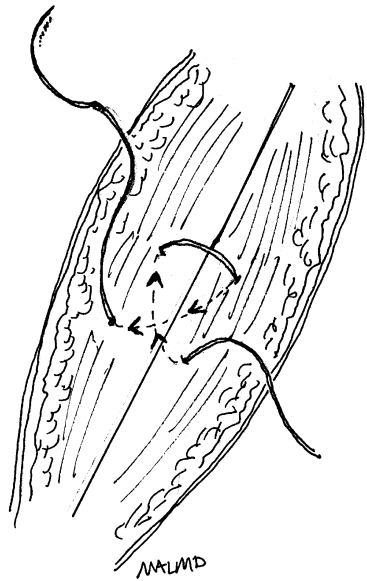
### *Figure-of-eight Sutures*

**Indication.** This technique is useful for bringing together underlying tissues such as muscle, fascia, or extensor tendons. It is not commonly used for skin closure.

### **Technique**

1. Usually a tapered needle and absorbable sutures are used.
2. Start on the side opposite from you. Go through the full thickness of tissues on that side, then finish the first half of the stitch by going from bottom to top on the opposite side. Advance just a little farther (1.0–1.5 cm) along the tissue. The needle should now be back on top of the tissue.
3. Now enter the first side (going from top to bottom) just across from the suture on the other side. Again go through the full thickness of the tissue and come out on the undersurface of the tissue.
4. Now enter the undersurface of the other side even with the first suture and come out on top.
5. The suture can now be easily tied.

Figure-of-eight suture. This technique is used primarily to reapproximate deep tissues such as muscle or fascia.

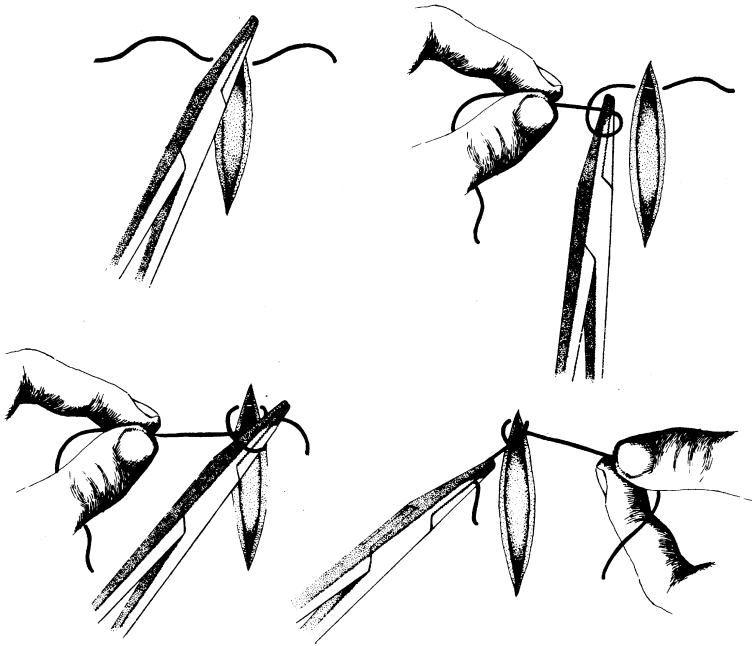


### *Tying the Suture*

The simplest way to tie the suture is by doing an “instrument tie,” described below.

#### *Simple Sutures*

1. Pull the suture through the skin so that just a short amount of suture material (a few centimeters) is left out.
2. Take the needle out of the needle holder.
3. Place your needle holder in the center between the skin edges parallel to the wound. One end of the suture should be on each side of the wound without crossing in the middle.
4. Wrap the suture that is attached to the needle once or twice around the needle holder in a clockwise direction.
5. Grab the short end of the suture with the needle holder.
6. Pull it through the loops, and have the knot lie flat. The short end of the stitch should now be on the opposite side.
7. Let go of the short end.
8. Bring the needle holder back to the center, parallel to the wound edges.
9. Repeat steps 4–8 at least one or two times more.
10. Cut the suture ends about 1 cm from the knot.



Instrument tie. Two loops of suture are wrapped around the distal portion of the needle holder, and the free end of the suture is then grasped and pulled through the loop thus formed. A third suture loop is wrapped around the needle holder in the opposite direction and pulled in a direction opposite to the first tie to form a square knot. Note that the short end of the suture switches sides as it is passed through the loop to create each knot. (From Simon RR, Brenner BE (eds): *Emergency Procedures and Techniques*, 3rd ed. Philadelphia, Lippincott Williams & Wilkins, 1994, with permission.)

### *Mattress Sutures*

1. Pull the suture through the skin so that just a short amount of suture material (a few centimeters) is left out.
2. Take the needle out of the needle holder.
3. Both ends of the suture are on the same side. Place your needle holder between the ends of the suture.
4. Wrap the suture that is attached to the needle once or twice around the needle holder in a clockwise direction.
5. Grab the short end with the needle holder.
6. Pull it through the loops, and have the knot lie flat. The short end of the stitch should now be on the opposite side.
7. Let go of the short end.

8. Bring the needle holder back to the center, between the suture ends.
9. Repeat steps 4–8 at least one or two times more.
10. Cut the suture ends about 1 cm from the knot.

### *Continuous Suture*

1. Do not pull the next to-the-last stitch all the way through; leave it as a loop.
2. Place your needle holder between the loop and the suture attached to the needle. The needle holder should be almost perpendicular to the wound.
3. Wrap the suture that is attached to the needle once or twice around the needle holder in a clockwise direction.
4. Grab the loop with the needle holder.
5. Pull it through, and have the knot lie flat. The short loop should now be on the opposite side.
6. Let go of the loop.
7. Bring the needle holder back to the center between the loop and the suture end.
8. Repeat steps 3–7 at least one or two times more.
9. Cut the suture ends about 1 cm from the knot.

## ***Suture Removal***

If the sutures are taken out within 7–10 days, suture removal is usually easy and should not cause more than a pinching sensation to the patient. (See chapter 11, “Primary Closure,” for more details concerning the timing of suture removal.)

### *Simple Sutures*

1. Cut the suture where it is exposed, crossing the wound edges.
2. Remove the entire stitch by grabbing the knot with a clamp or forceps and pulling gently.

### *Mattress Sutures*

Removal of mattress sutures can be a little more difficult.

1. Grab the knot and try to lift it up a little; this should allow you to see a space between the suture strands.

2. Cut one strand of the suture under the knot.
3. Remove the entire stitch by grabbing the knot with a clamp or forceps and pulling gently. This suture will be a little harder to remove than a simple suture.
4. If you accidentally cut both ends of the suture, you will leave suture material behind.
5. Look on the opposite side of the skin for the suture. Grab it with a clamp or forceps, and gently remove the remaining suture material.

### *Continuous Sutures*

1. Cut the suture in several places where it is exposed, crossing the wound edges.
2. Remove portions of the stitch by grabbing an end with a clamp or forceps and pulling gently.
3. The sutures to the knot must be cut in several places for removal.

## ***Alternatives to Suturing***

Other techniques can bring skin edges together to “suture” a wound closed without using sutures. These techniques require more expensive equipment than regular suturing.

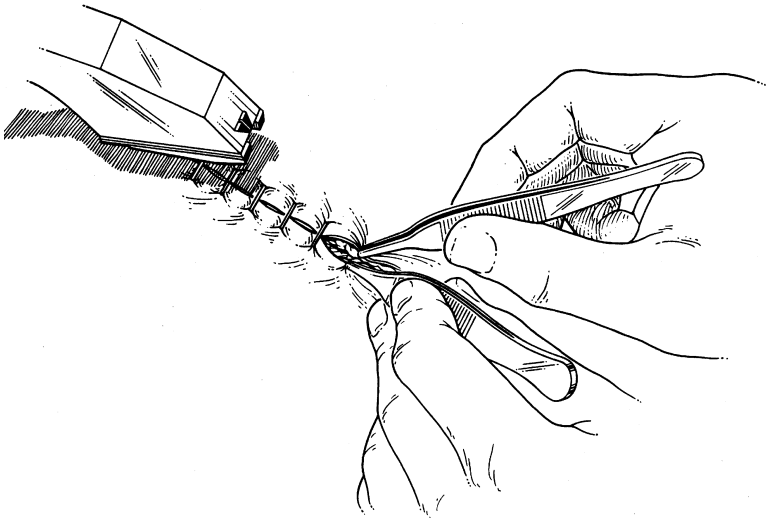
### *Skin Stapler*

**Indication.** The skin stapler is a medical device that places metal staples across the skin edges to bring the skin together. The area must be anesthetized before placing the staples. The main advantage of staples over sutures is that they can be placed quickly. Speed may be an important advantage when you need to close a bleeding wound quickly (e.g., on the scalp) to decrease blood loss. Staples tend to leave more noticeable marks in the skin compared with sutures. They should not be used on the face.

### **Technique**

1. The edges must be everted. Usually an assistant must help by using forceps to hold the skin edges so that the dermis on each side touches.
2. Place the center of the stapler (usually an arrow on the stapler marks the center) at the point where the skin edges come together.
3. Gently touch the stapler to the skin; you do not have to push it into the skin. Then grasp the handle to compress it; the compression releases the staple.





Close the skin with clips. The stapler should be centered over the skin edges before the staple is released. Be sure that the skin is everted. (From Skandalakis JE, et al (eds): *Hernia Surgical Anatomy and Technique*. New York, McGraw-Hill, 1989, with permission.)

4. Release the handle, and move the stapler a few millimeters back to separate the staple from the stapling device.
5. The staples should be placed about 1 cm apart.

### **To Remove the Staples**

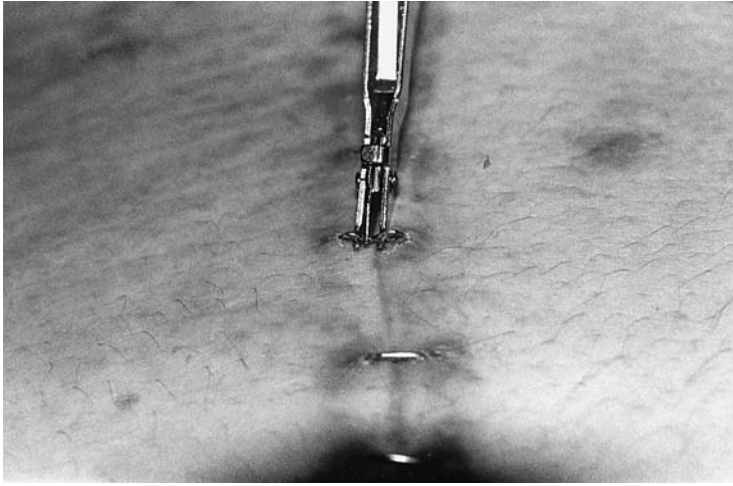
A staple remover device can be used to remove the staples easily (see figures on next page). Put the jaws under the staple, and close the device. This bends the staple and allows it to be removed.

If you do not have a staple remover, a clamp can be placed under the staple. Then open the clamp to bend the staple so that it can be removed. Removing a staple in this fashion can be painful.

### *Adhesives*

Specialized surgical adhesive materials allow the skin edges to be “glued” together. The advantage of adhesives is that the wound does not need to be anesthetized for closure. However, a traumatic wound must be thoroughly cleaned before closure, which often requires local anesthetic. Thus, this advantage may be only theoretical.

Adhesive compounds are quite expensive, and the quality of the resultant scar has still not been fully evaluated and compared with the scar

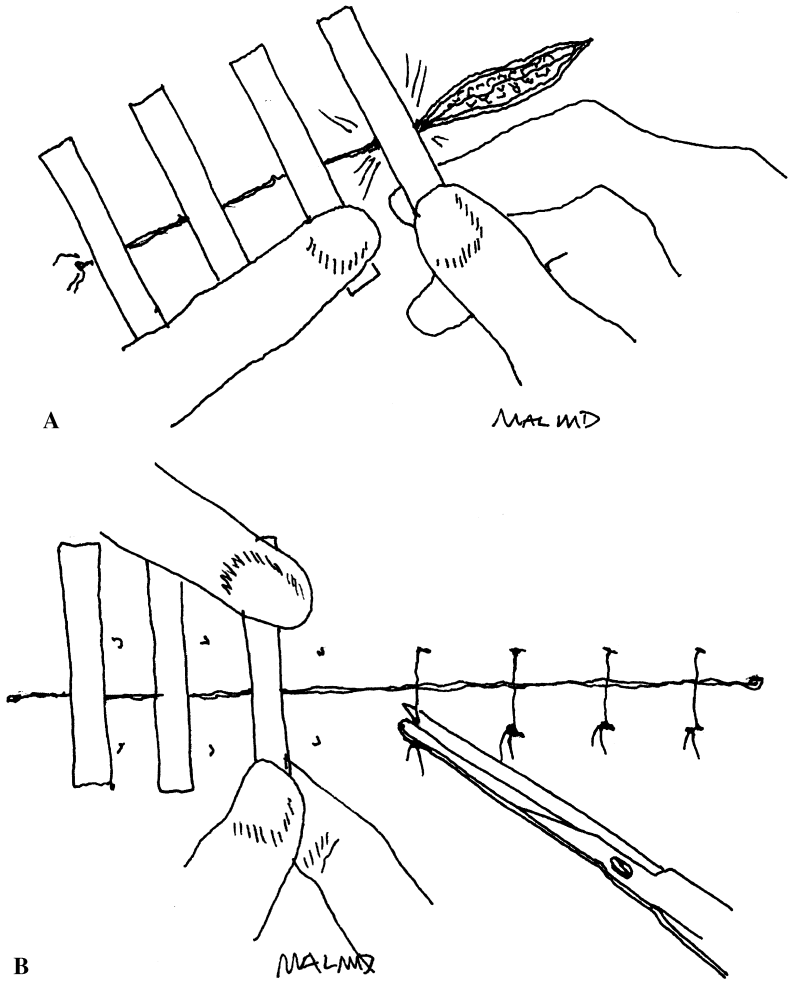


Removing a staple with a staple remover.

from a properly sutured wound. Thus only adhesive tapes are further discussed. *Never use regular household adhesives to try to close a wound.*

### *Adhesive Tapes*

Adhesive tapes often are placed after sutures are removed to help keep the skin closure from separating. They also can be used as a means of closure for relatively small wounds whose edges easily come together.



A, Closing the wound with adhesive strips. B, Placing adhesive strips to reinforce wound closure when sutures are removed.

After thoroughly cleansing the wound, gently hold the skin edges together with your fingers or a forceps. Cut the tape so that at least 2–3 cm are on each side of the skin edge once the tape is in place.

Place tape strips one at a time, several millimeters apart. The tapes should be placed across (perpendicular to) the long axis of the wound. Tapes stay in place for several days and should be allowed to fall off on their own. The patient can wash the area but should do so gently.

### ***Bibliography***

1. Edgerton M: The Art of Surgical Technique. Baltimore, Williams & Wilkins, 1988.
2. McCarthy JG: Introduction to plastic surgery. In McCarthy JG (ed): Plastic Surgery. Philadelphia, W.B. Saunders, 1990, pp 48-54.