



Surgery Guide

Suturing Techniques



Surgery Guide: Basic Suturing Techniques.

An Overview of Essential Suturing Methods and Patterns

A note for the reader: this guide is written by a right-handed surgeon, and assumes that the right hand is the dominant hand. If you are left-handed but using right-handed instruments, you will have to hold the needle holders in your right hand, otherwise your scissors and ratchets will not work as intended. Please note, Vi sell a range of dedicated left-handed instruments! If you are left handed, and using left handed instruments, you will have to transpose left for right and 'east for west' as you read the text.

Suturing is a fundamental skill for closure of wounds and surgical incisions. Understanding the different suturing techniques is crucial for effective wound closure, optimising healing and minimizing complications. This subject does not lend itself well to a written description, though a written description is given here; it is better to initially copy, and then practice, good technique. Many surgical texts cover this subject eg. the General Surgical Principles chapter of Fossum's Small Animal Surgery. Nurses studying for a diploma may wish to refer to the Decision Making in Wound Closure chapter of the BSAVA Manual of Canine & Feline Wound Management and Reconstruction.



[Click here](#) for a comprehensive, free-to -access resource including demonstrations, courtesy of Vet Surgery Online.

You will see highlighted boxes throughout this guide, titled 'Essential' or 'Top Tip'.

Essential: this is a vital point that may not be immediately obvious from the videos but is nonetheless essential to get right.

Top Tip: tips for improvement on the basic technique as your skills develop further.

Learning Objectives

- Terminology
- Holding Layer
- Knots: Square and Surgeons
- Interrupted suture patterns: simple and mattress
- Continuous suture patterns: simple and continuous
- Common errors
- Two-layer skin closure

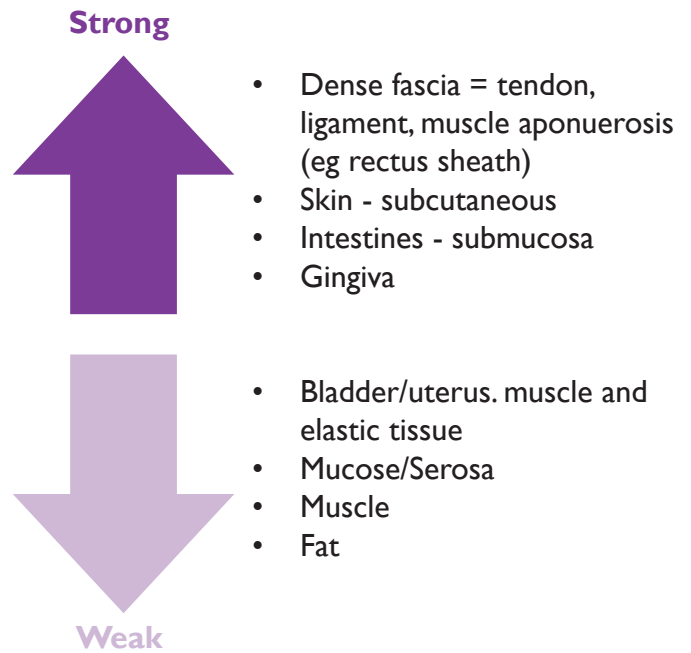


Suture vs Ligature

A suture is a medical device used to hold body tissues together whilst they heal. It involves stitching the tissue edges together with a needle and thread using techniques that have evolved from tailoring and sail making (many of the same terms are preserved). The aim is always the same – to close the gap between edges and so facilitate the fastest healing and best return to function.

Stapling devices exist to achieve the same closure as a suture.

A ligature, on the other hand, is used to encircle and then, by tightening, strangle a hollow structure or tissue and so prevent leakage. Used most commonly to tie off blood vessels or prevent leakage from the uterus. Clip devices exist to achieve the same effect as a ligature. Sutures are primarily for closing wounds, ligatures are primarily for haemostasis.



Tissue Holding Layer

The tissue holding layer is the layer within the wound that provides the most resistance to thread pull-through and so provide the closure with greatest strength. It is essential to correctly identify the holding layer and ensure that your needle bite incorporates it to properly ensure the sutured wound's structural integrity. (Try suturing two pieces of tissue paper together versus two pieces of denim to appreciate the difference). The more collagen in the tissue, the greater the holding strength, and the less likely your suture is to pull through.

For example, in abdominal surgery, the fascia layer of the rectus abdominis muscle is the primary holding layer, followed by the subcutis of the skin. The layers in between, the rectus muscle itself and the subcutaneous fat, have little to no strength, but are closed to minimise the dead space and prevent seroma formation.



Suture failure

A suture fails when it no longer holds the healing tissues in apposition. If this occurs along the length of the wound, the wound edges pull apart (dehiscence).

Sutures fail for one of three reasons.

- The suture material snaps, due to inadequate thickness of material, excess wound tension or poor knotting technique. It is worth noting that the knot is the weakest point of any suture or ligature. It should be noted that there are many different types of knot for different situations and this is why correct knotting is so important.
- The suture material pulls through the tissue - excessive wound tension or failure to encircle the holding layer.
- The knot unravels - poor knotting technique: accidental granny or slip knots, short ears; insufficient throws or wound interference (licking).

It is therefore essential that the suture "bite" ensnares enough collagen in the holding layer and that knots are correctly tied.

Instruments

A brief look in the Veterinary Instrumentation catalogue will reveal a multitude of different patterns of needle drivers (also known as needle holders, or needle holding forceps) and dissecting forceps (also known as tissue forceps, or tissue holding forceps).



The needle holders are held in the right hand and should align with the index finger.

The instrument loops are for the thumb and fourth finger.

Ratcheted needle holders, such as the Mayo, are preferred as they hold the needle securely without requiring constant pressure in the hand.

An in-built scissor is advantageous if working without an assistant. The Olsen-Hegar is a popular choice.

Lock the needle in the jaws of the instrument, approx. midway to 2/3rds from the point towards the swage. Never grip the thread except by the tail because this weakens the suture (the tail is going to be cut off so it doesn't matter if it is cracked).

The rat-toothed tissue forceps are held in the left hand and mimic the finger and thumb, or chopsticks, for manipulating tissue. Adsons are preferred because they have fine points – allowing visibility, but also have a wide grip for the finger and thumb, making them comfortable and secure.

Suturing language:

Bite, Pass, Throw, Turn and Knot

- Bite: passage of the needle through tissue on one side of the wound.
- Pass: the needle crossing the wound to the other side of the incision.
- Throw, or half hitch: a throw refers to each individual wrap of the suture material in the process of tying a knot.
- Turn: a turn is a single crossing of the suture material over itself (a U-turn). You will see this in the Aberdeen knot.
- Knot: a knot is a fastening joining two threads of suture material, made by tying to secure the position of the ends of the suture.

A knot relies on a series of throws and turns to provide friction that holds the threads together. Friction relies on surface area in contact. The more surface, the more friction, the more security.

Where to start?

Arrange your seat such that your wound to be closed is North-South or East-West. The light source should be behind you, ideally directed over your shoulder onto the wound to maximise illumination and minimise glare and shadowing.

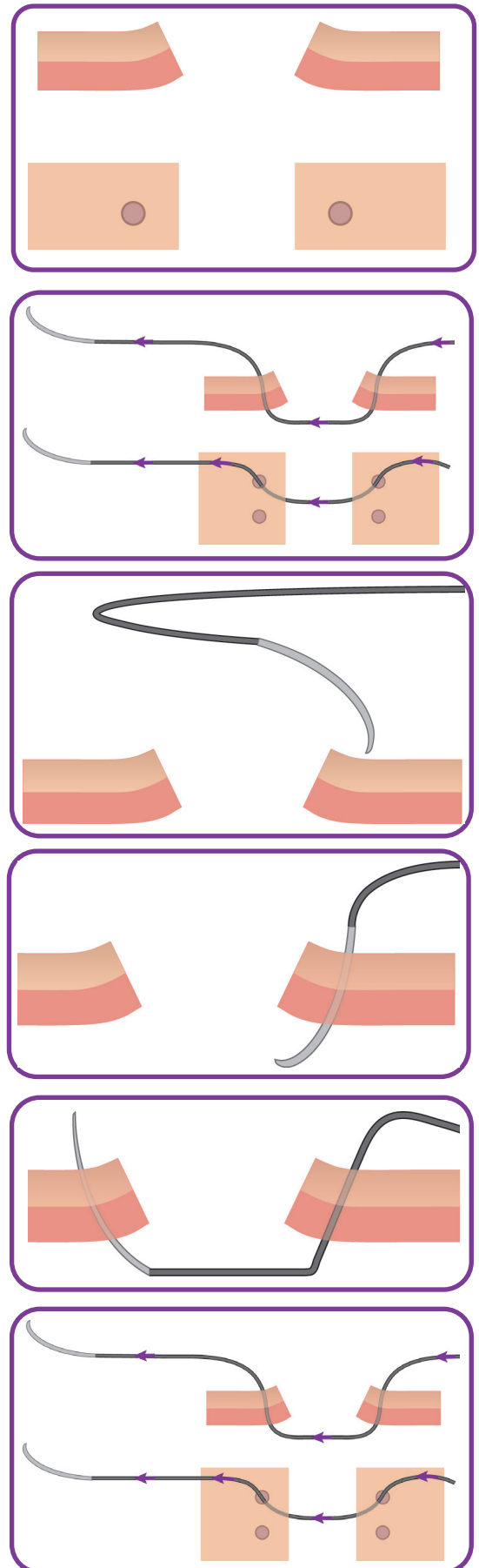
The following diagrams show two or three layers of tissue in cross section and an aerial view. The dots indicate the needle entry and exit points.

Interrupted Sutures: Bite – pass – bite – throw – tension – throw – tension – throw – lock.

The first pass:

All sutures start by taking a bite on one edge, passing across the gap and making a second bite on the other edge. This results in a long ('working') end with the needle attached and a short ('tail') end, and a volume of tissue of (hopefully) the holding layer that is within a bite.

- Lift the tissue edge with your forceps so that you can see where the needle enters and where it will emerge.
- Push the needle into the tissue and rotate the wrist until the point emerges.
- When piercing the tissue, the needle **always** enters or exits the tissue perpendicular to the surface - this ensures a full bite of tissue is taken.
- Push the needle fully through, allowing the needle to follow its own curve. This is the path of least resistance and will minimise both trauma to the tissue and blunting of the needle.
- Take the second bite on the near, or left edge, from deep to surface. Push the needle fully through. The aim is that the entry and exit points are the same distance from the edge as the first bite.
- Pull the point of the needle through with the forceps or needleholder.
- Gather the needle and working thread in the left hand.
- Draw the thread through to leave a short tail (2cm). The tail can be made shorter as your technique improves.





When a suture comes under tension, it will always adopt a circular path, cutting through tissues if necessary to achieve this. If we bear this in mind when placing the entry and exit points of the needle, and form a square, we spread the pressures evenly, minimise pull through (which is more comfortable for the patient) and make a more secure closure. The depth of the bite should be approximately twice the distance from the edge. This is something that becomes obvious with practice, you don't need a ruler!

Top Tip

Always try to ensure that your bites form a square or a short rectangle when the suture is tightened.

Top Tips

When taking a bite, the needle **always** enters perpendicular to the surface, then follows its own curve until it emerges.

You should always be able to see the needle tip exit the tissue.

The right-handed surgeon will start on the right-hand edge of a wound orientated north-south, or the top edge in a wound arranged east-west.

The knot: The two threads are joined with a knot to make a suture. There are many different variations.

Square Knot (AKA Reef knot or Flat knot)

Single throw: tension: single throw: tension: (3rd throw): lock.

A square knot is a secure and stable knot commonly used in suturing. Its main feature is its simplicity, and it lends itself well to instrument ties.

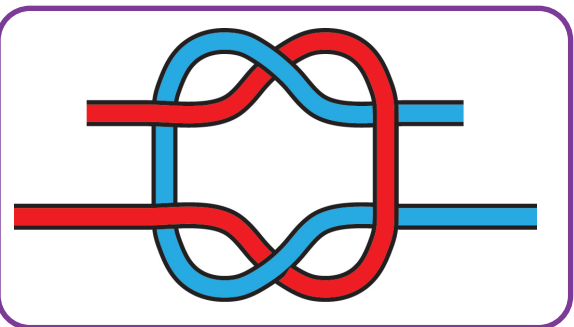
Consider making a square knot by hand with ropes, as a way to practice this technique.



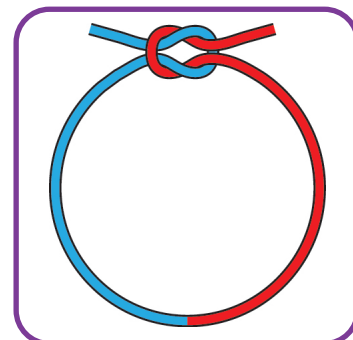
The two colours are to help you identify the working and tail ends but it is important to remember that these are two ends of the same thread, not separate threads.

The Instrument Tie:

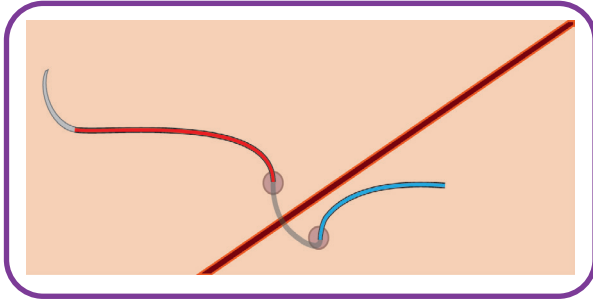
When translating this into instrument ties, we don't make overhand half hitches. Instead, we make a 'throw' by wrapping the working end (long thread with the needle) around the needle holders and then pull the spiral created over the short 'tail' end.



Two throws – right over left, then left over right. Note the importance of finishing with two **flat** loops that lock **more tightly together**, the more tension is applied.



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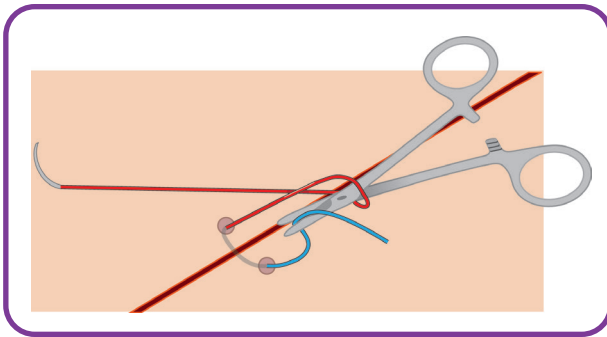
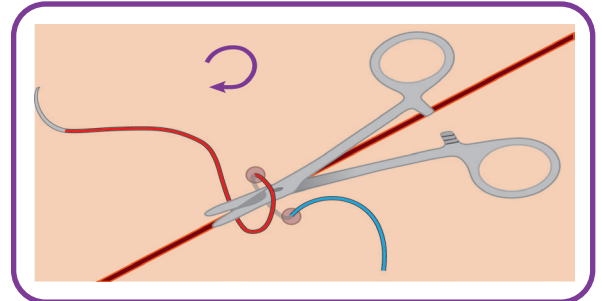


The red line is the apposed wound edges. The working end has the needle.

Create a throw.

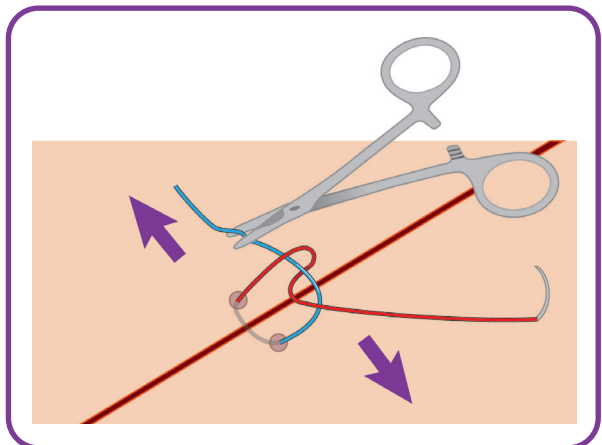
Hold the needle and working end in your left hand. In your right hand, place needle holders between the working and tail ends.

Wrap the working end around the jaws of the instrument, taking care to pass over the instrument and back under to the same side.



Grasp the tail end with the needle holders.

Slide the throw over the tail end by moving **both** hands to the opposite side of the wound from where they started. Cross your hands. Physically move them from one side of the wound to the other.



Top Tip

When you get confident with this, the same effect can be achieved with a roll of the wrist, but to begin with, **cross your hands**.

Run down the throw to loosely appose the wound edges.

Top Tip

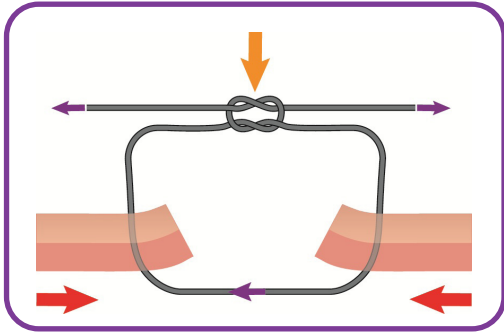
When making the throw, the needle holders must be in between the working end and the tail of the suture before you wrap the suture. This ensures that the throws are wrapped in the correct direction around the instrument, and you get the square knot desired.

Repeat the process to create a second throw: place the needle holders in between the two ends, wrap the working end around the needle holders and grasp the tail end, ensure your hands cross the wound to correctly create a second throw. Run down the second throw and tension to form the knot.

Top Tip

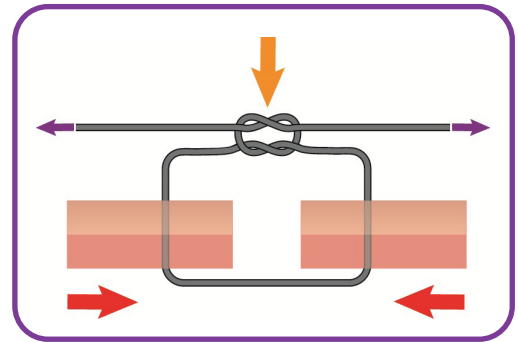
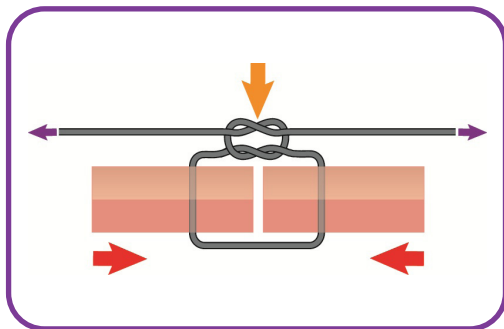
The working end and the tail are always on opposite sides of the wound.

Tensioning the throw and the knot



The two threads, “working end” and “tail end” are pulled apart to tension the knot (purple arrow heads). Both threads are kept **flat**, parallel with the surface, to keep the throws of the knot flat and correctly locked.

As tension is applied, two things happen, the wound edges move together as desired (red arrows) and the throw or knot is described as **running down** (orange arrow) into a tighter lock.



Correct Tension:

The aim is simply to pull the wound edges next to each other, not to crush or squeeze the edges together. Excess tension is painful and will result in wound interference; eversion delays healing and increases scarring.

Top Tip

In the skin, correct tension in a finished suture will allow the points of mosquito forceps under the loop of a completed simple interrupted suture.

Locking Throws: How Many?

You make your square knot after **just** two throws. After adjusting the tension, a third locking throw is placed. This locks the knot and prevents further tightening or loosening. However, it is still possible for the throws to unwind, especially with movement or with wound interference (licking), so extra throws are applied.

All the human surgical videos stop after 3 throws because, in the most part, the human patient cooperates with their surgeon. Our patients do not.

Three throws is the **minimum** number of throws to make a knot in veterinary surgery. To stop the knot unravelling, additional throws are necessary. More throws are needed with :

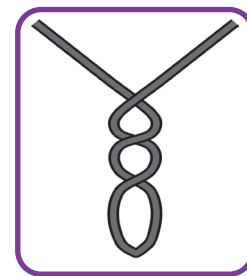
- Monofilament materials versus multifilament materials.
- Thicker materials (4 metric and bigger) versus 2M & 3M materials.
- Stiffer materials, eg Prolene, Leader Line versus nylon or monocryl.
- Continuous versus simple interrupted sutures.
- Exposed (ie lickable) versus buried knots.

In practice, 3-4 throws is routinely used for multifilament materials, 4-5 throws for monofilament materials and at least 6 throws for continuous sutures.

The Cut: How long should the ears be ?

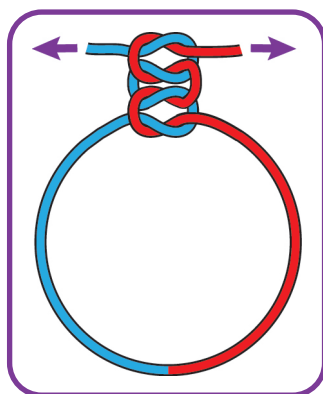
When cutting, grasp both threads to keep them taught. (Pulling on one thread may create a slip knot). Place the scissor blades so that 2mm of suture is left proud of the last throw. Turn the blade so you can see exactly where the cut will be made. Cut. This will create the 'ears' of the knot.

Cut the ears too short, and all that happens is your last throw will unwind, creating longer ears. So you get the correct length ears, but you lose a throw. Minimum length of ears is approximately 2mm, but this is something that becomes obvious with practice. Imagine an ant's antennae for proportion. Long ears are less likely to unwind.



CONGRATULATIONS!

You have just tied a surgical square knot.



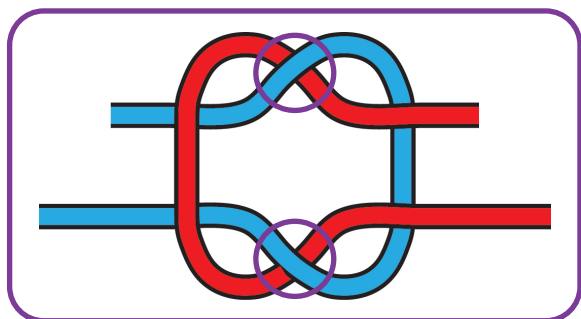
Top Tip

When placing skin sutures that are to be removed, please be sympathetic to the person who follows you and has to cut these loops. Especially if you know that the pet is difficult. It is grasping and raising the knot that is the difficulty. A couple of extra throws or a little extra length in the ears makes grasping the knot so much easier.

Before moving on ... The pitfalls and how to avoid them.

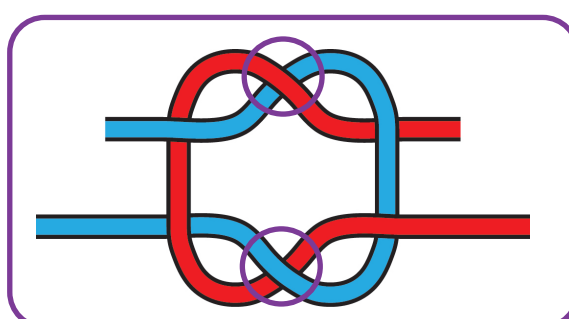
Accidentally creating a granny knot

The Square Knot:



Right over left then Left over right

The Granny Knot:



Right over left then Right over left

Note that the red runs **under** the blue in both throws of the square knot but runs **over** the blue thread of the second throw of the granny knot.

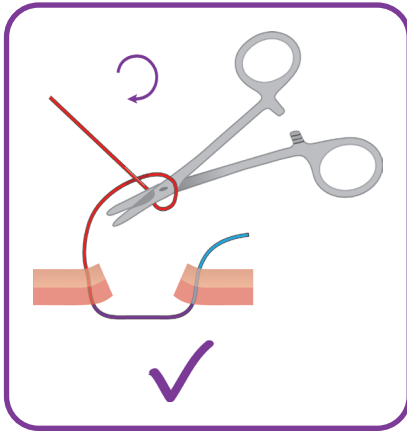
It is very easy to tie a granny knot by accident and the problem is more than cosmetic.

A granny knot looks similar to a square knot but is weaker (snaps at lower tension), is less secure (more likely to slip open) and easily created by accident. Granny knots do not lay flat. The throws will twist as they tighten and turn into a slip knot more readily.

It is to be avoided.

How are granny knots made accidentally?

Granny knots are made accidentally if not taking care to have the needle holder on the correct side of the long (working) strand before wrapping the throw.

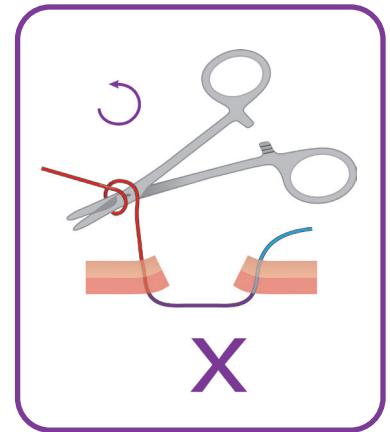


The mistake is when making the second throw, the needle holders are placed outside the working thread so that the throw is wrapped the wrong way.

It does not matter if this is the first or the second throw, it will result in a Granny knot.

To correctly make a square knot:

1. The needle holder is always placed in between the working and tail ends.
2. The working end is wrapped once over the top and underneath the needle holders.

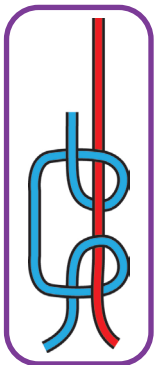


Top Tip

In the skin, correct tension in a finished suture will allow the points of mosquito forceps under the loop of a completed simple interrupted suture.

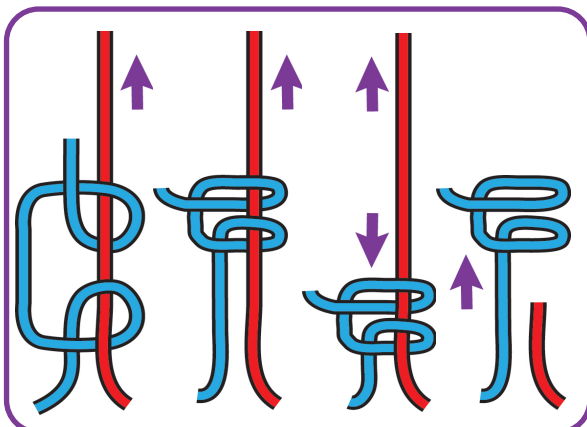
Accidentally making a slip knot.

A slip knot is a knot that can be easily adjusted by sliding up or down the long (working) thread. It is a simple noose.



Its very lack of a secure lock is its advantage. A slip knot is a wonderful thing when you mean to make one. It is a great 'get out of jail free' card when a ligature is needed in a deep and poorly accessible site so long as you add multiple locking throws at the end to prevent further slip. However, it is a liability if you make one accidentally because there is nothing to stop it opening up.

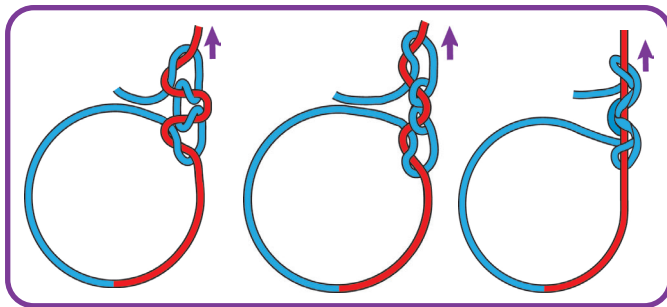
A square knot will convert to a slip knot if only the working end is pulled up (tensioned perpendicular to the wound).



When a square knot converts to a slip knot, you can run it down as normal. But without multiple locking throws it will just run back up and slip off as soon as the wound comes under tension.

Zero knot security

The same can occur for a square knot with multiple locking throws.



Tension upwards, perpendicular with the surface and the chain of flat throws converts into loops forming a slip knot around the working end. There is nothing to stop the blue loops sliding up and down the straight red thread.

Top Tip

When tensioning on the ends to run down the throw:

Ensure that **both** hands cross to the opposite side of the wound (the tendency is that only the dominant hand with the needle holders moves, which will lift one thread.)

You keep the two threads **flat** when tensioning, ie parallel to the skin surface. (The tendency is to pull one or both hands up, towards your face, and this will cause the throw to turn before it is run down).

See note on the slip knot.

Tension and Tensioning Sutures:

The first throw is always loose, and if there is any tension between the tissue edges at all, this will open whilst you are placing the second throw.

If using a monofilament suture material:

The laxity does not matter at all because you can tighten the second throw and the whole square knot will run down smoothly and not open again whilst you tie the third locking throw.

When using a monofilament, don't worry when the first throw opens up, but practice getting the tension correct on the second throw and lock the knot with the third throw.

If using a multifilament suture material there is more friction. The first throw is much less likely to not open up so practice setting the tension on the first throw and locking the knot with the second.

If the first throw does open up while the second throw is applied, the knot cannot be smoothly run down. When tension is applied to the second throw, at first it will lock and then will "jump" when excess tension is applied. It jumps from too loose to too tight. Too tight is painful and will trigger wound interference.

Strategies for overcoming wound tension are:

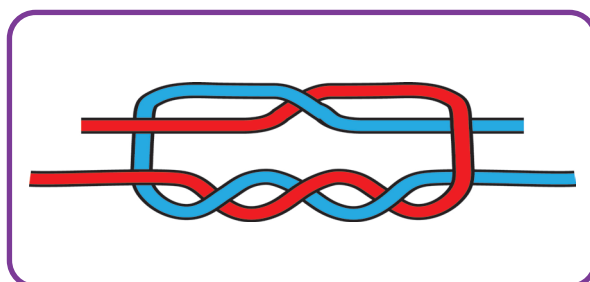
- make a deep suture layer to take the tension off the superficial layer
- place temporary tack sutures that hold the edges together and are removed when the closure is complete
- Use a **Surgeon's knot** instead of a **Square knot**.

The Surgeon's Knot:

Double throw, single throw, single throw

A small modification of a square knot is to make the first a double throw or double wrap.

The surgeon's knot is the simplest version of a tension knot or friction knot. The double first throw provides more friction and holds the two edges in apposition whilst you place the second throw.



The second throw does not run down easily so practice getting the tension correct with the first double throw.

The knot is bulkier than the square knot and tightens when the second throw is applied so again, practice getting the tension correct at the first double throw.

Once the third locking throw is in place, the knot is locked and will not tighten further or slip.

When using a multifilament, if the first throw opens up, convert to a surgeon's knot.

When using a monofilament, if the first throw opens up, run down the second throw until you get the correct tension.

The surgeon's knot is weaker than the square knot so is used when needed, not routinely.



[Click here](#) to watch a video of the Surgeon's knot.

Top Tip

In the skin, correct tension on a finished suture will allow the points of mosquito forceps under the loop of a completed simple interrupted suture.

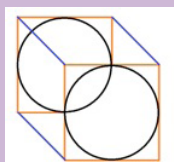
Suture Patterns:

A series of sutures is a pattern. These may be interrupted (or rather single) sutures or continuous sutures.

Top Tip

Cube the square:

Just as with the interrupted suture, when the aim was to take square bites; now you want to space passes the same distance apart as the depth of the bite, and so capture a cube of tissue.



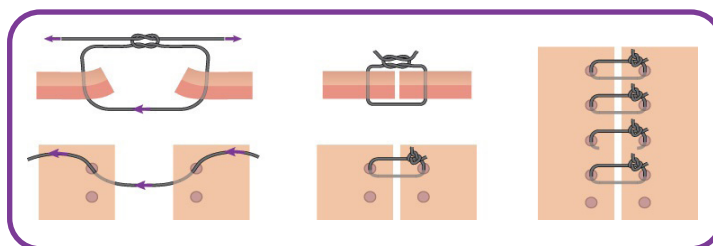
Interrupted sutures can be used as temporary tacks positioning the tissue before another closure technique or as the definitive closure. They are very precise, any suture can be placed anywhere in any order; very versatile and can adapt to any wound shape; very secure because each suture is backed up by its neighbour but very time consuming because it is the knots that take the time.

The Simple Interrupted Suture.

Two bites on opposite sides of the wound (ie one pass) joined by a knot. A simple interrupted suture.

Bites are typically 3-5mm from the wound edge.

Sutures are spaced 5-8mm apart.

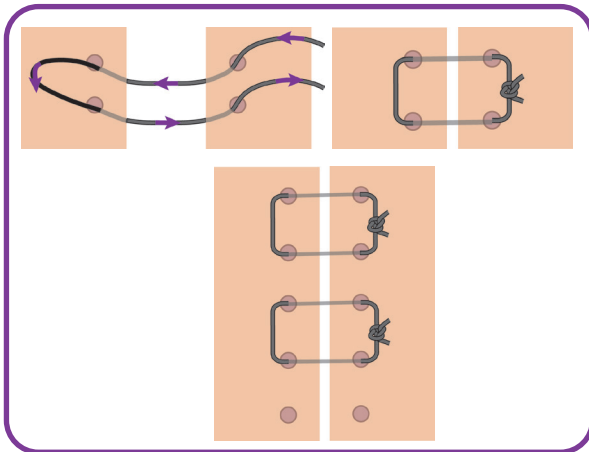


Mattress Sutures

Four bites, two parallel passes joined by a single knot. Essentially two simple interrupted sutures. This reduces the number of knots by half, therefore is faster.

Mattress sutures redirect the stresses, instead of across the wound into damaged/healing tissue to parallel with the wound in stronger healthy tissue – in this regard a mattress is stronger than a simple interrupted.

The Horizontal Mattress Suture



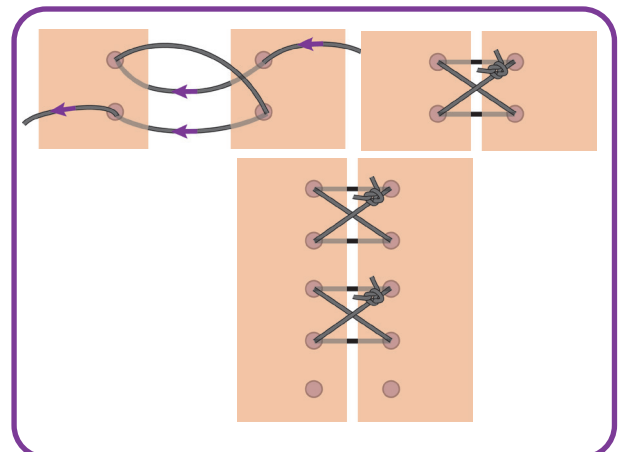
Draw or imagine, dots where the needle bites will be, equidistant from the edge and evenly spaced.

The first pass is made right to left crossing perpendicular to the wound. The needle is then reversed for a second pass left to right again crossing perpendicular to the wound.

The two parallel passes are then joined with a square knot to create a horizontal square.

A horizontal mattress suture provides excellent tension distribution and is ideal for closing wounds under moderate tension.

The Cruciate Mattress Suture



The cruciate mattress suture is a variation of the horizontal mattress suture. (Some websites refer to this as a figure 8 suture. This is incorrect.) Both parallel passes are made right to left, there is no reverse, therefore this is easier and quicker.

The long surface diagonals keep the skin edges flat and resist eversion.

These long diagonal loops also allow for easy access of a stitch cutting blade.

Crus is Latin for cross. Cruciate means crossing.

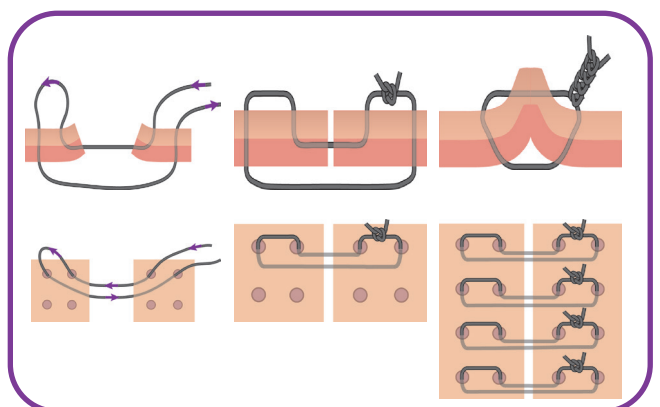
The cruciate mattress is a good compromise between strength and eversion.

The vertical mattress suture

This is the strongest of this type and the most difficult, therefore the slowest to tie. It is particularly useful for closing deep or gaping wounds **particularly as tacks to position tissue before a definitive closure.** Excessive tension will result in eversion which may or may not be acceptable.

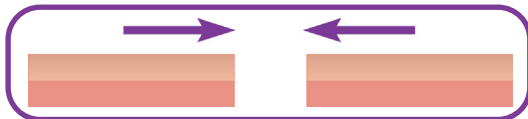
This requires two columns of imaginary dots. Near and far on both sides of the wound.

The first pass is near – near and is partial thickness perpendicular to the wound. Correct placement of these bites ensures the correct alignment of the suture. The needle is then reversed for a deep, full thickness pass that is far-far. This creates a vertical aligned loop enclosing a deep bite of tissue which is inherently strong.

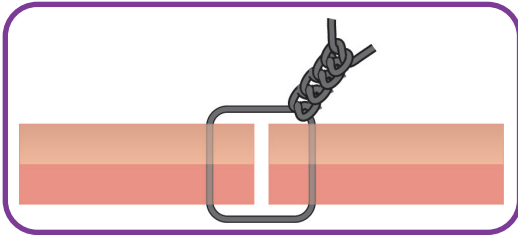


Excessive tension will result in eversion but the partial thickness near-near pass limits the extent of the eversion. Full thickness bites result in more severe eversion.

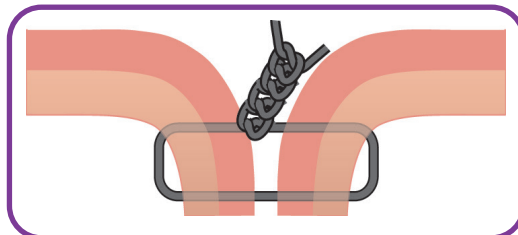
Apposition, Inverting, Everting and Overlap.



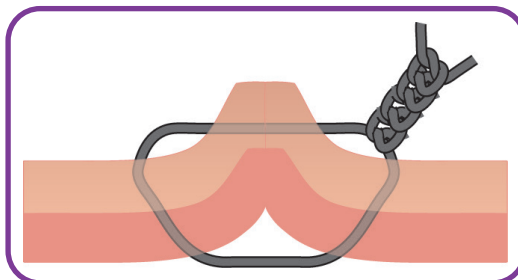
There are four ways to bring two wound edges together: apposition, inverting, everting and overlap.



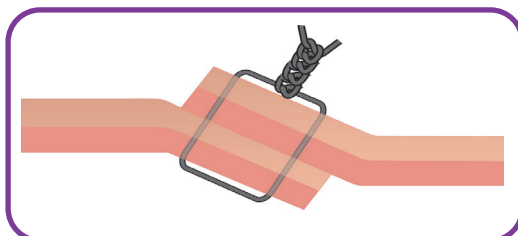
Apposing: Appositional suturing brings the wound edges together in their natural alignment of layers. It is the most common and preferred method for most surgical closures as it promotes most rapid healing and minimal scar formation.



Inverting: Inverting sutures turn the wound edges inward, which may be useful for hollow organ closures to prevent leakage. Healing is slow.



Everting: Everting sutures turn the wound edges outward, resulting in a big scar and slow healing, but may be acceptable when it's the only way to close a weak tissue or a tissue under excessive tension. Everting may be used with stents or buttons to reduce the risk of pull through.



Overlapping: Mayo Mattress Suture. Overlap or Imbricating suture.

Continuous versus Interrupted suture patterns

In an interrupted suture pattern, each suture is tied and cut individually after only one or two passes. This pattern provides great precision when reconstructing short or irregular shaped wounds and greater security as each suture is independent of the others.

In a continuous suture pattern, a single suture strand is used to close the entire wound with one knot at the beginning (Anchor knot) and one knot at the end (Terminal knot). This results in a faster closure time.

Continuous sutures are more comfortable because the tension is distributed evenly along the entire length of the closure. However, if one knot fails, the whole suture fails.

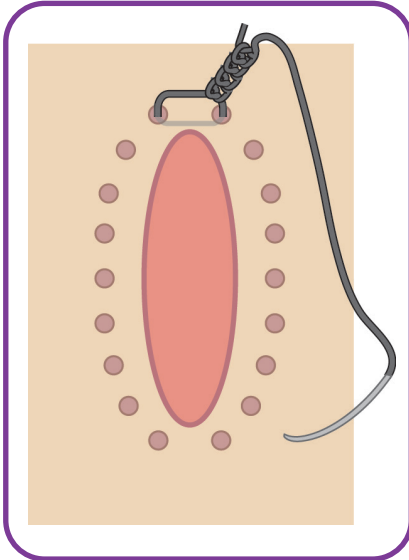
Continuous sutures are **usually** used for long, straight or gently curving wounds.

Simple Continuous suture

(A tailor's running stitch) Is the simplest of the continuous sutures.

It provides a secure and quick closure with simple knots.

Simple Continuous is the standard closure pattern for the abdominal muscle, deep fascia, subcutaneous fat and can be used in skin if you need to recover your patient in a hurry.



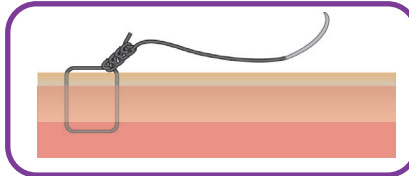
As in previous diagrams, the imaginary dots mark where the needle enters or emerges.

These are the same distance apart as they are distance from the edge.

For a wound oriented east – west, start at your non-dominant (left) end and work towards the right.

If the wound is north – south, start at the north end and work towards you.

This way, your non-dominant (left) hand keeps the working thread out of the way of your next bite & pass.



Anchor knot

First deep bite, full thickness through the layer being closed, proximal to the start of the wound.

Knot with six throws.

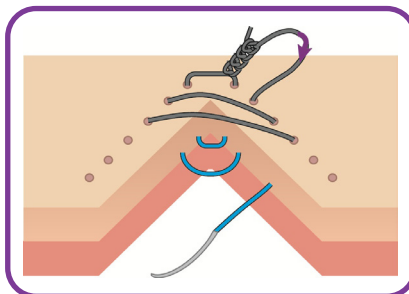
Trim the tail end to form a single ear.

Essential

The knot security is absolutely critical for continuous suture patterns to succeed.

If one knot fails, the whole suture line fails.

Use a minimum of six throws for the anchor knot.



Make a series of continuous passes.

Make the first bite with your dominant (right) side from superficial to deep, pass across the wound.

Second bite from deep to superficial on the non-dominant (left) side.

Repeat moving steadily down the wound towards you with evenly spaced passes.

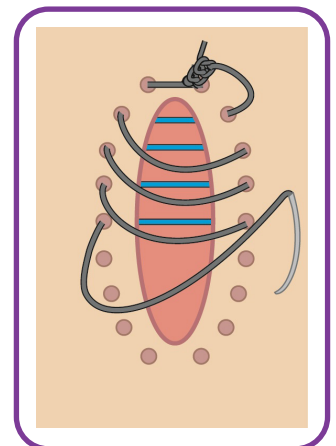
For a wound arranged east-west the first bite is on the north side of the non-dominant (left) end of the wound working towards the dominant (right). The entry and exit point of the needle is visible at all times.

The Terminal Knot:

To create a knot when there is only one free thread you must first create a loop. The loop is then treated as the tail end and tie a square knot as previously.

Knot security is everything for a continuous suture. The same care is taken with the terminal knot as with the anchor knot.

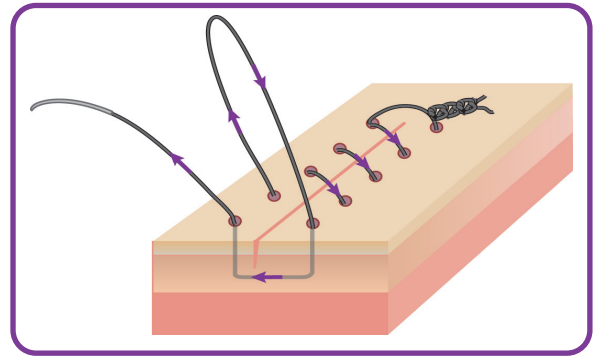
The terminal knot is inherently weaker than the anchor knot. You need an extra throw (ie seven throws) because tying three strands will not interlock as tightly and is less secure than tying two.



To make the loop, options are:

1. to make an extra pass through undamaged tissue distal to the wound.

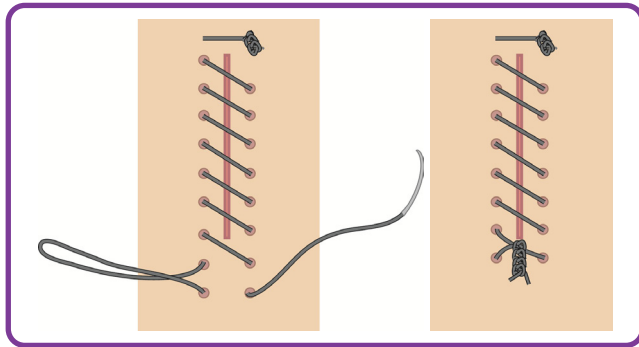
Pull up the last loop.



or

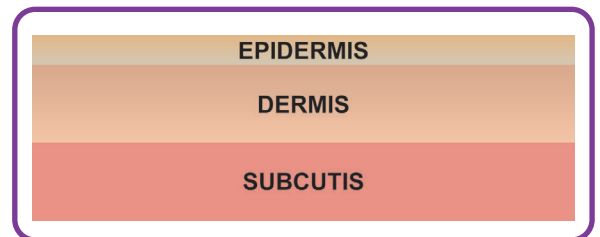
2. make a reverse pass.

This creates a loop with a narrower base and so a neater knot.



Two layer skin closure

The deep subcuticular layer incorporates the strongest holding layer in a strong continuous vertical mattress suture.



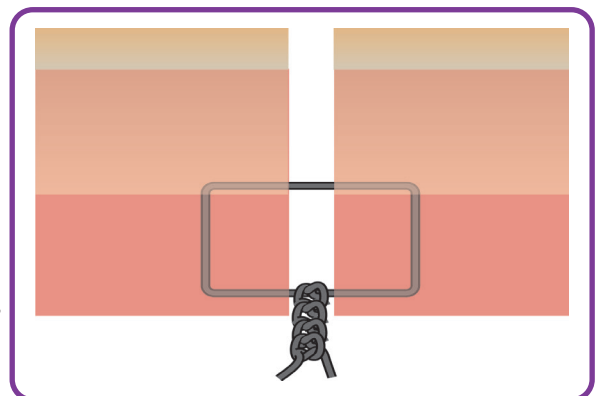
This removes all the tension from the **more** superficial intradermal layer which simply has to appose the epidermal edges.

This produces a strong closure with excellent cosmetic results and no skin sutures to remove later.

Step 1: Continuous vertical mattress suture in the deep subcutaneous tissue.

The subcuticular closure is a method where the suture is placed below the epidermis, within the vascular dermal tissue and subcutaneous fascia. The vertical mattress suture is ideal for this technique, providing strong and precise wound edge approximation.

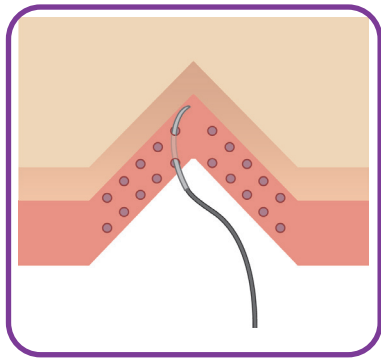
For a wound oriented east-west, start at the non-dominant left end and work towards the dominant right end. This will keep the length of suture material out of the way of subsequent bites.



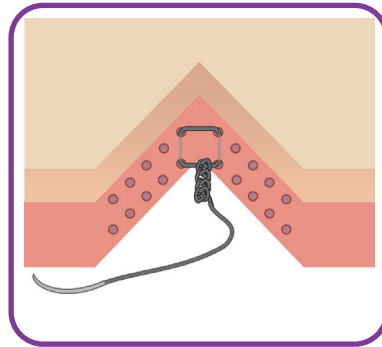
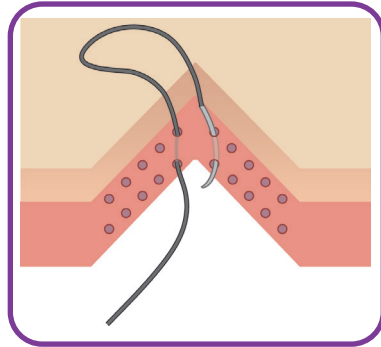
For a wound oriented north-south, place the anchor knot on the north end of the wound and work towards you.

Anchor Knot:

The traditional start is to make a first partial thickness vertical mattress in the subcuticular tissue close to the starting end of the wound.



The first bite is deep to superficial, the second is superficial to deep. This ensures the knot is placed deep.



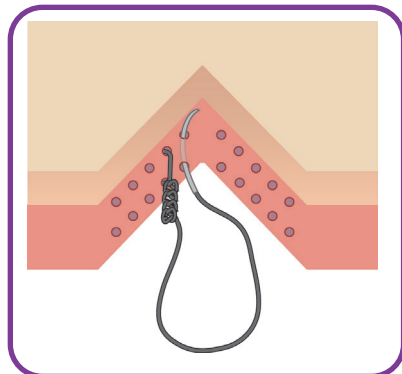
Essential

The knot security is absolutely critical for continuous suture patterns to succeed.

If one knot fails, the whole suture line fails.

Use a minimum of six throws for the anchor knot.

An easier alternative is to start with a single bite and knot on one side only. Allow room for the next bite closer to the start of the wound end.



When making the next bite, place it deep to superficial on the same side so that the knot is seated deeply and closer to the start of the wound.

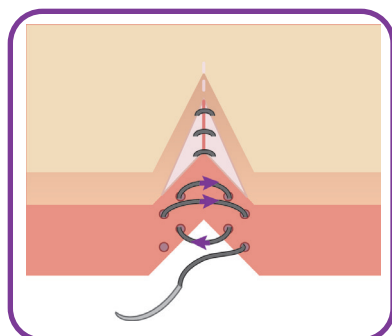
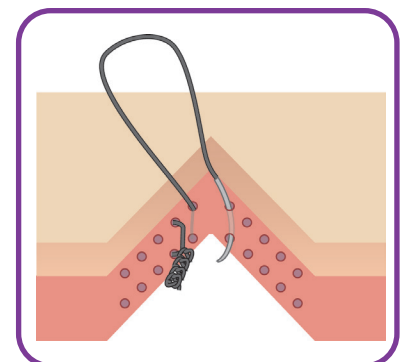
This allows more room so is easier for the beginner.

Essential

Make sufficient throws (minimum 6) to ensure a secure knot.

Make a series of continuous passes.

- In a wound oriented north – south, the first bite on the dominant (right) side of the north end of the wound, opposite the knot, from superficial to deep.
- The bites are made deep on the dominant (right) side and superficial on the (left).
- All the passes are the same direction, right to left with no reverses.
- Passes run from dominant (right) hand to non-dominant (left).



The suture material takes a spiralling path through both sides of the tissue towards you.

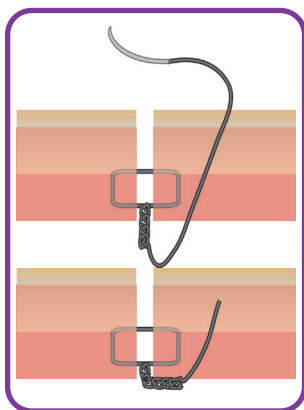
In a wound oriented east-west, the first bite is made on the north side of the non-dominant (left) end of the wound, from superficial to deep.

The bites are made deep on the north side and superficial on the south.
All the passes are the same direction – north to south with no reverses.
Passes run from dominant (right) hand to non-dominant (left).

The Terminal Knot

The same options apply as for the simple continuous suture.
Make a reverse on the dominant hand (right) side to keep a deep loop and a superficial to deep bite on the left/non-dominant side. Tie the three strands or tie and Aberdeen knot (see later in this guide).

Add one extra throw (seven) to allow for the weaker knot.



Bury the knot by taking the needle from deep out (transdermal) through undamaged skin.

Tension slightly and cut flush with the skin.

The end will retract and disappear.

As the deep subcutaneous layer is closed, the edges of the more superficial epidermis is drawn in closer meaning that the cutaneous or intradermal layer has less tension to overcome.

Note 1: the continuous vertical mattress suture can be used in any situation where the tissue is thick enough to accept the vertical bites.

Step 2: The Intradermal horizontal mattress within the Dermis

The intradermal closure involves placing the suture within the dermal layer of the skin. The epidermis is not pierced by the suture so, if done accurately, scarring is minimal.

Veterinary patients are less concerned by scarring. The advantage is a closure line that does not have skin stitches to remove.

This is probably the most technically difficult suture described because there are a lot of small bites, using forehand and backhand bites & making passes in a confined space.

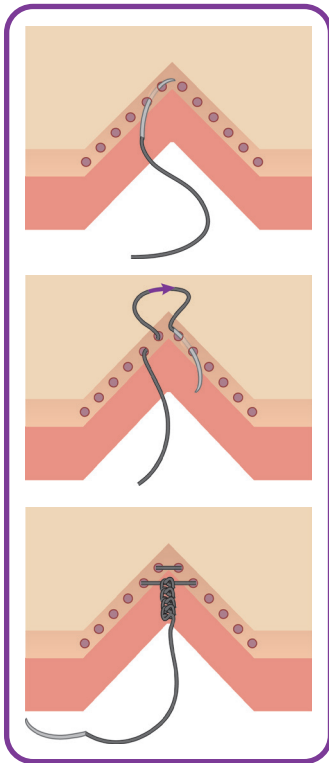
Note 2: You don't have to follow a subcutaneous suture with an intradermal. Alternative closures to the intradermal suture include simple continuous, simple interrupted, cruciate mattresses.

This is also the layer that is seen, so neatness is everything.

For a wound oriented east-west, place the anchor knot at the dominant (right) end and work towards the non-dominant left end. This will keep the length of suture material out of the way of subsequent bites.

For a wound oriented north-south, place the anchor knot on the north end of the wound and work towards you.

The Anchor Knot



Traditionally, start with a single horizontal mattress at the north or the dominant (right) end of the wound.

The first bite is a reverse bite towards the end of the wound.

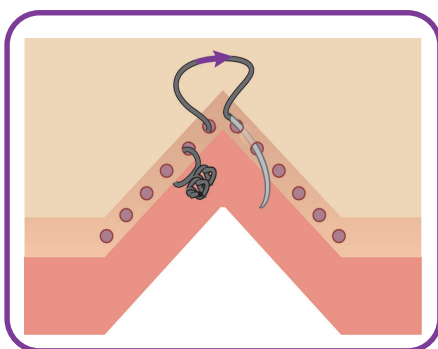
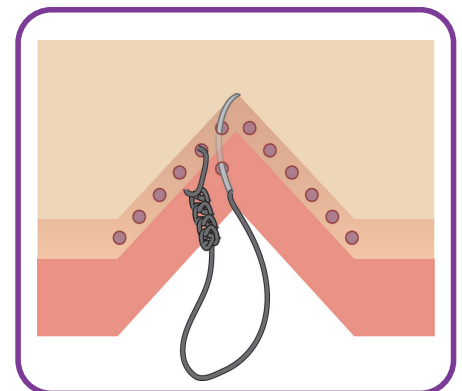
The second is a forward bite towards the other end of the wound.

Tie a six throw square knot and trim only the tail end.

An easier alternative is to start with a single vertical bite exactly the same as for the vertical mattress and knot on one side only.

Make the bite deep, so that the knot is secure and allow room for the next bite closer to the start of the wounds end.

Tie a six throw square knot and trim the tail end only.

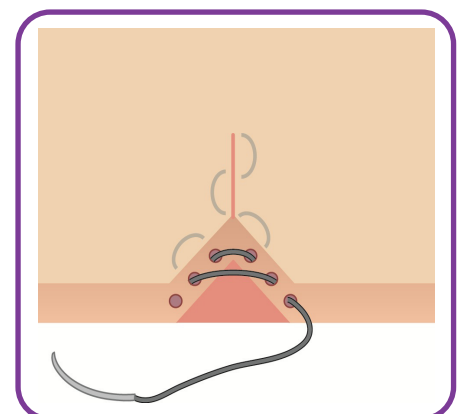


The second bite is made from deep to intradermal on the same side, closer to the wounds end. This seats the knot deep and starts the suture in the intradermal layer.

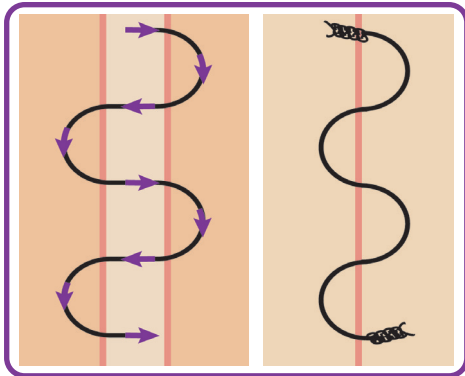
Make a series of continuous passes.

Alternating horizontal bites within the thickness of the dermis.

Progressing towards you (north-south) or from dominant (right) to non-dominant (left) end of the wound.



It is impossible to illustrate an intradermal suture properly because all the suture material is buried and hidden. So, imagine the skin is transparent and you are looking from above, the path of the suture material is as illustrated.



An intradermal suture is a series of horizontal bites and alternating passes, all in the same plane that appose the dermis edges once tensioned.

The bites are all in the same direction so start at the dominant (right) or north end of the wound as appropriate.

The passes are parallel and alternate direction.

The Terminal Knot

The same options apply as for the simple continuous suture.

Make a reverse on the dominant (right) side to create a loop and tie the three strands or tie an Aberdeen knot.

Add one extra throw (seven) to allow for the weaker knot.

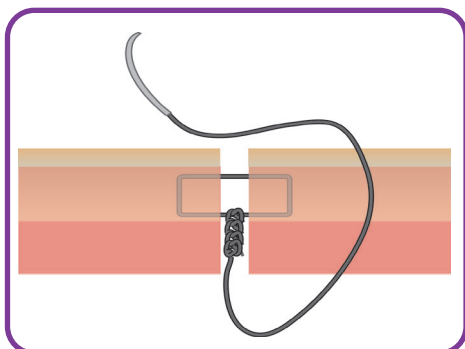
However, it is hard to bury a bulky knot with only a few millimetres of epidermis.

Alternatives

- Make a last bite a vertical superficial to deep bite and tie onto the last loop (this buries the knot deeper).
- Make a last bite on both sides a deep vertical bite so that you finish with a vertical mattress suture and tie a deep knot.
- Tie an Aberdeen knot.

The Intradermal closure is where the Aberdeen knot is preferred because it is less bulky and easier to bury than the alternatives.

Bury the knot by taking the needle from deep out through undamaged skin.



Essential

The knot security is absolutely critical for continuous suture patterns to succeed. If one knot fails, the whole suture line fails (Repetition, but it's worth repeating). Use a minimum of six throws for the anchor knot.

Author's note: It is often said that wound interference is less common when intradermal sutures are used instead of full thickness (transdermal) skin sutures.

However, it is more true to say, wound interference is less common with a **tension free** closure because it is more comfortable, regardless of which suture pattern is selected. It is tension that causes wound interference because it is uncomfortable. If you have dissipated the tension with deeper layered closure, then your final layer will be well tolerated whether it is intradermal or transcutaneous.

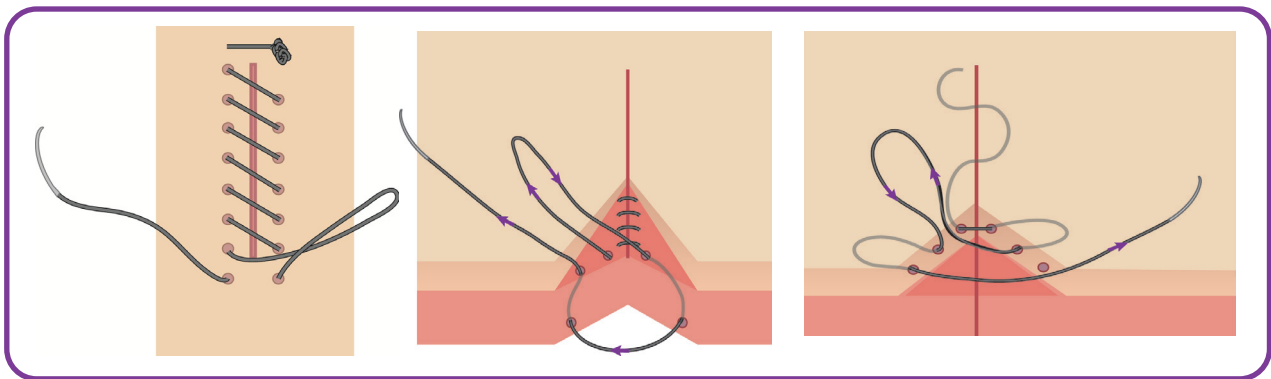
The Aberdeen Knot (an embroiderers chain stitch)

The Aberdeen knot is a hand tie rather than an instrument tie but is well worth learning.

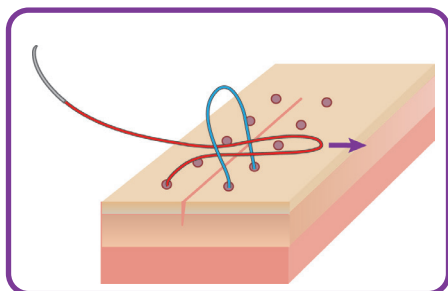
All the continuous suture patterns finish with a loop on one side of the wound and a free working end on the other.



[Click here](#) to watch a short video demonstrating tying an Aberdeen knot.



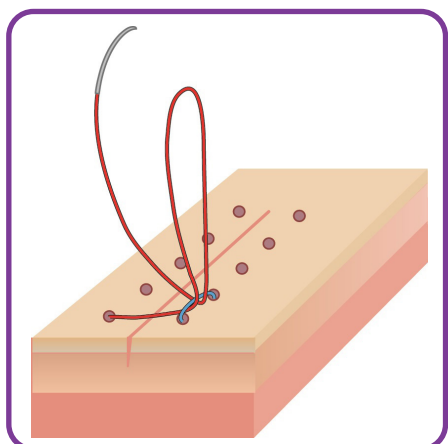
The Aberdeen knot starts with a loop and a free(working) end.



Start with the free working end in your non-dominant (left) hand and your dominant right hand holding the loop.

Advance the dominant (right) hand's finger and thumb through the loop and grasp the working strand.

The dominant hand (right) draws a loop of material (this is technically a turn) from the working end through the first loop.



The turn is then tensioned with the dominant hand whilst the non-dominant hand fixes the working end.

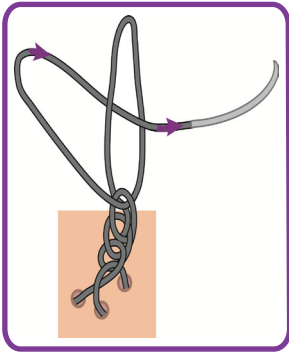
The working end does not move.

As you tension the turn, the first loop runs down forming a locking loop over the previous turn.

This leaves you with the free working end in your non-dominant (left) hand and your dominant right hand holding a loop.

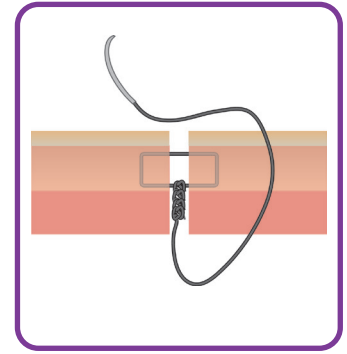
Each repeat of this process adds a link to the chain.

Experiments have shown that four turns provides the optimum knot strength.



To complete the knot, pull the needle through the last turn and pull taught.

Exit the needle from deep and out through intact skin to bury the knot.



The advantages of the Aberdeen knot over tying a square knot with the loop and free end are:

- It is stronger – breaks at higher tension.
- It is less bulky – the loops are tighter.
- Only 4 loops are required.
- It is easier to bury.

Tension Relieving Techniques

Tension relieving sutures are used to redistribute tension away from the wound edges to be taken up by healthier tissue with a better blood supply. This reduces the risk of dehiscence because there is a greater volume of healthier tissue that the suture material would have to pull through for the suture to fail.

Suture patterns such as the vertical and horizontal mattress sutures are commonly employed for this purpose. Additionally, stents or buttons can be applied to further reduce pressure on the skin.

However, a thicker suture material or a stronger knot is only going to increase wound strength so far before it is the tissue itself that fails and the suture material pulls through.

Layered closure is more effective than using a 'stronger' pattern, thicker material or stents. It recruits the deeper layers to share the load and not just rely on the skin.

It has additional advantages because it closes dead space and avoids seroma formation. Each layer closed reduces the tension in the layer above, until the epidermal layer has no tension on it at all.



**With sincere thanks to
Michael Shewring MA VetMB MRCVS
for his time and invaluable assistance
with this surgery guide.**

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Featured Products

Surgical Scissors

Surgical scissors are typically either one of two designs. The Mayo is the general purpose surgical scissor in which the blade occupies approximately one third of the length of the scissor. The 14cm straight Mayo is the standard veterinary surgical scissor. The Metzenbaum is a finer, lighter scissor in which the blade occupies approximately one quarter of the scissor length. Using a 14.5cm Metzenbaum rather than a 14cm Mayo will give you a finer scissor but a similar working distance.

Each style of scissor is available in four different versions which vary according to blade construction and cutting characteristics. They can be identified by handle colour:

- Standard: Stainless - silver-coloured throughout
- Supercut: Black handles
- Tungsten Carbide: Gold handles
- Supercut T.C.: One black handle, one gold handle

Surgical Scissor - Mayo



The Mayo is a general purpose surgical scissor.

745300	Mayo Chamf Blades Str 14cm 5.5"
745310	Mayo Chamf Blades Str 16.5cm 6.5"
745320	Mayo Chamf Blades Str 19cm 7.5"
745330	Mayo Chamf Blades Str 21.5cm 8.5"
745400	Mayo Chamf Blades Cof 14cm 5.5"
745410	Mayo Chamf Blades Cof 16.5cm 6.5"
745420	Mayo Chamf Blades Cof 19cm 7.5"
745430	Mayo Chamf Blades Cof 21.5cm 8.5"

Surgical Scissor - Metzenbaum



The Metzenbaum is a finer lighter scissor than the mayo.

746100	Metzenbaum Scissor Str 14.5cm 5.75"
746101	Metzenbaum Scissor Str 15cm 6"
746110	Metzenbaum Scissor Str 18cm 7"
746115	Metzenbaum Scissor Str 20.5cm 8"
746130	Metzenbaum Scissor Str 23cm 9"
746200	Metzenbaum Scissor Cof 14.5cm 5.75"
746210	Metzenbaum Scissor Cof 18cm 7"
746215	Metzenbaum Scissor Cof 20.5cm 8"
746230	Metzenbaum Scissor Cof 23cm 9"

Surgical Scissor - Supercut



One blade is sharpened to a tapered edge which greatly enhances the ability of the scissor to slice through tissues. The standard scissor has much more of a crushing action. Identified by having black handles.

760000	Mayo Supercut Str 14cm 5.5"
760002	Mayo Supercut Cof 14cm 5.5"
760008	Metzenbaum Supercut Str 14.5cm 5.75"
760009	Metzenbaum Supercut Cof 14.5cm 5.75"
760010	Metzenbaum Supercut Str 18cm 7"
760012	Metzenbaum Supercut Cof 18cm 7"

Surgical Scissors - Tungsten Carbide



Tungsten carbide cutting edges give long service life between sharpening. Gold handles distinguish these from standard scissors.

752250	Mayo Clinical Hard Edge Str 15cm 6"
752260	Mayo Clinical Hard Edge Str 18cm 7"
752280	Mayo Clinical Hard Edge Cof 15cm 6"
752290	Mayo Clinical Hard Edge Cof 18cm 7"
754020	Metzenbaum Hard Edge Str 14.5cm 5.75"
754030	Metzenbaum Hard Edge Str 18cm 7"
754060	Metzenbaum Hard Edge Str 23cm 9"
754080	Metzenbaum Hard Edge Cof 14.5cm 5.75"
754090	Metzenbaum Hard Edge Cof 18cm 7"
754120	Metzenbaum Hard Edge Cof 23cm 9"
754050	Metzenbaum Fino TC Cof 22cm 8.5"
754095	Metzenbaum Hard Edge Cof 35cm 14"

Surgical Scissor - Supercut T.C.



Combining the hard wearing characteristics of tungsten carbide with supercut tapered edges to provide a very fine cut and long interval between sharpening.

760000TC	Mayo Supercut T.C. Str 14cm 5.5"
760002TC	Mayo Supercut T.C. Cof 14cm 5.5"
760008TC	Metzenbaum Supercut T.C. Str 14.5cm 5.75"
760009TC	Metzenbaum Supercut T.C. Cof 14.5cm 5.75"
760010TC	Metzenbaum Supercut T.C. Str 18cm 7"
760012TC	Metzenbaum Supercut T.C. Cof 18cm 7"
760014TC	Metzenbaum Supercut T.C. Cof Fine 18cm 7"

Cosmetic Surgeon Scissors



Favoured by human cosmetic surgeons, these scissors have very fine razor-sharp blades with tungsten carbide inserts for long life. They have a beautiful action and a place in veterinary surgery where precise cutting is required, especially for fine skin.

755100	Cosmetic Surgeon Scissors T.C. Str 15cm 6"
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Stitch Cutters

Heath Stitch



General purpose stitch cutter.

743800	Heath Stitch Scissors 15cm 6"
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Littauer Stitch



Very nice for removal of small awkward sutures.

745095	Littauer Stitch Scissors 9cm 3.5"
745100	Littauer Stitch Scissors 11cm 4.5"
745110	Littauer Stitch Scissors 12.5cm 5"

Castroviejo Suture Removal Scissors



Designed for the removal of very fine sutures. The Castroviejo action matches that of the Castroviejo Needle Holders.

014185	Castroviejo Suture Removal Scissors 12cm 4.5"
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Needle Holders

Dedicated needleholders offer the best grip, and dedicated suture scissors offer the best cutting action. However combined needleholder/scissors are very popular for convenience in spite of the functional compromise. Most Vi needleholders are available with tungsten carbide jaw inserts. These grip and wear better. Particularly useful for smaller needles. Identified by gold handles.

Olsen Hegar Scissor/Needle Holder



Olsen Hegars are usually considered the 'go to' choice for general surgery. Highly recommended. Combined scissor/needle holder.

585400	Olsen Hegar Needle Holders 14cm 5.5"
585410	Olsen Hegar Needle Holders 16.5cm 6.5"
585420	Olsen Hegar Needle Holders 19cm 7.5"
605340	Olsen Hegar Needle Holders T.C. Jaws 11.5cm 4.5"
605350	Olsen Hegar Needle Holders T.C. Jaws 14cm 5.5"
605350S	Olsen Hegar Needle Holders 'S' Cut T.C. Jaws 14.5cm 5.5"
605355	Olsen Hegar Needle Holders T.C. Jaws 16.5cm 6.5"
605380	Olsen Hegar Needle Holders 'S' Cut T.C. Jaws 16cm 6"
605385	Olsen Hegar Needle Holders 'S' Cut T.C. Jaws 18cm 7"
605390	Olsen Hegar Needle Holders 'S' Cut T.C. Jaws 19cm 7.5"
605360	Olsen Hegar Needle Holders T.C. Jaws 19cm 7.5"
605361	Olsen Hegar Needle Holders Razor Cut 14.5cm 5.5 "
605362	Olsen Hegar Needle Holders Razor Cut 17cm 6.5"

Mayo & Mayo Hegar



Veterinary general purpose needleholder, available in a wide range of sizes with or without tungsten carbide jaw inserts. Mayo Hegar is the TC variant of standard Mayo.

584750	Mayo Needle Holders 12.5cm 5"
584760	Mayo Needle Holders 14cm 5.5"
584780	Mayo Needle Holders 16.5cm 6.5"
584765	Mayo Needle Holders 18cm 7.0"
584820	Mayo Needle Holders 20cm 8"
604700	Mayo Hegar T.C. Jaws 12.5cm 5"
604705	Mayo Hegar T.C. Jaws 14cm 5.5"
604715	Mayo Hegar T.C. Jaws 16cm 6"
604715L	Mayo Hegar T.C. Jaws - Left Handed 16cm 6"
604720	Mayo Hegar T.C. Jaws 18.5cm 7"
604735	Mayo Hegar T.C. Jaws 20cm 8"
604740	Mayo Hegar T.C. Jaws 23cm 9"

DeBakey Needle Holders



Much lighter in construction than the Mayo Hegar. These needleholders are very useful for deep surgical procedures where there is limited space e.g. chest surgery.

602005	DeBakey Needle Holders T.C. Jaws 18cm 7"
602010	DeBakey Needle Holders T.C. Jaws 20cm 8"
602030	DeBakey Needle Holders T.C. Jaws 22.5cm 8.5"
602015	DeBakey Needle Holders T.C. Jaws 23cm 9"
602020	DeBakey Needle Holders T.C. Jaws 25cm 10"
602025	DeBakey Needle Holders T.C. Jaws 30.5cm 12"

McPhails



The McPhails needle holder has one soft copper jaw for extra needle grip, the other is stainless steel. The catch engages with a moderate squeeze on the handles. Further pressure releases the catch and the needle.

584650	McPhails Needle Holders 15cm 6"
584660	McPhails Needle Holders 18cm 7"
584670	McPhails Needle Holders 20cm 8"

Gillies



Combined scissor/needle holder. No ratchet.

582950	Gillies Needle Holders RH 16cm 6.25"
582951	Gillies Needle Holders LH 16cm 6.25"
602950	Gillies Needle Holders T.C. Jaws RH 16cm 6.25"
602951	Gillies Needle Holders T.C. Jaws LH 16cm 6.25"

Foster Gillies



Smaller than the standard Gillies this instrument is useful for finer surgery or smaller hands.

- 582650** Foster Gillies Needle Holders RH 12.5cm 5"
- 602700** Foster Gillies Needle Holders T.C. Jaws RH 12.5cm 5"
- 602705** Foster Gillies Needle Holders T.C. Jaws LH 12.5cm 5"

Miniature Foster Gillies



- 602710** Miniature Foster Gillies T.C. 10cm 4"

Castroviejo



Classic ophthalmic needleholder with catch. Infrequent ophthalmic surgeons should also consider Miniature Fosters or Ryders as the squeeze action of Castroviejos requires patience and practice to master. Also available without catch.

- 014175** Castroviejo Needle Holders With Catch T.C. 15cm 6"
- 014177** Castroviejo Needle Holders Without Catch T.C. 15cm 6"

Castroviejo Needle Holders/Scissor



This Instrument functions as a standard Castroviejo needleholder but the jaws incorporate a suture cutting function in the style of Olsen Hegars or Gillies. Jaws are tungsten carbide for maximum grip.

- 014181** Castroviejo Needle Holders/Scissor Str T.C. 15cm 6"
- 014182** Castroviejo Needle Holders/Scissor Cof T.C. 15cm 6"
- 014183** Castroviejo Needle Holders/Scissor Str 'S'Cut T.C. 15cm 6"
- 014184** Castroviejo Needle Holders/Scissor Cof 'S'Cut T.C. 15cm 6"

Kilner Needle Holders



Kilner needle holders are similar to 140mm Mayos but the arms are cranked, offsetting the jaws from the handles by around 10mm.

- 608000** Kilner Needle Holders 14cm 5.5"

Ryder Needle Holders



Ideal for small needles. The smaller sizes are an alternative for ophthalmic needleholders.

- 606340** Ryder (Micro) T.C. Jaws 12.5cm 5"
- 606345** Ryder (Micro) T.C. Jaws 15cm 6"
- 606350** Ryder (Micro) T.C. Jaws 18cm 7"

Derf Needle Holder



The Derf needle holder is a small T.C. needleholder with slightly heavier jaws than the Ryder. More resistant to surgeon abuse!

- 607010** Derf Needle Holder T.C. Jaws 12cm 5"

Galibans Suture Forceps



Use when placing sutures under tension. A good example is the placement of a lateral stabilising suture in the management of cranial cruciate ligament failure or abdominal sutures in an overweight dog. Galibans used by an assistant are used to atraumatically secure the first throw. The Galibans are removed as the second throw is tightened.

- 58900** Galibans Suture Holding Forceps

Dissecting Forceps

Serrated Block End



General purpose dissecting forcep.

- 341070** Block End Serrated Dissecting Forceps 12.5cm 5"
- 341075** Block End Serrated Dissecting Forceps 15cm 6"
- 341080** Block End Serrated Dissecting Forceps 18cm 7"
- 347655** Dressing Forceps 20.5cm 8"

Treves Rat Tooth Forceps



General purpose rat tooth dissecting forceps.

- 346850** Treves Dissecting Forceps 1/2 Teeth 12.5cm 5"
- 346855** Treves Dissecting Forceps 1/2 Teeth 15cm 6"
- 346860** Treves Dissecting Forceps 1/2 Teeth 18cm 7"
- 347665** Fine Rat Tooth Thumb Forceps 20.5cm 8"

Dissecting Forceps 1/2 Teeth



- 341145** Dissecting Forceps 1/2 Teeth 15cm 6"
- 341160** Dissecting Forceps 1/2 Teeth 18cm 7"
- 341170** Lanes Dissecting Forceps 1/2 Teeth 6" 15cm
- 349520** Lanes Dissecting Forceps 2/3 Teeth 7" 18cm

Connective Tissue Forceps



DeBakey-style handles with Adson Brown tips, providing excellent grip of connective tissue with minimal trauma.

- 343001** Connective Tissue Forceps 15.3cm 6"
- 343002** Connective Tissue Forceps 18cm 7"

Adson



Ideal for fine surgical procedures. Available in a range of jaw designs.

- 341200** Adson Serrated Dissecting Forceps 12.5cm 5"
- 341201** Adson Serrated Extra Fine 12.5cm 5"
- 341210** Adson Dissecting Forceps 1/2 Teeth 12.5cm 5"
- 341212** Adson Brown Dissecting Forceps 12.5cm 5"
- 341214** Adson Brown Serrated/ Crocodile 15cm 6"
- 341215** Adson Brown 1/2 Teeth 15cm 6"
- 341220** Adson DeBakey Dissecting Forceps 12.5cm 5"

DeBakey - Atraumatic



Originally designed for cardiovascular surgery, these forceps grip firmly with minimal damage to delicate tissue, including bowel and urogenital system.

- 342005** DeBakey Dissecting Forceps 15cm 6"
- 342010** DeBakey Dissecting Forceps 18cm 7"
- 342020** DeBakey Dissecting Forceps 20.5cm 8.2"
- 342030** DeBakey Dissecting Forceps Angled 15cm 6"
- 342040** DeBakey Dissecting Forceps 24cm 9.4"

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