




How to

STITCH-UP WOUNDS

Suturing Course E-book



Master the technique of suturing

The art and science of suturing and wound care explained



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AN ILLUSTRATED HANDS-ON COURSE ON CD-ROM

Included - an 18 piece suturing Kit with all the instruments and items needed to learn how to suture lacerations!

Learn how to care for- and suture wounds AND get your 18-piece suture kit with real medical instruments and items – all you will need to practice wound suturing at home... or wherever you are!!

A product by



THE APPRENTICE CORPORATION

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WARNING:

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The Apprentice Corporation
2299 Kenmore Avenue
Buffalo,
NY 14207
U.S.A.

Or per e-mail: reg@TheApprenticeDoctor.com

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A BASIC COURSE IN SUTURING

CONTENTS

INTRODUCTION

01 - 05

Preface.....	01
Objectives of the Course.....	03
Disclaimer.....	04
List of Medical Instruments.....	05

PREPARATORY PROJECTS

09 - 20

Case Study - Dr. Shipton's Holiday.....	09
Project 1: Familiarize yourself with the suture kit.....	11
Project 2: Attach suture material to a needle.....	13
Project 3: How to clip the needle to the needle holder.....	16
Project 4: Prepare imitation skin for practicing suturing.....	18
Project 5: How to construct a rod to practice knot tying.....	20

BASIC KNOTS

23 - 56

Case Study - The Surgeon's Knot.....	23
Project Alpha: A demonstration of a square knot and a granny knot.....	25
Project Beta: Make a square knot: Two-hand tie.....	29
Project Gamma: Make a square knot: One-hand tie.....	33
Project Delta: Make a surgeon's knot: One-hand tie.....	41
Project Epsilon: Make a square knot: Instrument tie.....	52
Project Zeta: How to make a surgeon's knot (Instrument tie).....	56

SUTURING TECHNIQUES

61 - 129

Case Study - Rhodé's Ear.....	61
Case Study - Hazards at work.....	63
Basic principles of wound care.....	65
A basic course in suturing techniques.....	70
Project A: How to place subcutaneous sutures.....	71
Project B: How to place interrupted sutures.....	77
Project C: How to place interrupted sutures with buried knots.....	85
Project D: How to place continuous sutures.....	89

SUTURING TECHNIQUES (CONTINUE)



Project E: How to place continuous interlocking sutures.....	93
Project F: How to place horizontal mattress sutures.....	97
Project G: How to place vertical mattress sutures.....	101
Project H: How to place "Far-and-Near" sutures.....	105
Project I: How to place subcuticular sutures.....	109
Project J: How to place a purse string suture.....	115
Project K: How to correct a "Dog's Ear".....	118
Project L: How to correct unequal levels of tissue.....	121
Project M: How to remove sutures.....	125
Complications of suturing.....	129

CONCLUSION

131 - 132



Epilogue.....	131
Glossary.....	132



INTRODUCTION

PREFACE

Learning how to suture wounds and lacerations requires a thorough understanding of the theory of wound care and the basic principles of suturing. The student also needs to reach an advanced level of proficiency by practicing knot tying and suturing techniques.

The **The Apprentice Doctor® Suture Course and Kit** is not intended to substitute the clinical training of students but rather to offer a firm foundation and an opportunity to experience his/her initial learning curve in an imitation situation – so as to fill the student with confidence when he is faced with the real life clinical situation.

The **The Apprentice Doctor®** Suturing course material on CD-ROM consists of 3 sections:

1. Get acquainted with the instruments and items in the Kit
2. Basic Knot tying
3. Suturing techniques

Follow this specific order when working your way through the course material, and ensure that you understand the one section and are able to perform the practical projects skillfully before proceeding to the next section. Do not skip a section because you think it is unimportant or too simple. Basic principles are like that, they appear to be simple, but one needs to understand and practice these simple building blocks before proceeding to, and succeeding with the complicated stuff.

IMPORTANT NOTES:

Kindly note: For the purpose of this course the word suture will be used as the verb/noun pertaining to the closing-up or stitching-up of wounds/lacerations /incisions.

- The **The Apprentice Doctor®** Suturing Hands-on Course and Kit has been designed mainly for right-handed persons. Left-handed persons please exchange the terms left and right as they occur in the text where applicable.
- This Kit contains the bulk of the information, instruments and items to successfully practice your suturing technique. It is highly recommended that you invest in **The Apprentice Doctor® Basic Medical Course and Kit**, which wonderfully supplements **The Apprentice Doctor® Suturing Course and Kit!**

• TheApprenticeDoctor.com website and community compliments these 2 products and gives the future Healthcare professional a chance to join groups of like-minded students with the aspiration of becoming medical professionals, or to learn from other practicing Healthcare professionals. You will find a suitable community in your country/state – and will receive lots of free advice and support to help you fulfill your dream!

Dr Anton Scheepers and the staff of The Apprentice Corporation as well as all the Apprentice Doctor community leaders would like to wish you success with your future and look forward to being a small part of fulfilling your dreams!

Recommended training material for ...

All Healthcare Professionals whether prospective, in training or qualified:

- Medical students
- Pre-medical students
- Paramedics and EMT students
- Dental students
- Veterinary students
- Nursing students
- Surgery Interns/Registrars
- Advanced First Aid practitioners
- Medics in the military
- The Apprentice Doctors' Club Members
- High school students interested in a career in medicine
- Practicing Healthcare professionals who would like to improve or refresh their suturing technique.
- Non-medically qualified individuals with a keen interest in the practical aspects of medicine

OBJECTIVES OF THE COURSE:

To equip students with a basic understanding of the theory of suturing wounds and to acquire the skills to confidently tie surgical knots and suture lacerations.

The student should on completion of this course have a good understanding of:

- The basic principles of wound care
- Knot tying techniques (as related to knots used in surgery)
- Surgical instruments used in suturing
- Suture materials
- The various suturing techniques used by medical professionals



The student should have the following skills:

- Placing sub-cutaneous sutures
- Placing interrupted sutures
- Placing a variety of mattress sutures
- Tying a square knot (two-hand tie, one-hand tie, and instrument tie)
- Tying a surgeon's knot (one-hand tie, and instrument tie)
- Using a number of other types of suturing techniques
- Correcting minor discrepancies while suturing
- Removing sutures



Developed by a surgeon with more than 20 years of experience



PLEASE READ THESE WARNINGS CAREFULLY



- Your Suture and Dissection Kit contains sharp objects e.g. a scalpel-like knife, needles and scissors. Please be extremely cautious and careful when using these instruments!
- Not suitable for children under 12 years of age!
- Supervision/guidance by a responsible adult is recommended for students under 18 years of age.
- The user must always wash his/her hands before using the kit to minimize the risk of infection following accidental injury. For the same reason gloving is recommended.
- Always use clean instruments. Wash instruments with soap and water after each usage session, then leave it in an antiseptic solution e.g. Savlon for 60 minutes. Rinse thoroughly with clean water then dry before replacing it in the kit.
- For any cut or needle prick injuries – squeeze the wound for 15-30 seconds to bleed out impurities, then wash profusely with soap and water; apply pressure to stop the bleeding, then apply a plaster e.g. Band Aid. Seek professional medical assistance.
- Keep out of reach of babies, toddlers and children under the age of 10.
- Keep sharp instruments away from the eyes.

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- Offer any warranty regarding the accuracy or correctness of any information contained in this application;
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The supplier accepts no responsibility for the malfunction of any instrument or item.

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The use of the instruments, items and information supplied in this application is conditional upon the acceptance of this disclaimer as well as the undertaking to honor the copyrighted course material.

REIMBURSEMENT POLICY

The Apprentice Corporation is confident that you will be satisfied with this product in each and every way. If you are, for any reason dissatisfied with your choice, The Apprentice Corporation will be happy to reimburse you (less postage and shipping charges) should you wish to return the complete medical kit as well as the CD-ROM in an undamaged state within a reasonable time limit of not more than 8 weeks after acquiring this product.

**YOUR ORDER NUMBER AND THE DATE OF THE TRANSACTION
SHOULD ACCOMPANY YOUR REQUEST FOR REIMBURSEMENT.**

LIST OF MEDICAL INSTRUMENTS

Surgical scissors

Surgical scissors are classified according to the 2 blade tips - thus:

- Sharp-sharp
- Sharp-blunt
- Blunt-blunt

Sometimes scissors are classified according to function – for example:

- Suture cutting scissors
- Dissection scissors

In certain operations it is safer to carefully dissect your way towards an area/organ rather than cutting into the tissues with a sharp scalpel blade.

Use your *medium Sharp-blunt scissors* for general cutting purposes and to cut off excess suture material after placing a suture and tying the knot.

Use the *small Sharp-sharp scissors* to cut the suture for removal.



Surgical probes (seekers)

Your Kit has two probes:

- Sharp (straight)
- Blunt (slightly curved)

Probes are also classified as:

- Hollow
- Solid

A dentist uses a *sharp curved probe* to examine teeth and detect cavities.

Anesthetists and radiologists use *flexible blunt probes* to maneuver their way into specific veins or arteries in the body (for diagnostic or therapeutic purposes)



Skin hook (if available)

A skin hook is used to lift a section of skin, to facilitate the placement of sutures while minimizing the amount of injury to the tissues.

By placing two skin hooks into the tissue at the corners on the 2 sides of a laceration, and gently lifting both skin hooks, one can facilitate eversion (having a slightly raised sutured laceration compared to the adjacent tissue).



Scalpel

A scalpel is a surgical knife with a fixed or removable blade (cutting area). Removable blades are produced in a variety of patterns and sizes.

WARNING: *The scalpel is the most dangerous instrument in your Kit – handle with caution!*



Forceps

A **forceps** is an instrument used in medicine to grab or to hold something.

You Kit contains a **general-purpose tweezer-forceps**. The inside of the tips (jaws) are serrated to enhance gripping. This forceps is used for general handling and gripping of tissue or objects.



The other forceps is called a **tissue forceps**. The tip of this forceps shows a sharpish tip (jaws) on the one leg and a v-shaped groove on the other side. It is commonly referred to as a **rat-tooth forceps**.

Use this forceps to handle tissue when placing sutures.



Needle Holder

A Needle Holder is a special type of forceps, designed to securely hold the surgical suture needle when placing sutures.

Artery forceps are somewhat similar in appearance, but have longer jaws – some with straight and some with curved jaws.



Sutures

The main two groups of sutures are:

- *Absorbable.*

These sutures are broken down by bodily enzymes, and are used when sutures are placed within the body, below the skin (Chronic and Plain Catgut, Vicryl™ and Monocryl™)

- *Non-absorbable (e.g. Nylon and Silk).*

These sutures are more predictable as regards their strength. The patient needs to return to the hospital/surgery for removal of these sutures.



Sutures may also be subdivided as braided and monofilament. As a rule, braided sutures are easier to tie but cause a more intense tissue reaction.

Suture sizes

Modern suture diameters range from thick to thin and are represented by the series of numbers 5, 4, 3, 1, 0, 2-0, 3-0, 4-0, 5-0, 6-0, 7-0, 8-0, 9-0, 10-0 and 11-0. Number 5 sutures are heavy braided sutures used by orthopedic surgeons and 11-0 sutures are micro-fine monofilament sutures used by ophthalmic surgeons operating with the aid of a surgical microscope. Number 5-0 or 6-0 sutures are used to stitch up lacerations in cosmetically sensitive areas like the face.

Needles

Needles may be straight, a semi-circle or a section thereof. In cross section they may be round or triangular – with a cutting edge on either the inner curve or the outer curve.

The length and the diameter of needles may vary considerably.

The number used when describing a needle usually refers to the length in millimeters.

Modern needles are pre-assembled with a suitable suture material attached to the blunt end. These needles are referred to as "atraumatic" – meaning they do not have an eye that may injure the tissue as it traverses the tissues.

The needles in your Kit have a small eye on the side opposite to the tip for you to attach the suture to. Atraumatic needles are manufactured in all shapes for most sizes of sutures.



Imitation Skin

A 15 X 15 cm imitation skin is included in your kit. The white fiber-like part corresponds to the dermis and the thin plastic covering corresponds to the epithelium (the covering surface layer of skin and mucous membranes).

Remember you can practice your skills on a variety of vegetables – oranges, bananas potatoes etc.

The imitation skin in your kit is more life-like compared to a number of gel-like imitation skin products available on the market. Skin is in fact **anything but gel-like** in consistency.



Gloves

It is strongly recommended that you wash your hands hygienically clean (see "Project 00" in *The Apprentice Doctor® Basic Medical Course*) and glove before practicing placing sutures to make sure that you get in the right habits from the word go. You need to become accustomed to the "feel" of working while being gloved like a surgeon.

More information: <http://en.wikipedia.org/wiki/Suture>



CASE STUDY

[Real stories of real patients - names and details modified]

DR SHIPTON'S HOLIDAY

Dr Shipton usually reserves 2 weeks at their favorite holiday resort for their family's yearly holiday. Dr Shipton, his wife and their two children look forward to these 2 weeks of enjoyment months in advance. It is a time of re-uniting family ties, involving the whole family in games and activities, all at a beachfront venue, with their flat having an exceptionally great view of the treacherous Indian Ocean on the East coast of Africa.



The first week was great. The weather was good and the sea was perfect for swimming. "Let's get up early tomorrow morning and watch the fishermen reeling in their fish from the rocks," Jamie the elder Shipton son proposes, and the proposal is accepted unanimously. It is July and one of the most spectacular natural events is about to occur – the sardine run. Schools of millions of sardines migrate up the coast, followed by game fish like barracudas and sharks in their thousands – a fishermen's paradise!! Conditions for fishing have been forecast as optimal and hundreds of fishermen line the coast, the prime spot is Ekhakha's rock. Dr Shipton and his family haven't caught on to the fishing thing, but this event makes for great entertainment merely by being a spectator.



So 8 a.m. and everybody's ready to stroll down to the beach. They have to pass a number of neighboring flats on their way down. Suddenly they are stopped in their tracks, stunned by screaming followed by an urgent shout: "HELP! SOMEBODY, PLEASE HELP!!" One of their neighbors' flat door swings open with an even more urgent shout for help.



Dr Shipton dashes towards the flat and discovers the neighbor's 17-year-old son covered in blood. A simple slip and his head shattered the glass top on the coffee table. "Quickly bring me towels!" he shouts. He tightly drapes a large towel over the large cut in the scalp and puts on tight hand pressure for a couple of minutes. The towel slowly becomes red and more saturated with bright red blood.

The pressure helps but doesn't stop the bleeding. "Go get my first aid kit!" His wife rushes to their flat and returns with the kit. Dr Shipton always carries some local anesthetic as well as a couple of packets of suture material and the relevant instruments in his first aid kit. He quickly injects local anesthetic containing adrenalin and almost immediately starts to stitch up the long 25 cm (10 inch) laceration in the scalp.



With each stitch the bleeding gets less. Dr Shipton doesn't waste time cutting the stitches – just one long continuous suture. Time is of the essence. He has just one thing in mind... to stop the bleeding as soon as possible. He takes fairly large bites with the suture needle into the tissue adjacent to the laceration, and ensures that the stitches are tight by interlocking them. He uses another towel to clean up the wound. He then inspects the area for residual bleeding, and cleans up.



Dr Shipton writes a note to the Medical Officer at the local hospital giving him the relevant information and requesting him to take over the case. Just then, the ambulance arrives and the Paramedics rush to assist in stabilizing the patient. The patient is transported to the local hospital.

At long last the Shipton family is on their way to the beach – the subject under discussion is the events of the morning.

Would you like to be prepared for an emergency situation like Professor Shipton? Here is your chance to learn how to professionally suture wounds!



IMPORTANT WARNING



For those who are not qualified and officially registered as a medical professional, please keep the following in mind:

- Leave suturing on real patients to suitably medically qualified individuals.
- In an emergency call 911 or equivalent emergency number!
- Exert direct pressure on any bleeding point until help arrives.

PREPARATORY PROJECTS

PROJECT 1 - FAMILIARIZE YOURSELF WITH THE SUTURE KIT

Ensure that your Suture Kit is complete and that you know the names of each individual instrument

INFORMATION

Most metal surgical instruments are made from stainless steel – which is strong, durable and won't corrode (rust). They can be sterilized by steam autoclaving and will retain their characteristics.

REQUIREMENTS

Your suture Kit

STEP 1

Identify the components of your suture Kit using the list (provided on page 5). Our Kits are double checked for quality and completeness by our factory. In the unlikely event of problems, kindly contact customer support personnel at

Customercare@TheApprenticeDoctor.com.



STEP 2

2.1 Remove the Needle Holder from the Kit, and examine it. Identify its different parts.

2.2 Have a good look at the ratchet latch (lock) mechanism - it has 3 beveled teeth on the inside of both sides – designed to catch at 3 levels – light, medium and strong locking.

2.3 Put the thumb in the upper eye and the 4th finger in the lower eye of the handle – see picture right. Practice the locking and unlocking action of the ratchet latch mechanism at all three levels.

2.4 Clamp and unclamp small objects like pieces of paper or thin cardboard. Do the jaws leave a checked pattern on the paper?





2.5 Now examine the crosshatched pattern (photo) on the inner side of the Needle Holder's jaws. This pattern is designed to firmly grip the suture needle and prevent unnecessary slipping of the needle/suture.

Wear and tear will eventually cause this surface to become smooth – an indication to replace the Needle Holder with a new one.

STEP 3

Remove the two tweezer-forceps from the set. The forceps has two legs joined at the hinge. Examine the inside of the tips. The one forceps has jaws with a serrated inner surface and



the other one has a v-shaped tooth on the inside of the jaw and a v-shaped groove on the other side (the tooth fitting into the groove). Use this forceps to gently handle tissue with the left hand when placing sutures.

STEP 4

Have a look at the skin hook (substituted with a sharp curved probe in some sets). It is used to gently lift skin during suturing. Hook the skin on the inside (raw) surface – not the epithelial surface.



POINTS OF INTEREST

1. Quite a variety of scissors each with a unique purpose are available. Examples are:

- A pair of scissors that can cut through stainless steel wire – used by orthopedic surgeons and maxillofacial surgeons
- A pair of dissection scissors – meant to carefully dissect through tissue instead of cutting with a scalpel. These scissors are usually slightly curved with pointed, though slightly rounded tips
- Micro scissors – used in eye surgery and microscopic surgery (e.g. joining small arteries, veins and nerves under the surgical microscope)



A pair of micro scissors

2. A surgeon is only as good as his/her tools. Know your instruments and always use good quality medical instruments. Order affordable quality medical instruments at: <http://www.affordabledrtools.com/>

3. Order a professional suture set (IFRC specifications): <http://www.affordabledrtools.com/>

PROJECT 2 - ATTACH SUTURE MATERIAL TO A NEEDLE

How to attach a piece of suture material to a surgical needle

INFORMATION

In past generations, a medical professional would routinely use a needle with an eye (an "eye" is a small hole on the blunt side of a needle where the thread is held) for suturing purposes. The eye part of such a needle may cause minimal damage as it traverses the tissue.

Modern suturing materials have pre-attached thread. Pre-attached sutures allow for a smooth transition from the needle's body to the swage and then to the suture – and are thus referred to as an "atraumatic design" (won't cause further injury to the tissue).

The needle-suture attachment is an occasional weak link, and on rare occasions may become undone. This attachment occupies about $\frac{1}{8}$ inch (3 mm) on the suture end of the needle (the swage). One should avoid clamping the **Needle Holder** to the swage of the needle as one may interfere with the secure attachment of the suture to the needle.

Suppose you land yourself up in a far-off mission hospital or a military field hospital and you only have thread and needles with eyes – will you be able to help your patient? *Learn how to attach suture material to a needle by following these steps:*

REQUIREMENTS

You will need:

- About (12-18 inches) 45 cm of silk suture
- One no 16 semicircular needle





STEP 1

Unroll about 12-16 inches (30-40 cm) of silk suture from one of the reels supplied.



STEP 2

Remove one no 16 needle from the package using the Needle Holder. Clamp the needle roughly in the middle of the needle's body. Secure the Needle Holder by clamping it to the first ratchet. (Be careful when working with sharp objects).



STEP 3

Fold the last 1½-inch (4 cm) of suture double and pass the double thread through the eye of the suture needle.



STEP 4

Open up the double thread slightly to form a loop, and pass the needle through the loop.



STEP 5

Firmly pull the long and short loose ends of the double thread away from the needle - thus tightening the simple loop knot to attach the thread to the needle.

POINTS OF INTEREST

1. *Needles with eyes can be re-used a couple of times under the following conditions:*

- The tips remain sharp
- The needles are structurally undamaged
- They are properly sterilized
- Re-use for not more than 4-6 times

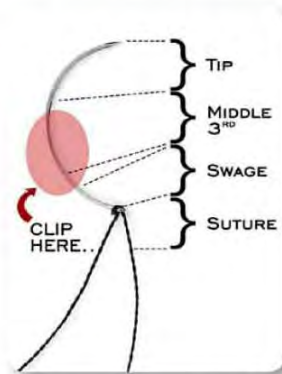
2. *Practice and perfect your technique by ordering a variety of real pre-assembled, pre-packed sterile surgical sutures from <http://www.affordabletools.com/>*

PROJECT 3 - HOW TO CLIP THE NEEDLE TO THE NEEDLE HOLDER

Learn the technique on how to properly clip and secure a needle onto a Needle Holder

INFORMATION

Note: One should ideally clip the Needle Holder onto the mid-section of the needle – somewhat closer to the swage. Avoid clipping the Needle Holder onto either the Tip or swage sections!



The various parts of a surgical needle

REQUIREMENTS

- The Needle Holder
- One no 16 Needle with suture material attached (see Project 2)





STEP 1

Wash your hands, dry and put on a pair of gloves (Project 00 of The Apprentice Doctor® Basic Medical Course). The Gloves serve as a surgical barrier between operator and patient, and provide protection from accidental needle injuries. Double gloving is advised for high-risk patients e.g. patients with Hepatitis B and HIV infections.



STEP 2

Follow the principle of minimal handling of sharp instruments and items. Use a tweezer-forceps to remove one no 16 needle from the package using your left hand. Present the needle to the needle holder with this tweezers forceps.



STEP 3

Use your needle holder to clip the needle, secure the latch mechanism (listen for the first or second "click") – avoid clipping it onto the swage third (may damage the suture-needle attachment) or the tip third (may damage the sharpness of the tip) of the needle.

STEP 4

Inspect the suture part and ensure that it is untangled and without any knots.

POINTS OF INTEREST

- *Accidental needle injuries are common causes for the accidental contraction of HIV and Hepatitis B infections*
- *All patients should be considered carriers of infective diseases.*
- *Hospitals have specific protocols on what steps to take following accidental needle injuries – familiarize yourself with your hospital's protocol*

- Handle sharp objects and instruments once – minimize the handling of sharps. Surgeons should get into the habit of taking scalpels and assembled needles for suturing directly from the instrument tray. Do not ask the assisting theatre sister to hand you such sharp instruments/items if at all possible. Many “sharps” injuries in theatre occur during the transfer of “sharps” from one person to the other.

PROJECT 4 - PREPARE IMITATION SKIN FOR PRACTICING SUTURING

Prepare a piece of imitation skin for practicing your suture technique

INFORMATION

The imitation skin for practicing your suture technique consists of three layers – just like natural skin:

- A superficial covering layer (1 mm)
 - representing the epithelium
- A white fibrous layer (3 mm / 1/8 inch)
 - corresponding to the dermis
- A spongy layer (6 mm / 1/4 inch)
 - corresponding to the subcutaneous tissue



This patented imitation skin, provided with *The Apprentice Doctor® How to Stitch-up Wounds Kit*, is a remarkably effective substrate for practicing suturing techniques, and sutures can be placed, and removed repeatedly along the same incision line!

REQUIREMENTS

- A 4 X 6 inches (10 x 15 cm) piece of imitation skin
- The large scissors
- The small scissors
- A pen and ruler (a skin marker pen and ruler is available in *The Apprentice Doctor® Basic Medical Kit*)



STEP 1

One sheet of imitation skin can be used to create ± 3 imitation lacerations. Divide the imitation skin sheets into 3 sub-sections and draw 3 straight lines of ± 11 cm (4 inches) on it – as indicated in the diagram.



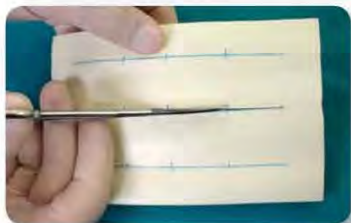
STEP 2

Make a short 5 mm ($\frac{1}{4}$ inch) vertical line at 90 degrees to the straight line - in the middle of each of these 3 lines.



STEP 3

Divide each of these halves into quarters and draw another two short 5 mm ($\frac{1}{4}$ inch) vertical lines in these regions. (These lines will enable you to check the alignment of the skin following closure of the laceration with sutures).



STEP 4

Use the sharp-sharp scissors and push one blade into the skin at one end of the horizontal line and cut the full thickness of the skin along the straight line up to the end of the 11cm (4 inches) horizontal line. (The larger scissors will be more effective in cutting the imitation skin). Repeat the same procedure with the other 2 lines to create 3 imitation lacerations. These cuts represent surgical incisions or traumatic lacerations in the skin.

POINTS OF INTEREST

- In a recent survey in the state of Virginia, U.S.A, minor soft tissue injuries like abrasions, lacerations and contusions ranked as the third most common reason why patients visited their family physician.
- A neat suture technique will go a long way to avoiding ugly scarring and the need for scar revision by a plastic surgeon
- The saying "practice makes perfect" is especially true in this regard!

PROJECT 5 - HOW TO CONSTRUCT A BAR/ROD TO PRACTICE THE VARIOUS TECHNIQUES OF TYING KNOTS

INFORMATION

Suturing, like the other fields of medicine, is both an art and a science. It follows that to become a proficient operator you will need to gain a good understanding of the theory, TOGETHER with frequent practicing of the techniques of suturing.

REQUIREMENTS

- Masking tape or equivalent
- The inside cardboard cylinder from a toilet roll or a tissue roll
- A table or suitable working surface to practice making knots



STEP 1

Cut 2 parallel lines along the long axis of the cardboard tube – about 3.5 cm (1½ inch) width on both sides, along the same long axis lines.



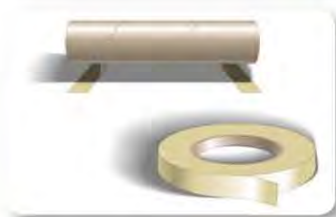
STEP 2

Bend a 90 degrees leg downwards on both sides.



STEP 3

Bend a 1.5 (½) inch foot outwards (again 90 degrees to the leg)



STEP 4

Position the rod-like tube with its long axis horizontally in front of you, and about 30 cm (6 inches) away from the table's edge. Strap the foot down - on the table or working surface you intend to use to practice making knots with adhesive tape e.g. masking tape or "sticky" tape.

Alternatively simply place your ruler on two spacers on the two ends (the suture reels will work just fine for this purpose) and strap it down with masking/sticky tape.

POINTS OF INTEREST

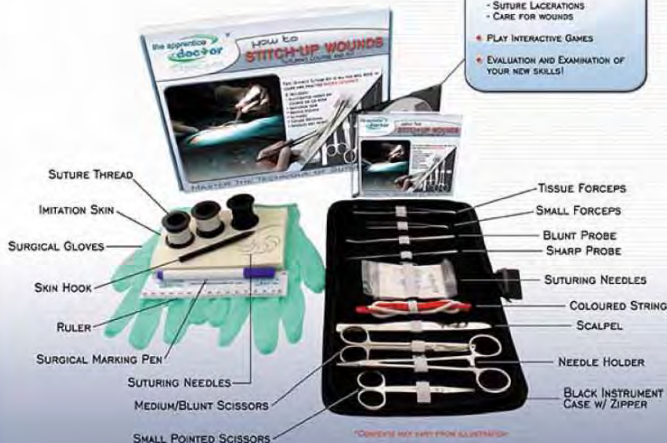
1. *Interesting what useful purposes a piece of trash can serve!*
2. *Get into a habit of thinking along these lines:*
 - What useful purpose can an item serve before trashing it?
 - Can it be recycled?
 - Think "green"! Don't be wasteful!
3. *"Prevention is the best cure" — let us apply it in all the areas of our lives!*

How to STITCH-UP WOUNDS

SUTURING COURSE AND KIT

HANDS-ON CD-ROM

- LEARN AND PRACTICE HOW TO...
 - TIE SURGICAL KNOTS
 - SUTURE LACERATIONS
 - CARE FOR WOUNDS
- PLAY INTERACTIVE GAMES
- EVALUATION AND EXAMINATION OF YOUR NEW SKILLS!



RECOMMENDED TRAINING MATERIAL FOR . . .

- MEDICAL STUDENTS • PRE-MEDICAL STUDENTS • PARAMEDICS AND EMT STUDENTS • DENTAL STUDENTS
- VETERINARY STUDENTS • NURSING STUDENTS • SURGERY INTERNS/REGISTRARS
- ADVANCED FIRST AID PRACTITIONERS • MEDICS IN THE MILITARY • *Top Ambulance Command • Local Residents*
- HIGH SCHOOL STUDENTS INTERESTED IN A CAREER IN MEDICINE
- PRACTICING HEALTHCARE PROFESSIONALS WHO WOULD LIKE TO IMPROVE OR REFRESH THEIR SUTURING TECHNIQUE
- INDIVIDUALS WITH A KEEN INTEREST IN THE PRACTICAL ASPECTS OF MEDICINE

PART OF THE: **the apprentice doctor**
MEDICAL TRAINING SERIES

ALSO CHECK OUT: **How to EXAMINE PATIENTS**
FOUNDATION MEDICAL COURSE & KIT

CASE STUDY

[Real stories of real patients - names and details modified]

THE SURGEON'S KNOT

Dr Buys is in a wonderful mood. This is Friday afternoon and he has booked a short operating list because he plans to go on a special weekend, just he and the Missus.

This is the last case, a routine laparoscopic removal of a diseased gallbladder. He has done so many over the years and has become quite an expert. "I'm sure I will be able to remove this gallbladder with my hands behind my back!" he jokingly remarks.

First, second and third incisions, instrumentation in place and now for the careful dissection... "Thirty minutes and I am out of here!" he remarks.



The inflammation has caused quite a bit of scar tissue, and the anatomy is not as clear as he expected. Suddenly - a surge of bright red blood! "Suction!! Suction!!!" He shouts - but it is obvious that the bleeding is much too fast for the suction to handle. Vision becomes impossible and now is the time for quick, life-and-death decisions!

"Let's open up!!" He shouts to the scrub sister. "Scalpel! Diathermy! ... Abdominal swabs!! ... Artery forceps!!"



Dr Buys knows that he needs to abort the laparoscopic-camera procedure via the small buttonhole incisions. He will have to make a larger incision to access the bleeder and stop the bleeding.

If the patient loses more than a certain amount of blood, she will go into surgical shock and may die!



At last the bleeder has been identified and everybody takes a brief sigh of relief. "Tie suture", Dr Buys continues, amazingly relaxed now. "Remove artery." He ties off the bleeder with an amazing amount of finesse and ease.

Would you like to know how to make a surgeon's knot?

NOTE:

- "Near side" refers to the area closer to you and the term "far side" refers to the area away from you.
- Left-handed individuals – kindly substitute the word "right" for "left" and visa-versa. Apologies for any inconvenience!
- The word "throw" refers to a single basic subunit or tightened loop of a knot.

BASIC KNOTS

PROJECT ALPHA - A DEMONSTRATION OF A SQUARE KNOT AND A GRANNY KNOT

View a demonstration of the difference between a Square knot and a Granny knot

INFORMATION

- **Definition – knot:** The American Heritage® Dictionary defines a knot as: “A fastening made by tying together lengths of material, such as rope, in a prescribed way.”
- **Description of a square knot:** The square knot consists of two “throws” or turns of the two ends of a piece of string/rope.
- A thorough understanding of knots is essential before you can proceed with acquiring suturing skills.

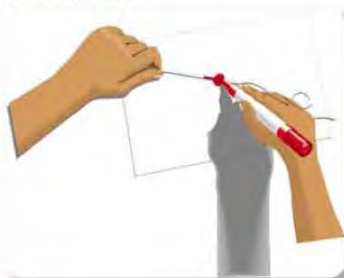
REQUIREMENTS

You will need:

- The colored and white string (included in the kit)



Follow these steps:



STEP 1

Color the one tip of the string with a bright color using a color ink pen. In the text I will refer to the colored part as the “colored section” and the uncolored part as the “white section”.



Step 2



Step 3



Step 4

STEP 2

Place the section of string in the form of an incomplete circle in front of you, with the colored end to your left-hand side and the white section to your right-hand side. The opening of the loop should face to the far side.

Copy the following descriptions with the piece of string:

STEP 3

First throw - colored tip cross over white tip.

STEP 4

Colored tip goes into loop from beneath and out of the loop to the top. Close the loop to some extent.



Step 5



Step 6

STEP 5

Colored tip goes into loop from beneath and out of the loop to the top. Close the loop to some extent.

STEP 6

Second throw - colored tip crosses over white tip.



Step 7a



Step 7b



Step 8

STEP 7

White tip goes into loop from the top and out of the loop to the bottom (under the red section).

STEP 8

Complete the knot by tightening it – pulling the colored end to the left with your left hand and the white end to the right with your right hand.

Make a “granny knot” by following these steps:

Follow **Step 2** to **Step 5** as with the square knot (above)



Step 6



Step 7a



Step 7b

STEP 6

Second throw – white tip crosses over colored tip.

STEP 7

White tip goes into loop from beneath (under the red section) and out of the loop to the top.



STEP 7

Complete the knot by tightening it – pulling the colored end to the left with your left hand and the white end to the right with your right hand.

POINTS OF INTEREST

1. A granny knot tends to tighten on the tissue, while a square knot tightens on itself. A granny knot tends to slip where a square knot would have held.
2. Fishermen and sailors are often masters in making a variety of secure knots.
3. **Macramé** is a form of textile-making that uses knotting rather than weaving or knitting. People practicing the art form of macramé are usually real knot experts.

PROJECT BETA - MAKE A SQUARE KNOT: TWO-HAND TIE

INFORMATION

The Square Knot is the recommended knot for tying most types of sutures. Be sure not to tie a Granny knot (this knot results when you tie two throws in the same direction). Square knots hold, granny knots slip.

REQUIREMENTS

You will need:

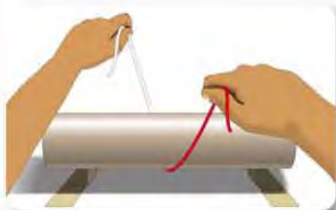
- The colored and white string (included in the kit)
- The cardboard tube constructed in Project 5
- Good lighting

Follow these steps:



STEP 1

Prepare the cardboard tube and strap it to the tabletop or working surface using masking/sticky tape (see Project 5).



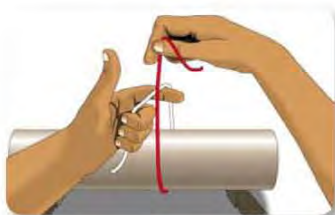
STEP 2

Slip the string underneath the cardboard tube with the colored end towards you (near side), and the white end away from you (far side).



STEP 3

Let the open palm of your left hand face you. Bring the white end from the back and let it come over the index finger, cross the palm down to the little finger. Close the bottom 3 fingers around the white string, while maintaining an extended index finger.



STEP 4

Hold the colored strand in your right hand between your right thumb and index finger. Bring the colored strand forward and let it cross over the white strand (and thus over the left index finger).



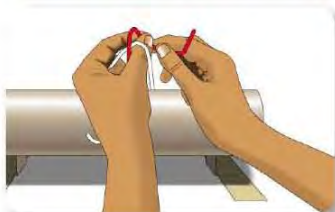
STEP 5

Let the tips of the left thumb and index finger touch to enclose the two strands of string. Keep holding the colored end with your right thumb and index finger.



STEP 6

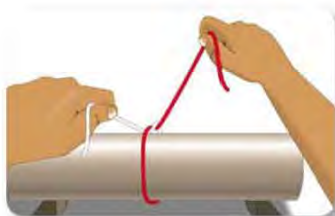
While keeping the tips of your left thumb and index finger touching, rotate these fingertips away from you, moving your thumb under the two strands and into the loop.



STEP 7

Place the colored end, currently in your right hand, between your left thumb and index finger, and let go of it with your right hand. Rotate your hand back to the starting position, bringing the colored tip through the loop.





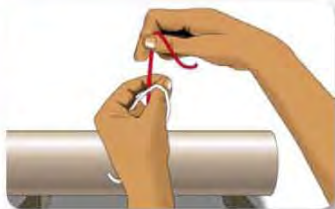
STEP 8

Pull the white section towards you with your left hand and the colored end away from you with your right hand, thereby tightening the first throw of the knot.



STEP 9

Let the open palm of your left hand face towards your right-hand side. Make a V-shaped opening between your left thumb and index finger, and pull the white tip over the thumb into the "V" with the free end hanging down the palm past the little finger. Hold the white tip in the palm of the left hand by closing the bottom three fingers. The hand is held in a position almost as if pointing a gun.



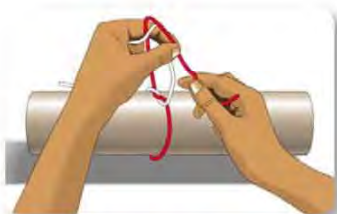
STEP 10

With the right hand, bring the colored strand toward you, and place it between the left thumb and index finger, crossing over the white strand. Place the index finger of your left hand over the colored section and touch the tip of the left thumb - enclosing the two strands.



STEP 11

Rotate these fingertips downwards and towards you. The left index finger goes under the two strands and into the loop. Take the colored tip held by the right hand, and place it between your left thumb and index finger while releasing it from your right hand.



STEP 12

While maintaining your grip on the colored end between your left thumb and index finger, rotate your left hand back allowing the left thumb and index finger to carry the colored strand through the loop. Grip the colored strand between your right thumb and index finger and release it from the left hand.



STEP 13

*Loosely tighten the knot by moving your left hand holding the white tip away from you and your right hand holding the colored tip toward you - thereby completing the second throw of the square knot.

**If you tie the knot too tightly you might not be able to untie the knot for re-using the rope!*

KEEP IN MIND:

If required, you may add another throw (by following Steps 3-8) or another two throws (by following Steps 3-13) again. In the last instance you will have tied a double square knot.

STEP 14

Practice the technique of making a square knot using the two-hand tie method before proceeding to the one-hand tie technique.

INTERESTING SITES:

(See video clips of a number of knot tying techniques):

1. <http://www.vetmed.ufl.edu/coursevideos/adin/tiesvid.asp>
2. http://www.edu.rcsed.ac.uk/video_album_clips_menu_basicskills.htm
3. <http://cal.vet.upenn.edu/surgery/5000.htm>
4. <http://www.edu.rcsed.ac.uk/madras/T1-1.HTML>

PROJECT GAMMA - MAKE A SQUARE KNOT; ONE-HAND TIE

Take a couple of short cuts towards tying a square knot more efficiently

INFORMATION

I will describe 2 methods to tie a "one-hand square knot". **Method 1** will suit most right-handed persons and **Method 2** most left handed persons, although a couple of right-handed persons may find Method 2 somewhat easier and visa versa.

The basic difference between a "two-hand tie square knot" and a "one-hand tie square knot" is the time it takes to make a secure knot – remember – occasionally during surgery, seconds may be the difference between life and death!

REQUIREMENTS

You will need:

- The colored and white string (included in the kit)
- The cardboard tube constructed in **Project 5**
- Good lighting

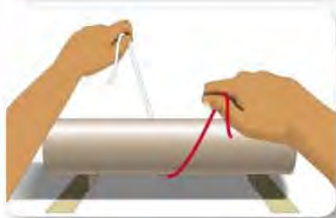
METHOD 1

Follow these steps:



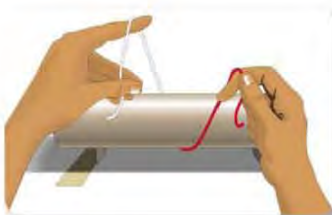
STEP 1

Prepare the cardboard tube and strap it to the tabletop or working surface using masking/sticky tape (see **Project 5**).



STEP 2

Slip the string underneath the cardboard tube with the colored end towards you (near side), and the white end away from you (far side).



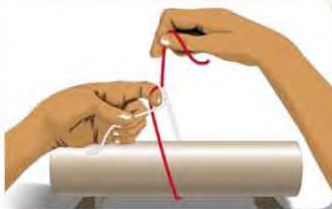
STEP 3

Hold the colored end in your right hand between your index finger and thumb, and the white section in your left hand, between your middle finger and thumb. Let the white section cross over the palm's side of the open 3rd to 5th fingers of the left hand with the white tip hanging down past the little finger. Place the index finger of your left hand under the white section, and extend the index finger – draping the string over the tip of the index finger.



STEP 4

Take the colored section to the far side, crossing over the index finger of the left hand and over the white section of string forming an "X".



STEP 5

Bend (flex) the index finger of the left hand around the colored strand and rotate it under the white strand held by the middle finger and thumb.

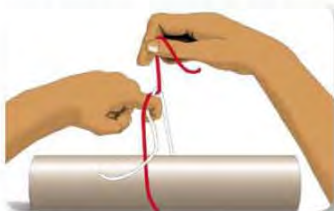


STEP 6a

Open (extend) the index finger making sure that the white section of string stays on the nail's side of this finger.

STEP 6b

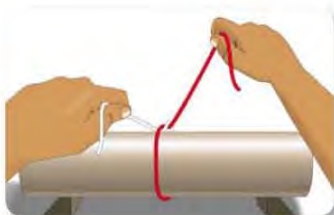
Rotate the hand - pulling the white section of string through the loop.



Step 6b[1]



Step 6b[2]



STEP 7

Pull the white section towards you with your left hand and the colored end away from you with your right hand and tighten the first throw of the knot.



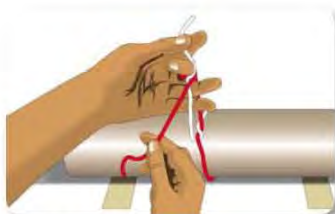
STEP 8

Hold the white end in your left hand between the tips of your index finger and thumb, and the colored section in your right hand between your index finger and thumb. Allow the white section to cross over the palm's side of the open (extended) 3rd to 5th fingers of the left hand.



STEP 9

Bring the colored section from the far side to the near side, looping it over the 3rd to 5th fingers of the left hand, and over the white section of string to form an "X" shape.



Step 10a



Step 10b



Step 10c

STEP 10

Bend the middle finger of the left hand and hook it around the colored section and beneath the white section of string. Straighten the index finger again while pulling the white end through the loop in a rotating motion. Take it now between the tip of the index finger and thumb.



STEP 11

Pull the colored end towards you with your right hand and the white section away from you with your left hand, tightening the second (throw) part of the knot.

NOTE:

If required, you may add another loop (by following Steps 4-8) or two (by following Steps 4-13) again.

STEP 12

Practice the technique of making a square knot using the one-hand tie method before proceeding to the instrument tie technique.

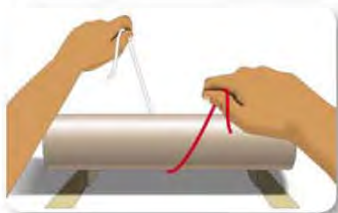
METHOD 2

Follow these steps:



STEP 1

Prepare the cardboard tube and strap it to the tabletop or working surface using masking/sticky tape (see Project 5).



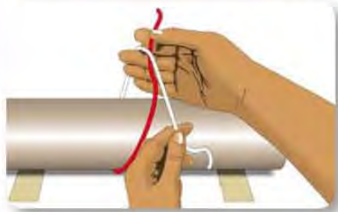
STEP 2

Slip the string underneath the cardboard tube with the colored end towards you (near side), and the white end away from you (far side).



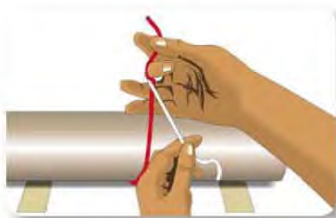
STEP 3

Hold the colored end in your right hand between your index finger and thumb with the tip pointing upwards, and the white section in your left hand, between your index finger and thumb. Rotate the right hand slightly so the palm is facing you. Ensure that the colored string passes over the palm's side of the open (extended) 3rd to 5th fingers of the left hand.



STEP 4

Bring the white section to the near side - over the colored section of string crossing over it in the form of an "X" across these 3 fingers.

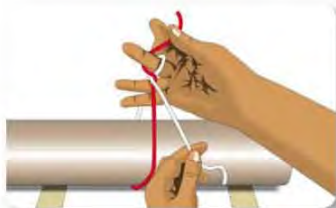


STEP 5

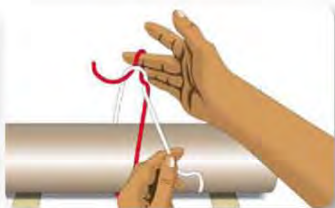
Bend the middle finger of the right hand, and close (flex) it around the white section and under the colored section of string held by the index finger and thumb of the right hand.

STEP 6

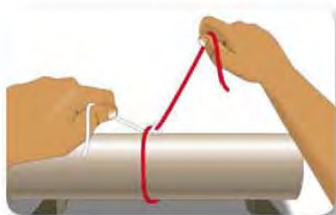
Open this finger, and hold the colored end between the middle and fourth finger, while rotating the hand - pulling the colored end through the loop. Take the colored section between the thumb and index finger of the right hand.



Step 6a

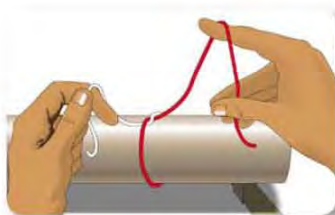


Step 6b

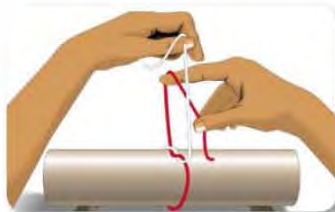


STEP 7

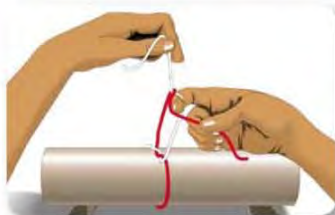
Pull the white section towards you with your left hand and the colored end away from you with your right hand and tighten the first throw of the knot.

**STEP 8**

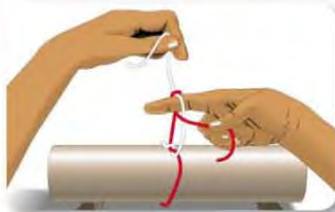
Hold the colored end in your right hand between the tips of your middle finger and thumb (the tip of the colored end hanging down on the palm's side past the little finger), and the white section in your left hand between your index finger and thumb. Place the index finger of your right hand under the colored section, and extend the index finger – looping the string over the tip of the index finger.

**STEP 9**

Take the white section to the far side, crossing over the index finger of the right hand and over the colored section of string forming an "X" shape.

**STEP 10**

Bend the index finger and flex it around the white section and underneath the colored section held in the right hand.



Step 11a



Step 11b



Step 11c

STEP 11

Straighten the index finger again while pulling the colored end through the loop in a rotating motion. Hold the colored end between the tip of the index finger and thumb of the right hand.



STEP 12

Pull the colored end towards you with your right hand and the white section away from you with your left hand, tightening the second (throw) part of the knot.

NOTE:

If required, you may add another loop (by following Steps 3-7) or two (by following Steps 3-12) again.



Basic Square Knot



1. Additional Loop



2. Additional Loops

STEP 13

Practice the technique of making a square knot using the one-hand tie method before proceeding to the instrument tie technique.

POINTS OF INTEREST

- Both hands are used to tie a One-hand tie knot. The non-dominant hand plays a passive roll and the dominant hand an active roll during the knot tying sequence.
- Most surgeons can tie a one-hand tie square knot in their sleep. Keep on practicing until it becomes almost reflexive actions.
- If a square knot slips add another loop (or two or three) to the square knot. Note: consecutive loops should always be in the opposite direction to the previous loop.
- Different suture materials vary in the number of loops required to secure the knot thus avoiding unraveling.

PROJECT DELTA - MAKE A SURGEON'S KNOT; ONE-HAND TIE

The technique on how to tie a secure Surgeons Knot with your hands

INFORMATION

A surgeon's knot is essentially a square knot with the difference that the thread is passed twice through the first loop.

The surgeon's knot is a very important knot. Master it thoroughly -your patient's well-being or even his /her life will depend on your level of skill when tying this knot.

Like with the square knot, I will describe 2 methods to tie a "one-hand surgeon's knot". Method one will suit most right-handed persons and Method 2 most left handed persons, although a couple of right-handed persons may find Method 2 somewhat easier and visa versa.

REQUIREMENTS

You will need:

- The colored and white string (included in the kit)
- The cardboard tube constructed in Project 5
- Good lighting

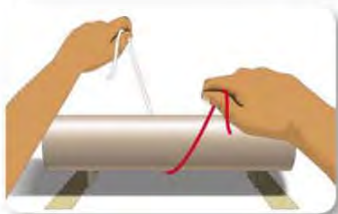
METHOD 1

Follow these steps:



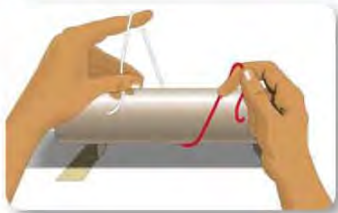
STEP 1

Prepare the cardboard tube and strap it to the tabletop or working surface using masking/sticky tape (see Project 5).



STEP 2

Slip the string underneath the cardboard tube with the colored end towards you (near side), and the white end away from you (far side).



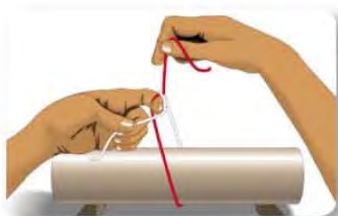
STEP 3

Hold the colored end in your right hand between your index finger and thumb, and the white section in your left hand, between your middle finger and thumb. Let the white section cross over the palm's side of the open 3rd to 5th fingers of the left hand with the white tip hanging down past the little finger. Place the index finger of your left hand under the white section, and extend the index finger – draping the string over the tip of the index finger.



STEP 4

Take the colored section to the far side, crossing over the index finger of the left hand and over the white section of string forming an "X".

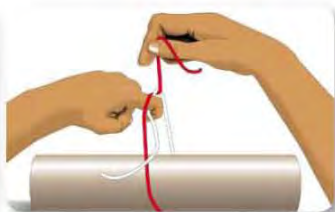


STEP 5

Bend (flex) the index finger of the left hand around the colored strand and rotate it under the white strand held by the middle finger and thumb.



Step 6a



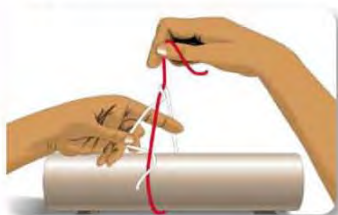
Step 6b



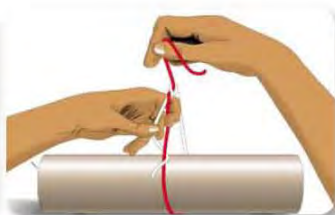
Step 6c

STEP 6

Open (extend) the index finger making sure that the white section of string stays on the nail's side of this finger. Rotate the hand - pulling the white section of string through the loop.



Step 7a



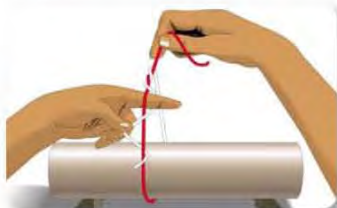
Step 7b



Step 7c

STEP 7

Do not close the loop. Place the index finger of your left hand into the loop again, then bend this finger around the colored section of string, and rotate it under white section of string held by the index finger and thumb of the right hand.



Step 8a



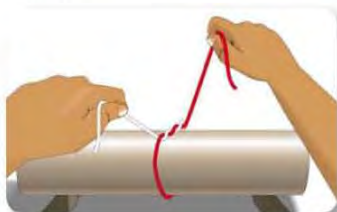
Step 8b



Step 8c

STEP 8

Straighten this finger, and in a rotating motion pull the white end through the loop for a second time.

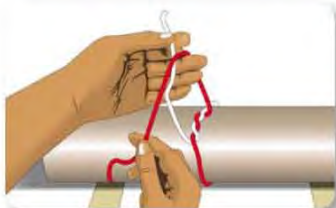


STEP 9

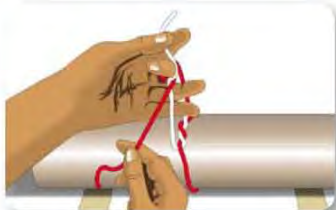
Pull the white section towards you with your left hand and the colored end away from you with your right hand and tighten the first throw of the knot.

**STEP 10**

Hold the white end in your left hand between the tips of your index finger and thumb, and the colored section in your right hand between your index finger and thumb. Let the white section to cross over the palm's side of the open (extended) 3rd to 5th fingers of the left hand.

**STEP 11**

Bring the colored section from the far side to the near side, looping it over the 3rd to 5th fingers of the left hand, and over the white section of string to form an "X" shape.



Step 12a



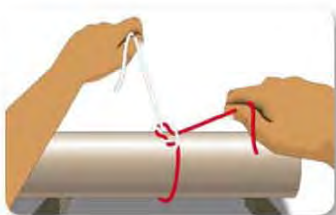
Step 12b



Step 12c

STEP 12

Bend the middle finger of the left hand and hook it around the colored section and beneath the white section of string. Straighten the index finger again while pulling the white end through the loop in a rotating motion. Take it now between the tip of the index finger and thumb.



STEP 13

Pull the colored end towards you with your right hand and the white section away from you with your left hand, tightening the second (throw) part of the knot.

NOTE:

If required, you may add another loop or two to prevent the knot from unraveling.

STEP 14

Practice the technique of making a square knot using the one-hand tie method before proceeding to the instrument tie technique.

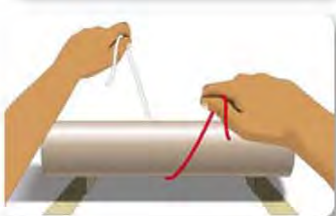
METHOD 2

Follow these steps:



STEP 1

Prepare the cardboard tube and strap it to the tabletop or working surface using masking/sticky tape (see Project 5).



STEP 2

Slip the string underneath the cardboard tube with the colored end towards you (near side), and the white end away from you (far side).



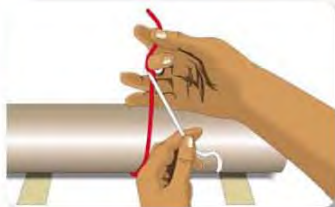
STEP 3

Hold the colored end in your right hand between your index finger and thumb with the tip pointing upwards, and the white section in your left hand, between your index finger and thumb. Rotate the right hand slightly so the palm is facing you. Ensure that the colored string passes over the palm's side of the open (extended) 3rd to 5th fingers of the left hand.



STEP 4

Bring the white section to the near side - over the colored section of string crossing over it in the form of an "X" across these 3 fingers.

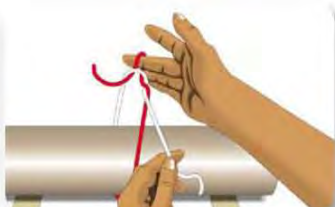


STEP 5

Bend the middle finger of the right hand, and close (flex) it around the white section and under the colored section of string held by the index finger and thumb of the right hand.



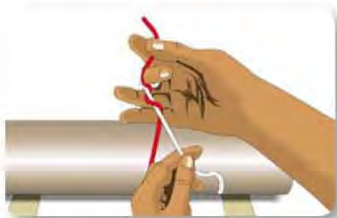
Step 6a



Step 6b

STEP 6

Open this finger, and hold the colored end between the middle and fourth finger, while rotating the hand - pulling the colored end through the loop. Take the colored section between the thumb and index finger of the right hand.



STEP 7

Do not close the loop. Place the middle finger of your right hand into the loop again, then bend this finger, and rotate it under colored section of string held by the index finger and thumb of the right hand.

STEP 8

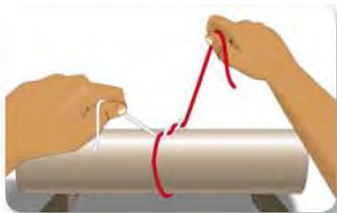
Straighten this finger, and hold the colored section between the middle and fourth finger, while rotating the hand - pulling the colored section through the loop for a second time.



Step 8a

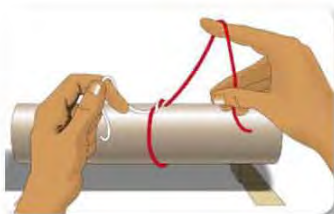


Step 8b



STEP 9

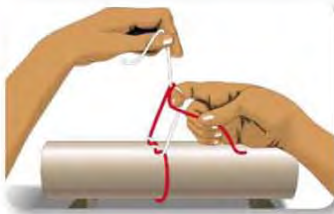
Pull the white section towards you with your left hand and the colored end away from you with your right hand and tighten the first throw of the knot.

**STEP 10**

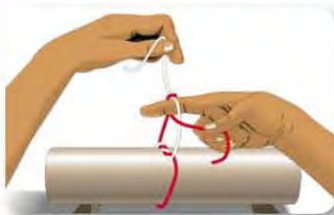
Hold the colored end in your right hand between the tips of your middle finger and thumb (the tip of the colored end hanging down on the palm's side past the little finger), and the white section in your left hand between your index finger and thumb. Place the index finger of your right hand under the colored section, and extend the index finger – looping the string over the tip of the index finger.

**STEP 11**

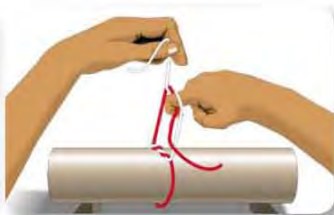
Take the white section to the far side, crossing over the index finger of the right hand and over the colored section of string forming an "X" shape.

**STEP 12**

Bend the index finger and flex it around the white section and underneath the colored section held in the right hand – straighten the index finger again while pulling the colored end through the loop in a rotating motion. Hold the colored end between the tip of the index finger and thumb of the right hand.



Step 13a



Step 13b



Step 13c

STEP 13

Pull the colored end towards you with your right hand and the white section away from you with your left hand, tightening the second (throw) part of the knot.

NOTE:

If required, you may add another loop or two to prevent the knot from unraveling.



Basic Square Knot



1. Additional Loop



2. Additional Loops

STEP 14

Practice the technique of making a square knot using the one-hand tie method before proceeding to the instrument tie technique.

POINTS OF INTEREST

- The surgeon's knot is the most basic skill as far as tying knots is concerned. It is used to tie off bleeders, to tie interrupted sutures as well as a number of other suture knots.
- When tying off a bleeder – tie the first tie, and then inspect the stump for oozing or residual bleeding. If you have succeeded in stopping the bleeding, proceed with another knot or preferably two.
- No needle is required for a tie suture. If you use a suture with a pre-assembled needle, cut off the needle before proceeding to avoid injury to yourself or to the assistant.
- In most cases an absorbable suture is required when tying off a bleeder in the depth of tissue. A "2-0, 3-0 or 4-0" braided absorbable suture like "Vicryl®" will be appropriate in most cases (depending on the size of the blood vessel being tied off).
- Anticipate complications in even the most simple of surgical procedures. A routine case does not exist! Every case is unique and every patient is special.

PROJECT EPSILON - MAKE A SQUARE KNOT: INSTRUMENT TIE

INFORMATION

The majority of square knots that most medical professionals tie in their careers are done with a tissue forceps and a needle holder. Master the technique well using imitation skin – it is never a good idea to practice on real patients. The surgical instruments become extensions of the clinician's hands, making the whole process of suturing more efficient and adding finesse to the procedure.

REQUIREMENTS

You will need:

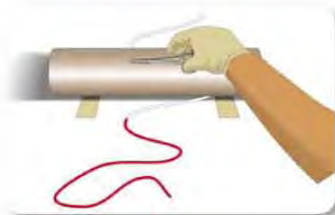
- The colored and white string (included in the kit)
- The cardboard tube constructed in Project 5
- Good lighting



Follow these steps:

STEP 1

Slip the string under the cardboard tube with the colored section towards you (near side), and the white tip away from you (far side). The white section should be shorter than the colored section.



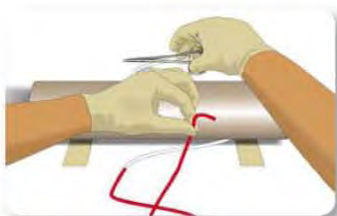
STEP 2

Hold the needle holder in your right hand (see Project 1, Step 2)



STEP 3

Place the needle holder parallel to the cardboard tube with the tip pointing to the left hand side. The latch mechanism of the needle holder must be unengaged at the stage.



STEP 4

Hold the colored section on the near side between the thumb and index finger of the left hand.



STEP 5

The colored section of the string is brought from the near side, over the needle holder, down and back to the near side – thus making the first loop.



STEP 6

Open the jaws of the needle holder and grasp the white section on the far side, close to the tip of the string. Engage the ratchet latch mechanism (listen for the first or second "click").



Step 7a



Step 7b

STEP 7

Pull the white section towards you using the needle holder and the colored section away from you using your left hand. Tighten the knot – thus completing the first throw.



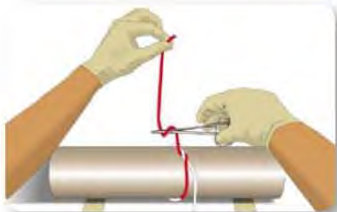
STEP 8

Unclick the latch of the needle holder and release the white tip.



STEP 9

Place the needle holder again parallel to the cardboard tube with the tip pointing to the left hand side. Hold the colored section on the far side between the thumb and index finger of the left hand.



STEP 10

The colored section of the string is brought from the far side, over the needle holder, down and back to the far side – thus making the second loop.

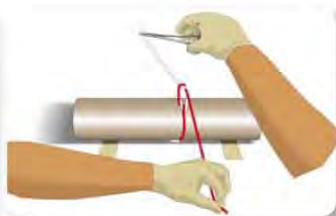


STEP 11

Open the jaws of the needle holder and grasp the white section (now on the near side) close to the tip of the string. Engage the ratchet latch mechanism (listen for the first or second “click”).



Step 12a



Step 12b

STEP 12

Pull the white section away from you using the needle holder and the colored section towards you using your left hand. Tighten the knot – thus completing the second throw.



STEP 13

Unclip the latch lock of the needle holder and release the white tip.

POINTS OF INTEREST

Let's talk a bit about wound dehiscence (it simply means the wound edges open up again).

Reasons for wound dehiscence:

- You tied an inappropriate knot – e.g. a granny knot instead of a square knot
- The knots were tied too laxly (loose)
- You used an inappropriate suture material – e.g. a thin mono-filament suture in a tension area
- You used a cutting needle and should have used a round body needle – some bodily structures are quite thin and friable, so always remember a cutting needle can actually cut through the tissue like a scalpel.

Consider using a reverse cutting needle in certain situations

- Too much wound tension – the truth is that wound closure should ideally be tension free
- You closed an infected wound – deal with the infection issue first!
- Placing the suture too close to the wound edge
- You used the wrong suture technique e.g. placing a continuous suture instead of interrupted or mattress sutures

- You removed the sutures too soon – especially in the lower extremities!
- A foreign object was inadvertently left in the wound
- A large blood clot (hematoma) formed and is forcing the two wound edges apart
- An arterial bleed is putting an immense amount of pressure within the wound and forcing it open – always control bleeders first by appropriate means – e.g. ligation (tying bleeding vessels off) or diathermy (burn them closed with an electric current)
- You are placing sutures in a malignant tumor. One of the attributes of a cancerous growth is the loss of cellular adhesion

PROJECT ZETA - HOW TO MAKE A SURGEON'S KNOT (INSTRUMENT TIE)

The technique on how to tie a secure Surgeons Knot using surgical instruments

INFORMATION

A surgeon's knot is essentially a square knot with the difference that the thread is passed twice through the first loop.

The surgeon's knot is a very important knot. Master it thoroughly -your patient's well-being or even his /her life will depend on your level of skill when tying this knot.

REQUIREMENTS

You will need:

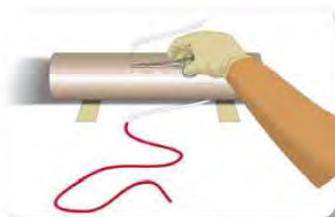
- The colored and white string (included in the kit)
- The cardboard tube constructed in Project 5
- Good lighting

Follow these steps:



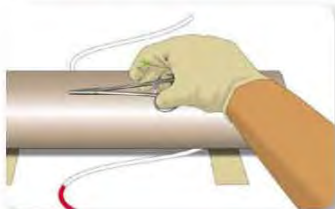
STEP 1

Slip the string under the cardboard tube with the colored section towards you (near side), and the white tip away from you (far side). The white section should be shorter than the colored section.



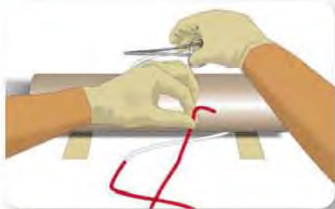
STEP 2

Hold the needle holder in your right hand
(see Project 1, Step 2)



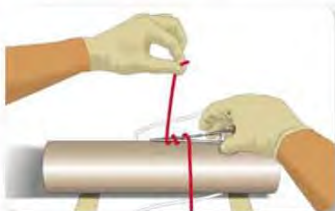
STEP 3

Place the needle holder parallel to the cardboard tube with the tip pointing to the left hand side. The latch mechanism of the needle holder must be disengaged at this stage.



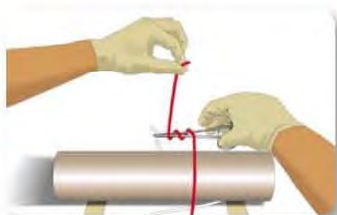
STEP 4

Hold the colored section on the near side between the thumb and index finger of the left hand.



STEP 5

The colored section of the string is brought from the near side, over the needle holder, down and back to the near side – thus making the first loop. Repeat this maneuver again (the string is brought from the near side, over the needle holder, down and back to the near side) – wrapping the string around the needle holder a second time.



STEP 6

Open the jaws of the needle holder and grasp the white section on the far side, close to the tip of the string. Engage the ratchet latch mechanism (listen for the first or second “click”).



Step 7a



Step 7b

STEP 7

Pull the white section towards you using the needle holder and the colored section away from you using your left hand. Tighten the knot – thus completing the first throw.



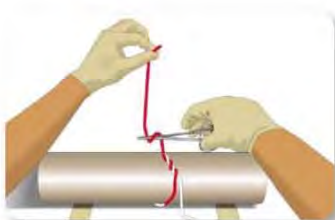
STEP 8

Unclick the latch of the needle holder and release the white tip.



STEP 9

Place the needle holder again parallel to the cardboard tube with the tip pointing to the left hand side. Hold the colored section on the far side between the thumb and index finger of the left hand.



STEP 10

The colored section of the string is brought from the far side, over the needle holder, down and back to the far side – thus making the second loop.

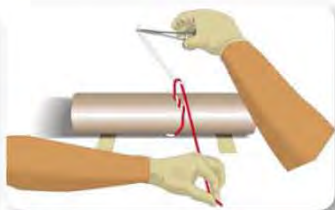


STEP 11

Open the jaws of the needle holder and grasp the white section (now on the near side) close to the tip of the string. Engage the ratchet latch mechanism (listen for the first or second "click").



Step 12a



Step 12b

STEP 12

Pull the white section away from you using the needle holder and the colored section towards you using your left hand. Tighten the knot – thus completing the second throw.



STEP 13

Unclip the latch of the needle holder and release the white tip.

POINTS OF INTEREST

More information:

Visit this site for **great video-clip demonstrations** of tying surgical knots:

<http://www.vetmed.ufl.edu/coursevideos/adin/tiesvid.asp>

Other useful sites:

<http://www.bumc.bu.edu/Dept/Content.aspx?DepartmentID=69&PageID=5734>

<http://cal.vet.upenn.edu/surgery/5000.htm>

http://www.edu.rcsed.ac.uk/video_album_clips_menu_basicskills.htm

A classical work for any student of suturing is an e-book with the title:

Suture Materials & Techniques by Ethicon® download it for free from this address:

http://www.jnjgateway.com/public/USENG/Knot_Tying_Manual.pdf

You will need an Acrobat Reader to open this document – download Acrobat Reader from:

<http://www.download.com/3000-2378-10000062.html>

CASE STUDY

[Real stories of real patients - names and details modified]

PERFORMING A SMALL MIRACLE! RHODE'S EAR

One of those routine warnings by parents... "Rhodé and Michelle! Please don't chase the dog around in the house!" And one of those inevitable outcomes – Rhodé falls and hits the side of her head on the coffee table "Ouch!" she exclaims, not thinking much about the incident, "...let's go and have some cold drink Michelle".

Sitting on the couch in the family room Michelle notices blood on Rhodé's ear "Rhodé, there's blood on your ear!" Rhodé calls her mom, who discovers to her horror that a chunk of skin is missing from the top of her daughter's ear!



Michelle goes back to the coffee table and discovers the missing piece of skin. They place it in a container, add a small block of ice, and rush off to the emergency department of the hospital!

Dr Wright has been on call for the past 12 hours and makes himself ready to leave following a fairly quiet shift, for a change.

"Please Doctor," the sister requests, "We have a young lady with part of her ear missing!" Time is of the essence and Dr Wright prepares to do a full thickness skin graft using the severed piece of skin as the graft.



"Don't look so worried, we'll fix this like new," He reassures the patient and mother and starts with the procedure. Local anesthetic... cleaning... suturing... and dressing. "Will the injection hurt?", "How many stitches will I get?" Dr Wright talks them through the procedure.



The job is neatly done, almost reflexively, and then the patient and mother receive instructions, "please don't wash your hair or allow water on the wound for 48 hours.

Use this ointment liberally on the wound twice daily and please return in a week for the removal of the stitches. Don't hesitate to call me if you have any problems whatsoever!" And off go the patched-up patient and relieved mother...

Would you like to be able to master how to care for wounds?

CASE STUDY

[Real stories of real patients - names and details modified]

HAZARDS AT WORK

James is off to work. "Smooch!" He kisses his wife Leticia goodbye ...and another 4 kisses to his 4 children James Junior, Jake, Susan and Baby Brad. "See you guys tonight" he exclaims as he closes the door.



James is a welder – and not any type of welder – he specializes in repairing gas cylinders – big or small – even the large tanker types for transporting truckloads of various types of gas.

Today is a high-intensity day – 30 gas cylinders to repair, then the pressure testing and final quality control checks. The protocol is clear – first empty the cylinders – then flush them with air and finally, fill the cylinder with Nitrogen before starting with the welding. Two inspection checks before James gets to do his job.

Now some people work well under pressure and James is one of those, but James's friend Jerry is not – a bit lazy on occasion he decides to take a couple of short-cuts – and yes it seems to work out well, at first.



"It is 3 p.m. Only 10 cylinders to go, and then I can head home", James thinks as he starts repairing the fine metal crack on the bottom of this cylinder.

Then it all happens in less than an instant – a massive explosion as the 7 mm (¼ inch) metal casing explodes due to a trickle of flammable gas remaining in this specific cylinder!



James is seriously injured – the soft tissue and bones of his face are in pieces and there's blood everywhere. His co-workers do what they can to stop the bleeding until the paramedics arrive. The Paramedics finally arrive, resuscitate him, and evacuate him to the trauma unit.

Miraculously, James' friend Jerry emerges physically uninjured from the tearoom, because he took the liberty of stretching his 15-minute tea break to 20 minutes.

James is profusely bleeding from his scalp lacerations. The trauma doctors place a number of interrupted sutures, tying them tightly to control the bleeding.

Next, it's off to theatre. The anesthetist works like a machine to keep James alive. He requests urgent blood tests, administers IV fluids and a number of life-saving medications.

The Trauma Surgeon secures the airway by doing a tracheotomy and this is followed by a multidisciplinary repair involving Neurosurgeons, an Ophthalmic surgeon, a Maxillofacial Surgeon and a Plastic and Reconstructive Surgeon.

The lower lip is in rags, but applying the basic principles of wound care, the Plastic Surgeon starts cleaning, removing all foreign material and dead tissue. He then plans a layered closure and 45 minutes later... well the lip is fixed and presentable!



Would you like to know how to repair major soft tissue lacerations? Well stick to the basic principles of surgery and practice, practice and practice!!

SUTURING TECHNIQUES

THE BASIC PRINCIPLES OF WOUND CARE

Know your patient

If time allows – take a good medical history, if not take a brief medical history – but always take a medical history - (see “Project 0” of The Apprentice Doctor® Course and Kit). Is your patient allergic to certain local anesthetics, antibiotics and pain medication, antiseptic solutions or plasters/strapping? Does he/she suffer from chronic diseases like Diabetes or bleeding disorders? Are they using any chronic medications? Etc.



Good vision (good lighting)

Fact is that medical schools have trained a number of blind physicians over the years – but no blind surgeon yet. Scrub sisters have a saying that the good surgeons are those who always complain about the light – might be true, because the whole success of the surgical procedure depends on good, proper lighting of the operative field offering the surgeon with optimal visual sensory input!



Anesthesia

The surgeon will make decisions regarding local anesthesia / general anesthesia and/or sedation. You cannot do your best for a patient who is jumping, jerking screaming or crying all the time.

Aseptic Technique

Complete sterility of the operative field is not attainable. Sterile instruments and suture material must be used. Excess suture material must be discarded in a container purposed for biological waste. The needle must be discarded in a suitable biological sharps waste container). Avoid using strong antiseptic preparations for cleaning the wound. Most antiseptic solutions will cause damage to the friable exposed tissue cells. In most cases a normal saline solution will be sufficient to clean an uninfected wound!



Remove All Foreign Material

The removal of all foreign material must be ensured. Remove all pieces of glass, soil, plant material etc. Soil remaining in the wound will cause a traumatic tattooing (very difficult if not impossible to remove at a later stage!) If necessary brush the wound with a bristled brush combined with a mild soap solution e.g. Savlon. Leave the least number of sutures buried in the depth of the tissue - within the limits of getting a secure closure. Remember that suturing materials although necessary are considered by the tissue as foreign material.



Leave Minimal Dead Space

While suturing, the operator will try to suture living tissue to living tissue. Do not leave empty spaces filled with air, blood or tissue fluid. Dead spaces produce wonderful opportunities for bacteria to proliferate and to cause infection. Dead space may fill up with blood clot and will contribute to the formation of excessive scarring.

Handle Tissue Gently

Always perform surgery - showing respect for living tissue. Careless suturing may cause more unsightly damage compared to the original wound! Use a toothed forceps to handle the skin (gently touch though). A flat forceps slipping all the time will cause more damage compared to a toothed forceps handled gently.

Control Bleeding

Bleeding can be reduced with suctioning and gentle sponging, and controlled by Electro-cautery (electrical burning) and suturing – ligate (tie-off) larger veins and arteries and use tight suturing over bleeding areas (within reasonable limits of course). Excessive bleeding will decrease your ability to see what you are doing – and good vision is the first principle of surgery!

General bleeding and an inability of blood to clot may be due to a number of medications e.g. aspirin (pain-killer), Hemophilia (a hereditary absence of clotting factors in the blood), Liver disease, a number of blood diseases, anti-cancer medication (chemotherapy may reduce the blood platelets which are essential for normal blood clotting to occur) and alcohol consumption (not an infrequent finding with patients reporting to a hospital's emergency section). Do take a **thorough patient history** before you start treating the injury!

The acronym **LACERATE** will help you to stay on track when confronted with a laceration to repair.



Look At The Wound, Assess It



Anesthetic Considerations



Cleaning The Wound



Equipment – Set Up



Repair Of The Wound



Assessing Results, Anticipate Complications



Tetanus Immunization Status



Educate The Patient Regarding Wound Care

THE REPAIR OF WOUNDS

Goals For Suturing Wounds

Optimal wound care aims at maximizing functional restoration as well as optimizing the esthetic result. These goals must occur within the limits of maximum patient safety and patient comfort (a calm patient experiencing the minimal amount of pain and discomfort).

Suturing a wound may assist the healthcare professional with 3 immediate goals:

- Tight sutures will assist in controlling bleeding (securing hemostasis). It is not a substitute for normal bleeding control measures e.g. ligating arterial bleeds in the depth of the wound etc.
- It reduces the chances of wound infection. A closed wound is much less prone to wound sepsis than an open wound. Further contamination from the outside environment is also reduced considerably!
- Reduced pain. An open wound leaves the severed sensory nerve endings open – thus increasing pain.

Suturing a wound will optimize the traumatized tissue's chances of retaining its blood supply, and at the same time minimizing the formation of unsightly scar tissue.

Wound closure is divided into:

- Primary closure – closure within the first 24 hours
- Secondary closure – wound closure more than 24 hours after the injury.

Primary closure of wounds should be the norm in most cases. Exceptions to the rule would be highly compromised tissue where the medical professional anticipates debridement of the wound (cleaning and cutting away dead tissue and/or foreign material) to be necessary.



Lesion



Markings



Excision



Excision



Removal



Wipe blood



Suturing



Completed sutures

Reasons for wound breakdown:

- Suturing under tension. Suturing should be passive – do not stretch tissue and try to close the wound under tension – it will break down!
- Sepsis. Common reasons for sutured wounds to open up again are wound contamination by bacteria and/or foreign material.
- Poor blood supply to the wound edges due to the extent of the trauma.
- Other factors include irradiated tissue, certain systemic diseases like diabetes, AIDS etc.

A BASIC COURSE IN SUTURING TECHNIQUES

May I repeat, **The Apprentice Doctor® Suture Course and Kit** is not intended to substitute the clinical training of students but rather to offer a **firm foundation** and an opportunity to **experience** his/her **initial learning curve** in an **imitation situation** – so as to fill the student with confidence when he is faced with the real life clinical situation.

During practical **Projects A to L**, guidelines are given regarding distances, spacing of sutures and needle bite sizes. These indications are only **average guidelines** and will vary quite a bit depending on the specific area of the body one is suturing.

Each of the following variables will influence the choice of suture, needle and suturing technique:

- The relative cosmetic importance of the wound site
- Suturing elastic skin (neck) versus non-elastic skin (scalp)
- Skin covering soft tissue structure like muscles (chest and thigh) versus skin covering bone (the shin)
- Skin covering specialized structures (the nose and ears) versus general covering (the torso and extremities)
- Skin covered by hair (scalp) versus hairless skin (palms of the hand)
- Thin skin (the ears) and thick skin (soles of the feet)
- Tough skin (around the umbilicus) and soft skin (the eyelids)
- Blood-rich skin (nose) versus skin with a less plentiful blood supply (lower extremities)
- Patient variables like age, access to medical facilities, medical history etc.
- Wound variables e.g. abrasion, depth of laceration, neat or ragged wound edges, contamination, infection etc.

In the final analysis the student will be gaining experience by suturing real wounds on real patients. There is no substitute to the clinical teaching situation and skills transfer from experienced clinicians to students.

PROJECT A - HOW TO PLACE SUBCUTANEOUS SUTURES

Learn the technique for placing continuous subcutaneous sutures

IMPORTANT NOTE:

- In ALL the Projects – all uneven numbers represent the needle going into the tissues and all even numbers represent the needle emerging from the tissues
- Dotted lines represent the suture within the skin below the epithelial surface, and solid lines represent the suture above the epithelium surface
- Handle the imitation skin with care! After placing sutures practice your suture removal skills (Project L), and then re-use the incision to practice other suturing techniques

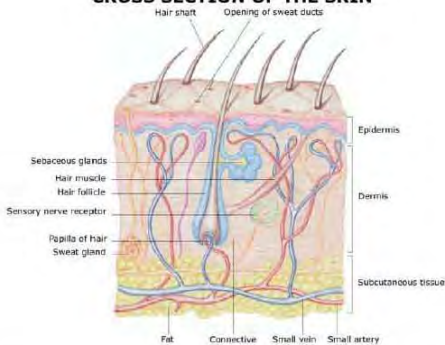
INFORMATION

One should ideally suture wounds in anatomical layers. For instance, the surgeon cuts through skin (epithelium, dermis, subcutaneous tissue), then through a layer of connective tissue called fascia, then through a muscle and through a 2nd layer of connective tissue to get access in removing a diseased salivary gland.

As he closes up, he will suture the 2nd layer of connective tissue, then the muscle, the first layer of connective tissue, the subcutaneous tissue and lastly the skin. He/she will aim at getting wound closure and eversion of the wound edges (being turned outward). All the layers except the skin will require absorbable sutures.

(Recommend: Study the section on the Skin in [The Apprentice Doctor® Basic Medical Course](#) - if available)

CROSS SECTION OF THE SKIN



REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

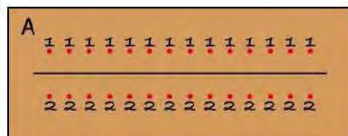


STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2](#) and [3](#).

STEP 2

Place the imitation skin (with the prepared ± 7 cm (2,5 inch) lacerations - see [Project 4](#)) - with the long axes horizontally positioned in front of you. For stability, secure the imitation skin to the table with surgical strapping/ sticky- or masking tape. (You may want to work on a piece of cardboard to protect the desk). These cuts in the imitation skin represent surgical incisions or traumatic lacerations. Study the diagram [A] shown below.



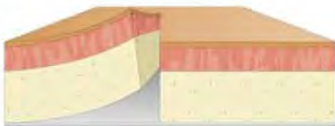


STEP 3

Take the tissue forceps in your left hand and the Needle Holder in your right hand (thumb in the upper eye and fourth finger in the lower eye of the handle as described previously). Ensure that the needle tip is facing forward and upwards.

STEP 4

Use the Tissue Forceps to gently lift and open the far side of the incision/laceration on the imitation skin.



STEP 5

Start by inserting the needle in the deep side of the laceration, penetrating the tissue in an upwards direction - letting the needle emerge just (1-3 mm/1/8 inch) below the epithelium. Assist the emerging needle through the tissues with your tissue forceps - then deliver ± 3.5 cm / ± 1.2 inches of suture thread out of the incision. Re-clip the needle holder - needle tip facing towards you and downwards.



Step 5a



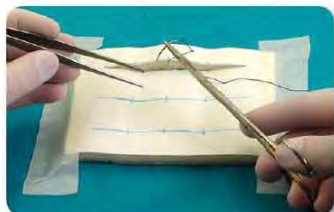
Step 5b



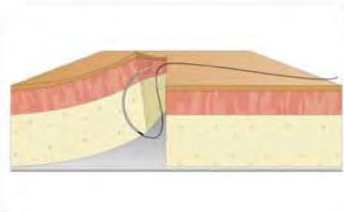
Step 5c



Step 5d

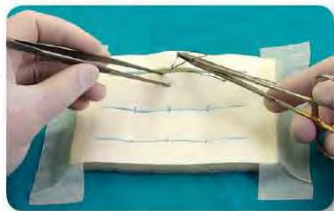


Step 5e

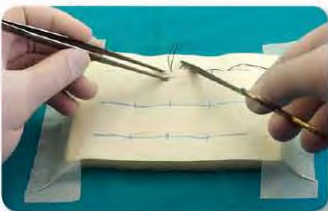


STEP 6

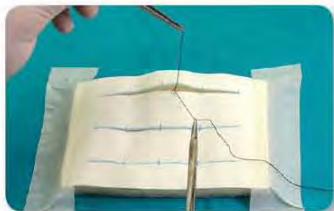
Insert the needle directly opposite the spot where the needle emerged previously, at exactly the same distance below the epithelium directing the needle downwards - aiming at taking an equivalent sized bite from the tissue on the opposite side. Assist the emerging needle and deliver it out of the tissue using the tissue forceps. Clip the Needle Holder on the needle and deliver the suture thread with $\pm 3-5$ cm / $\pm 1-2$ inches of the free end remaining on the surface.



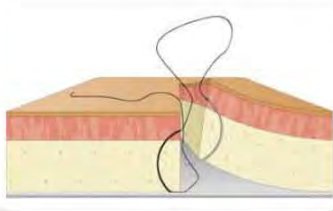
Step 6a



Step 6b



Step 6c

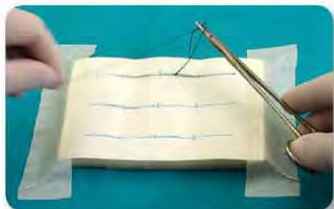


IMPORTANT NOTE: Ensure that both ends of the suture are either to the left or to the right side of the suture loop in the tissue. If one end is to the left and the other end to the right of the suture loop, the knot will land on top of the suture loop – defying the object of burying the knot in the deep part of the wound!



STEP 7

Make a square knot ensuring that the two tissue sides are brought closely together (into close proximity). If the square knot slips add another loop to the square knot – always in the opposite direction to the previous loop, alternatively you may choose to tie a surgeons knot.



Step 7a



Step 7b



Step 7c



STEP 8

Cut the suture about 3 mm ($\frac{1}{8}$ inch) away from the knot – ensure that the tips of the cut suture do not protrude through the wound.

POINTS OF INTEREST

- *Eversion of the sutured wound means that the incision line is somewhat raised above the skin surface. This accommodates scar tissue formation – so that the laceration surface ends up at the same level as the rest of the skin*
- *Subcutaneous sutures are placed to eliminate so-called dead space, and to minimize tension on the skin sutures. It also assists in everting the incision line*
- *Place enough subcutaneous sutures to do the job, but always keep in mind that all sutures are in essence foreign objects, so at the same time, keep these sutures to a minimum*
- *Both “too much dead space” as well as “too many sutures” will increase the chances of wound infection – so keep it to a happy medium!*
- *Subcutaneous sutures should always be of the absorbable variety. If you need suture strength to remain for an extended period of time – use standard Vicryl® or equivalent sutures (for shorter periods of time use the “rapid” variety).*

PROJECT B - HOW TO PLACE INTERRUPTED SUTURES

Learn the technique on how to place interrupted sutures

INFORMATION

The interrupted suture is by far the most common suture placed by medical professionals in a wide variety of clinical situations. In general it is easy to place and with the prerequisite that the wound is not compromised, and can be closed without tension, this knot gives predictable results.

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

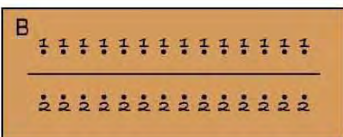


STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2](#) and [3](#).

STEP 2

Place the imitation skin (with the prepared ± 7 cm (2,5 inch) lacerations - see [Project 4](#)) - with the long axes horizontally positioned in front of you. For stability, secure the imitation skin to the table with surgical strapping/ sticky- or masking tape. (You may want to work on a piece of cardboard to protect the desk). These cuts in the imitation skin represent surgical incisions or traumatic lacerations. Study the diagram [B] shown on page 78.

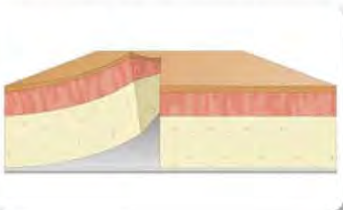


STEP 3

Take the tissue forceps in your left hand and the Needle Holder in your right hand (thumb in the upper eye and fourth finger in the lower eye of the handle as described previously). Ensure that the needle tip is facing downwards and towards you.

STEP 4

Use the Tissue Forceps to gently lift and open the imitation skin on the far side of the incision/laceration.



PLACE THE INTERRUPTED SUTURE IN A SINGLE STEP:

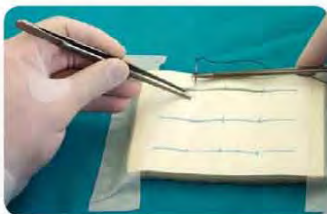
STEP 5 (Option 1)

Let the needle penetrate the surface of the imitation skin on the far side, approximately 3 mm ($\frac{1}{8}$ inch) from the margin of the incision – at an angle of 90 degrees to the surface (or slightly more). Let the needle penetrate both the epidermis and the dermis. Do not unclip the needle holder. With the Tissue Forceps, evert (lift and open / outwardly turn) the imitation skin on the near side of the incision/laceration.

Insert the needle in the depth of the tissue on the near side - exactly opposite the spot where the needle emerged from the far side. The course of the needle on the near side should mirror the course of the needle on the far side. Deliver the needle completely out of the tissue including most of the suture thread (leave $\pm 3-5$ cm / $\pm 1-2$ inches of suture thread free).



Step 5a



Step 5b



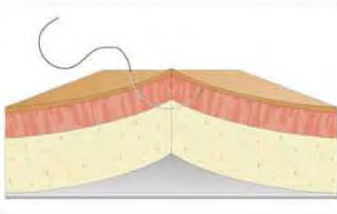
Step 5c



Step 5d



Step 5e



OR DIVIDE STEP 5 INTO TWO SUB-STEPS:

STEP 5a (Option 2)

Let the needle penetrate the surface of the imitation skin on the far side, approximately 3 mm ($\frac{1}{8}$ inch) from the margin of the incision – at an angle of 90 degrees to the surface (or slightly more). Let the needle penetrate both the epidermis and the dermis (including 1 or 2 mm of the subcutaneous tissue would be quite acceptable). Assist the emerging needle through the tissues with your tissue forceps – then deliver $\pm 3\text{--}5\text{ cm}$ / $\pm 1\text{--}2$ inches of suture thread. Occasionally it may be easier to pull most of the suture thread through leaving only $\pm 3\text{--}5\text{ cm}$ / $\pm 1\text{--}2$ inches of the free end out of the skin. Re-clip the needle holder – needle tip facing downwards and towards you.



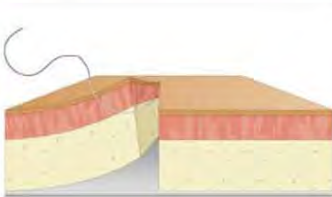
Step 5a



Step 5b

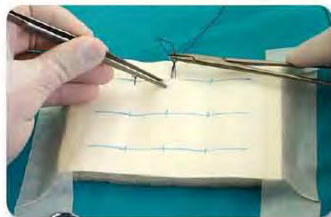


Step 5c

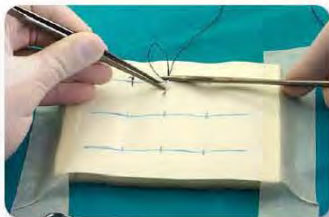


STEP 5b (Option 2)

With the Tissue Forceps evert (outwardly turn / lift and open) the imitation skin on the near side of the incision/laceration. Insert the needle in the depth of the tissue (on the side closer to you) exactly opposite the spot where the needle emerged previously. Try to mirror the course of the needle on the two sides - ensuring the deep part is slightly wider than the surface part. Deliver the needle completely out of the tissue including most of the suture thread (leave $\pm 3\text{--}5\text{ cm}$ / $\pm 1\text{--}2$ inches of suture thread free).



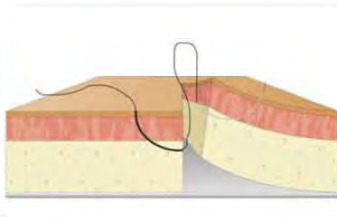
Step 5a



Step 5b



Step 5c



PRACTICAL HINTS WHEN PERFORMING STEP 5 IN A CLINICAL SITUATION:

1. Place the two tips of the tissue forceps at some distance on either side of the incision. Exert some pinching pressure – raising the incision somewhat – you are everting the wound, and will be able to traverse the tissue from the far side to the near side in one single thrust of the needle.



Step a



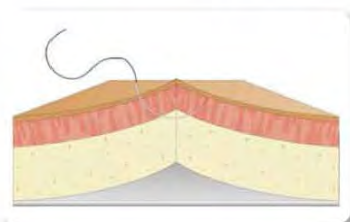
Step b



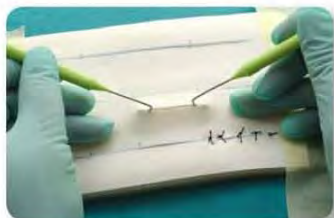
Step c



Step d



2. When working in elastic tissue like the neck, ask an assistant to place a skin hook at the two edges of the incision, and to lift the skin hooks up somewhat. This will assist with wound eversion, and the ease of suturing the wound.



Step a



Step b



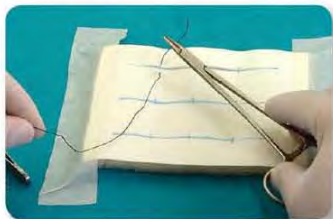
Step c



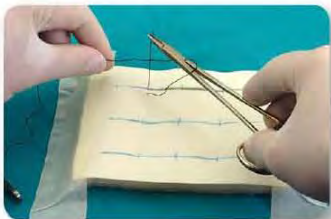
Step d

STEP 6

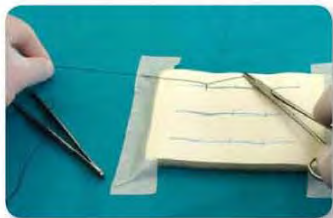
Tie an "Instrument Square Knot" – see "Project Epsilon". Cut the loose ends; leave at least 3 mm ($\frac{1}{8}$ inch) of suture material beyond the knots ensuring a long enough piece of suture to facilitate the removal of the sutures at a later stage. On completion, pull the knot to one side of the incision line (pull away from sensitive structures like the eyes or lips and ala of the nose).



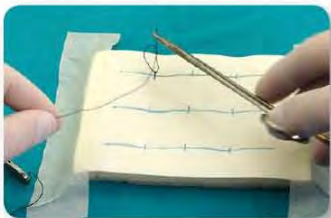
Step 6a



Step 6b



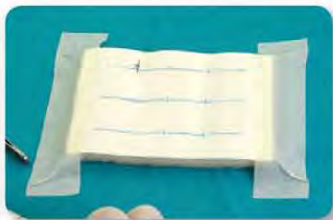
Step 6c



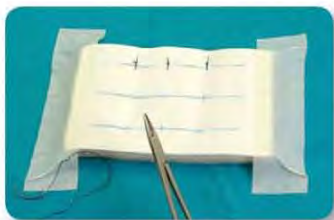
Step 6d



Step 6e



Step 6f



STEP 7

Repeat steps 4 to 6 at the other vertical marks over the incision line. Place some more interrupted sutures by repeating these steps - placing a suture approximately every 5mm ($\frac{1}{4}$ inch) over the width of the entire incision. Pull all the knots to the same side. Place additional sutures if you see any gaping areas.

POINTS OF INTEREST

- A gifted surgeon, colleague and mentor to myself, Professor Johan Reyneke taught us that your suturing represents your signature when operating. The message is - do not perform a great operation and then sign off with messy sutures. Neat suturing says something about you as person!
- Never pull wound margins together under any significant degree of tension. Rather undermine the skin somewhat, use local skin flaps or skin grafts to get skin to cover the wound surface without tension.

PROJECT C - HOW TO PLACE INTERRUPTED SUTURES WITH BURIED KNOTS

Learn the technique on how to place interrupted sutures with buried knots

INFORMATION

When suturing sensitive organs like the tongue – you may want to avoid placing suture knots and loose suture ends on the surface. By burying the suture ends and knots, the patient may feel a lot more comfortable! Use only absorbable sutures when using this method.

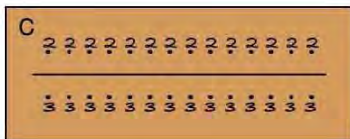
The disadvantage of this technique is the fact that one is increasing the amount of foreign (suture) material in the tissue and as a consequence the risk of infection (suture abscess).

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

STEP 1 - 4

Follow Steps 1-4 as explained above (PROJECT B - HOW TO PLACE INTERRUPTED SUTURES). Study the diagram shown below.



STEP 5a

Insert the needle on the far side ± 4 mm ($\frac{1}{4}$ inch) **within the depth of the laceration** and directing the needle in an upward direction towards the surface on the far side. Aim for the needle to emerge about ± 3 -5 mm ($\frac{1}{4}$ inch) from the wound edge on the far side surface. Assist the emerging needle through the tissues with your tissue forceps – then deliver ± 3 -5 cm / ± 1 -2 inches of suture thread out of the incision. Re-clip the needle holder – needle tip facing towards you and downwards.



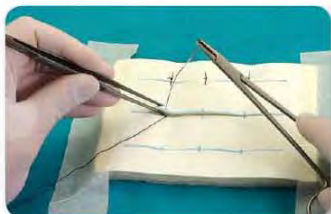
Step 5a



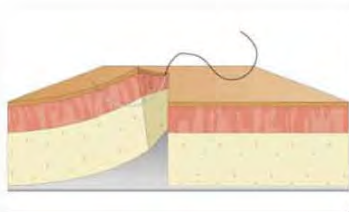
Step 5b



Step 5c



Step 5d



STEP 5b

Go to the near side and insert the needle $\pm 3-5$ mm ($\frac{1}{4}$ inch) from the edge of the laceration on the skin surface on the near side. Direct the needle to the far side and aim for the needle to emerge ± 4 mm ($\frac{1}{4}$ inch) into the depth of the wound. Deliver the needle completely out of the tissue including most of the suture thread (leave $\pm 3-5$ cm / $\pm 1-2$ inches of suture thread free).



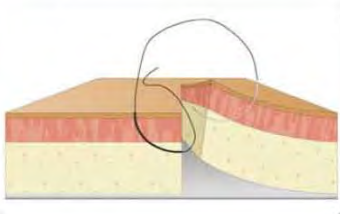
Step 5a



Step 5b

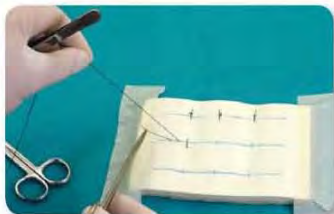


Step 5c

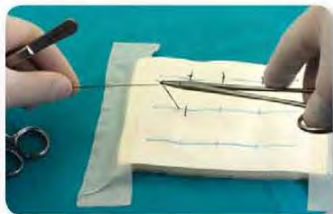


STEP 6

Ensure that both ends of the suture thread are either to the left or to the right side of the suture crossing the surface. (If they cross over under the suture, the knot will land on top of the suture – defying the object of burying the knot in the deep part of the wound!) Make a square knot ensuring that the two tissue sides are brought closely together (into close proximity).



Step 6a



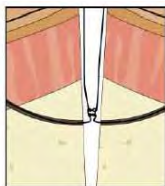
Step 6b



Step 6c



Step 6d



STEP 7

Cut the suture about 1.5 mm (1/16 inch) away from the knot – ensure that the tips of the cut suture do not protrude through the wound.

STEP 8

Place another number of sutures by repeating steps 5 and 6 above - placing a suture approximately every 5 mm (¼ inch) over the width of the entire incision. Place additional sutures if you see any gaping areas.

PROJECT D - HOW TO PLACE CONTINUOUS SUTURES

Learn the technique on how to place continuous sutures

INFORMATION

The continuous suture is also known as "simple running sutures". It basically is a continuous variant of the Interrupted suture ([Project B](#)). Continuous sutures can be used to close long lacerations and surgical incisions as well as to secure a split- or full-thickness skin grafts.

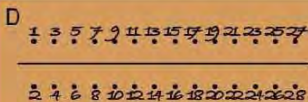
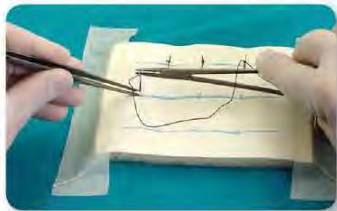
Scarring may be reduced with running sutures as compared to interrupted sutures as fewer knots are made with continuous sutures. Continuous sutures are also indicated to quickly control bleeding in the absence of other bleeding control measures e.g. a profusely bleeding scalp wound.

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source
3. An assistant

STEP 1

Start the suture 1-2 mm ($\frac{1}{4}$ inch) from the left hand edge of the prepared laceration (or at one of the positional markings) on the imitation skin over the incision/laceration. Follow steps 1 to 5 as described in [Project B](#) to place the first suture. Study the diagram [D] shown below.



STEP 2

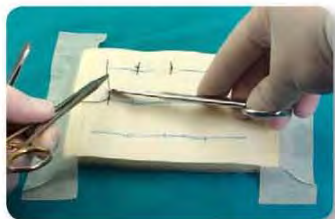
Tie an "Instrument Square Knot" – see "Project Epsilon". Cut **ONLY** the short end (the end without the needle) of the suture leaving at least 3 mm ($\frac{1}{4}$ - $\frac{3}{8}$ inch) of suture material beyond the knot.



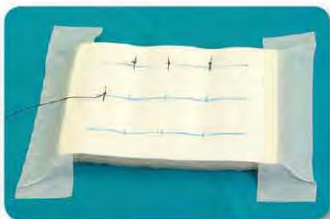
Step 2a



Step 2b



Step 2c

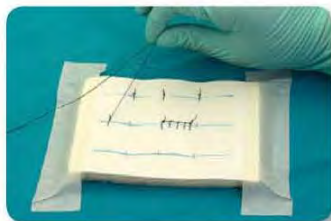


Step 2d

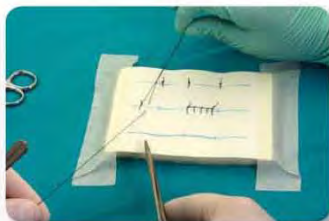
STEP 2

Ask the assistant to hold part of the long end of the suture – pulling it with mild tension (this is called "follow-up"), so as to prevent the wound from opening spontaneously.

Proceed with the next suture loop approximately 3-5 mm ($\frac{1}{4}$ - $\frac{3}{8}$ inch) further away from the knot. Ask the assistant to release the suture as you proceed with tightening the second suture loop.



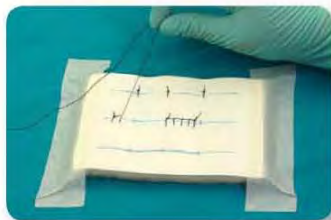
Step 3a



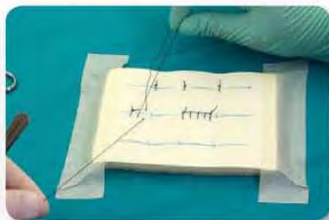
Step 3b

STEP 4

Repeat step 3 at intervals of 3-5 mm ($\frac{1}{4}$ - $\frac{1}{2}$ inch) until you arrive at the other wound margin.



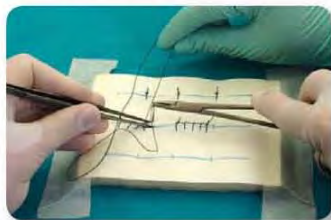
Step 4a



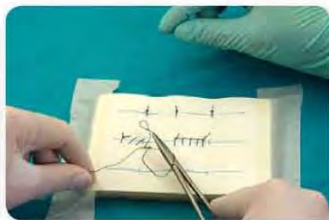
Step 4b

STEP 5

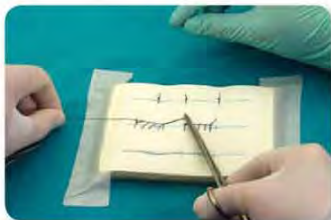
When you anticipate that you are going to place the last stitch – ask your assistant not to tense (follow-up) the suture. Make a square knot using the double suture line of the pen-ultimate stitch and the remaining free end of the suture (the end with the needle attached).



Step 5a



Step 5b



Step 5c

STEP 6

Cut the 3 ends with a suture cutting scissors leaving not less than 3 mm of free suture ends.



POINTS OF INTEREST

Advantages of the simple running suture include:

- Quicker placement and more rapid closure of wounds (compared to other types of sutures)
- The continuous suture is easy to place - even in inexperienced hands

Disadvantages include:

- The possible formation of skin marks (crosshatching) and the risk of opening (dehiscence) if the suture material breaks anywhere along the length of the laceration
- It is difficult to make fine adjustments along the suture line, and
- Elastic parts of the skin may become bunched up (do not use this to close a laceration on an eyelid for instance)

PROJECT E - HOW TO PLACE CONTINUOUS INTERLOCKING SUTURES

Learn the technique on how to place continuous interlocking sutures

INFORMATION

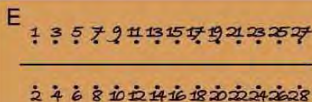
The indications, advantages and disadvantages of the continuous interlocking suture are similar to that for the continuous suture although the strength of the wound closure is somewhat enhanced as each suture sub-unit gets locked in by the previous sub-unit.

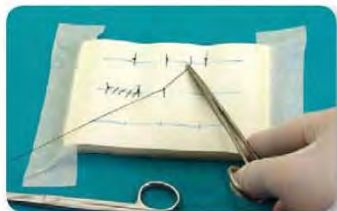
REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source
3. An assistant

STEP 1

Start the suture 1-2 mm ($\frac{1}{8}$ inch) from the left hand edge of the prepared laceration (or at one of the positional markings) on the imitation skin over the incision/laceration. Follow steps 1 to 5 as described in [Project B](#) to place the first suture. Study the diagram [E] shown below.





STEP 2

Tie a double "Instrument Square Knot" – see "Project Epsilon". Cut **ONLY** the short end (the end without the needle) of the suture leaving at least 3 mm of suture material beyond the knot.

STEP 3

Proceed with the next suture loop approximately 5 mm ($\frac{1}{4}$ - $\frac{1}{2}$ inch) further away from the knot. Before tightening the second loop, take the open loop from the assistant's hand, and then put the needle through the loop – using the needle holder and the tissue forceps. Tighten the suture thread.



Step 3a



Step 3b

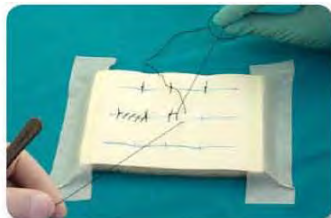


STEP 4

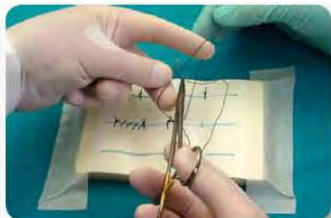
Ask the assistant to hold part of the long end of the suture – pulling it with mild force as to assist in keeping the wound closed (this is called "follow-up").

STEP 5

Repeat step 3 and 4 every 5 mm ($\frac{1}{4}$ inch) until you arrive at the other end of the wound margin.



Step 5a



Step 5b



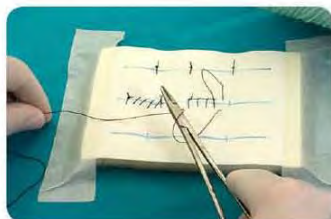
Step 5c



Step 5d

STEP 6

When you anticipate that you are going to place the last stitch – ask your assistant not to tense (follow-up) the suture. Make a square knot using the double suture line of the pen-ultimate stitch and the remaining free end of the suture (the end with the needle attached).



Step 6a



Step 6b

STEP 7

Cut the 3 ends with a suture cutting scissors leaving not less than 3 mm ($\frac{1}{4}$ - $\frac{3}{8}$ inch) of free suture ends.



Step 7a



Step 7b

POINTS OF INTEREST

Advantages of locked sutures include:

- Increased tensile strength
- Can be used in wounds under moderate tension
- Useful in wounds oozing from the skin edges where it can assist with control of bleeding (hemostasis)

Disadvantage:

- Running locked sutures have an increased risk of impairing the microcirculation in the wound area, and they may cause tissue strangulation if placed too tightly. This type of suture should be used in areas with good blood supply e.g. the scalp.

PROJECT F - HOW TO PLACE HORIZONTAL MATTRESS SUTURES

Learn the technique on how to place horizontal mattress sutures

INFORMATION

Indications:

- Horizontal mattress sutures provide both strength and wound eversion, and are therefore useful with the closure of wounds under tension
- Mattress sutures are also indicated when the operator wants to maximize the raw on raw surface area. An example is the secure closure of an opening between 2 cavities e.g. the oral and nasal cavity
- These sutures may also be used temporarily as so-called "stay sutures" to approximate wound edges, allowing placement of e.g. interrupted or subcuticular sutures. The temporary mattress sutures may then be removed
- To assist with wound eversion – place alternating horizontal mattress and interrupted sutures

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

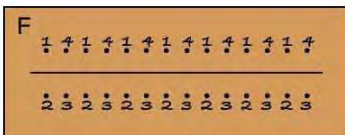


STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2](#) and [3](#).

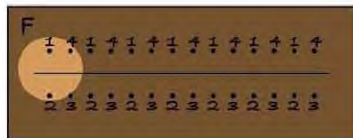
STEP 2

Use of the prepared imitation skin (see [Project 4](#)) with the ± 7 cm (2,5 inch) cut representing a surgical incision or a laceration in the skin. Study the diagram [F] shown on page 98.



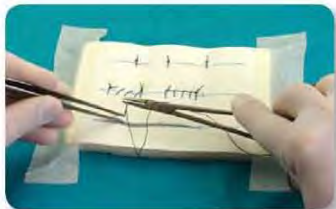
STEP 3

Start the suture in the region of one of the positional markings on the mock laceration of the imitation skin, on the far side. Follow the example on the diagram shown below.



STEP 4

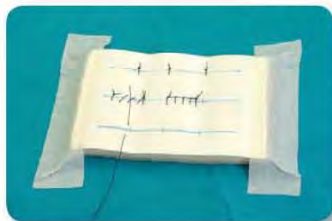
Evert the far side of the laceration with the tissue forceps and insert the needle - 5-10 mm ($\frac{1}{4}$ to $\frac{1}{2}$ inch) away from the wound edge (as described previously). Now evert the near side of the laceration and mirror the course of the needle, aiming for it to emerge at an equal distance from the laceration edge on the near side. Do not tie or cut the suture at this stage. Move $\frac{4}{5}$ mm ($\frac{1}{4}$ inch) to the right of this subsection of the stitch (stay parallel to the incision line) and place the second subsection of the horizontal mattress suture like the first part – but this time from the near side to the far side. Follow the pattern on the template: In “1”, out “2” then in “3” and out “4”.



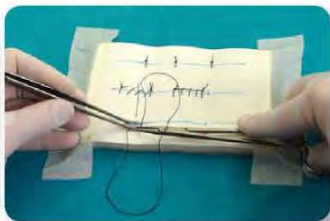
Step 4a



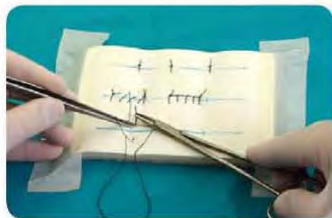
Step 4b



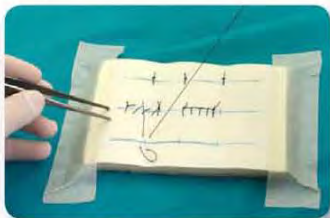
Step 4c



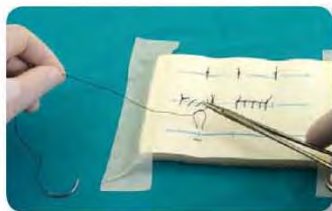
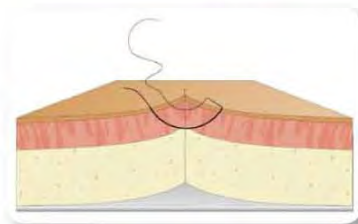
Step 4d



Step 4e



Step 4f



Step 5a

STEP 5

Tie a double "Instrument Square Knot" ("Project Epsilon") or a surgeons knot – ("Project Zeta"). Cut both ends of the suture leaving at least 3 mm ($\frac{1}{4}$ - $\frac{1}{2}$ inch) of suture material beyond the knot.



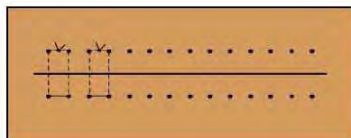
Step 5b



Step 5c

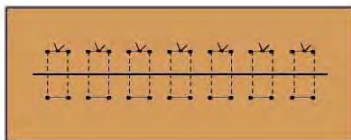
STEP 6

Place a second horizontal mattress suture $\pm 3\text{--}4$ mm ($\frac{1}{8}$ inch) to the right of the first suture by repeating Steps 4 and 5.



STEP 7

Follow with another couple of horizontal mattress sutures – until you reach the right edge of the laceration.



POINTS OF INTEREST

Advantages:

- Improved eversion may be achieved
- Can be used in wounds under a fair amount of tension

Disadvantages:

- High risk of producing suture marks if left in place for too long – especially where the suture exerts pressure on the skin surface
- High risk of tissue in the wound edge dying (necrosis) due to compromised blood supply – especially if they are tied too tightly. Do not place these sutures too close to the wound edges and consider removing the sutures as early as possible.

PROJECT G - HOW TO PLACE VERTICAL MATTRESS SUTURES

Learn the technique on how to place vertical mattress sutures

INFORMATION

Just like the horizontal mattress suture, the vertical mattress suture excels with the closure of wounds under tension. Since the suture bites can be placed quite a distance from the wound margin within healthy tissue, these sutures are probably the best choice to help with the closure of a wound under tension. On the down side are the increased risk of leaving suture marks – especially if they are left for too long in the tissues.

As a general rule, mattress sutures should be removed after 5 days – definitely not longer than 7 days. One way of reducing the risk of leaving suture marks is the use of soft plastic rods placed between the skin and the surface loop of the vertical mattress suture.

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source



STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2](#) and [3](#).

STEP 2

Use of the prepared imitation skin (see [Project 4](#)) with the ± 7 cm (2,5 inch) cut representing a surgical incision or a laceration in the skin. Study the diagram [G] shown on page 102.



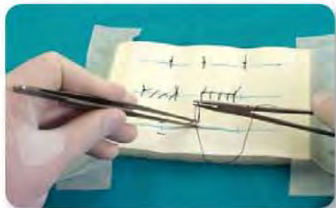
STEP 3

Start the suture in the region of one of the positional markings on the mock laceration of the imitation skin, on the far side. Follow the example on the diagram shown below.



STEP 4

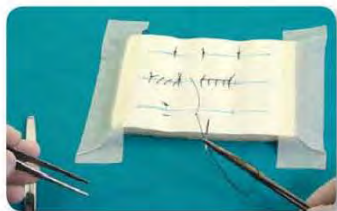
Evert the far side of the laceration with the tissue forceps and insert the needle - about 5 mm (¼ inch) on the far side of the laceration (as described previously). Now evert the near side of the laceration and mirror the course of the needle, aiming for it to emerge at an equal distance from the laceration edge on the near side.



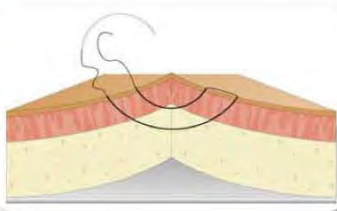
Step 4a



Step 4b

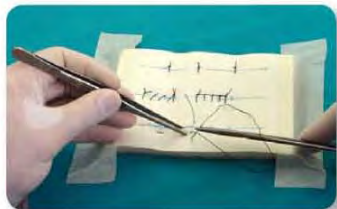


Step 4c



STEP 5

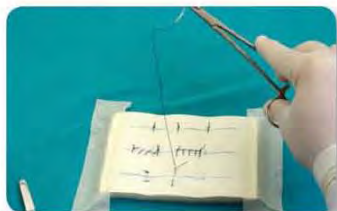
Insert the needle ± 8 mm ($\frac{3}{8}$ inch) from the left wound edge on the near side and mirror the course of the needle on the far side of the laceration. Follow the pattern on the template: In "1", out "2" then in "3" and out "4".



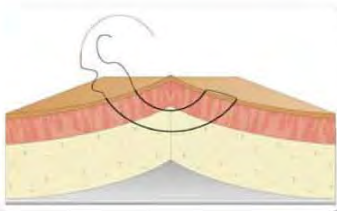
Step 5a



Step 5b



Step 5c



STEP 6

Tie an "Instrument Square Knot" ("Project Epsilon") or a surgeons knot – ("Project Zeta"). Cut both ends of the suture leaving at least 3 mm of suture material beyond the knot.



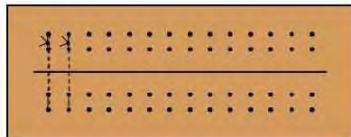
Step 6a



Step 6b

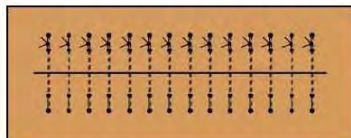
STEP 7

Place a second vertical mattress suture ± 6 mm ($\frac{1}{4}$ inch) to the right of the first suture by repeating Steps 4 to 6.



STEP 8

Follow with another couple of vertical mattress sutures – until you reach the right side edge of the laceration.



POINTS OF INTEREST

The advantages and disadvantages of the vertical mattress suture are similar to that of the horizontal mattress suture.

PRACTICAL HINT TO PROSPECTIVE DENTISTS / ORAL SURGEONS

As a dentist you will have to become proficient in suturing within a confined cavity. Simulate suturing inside the oral cavity by gluing a piece of sponge or cloth to the bottom of a plastic container or disposable cup. Now practice your newly acquired suturing skills by placing sutures in the sponge or cloth in the bottom of this container/cup.

Suturing Techniques

Learn the technique on how to place "far-and-near" sutures

INFORMATION

Mattress sutures – in the process of everting the wound may leave the wound edge slightly open at the end of the day. "Far-near-near-far" sutures are great with eversion, are strong, so can be used in wounds under tension. In addition they will assist in closing the wound margins as they cross over the wound margins twice.

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

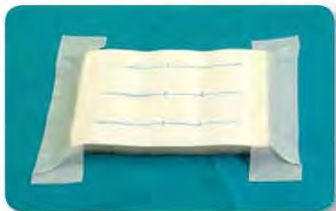


STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2 and 3](#).

STEP 2

Use of the prepared imitation skin (see [Project 4](#)) with the ± 7 cm (2,5 inch) cut representing a surgical incision or a laceration in the skin. Study the diagram [H] shown below.

[illegible]

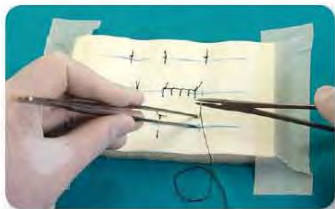
STEP 3

Start the suture in the region of one of the positional markings on the mock laceration of the imitation skin, on the far side. Follow the example on the diagram shown below.

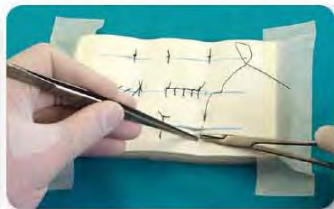


STEP 4

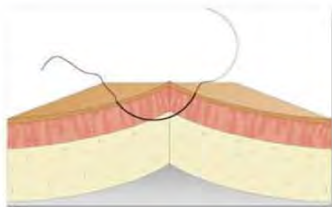
Evert the far side of the laceration with the tissue forceps and insert the needle (as described previously) – about 8 mm ($\frac{3}{8}$ inch) away from the wound margin - on the far side of the laceration. Now evert the near side of the laceration and aim for the needle to emerge 5 mm ($\frac{1}{4}$ inch) on the near side of the laceration.



Step 4a



Step 4b



STEP 5

Insert the needle ± 5 mm ($\frac{1}{4}$ inch) on the far side and aim for the needle to emerge about 8 mm ($\frac{3}{8}$ inch) on the near side of the laceration. Follow the pattern on the template: In "1", out "2" then in "3" and out "4".



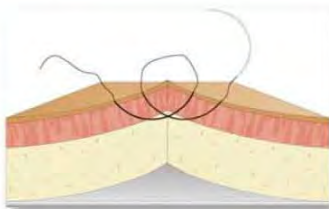
Step 5a



Step 5b



Step 5c



STEP 6

Tie a double "Instrument Square Knot" ("Project Epsilon") or a surgeons knot – ("Project Zeta"). Cut both ends of the suture leaving at least 3 mm of suture material beyond the knot.



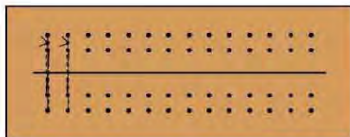
Step 6a



Step 6b

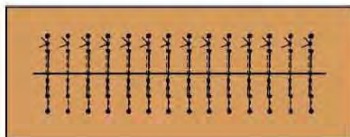
STEP 7

Place a second "far-and-near" suture $\pm 3-4$ mm ($\frac{1}{8}$ inch) to the right of the first suture by repeating Steps 4 to 6.



STEP 8

Follow with another couple of "far-and-near" sutures – until you reach the right side edge of the laceration.



POINTS OF INTEREST

Far-near-near-far sutures are useful when the clinician wants additional closure strength. Otherwise the advantages and disadvantages are similar to the horizontal and vertical mattress sutures.

A variant of the "Far-near-near-far suture" is the "Pulley suture". In my opinion it does not have any significant advantages compared to the other mattress sutures and will therefore not be discussed any further.

PROJECT I - HOW TO PLACE SUBCUTICULAR SUTURES

Learn the technique on how to place a continuous subcuticular suture

INFORMATION

The subcuticular suture is indicated in cosmetically sensitive areas like the face. It is time-consuming and more difficult to master compared to the other suturing techniques.

Keep in mind that cosmetic results are much better when minimal tension is placed on wound edges at the time of repair. The most favorable wounds from a cosmetic point of view are those where the long axis is parallel to the natural skin tension lines. Repair of such a wound will result in a fine cosmetically acceptable linear scar.



REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

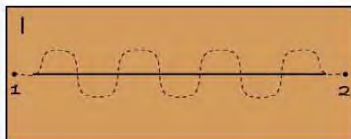


STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2 and 3](#).

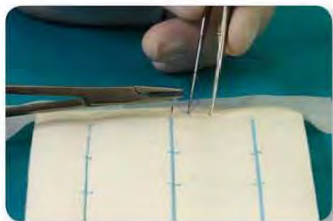
STEP 2

Use of the prepared imitation skin (see [Project 4](#)) with the ± 7 cm (2,5 inch) cut representing a surgical incision or a laceration in the skin. Study the diagram [I] shown below.



STEP 3

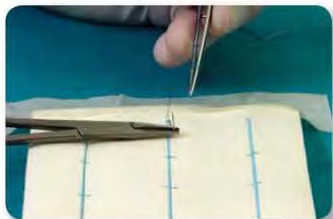
Insert the needle about 3 mm ($\frac{1}{8}$ inch) to the left of the left corner of the laceration (and in line with the long axis of the laceration) – aiming for the needle to emerge just below the epithelium on the inside of the laceration.



Step 3a



Step 3b



Step 3c



Step 3d

STEP 4

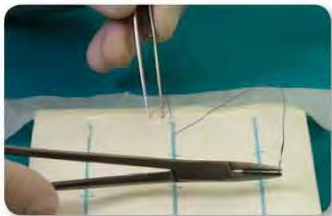
Insert the needle just below the epithelium on the **near** side of the laceration - taking a ± 3 mm ($\frac{1}{8}$ inch) bite of tissue – and aim for the needle to emerge just below the epithelium inside the laceration. Do not allow the needle to emerge through the skin surface. If the needle emerges through the skin – pull back slightly and redirect the needle to remain just below the epithelium.



Step 4a



Step 4b



STEP 5

Deliver the emerging needle from the near side - using the needle holder and pull enough suture string through to allow you to proceed with the suturing unrestrained.



Step 6a

STEP 6

Insert the needle just below the epithelium on the far side of the laceration opposite to the point where the needle emerged from the far side of the laceration - taking again a ± 3 mm ($\frac{1}{4}$ inch) bite of tissue as described in "Step 4".



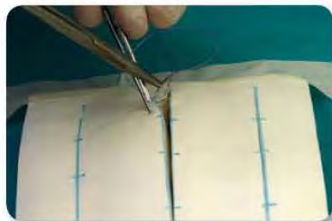
Step 6b



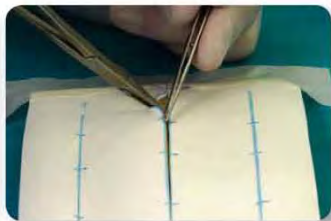
Step 6c

STEP 7

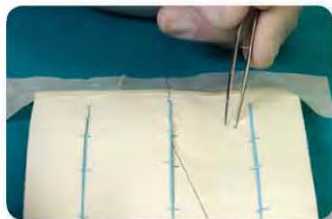
Work your way to the right-hand side of the laceration - alternating small bites of tissue on the near and far sides of the laceration (as described in "Step 4").



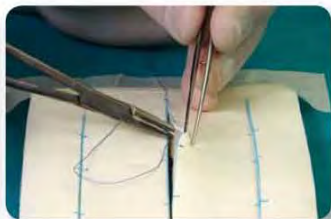
Step 7a



Step 7b



Step 7c



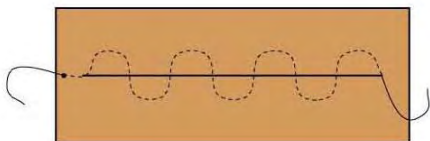
Step 7d



Step 7e



Step 7f

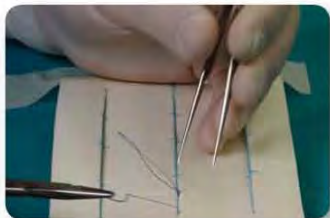


STEP 8

When needle emerges within 3 mm ($\frac{1}{8}$ inch) from the left edge of the laceration, insert the needle just below the epithelium – but aim for the needle to emerge about 3 mm ($\frac{1}{8}$ inch) away from the right edge of the laceration emerging through healthy skin – in line with the long axis of the laceration.



Step 8a



Step 8b



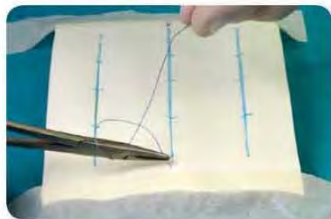
Step 8c



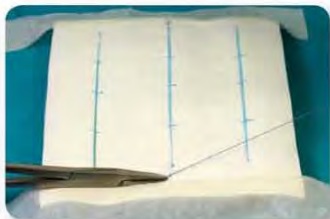
Step 8d

STEP 9

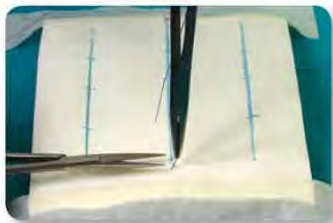
Pull the two ends of the suture tightly away from each other and strap the loose ends to the adjacent skin with a suitable strapping like **Steri-strips®**. Alternatively, make a knot at both ends of the emerging suture thread.



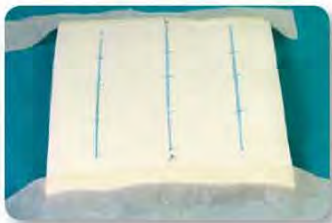
Step 9a



Step 9b



Step 9c



Step 9d

POINTS OF INTEREST

Have a look at the suggested surgical incision lines in the facial area – to ensure optimum cosmetic results after wound closure. As a general rule these lines run perpendicular (at an angle of 90 degrees) to the underlying muscles of facial expression.

PROJECT J - HOW TO PLACE A PURSE STRING SUTURE

Learn the technique on how to place a purse string suture

INFORMATION

Two examples of where a purse string suture may be used are:

- Closure of the colon after the removal of the appendix and
- Closure of the opening into the chest when a chest drain has been placed

REQUIREMENTS

1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A marker pen
3. A bright study lamp or equivalent light source

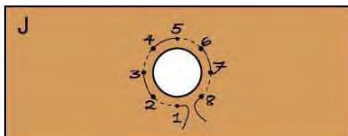


STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2 and 3](#).

STEP 2

Mark out a ± 1.2 cm ($\frac{1}{2}$ inch) circle on the bottom (sponge) side of the imitation skin - see the example on the template. This circle represents either a circular defect in elastic tissue or an opening in a hollow organ.



Step 3a

STEP 4

Start about 3 mm away from the wound margin on the near side of the circular wound. Place a suture parallel to the circumference of the wound margin. Take ± 3 mm ($\frac{1}{8}$ inch) bite then leave a space of $\pm 3-4$ mm ($\frac{1}{8}$ inch) before taking the next bite. Work your way clockwise or anti-clockwise around the wound - placing further sutures - until the last suture emerges about 3-4 mm ($\frac{1}{8}$ inch) away from the starting point.



Step 3b



Step 3c

**STEP 4**

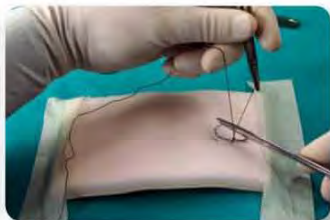
Cross the two loose ends over and pull these two ends of the suture tightly in opposite directions.

STEP 5

Tie a double "Instrument Square Knot" ("Project Epsilon") or a surgeons knot – ("Project Zeta"). Cut both ends of the suture leaving at least 3-5 mm ($\frac{1}{8}$ - $\frac{1}{4}$ inch) of suture material beyond the knot.



Step 5a



Step 5b

Variation: Cut off part of the finger from a surgical glove and practice the purse string suture on the remaining finger stump.

POINTS OF INTEREST

Never use a purse string suture for closing round defects on the skin – especially in cosmetically sensitive areas – it invariably gives poor cosmetic results! Rather convert the round defect into an ellipse, undermine the skin to alleviate tension and close with e.g. mattress sutures.

Where can I buy more **Imitation Skin**?

PROJECT K - HOW TO CORRECT A "DOG'S EAR"

How to get rid of those ugly, unwelcome dog's ears

INFORMATION

A Dog's ear defect occurs when one edge of the wound is longer than the other. The result is an extra amount of tissue at the end of the wound in the process of being closed. Do not attempt to "suture it away" it will not work!

REQUIREMENTS

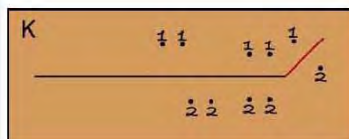
1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source



STEP 1

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2](#) and [3](#).

Suturing Techniques



Intentionally place a number of oblique or "skew" sutures in the incision (all in the same direction) next to the lifted skin section. This should produce a misaligned wound closure with the superficial layer of skin "bunching" up on the one side, thus producing a so-called dog's ear. Use a tissue forceps to lift the dog's ear out up somewhat.



Step 3b



On the dog's ear side the incision, at the end of the incision, make a short ± 5 mm ($\frac{1}{4}$ inch) mark on the imitation skin angled at ± 45 degrees to the original incision line. Cut this incision line using either the sharp-sharp scissors or the scalpel.

STEP 5

Apply gentle traction with a forceps (or a skin hook) to the excess triangle of skin to match the extended wound margin, and cut it off with the scissors.



Step 5a



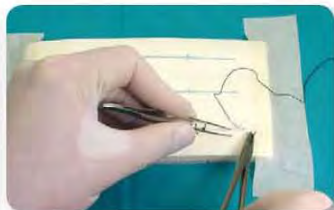
Step 5b

STEP 6

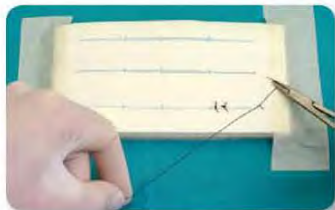
Continue placing interrupted sutures on the original incision. Now place one or two interrupted suture on the side of the incision that formed when the small excess piece of tissue was cut off. The final result is a sutured laceration that resembles a hockey stick.



Step 6a



Step 6b



Step 6c



Step 6d

ALTERNATIVE METHOD:

Simply perform a neat elliptical excision of the dog's ear as indicated on the diagram. Now proceed with placing another couple of interrupted sutures.

POINTS OF INTEREST

- *By making strategically placed cross markings on a surgical incision with a surgical pen – before making the incision, you will be creating landmarks for closure later on – and thus avoid creating Dog's ears.*
- *With the exception of quite minor incisions, it is always a good idea to use a surgical pen to plan your incisions.*
- *Need more Information on dog's ears? - <http://www.dogfacts.org/hearing-dog-facts.htm>*

PROJECT L - HOW TO CORRECT UNEQUAL LEVELS OF TISSUE

Learn how to "flatten" unequal heights of tissue during suturing.

INFORMATION

Occasionally – even with the best of efforts to avoid unequal heights of tissue- one may be confronted with somewhat unequal levels of skin at the wound edge during the suturing process. A common cause is the mal-positioning of sutures in the deeper layers of the skin during a layered closure. If the discrepancy is large – rather undo the deeper sutures and redo them at the correct level. If the discrepancy is slight – the method described below will assist you to correct the problem with ease.

REQUIREMENTS

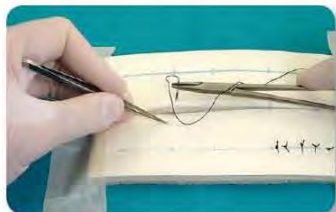
1. The Suture Kit
 - 1.1. Tissue forceps
 - 1.2. A suture needle with an eye
 - 1.3. Suture thread
 - 1.4. A needle holder
 - 1.5. Imitation skin
2. A bright study lamp or equivalent light source

**STEP 1**

Use a needle with suture material attached, clipped to a Needle Holder – see [Project 2 and 3](#).

STEP 2

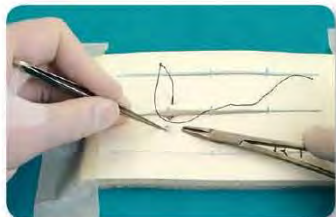
Use of the prepared imitation skin (see [Project 4](#)) with the ± 7 cm (2,5 inch) cut representing a surgical incision or a laceration in the skin. Study the diagram [L] shown below.



Step 3a

STEP 3

Intentionally place two "uneven" sutures at a distance of ± 2.5 cm (1 inch) apart from each other by taking a deep bite of tissue on the far side and a shallow bite on the near side of the incision – tie a square knot or surgeons knot. You have produced a misaligned wound with the far wound edge higher and the near one lower.



Step 3b



Step 3c



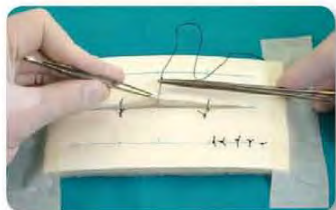
Step 3d



Step 3e

STEP 4

Correct these uneven edges by placing Interrupted sutures- but intentionally take a shallow bite on the far side and a deeper bite on the near side. See the uneven heights even out as you tie the sutures.



Step 4a



Step 4b



Step 4c



Step 4d



Step 4e



Step 4f

POINTS OF INTEREST

- *Unequal levels at the wound margin may be due to a foreign object remaining in the wound e.g. a piece of glass after a motor vehicle accident. Always make sure that you remove all foreign objects from the wound before closure. A small piece of glass may be difficult to find. A radiograph can often assist in identifying a fragment of glass.*
- *Unequal tissue levels may also be due to wound infection. As a general rule, an infected wound should not be sutured. Rather clear up the wound infection by debridement (surgical excision of dead, devitalized, or contaminated tissue and removal of foreign matter from a wound) suitable dressings and possibly antibiotic therapy and perform so-called secondary closure at a later stage.*
- *Get more information here:*

http://www.plasticsurgery.org/medical_professionals/publications/Everyday-Wounds-Ch02-How-do-Wounds-Heal.cfm

PROJECT M - HOW TO REMOVE SUTURES

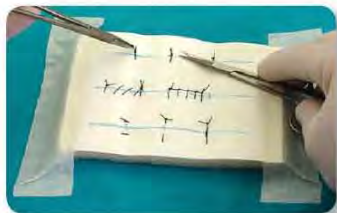
Learn how to remove sutures the correct way.

INFORMATION

Suture removal is usually an easy office procedure. The idea is to remove the sutures as soon as they have done their job of wound closure and before they start causing suture related complications like suture scarring and suture abscesses. Most patients are somewhat apprehensive about this procedure, but the discomfort with the removal of sutures is usually minimal - if any at all.

REQUIREMENTS

1. Your Suture Kit
2. Sharp-sharp scissors
3. The regular tweezers forceps
4. Imitation skin (This project requires completion of *Project B to G*)
5. A bright study lamp or equivalent light source
6. Your reading glasses (if you are over 40 years of age or you have placed 6-0 or thinner sutures)

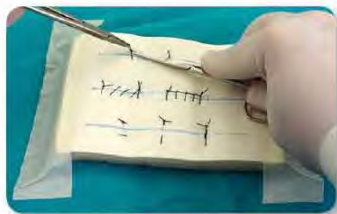


STEP 1

Remove the sutures placed previously in Projects B to J. Start with the interrupted sutures in "Project B".

STEP 2

Clean the area with a mild anti-septic solution (in a clinical situation).

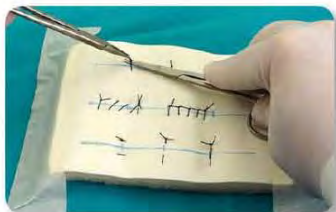


STEP 3

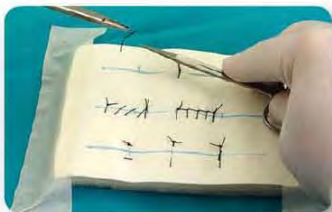
Lift the knot with a forceps and pull gently away from the skin and slightly towards the wound edge.

STEP 4

Ease the one leg of the scissors within the suture loop – remaining as close to the skin as possible.



Step 4a



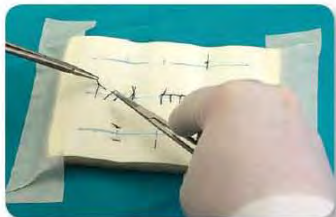
Step 4b



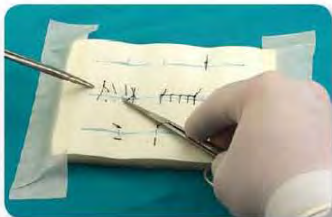
Step 5a

STEP 5

Gently cut the stitch, and remove by pulling it out with the forceps holding onto the knot.



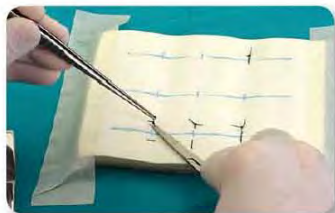
Step 5b



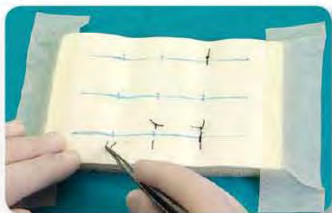
Step 5c

STEP 6

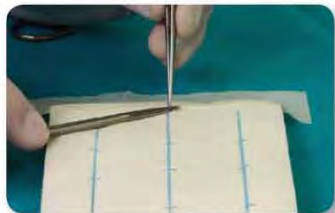
Give another quick wipe with a mild antiseptic solution and apply a conservative wipe of local antibiotic ointment.



Step 6a



Step 6b



Step 7a

STEP 7

Remove continuous sutures by carefully easing the one leg of the scissors under each of the loops – again remain right next to the skin surface. Remove the suture loops by pulling all the loose ends out of the skin.



Step 7b



Step 7c

STEP 8

Remove mattress sutures by gently lifting the knot – then cut both sides of the knot-loop just above the skin surface and remove by pulling the loop remaining on the skin surface.

STEP 9

Remove sub-cuticular sutures by removing the 2 securing straps at the ends, cut one end next to the skin surface and pull the remaining suture filament out – away and in line with the long axis of the laceration.

POINTS OF INTEREST

- A stitch-cutter or a scalpel blade can be used as an alternative for cutting sutures.
- Always work with a sharp scissors – ensure that the tips remain sharp and able to cut (and not chew) the sutures
- Ensure that you use a forceps that doesn't slip.
- Do not test the strength of the wound closure after suture removal – if you stretch the wound open with enough force it will open up again! Rather assist the immature closure with a number of small strappings like Steri-Strips®.
- If you are unsure about the strength of the wound closure, consider removing alternative sutures today – and the balance tomorrow.
- Recommended removal time in days for sutures in different areas of the body:
- Face: 3 - 5, Neck: 5 - 8, Scalp: 7 - 9, Upper extremity: 8 - 14, Trunk: 10 - 14, Extensor surface hands: 14, Lower extremity: 14 - 28.

COMPLICATIONS OF SUTURING

It is always wonderful when everything goes smoothly – but in medicine it occasionally doesn't...

lets consider:

1. Stitch "tear-through"

Occasionally when placing or tying a suture, the stitch may tear through the tissue. This is always an unfortunate mishap and will contribute to a cosmetically less pleasing result. Reasons of for this include:

- Placing a stitch too close to the wound margin. Avoid this by taking a reasonable bite at a fair distance from the wound margin.
- Taking a too superficial bite. Ensure that you include the full thickness of dermis in the bite!
- The inappropriate use of a cutting needle. Consider using a reverse cutting needle or a round-body needle.
- Placing stitches in diseased tissue e.g. infected wound or tumors.

2. Wound dehiscence

See *Points of Interest - Project Epsilon* (p.55 - 56)

3. Stitch abscess

A small yellowish collection of puss is visible where the suture emerges from the skin, adjacent to the suture material. Remove the stitch, and cover the wound with a topical antiseptic or antibiotic ointment. An isolated stitch abscess is rarely an indication for systemic (oral or intra-venous) antibiotics.

4. Defective scar

The scar is in the form of a groove or a dimple. The most common reason for this is that the operator did not pay enough attention to wound eversion. Another possible cause would be leaving too much dead space in the subcutaneous tissue. Suture in anatomical layers and do not suture the surface of the skin while neglecting to suture the subcutaneous tissue!



5. Hypertrophic scar

The wound healing is somewhat exuberant, causing a raised and thickened scar. This may relate to mild mechanical or bacterial irritation, of the wound during the healing process or to wound dehiscence.

A Hypertrophic scar increases in size up to a point, then regresses again to some extent. Leave this type of scar for at least 6 months and re-evaluate for a scar revision.



6. Keloids

A keloid is similar to a hypertrophic scar, with the difference that it is not self-limiting, but continues to increase in size, thus behaving like a true tumor, growing beyond the margins of the original wound/scar. Surgical excision or wound revision usually produces poor results and the formation of a new keloid. Keloids are best handled by the relevant professionals e.g. Dermatologists or Plastic surgeons.

7. Stitch marks

All stitch types piercing the epidermis will cause small "dot-like" marks next to the incision line. Limit these marks by removing sutures as soon as possible without risking wound dehiscence. Consider using alternative methods like wound strapping e.g. Steri-Strips®, subcuticular sutures or wound glue.

8. Crosshatching

Crosshatching is linear scars corresponding to pressure lines produced by the suture material pressing the underlying tissue. Avoid using inappropriate suture techniques and do not suture wounds under tension.

9. Wound contracture

Wound contraction is a normal part of wound healing. Wound contracture on the other hand is abnormal and implies distortion of the surrounding tissue. A contracture in areas like eyelids, fingers, toes etc. may cause limitation of movement of these structures. Plan surgical incisions and flaps properly and apply basic surgical principles like aseptic technique, anatomical and physiological considerations.

A photograph of two surgeons in an operating room, wearing masks and caps, focused on a surgical procedure. The image is in a purple-tinted style.

CONCLUSION

EPILOGUE

Suturing in essence is a surgical procedure and is governed by the basic principles of surgery like aseptic technique etc. At the end of the day we should be reminded that historically, surgery has been seen as a last resort. Let us also be reminded of the famous quotation by the famous surgeon in history, Ambrose Paré (1510–1590), who on occasion remarked, “I dressed the wound, and God healed it!”

The body has healing mechanisms of its own. Most wounds if left for a sufficient period of time will close completely/significantly on its own by the process of wound contraction. Remember – do not suture each and every single little wound – some minor cuts and bruises in esthetically unimportant areas will heal perfectly well without suturing. Sometimes cleaning and a small band-aid strapping is the appropriate way to manage a cut. Some wounds may even heal better if left undisturbed by invasive measures...

GLOSSARY

ABSORBABLE SUTURE	Suture material that will disappear over a period of time when placed in bodily tissue - usually due to enzymatic breakdown
ABRASION	The scraping away of part of the surface of the skin or mucous membrane
AIDS	A fatal disease caused by the Human Immunodeficiency Virus with the ability to slowly destroy part of a person's immune system
ALCOHOL	Usually referring to ethyl alcohol found in alcoholic beverages. In high concentrations it has medically useful antiseptic properties
ANATOMY	Bodily structure./ The study of the form and arrangement of bodily parts
ANTIBIOTICS	A group of biochemical substances produced by a variety of fungi with the ability of slowing down the growth of, or kill bacteria
APPRENTICE	A beginner or learning a trade or an occupation
ARTERIAL BLEED	Blood squirting, usually in a pulsating fashion, out of a blood vessel - moving blood away from the heart
ARTIFICIAL	An imitation of something natural e.g. artificial teeth
ASPIRIN	A medication for relieving pain, reducing fever and "thinning" blood
ATRAUMATIC	Causing minimal or no injury to the tissue
ATRAUMATIC NEEDLE	A suture attached to the end of an eyeless needle
AUTOCLAVE	An apparatus using steam under high pressure to sterilize medical instruments, items and equipment
AXIS	The center line of a structure or body
BITE	The amount of tissue included when inserting a needle into the tissue on either side of a laceration
BLEEDERS	A blood vessel leaking blood into a wound
BLOOD CLOTTING	Blood changing from a liquid to a gel state - an essential step towards stopping the process of active bleeding
BRAIDED	An interconnected network of fibers to form a suture, string or rope
CATGUT	A tough, thin cord made from the treated and stretched intestines of certain animals and used for surgical closure of wounds
CENTIMETER	The metric unit of length equal to one hundredth of a meter
CHEMOTHERAPY	Specific chemical agents or drugs that selectively destroy cancerous (malignant) cells and tissues
CHEST	The part of the body between the neck and the abdomen
CHROMIC	Chromic is an absorbable suture made from purified collagen, and treated with chromic acid salts
CLINICIAN	A medical practitioner who does clinical work (interact with patients)
COMMUNITY	A group of people having a common interest/s

COMPLICATION	A development that complicates any disease or disorder or occurs during or following medical or surgical treatment
CONTAMINATION	The presence of harmful foreign or infectious material in a wound or in a preparation
CONTINUOUS SUTURE	A suture made from a continuous (uninterrupted) succession of stitches and fastened at the two ends by a knot
CONTRACTURE	An abnormal reduction in the dimensions of a healing wound due to the contraction of scar tissue
COSMETIC	Pertaining to the improvement of appearance or a physical feature
CROSSHATCH	Shading, marks or prominences consisting of multiple crossing lines
CURRICULUM	Planned courses of academic study
CUTANEOUS	Pertaining to skin
CUTTING NEEDLE	A needle with a sharp edge as viewed in cross section
DEAD SPACE	Referring to a significant residual space (gap) within the tissues of the body following injury or surgery
DEBRIDEMENT	The surgical cleaning of a wound by excising dead (devitalized) and contaminated tissue and the removal of foreign material
DEHISCENCE	The splitting or bursting open along a sutured line
DENTISTRY	The profession concerned with the teeth, mouth and associated structures
DERMIS	The layer of the skin below the epidermis containing fibrous tissue, blood vessels, nerves and sweat glands
DEXTERITY	Pertaining to the ability of a person to skillfully coordinate their movements - especially referring to the hands
DIABETES MELLITUS	A chronic disease in which the body is unable to properly process glucose due to an insufficient production of / a resistance to insulin
DIATHERMY	The use of electromagnetic currents to produce heat for sealing off blood vessels by coagulating blood and denaturalizing proteins
DISEASE	A pathological (abnormal) condition of a part, organ, or system of the body characterized by an identifiable group of signs or symptoms
DISENGAGED	To unlock or cause to become unlocked
DISSECTION	The surgical separation or disassembling of a part of the body to expose internal structures
DOG'S EAR	An excess amount of tissue remaining at the edge of a sutured wound resembling the ear of a dog
DRESSING	A therapeutic or protective material applied over a wound surface
ELASTIC TISSUE	Tissue that deforms (stretches) when an external force is applied, but then returns to its original shape when the force is removed

ELECTRO-CAUTERY	The use of a needle-like probe heated by electric current to destroy tissue
EMT	Emergency Medical Technician
ENGAGED	To interlock or cause to interlock
ENTHUSE	To cause to become enthusiastic
ENZYMES	A chemical substance produced by living cells which promotes chemical reactions
EPITHELIUM	The outer (surface or covering) layer of skin and mucous membranes
EVACUATE	To remove the contents of, or to empty
EVERSION	The condition of being turned outward
EVERT/EVERTING	To cause to turn outwardly
EXTREMITIES	Limbs (arms or legs)
EYELIDS	Skin folds covering the exposed parts of the eyeball when in the closed position
FIBER	A thread-like structure
FIBROUS	Consisting of microscopic fibers
FIRST AID	Emergency treatment of a victim of sudden illness or injury while awaiting professional medical care
FLAT FORCEPS	An instrument similar to a pair of pincers or tongs, used for grasping. The grasping surface is flat or somewhat serrated
FOREIGN MATERIAL	A contaminating substance, not usually found in the body, which entered the tissue unintentionally during injury
GALLBLADDER	A small bag attached to the under-side of the liver serving as a temporary storing area for bile
GENERAL ANESTHETIC	An agent that acts on the brain producing an absence of sensation or feeling in the whole body as well as a loss of consciousness
GRANNY KNOT	A knot similar to a square knot, but with the second tie crossed in the opposite direction, which easily becomes undone
HEALTHCARE	The management of the various aspects of health and illness
HEMATOMA	A blood clot within a body cavity or tissue space
HEMOPHILIA	A hereditary blood disorder marked by the inability of the blood to clot and the risk of excessive bleeding
HEPATITIS B	An infection of the liver, caused by a specific virus and transmitted by blood or blood derivatives from a carrier of this virus
HEREDITARY	Transmitted genetically from parent to offspring
HIV	Human immunodeficiency virus, the causative agent of the disease AIDS
HYGIENE/HYGIENICALLY	Pertaining to cleanliness and the prevention of infections and sepsis
HYPERTROPHY	An increase in the size of a tissue or an organ due to growth of individual cells
IMITATION	A copy that is similar regarding certain attributes to an original
IMPAIRED	Diminished in strength, value, or quality

INCH	A measure of length equal to one-twelfth of a foot or 2.54 centimeter
INCISION	A cut into the body, tissue e.g. skin or an organ - especially referring to a surgical cut
INDEX FINGER	The finger next to the thumb
INFECTED	Contaminated with a disease-forming microorganism or agent
INFECTION	Invasion and multiplication of disease-producing microorganisms in tissue, an organ, or a part of the body
INFLAMMATION	The response of tissue to injury characterized by pain and swelling
INFUSE	Introducing a solution into the body through a vein
INJECTION	The introduction of a fluid into the body by means of a needle and or cannula (flexible tube)
INTERLOCKING SUTURES	A modified type of continuous suture where each suture loop is connected to the previous suture loop
INTERNS	A recent graduate or advanced student who assists with the medical or surgical care of hospital patients
INTERRUPTED SUTURES	Individual sutures (stitches) are placed, the ends are tied into a knot and both ends are cut before proceeding with placing next suture
INVASIVE	Pertaining to a medical procedure where a part of the body is entered into
JAWS	The gripping part of a forceps / needle holder / tweezers or similar instrument usually somewhat serrated, crosshatched or "toothed"
KELOIDS	The formation of excessive amounts of scar tissue caused by an exuberant repair response following trauma or a surgical incision
KNOT	A fastening made by tying together lengths of string or rope, in a specific way
LACERATE	To cut, tear or wound
LACERATION	A cut, tear or wound
LAPAROSCOPIC	A minimally invasive surgical procedure that uses a flexible endoscope (camera) to view structures in the abdomen
LATCH	Catch for fastening or connecting two parts of an object e.g. the two legs of an artery forceps
LATEX	A natural rubber material used in the manufacturing of products like surgical gloves
LIGATION	Tying a blood vessel with a ligature during surgery to stop bleeding
LIGATURE	A thread or suture cord used in surgery to tie off vessels and tubular structures
LOCAL ANESTHETIC	Absence of sensation or feeling in a restricted area of the body
LOOP	A length of string, rope or suture material that is circular or curved to form an opening
MALIGNANT	A life threatening disease (cancerous growth) tending to metastasize (form new growths distant to the initial site)

MATTRESS SUTURE	A "double suture" used to assist with wound eversion
MAXILLOFACIAL	Pertaining to the facial skeleton - including the jaws, mouth and teeth
MEDICAL	Pertaining to the study or practice of medicine
MEDICAL HISTORY	An account of a patient's past and present state of health
MEDICINE	The science that relates to the prevention, and treatment of diseases / Drugs and potions used for restoring health
MICROCIRCULATION	Blood flow through the smallest vessels of the body (venules, capillaries, and arterioles)
MONOCRYL	A monofilament absorbable suture material (trade name)
MONOFILAMENT	A single strand of untwisted synthetic fiber used to manufacture suture cord
MUCOUS	Pertaining to the production and secretion of mucus
MUCOUS MEMBRANES	Membranes lining interior body surfaces opening to the exterior e.g. the nose and mouth
MULTIDISCIPLINARY	Making use of several experts in a number of different disciplines
MUSCLE	A specialized tissue with the ability to contract, making movement possible
NEEDLE	A small, slender device used for surgical suturing. The sharp hollow device placed at the tip of a syringe to inject medication into the body
NEEDLE HOLDER	A surgical instrument used for gripping the needle for suturing
NON-ABSORBABLE SUTURE	Suture material requiring removal following placement - the body being unable to digest these suture's fibers
NON-ELASTIC	Tissue that resists deformation (stretching) when an external force is applied
NURSING	The science of providing care for sick and frail people
NYLON	A non-absorbable suture fiber, manufactured from a synthetic plastic material
OOZING	A liquid e.g. blood seeping or leaking out slowly through small blood vessels
ORTHOPEDIC	Relating to abnormalities and injuries of bone, muscles and joints
PAIN	An unpleasant sensation (hurting / suffering) usually occurring as a consequence of injury or disease
PALM	The flexor (inside) surface of the hand
PARAMEDIC	A person who is trained to give emergency medical treatment
PENETRATE	To pierce, enter into something or make a way through something
PERFUSE	To permeate with e.g. a liquid
PERPENDICULAR	A line at a right angle (90 degrees) to another line
PHYSIOLOGY	Study of the function of living organisms and their parts
PLASTIC SURGEON	Surgery dedicated to the repair and restoration of the body, especially as it relates to the enhancement of appearance
PRACTITIONER	A person who practices medicine or an allied health profession
PRE-MEDICAL	A pre-medical degree (pre-med) is one preparing a person for entrance into medical school

PRIMARY CLOSURE	Final closure of a wound or laceration within 24 hours after sustaining the injury
PROBE	A slender flexible surgical instrument with a sharp or rounded tip used for exploration purposes
PURSE STRING SUTURE	A suture designed to close a rounded surgical defect or wound
RAGGED	Having an irregular or uneven surface or edge
RATCHET	A toothed component or tool, operating with a catch mechanism, locking movement in one direction only
RAT-TOOTHED	A forceps with a tip having a tooth-like projection for holding tissue when suturing or performing surgery
RECONSTRUCTIVE	Pertaining to the restoration and correction of appearance and function of defective or damaged body parts
REFLEXIVE	Without conscious control
REGISTRARS	A specialist in training who acts as assistant to the attending specialist (term used in British hospitals)
REPAIR	Restoring to health and a functional condition following damage or injury
RESUSCITATE	To restore consciousness or life (to revive) following a life threatening incident
ROUND NEEDLE	A suture needle with a round contour when viewed in cross-section
RUNNING SUTURES	A suture made from a continuous (uninterrupted) succession of sutures and fastened at the two ends by a knot
SCALP	The skin covering the top of the human head
SCALPEL	A surgical knife with an extremely sharp blade used for dissections and for performing surgery
SCAR	A mark left on the skin following an injury or wound that has healed
SCAR TISSUE	Dense, fibrous connective tissue that forms over a healed wound or incision
SCISSORS	A cutting tool consisting of two blades and two handles, joined by a swivel pin that allows the blades to be opened and closed
SECONDARY CLOSURE	Suturing a wound a number of days after the injury
SEDATION	Sedation involves the administration of calming drugs to facilitate the performance of a surgical procedure
SEMICIRCULAR	A form in the shape of half a circle
SEPSIS	A bacterial infection in the bloodstream or body tissues
SERRATED	A saw-toothed edge / a margin notched with tooth-like projections
SHARPS	Referring to all sharp or potentially sharp surgical items like scalpel blades, needles, glass cartridges etc.
SHIN	The front part of the leg between the knee and the ankle
SKIN GRAFT	The process of harvesting and transferring skin from a donor to a recipient site, and securing it at the recipient site

SKIN TENSION LINES	Surgical incision lines with directions designed to minimize scar tissue formation
SOLE	The underside of the foot
SQUARE KNOT	A double knot in which the two loops are tied in opposite directions, used to join the two ends of a suture or a ligature
STAY SUTURES	Temporary sutures placed to approximate two sides of a wound or laceration to assist in aligning the wound/incision correctly
STERILITY	Sterility indicates the total absence of infectious micro organisms
STERI-STRIPS	Small plaster strips used to close minor lacerations or to reinforce sutured lacerations (trade name)
STITCH	A single suture
STRAPPING	A strip of adhesive plaster, used in attaching parts to each other
STRING	A cord used for fastening or tying
SUBCUTANEOUS	Below the skin
SUBCUTANEOUS SUTURES	Sutures placed to approximate the subcutaneous layers of tissue in a wound or surgical incision
SUBCUTANEOUS TISSUE	The layer of tissue just below the dermis of the skin
SUBCUTICULAR SUTURES	A continuous suture placed just below the cuticular layer of the skin
SURGEON	A physician who specializes in surgery
SURGEON'S KNOT	A modified square knot - the first loop consists of a double throw
SURGERY	The branch of medicine that deals with the diagnosis and treatment of injury, deformity, and disease by invasive means
SUTURE	The surgical technique used to close a wound or join tissues
SWAGE	The section of an atraumatic needle where the suture connects to the needle
TECHNIQUE	The skill and procedure with which a surgical procedure is carried out
TENSION	The act of stretching something tight
TETANUS	An infectious disease, also known as lockjaw, caused by the toxin of tetanus bacteria (<i>Clostridium Tetani</i>)
THEATRE	Referring to an operating theatre - the room where surgical operations take place
THIGH	The section of the leg between the hip and the knee
THREAD	A cord of natural or manufactured material
THROW	A basic step in the process of tying a knot
THUMB	The short thicker digit of the human hand, next to the index finger and opposable to the other four digits
TIE	To fasten or to secure with, e.g. rope or string by making a knot

TIE SUTURE	A section of suture material without a needle used to tie-off (close -off) e.g. blood vessels
TISSUE	A collection of similar cells
TORSO	Trunk or body without the head and limbs
TOXIC	Able to cause injury or death - especially pertaining to chemicals (poisonous)
TRACHEOTOMY	A tracheotomy is an operation in which an opening is made in the windpipe (trachea)
TRAUMA SURGEON	A surgeon specializing in the various aspects of diagnosing, managing and treating injured patients
TRAUMATIC TATTOOING	The inclusion of foreign material into an abrasion or wound causing a change in the color of the skin following wound healing
TRAUMATIZED	Wounded or injured
TUMOR	A swelling, especially referring to swellings caused by the abnormal growth of cells or tissue.
TWEEZERS	Instruments that are usually held with the thumb and forefinger and used for handling or manipulating tissue during surgery
UNDERMINE	Dissecting some distance under the skin's surface at a plane parallel to the surface
UNRAVEL	The fibers of a suture thread becoming undone
VETERINARY	Medicine and surgery related to animals
VICRYL	A braided absorbable suture material (trade name)
WOUND CONTRACTION	The body's repair mechanisms producing shrinkage (reduction of the size) of the wound during the healing process
WOUND EDGE	The side margin of a wound or laceration