SUTURE MATERIALS AND SUTURE TECHNIQUES

CONTENT

- Introduction
- Goals of suturing
- Requisites of suture material
- Classification of suture material
- Suture characteristics
- Principles of selection of suture material
- Armamentarium of suturing
- Principles of suturing
- Suturing techniques
- Surgical knot
- Removal of suture
- Complications
- Alternatives to suture

INTRODUCTION

A suture is strand or thread of material used to approximate tissues and also to ligate blood vessels. To suture is the act of sewing or bringing tissues or flaps edges together and holding them in apposition until normal healing takes place. Sutures help the wound to withstand normal functional stresses and to resist wound reopening.

GOALS OF SUTURING

- Wound edge apposition
- Provide adequate tension
- Maintain haemostasis
- Aid in wound healing
- Avoid wound infection
- Produce aesthetically pleasing scar by approximating skin edges

REQUISITES FOR SUTURE MATERIAL

- Tensile strength: Important quality in selection of thread. Depending upon the elasticity of material the strength will vary. Flexible material will have greater ability to stretch and bear stress. Adequate material strength will prevent suture breakdown and the use of proper knots slippage.
- Tissue biocompatibility, low tissue irritation and reaction : Organic material suture evoke higher response than synthetic ones. Also tissue reaction is

REQUISITES FOR SUTURE MATERIAL

- Low capillarity : Multifilament type sutures soak up the tissue fluid by capillary action thus providing a rich medium for proliferation of microbes in turn increasing the chances of inflammation & infection.
- Good handling and knotting properties : Ease of tying and a thread type that permits minimal slippage also influence the thread selection.
- Sterilization without deterioration of properties: Sterilization should not damage

Classification of suture material

- According to source:
  1) Natural
  2) Synthetic
  3) Metallic

- According to structure:
  1) Monofilament
  2) Multifilament

Classification of suture material

- According to fate:
  1) Absorbable
  2) Non absorbable

- According to coating:
  1) Coated
  2) Uncoated

Natural

Absorbable

- Catgut
- Chromic catgut
- Collagen
- Fascia lata
- Beef tendon

Non Absorbable

- Silk
- Linen
- Cotton
- Ramie

Synthetic

Absorbable

- Polyglygolic acid
- Polyglactic acid
- Polyglactin(vicryl)
- Polydioxanone(PDS)

Non absorbable

- Nylone(polyamide)
- Polypropylene
- Polyesters
- Polyethylene

Metallic

- SS (stainless steel)
- Tantalum
- Silver
- Gold
- Aluminium

Monofilament

Absorbable

- Catgut
- Chromic catgut
- Vicryl
- PDS

Non absorbable

- Polypropylene
- Polyester
- Nylone
- Polyvenyleidene fluoride/PVDF suture

Multifilament

Absorbable

- Vicryl
- Polyglycolic acid

Non absorbable

- Silk
- Cotton
- Linen


Absorbable
Nonabsorbable
MAXON
DEXON II
4-0 CHROMIC GUT
2-0 VICRYL
3-0 MONOCRYL Y427
3-0 PDS II Z452
SILK
PROLENE
3-0 NOVAFIL
3-0 ETHILON
10-0 MERSILENE R721
ETHICON

Absorbable VS Non absorbable

Absorbable

- Degraded by enzymes, hydrolysis or phagocytosis.
- Used to hold the edged in approximation temporarily until the wound is healed.

Non absorbable

- Encapsulated or walled off by fibrosis.
- Used to suture at sites where tensile strength need to be maintained.

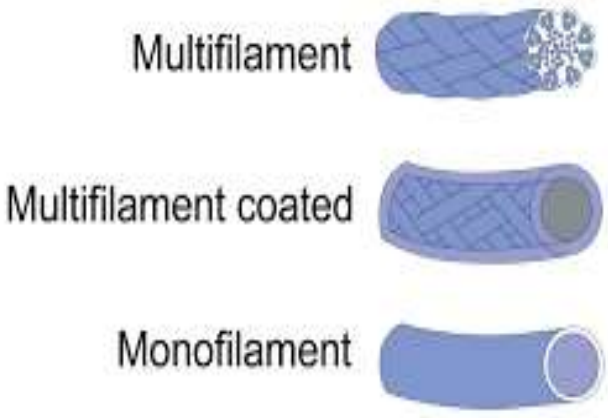
Monofilament VS Multifilament

Monofilament

- Has no capillary action
- Less infection risk
- Smooth tissue package
- Higher tensile strength
- More throws required

Multifilament

- Has capillary action
- Increased infection risk
- Less smooth passage
- Less tensile strength
- Better knot security



SUTURE CHARACTERISTICS

Physical structure- MONOFILAMENT

- This suture material is smooth & tends to slide through tissue easily.
- Difficult to knot.
- Can be damaged by gripping it with needle holder or forceps. That can lead to fracture of suture materials.

SUTURE CHARACTERISTICS

MULTIFILAMENT

- Easy to knot.
- Have greater surface area than monofilaments.
- Have capillary action where bacteria may lodge and be responsible for persistent infections.
- This material may be coated with silicone in order to make it smooth.

Principles of suture material selection

- Rate of healing : Surgeons should select suture that will lose its tensile strength at about same rate that the tissues gain strength. Tissues that heal slowly like skin, facia, tendon, should be closed with non absorbable suture while the ones that heal rapidly like muscles should be closed with absorbable suture.
- Tissue contamination : Multifilament sutures soak up the tissue fluid providing rich media for bacterial growth thus leading to infection. Hence in contaminated wounds monofilament absorbable or non absorbable suture are placed.
- Cosmetic results : Depending on cosmetic results smallest, inert monofilament suture material like polyamide or polypropylene is used.
- Microsurgical procedures : Tissues like nerves, arteries, veins most commonly suture used are 10-0 polyamide monofilament.
- Cancer patients : Low protein in body & chemotherapy can breakdown the wound. Synthetic non absorbable suture are used. If patient is to be irritated in postoperative period, monofilament polypropylene should be used, instead polyester should be used.

Principles of suture material selection

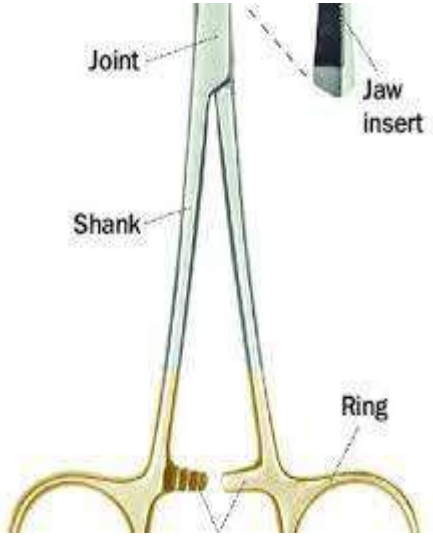
- Wound repair in patients causing irradiation: In such patients not only the normal healing process is delayed, but the tolerance to trauma of irradiated tissues is markedly reduced. Thus extremely careful & gentle surgical techniques are used, avoid tension suture & mattress sutures as they increase the degree of ischemia. Avoid continuous and constant pressure on irradiated areas. For facial areas use non absorbable sutures, polypropylene.
- Nutritional status: When a patient is malnourished non absorbable suture is used as tissues need to be kept in approximation for longer period of time. Use of absorbable suture may result in wound dehiscence.
- Suture size: The size of the suture material should be properly selected depending upon the tensile strength of tissues to be approximated and whether or not there will be flap tension or freely mobile tissues.

ARMAMENTARIUM OF SUTURING

- Needle holder
- A suture needle
- Suture material

Needle holder

- Parts:
  - working tip/jaws
  - hinge joint
  - shank /body
  - catch mechanism/ratchet
  - grip area



How to hold:

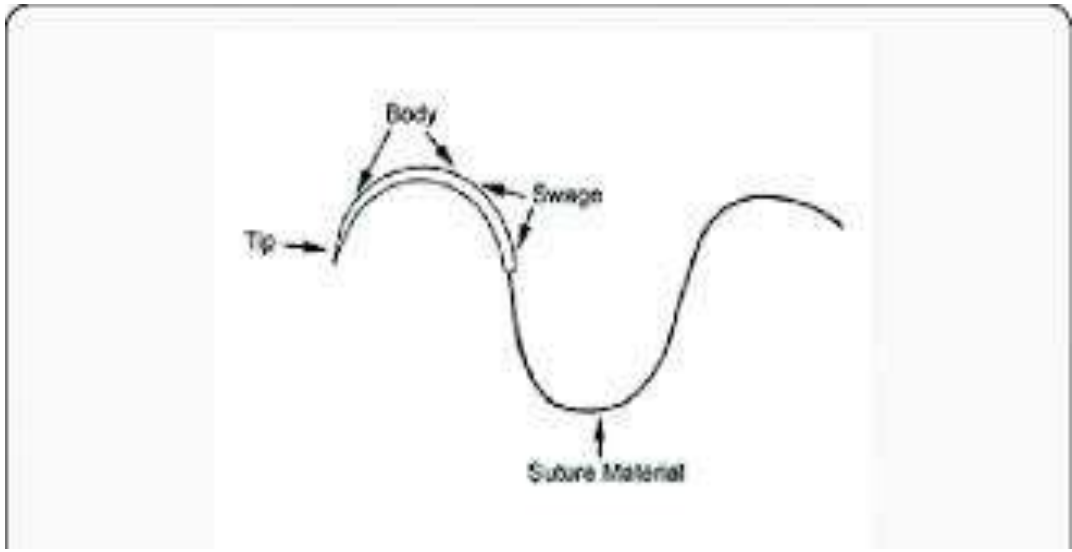
The needle holder is held with thumb and ring finger through the rings & with the index finger along the length of the needle holder to provide stability and control

A suture needle

Made of either SS (stainless steel) or carbon steel.

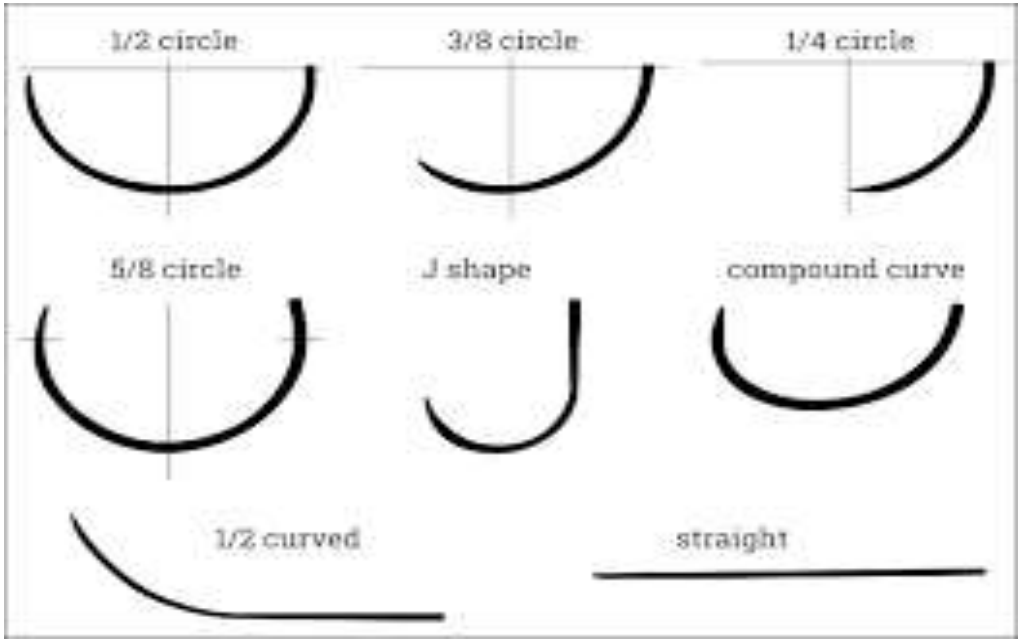
PARTS:

1) tip/point
2) body/shaft
3) eye/swaged end



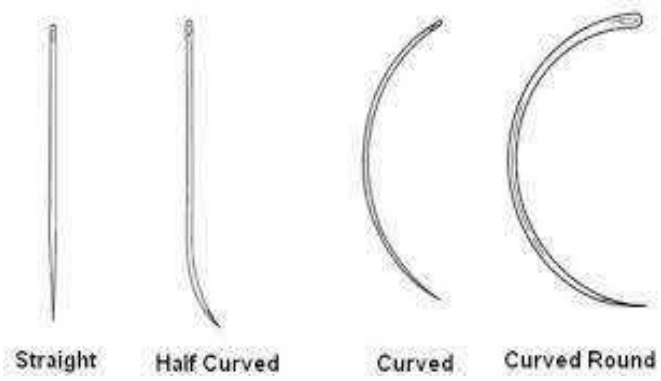
A suture needle

Shape of needle:

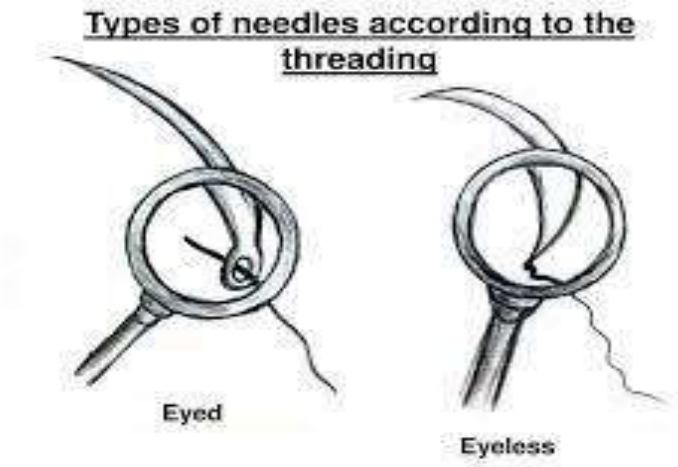


Classification of needle

- According to shape:
  1)Straight
  2)Curved

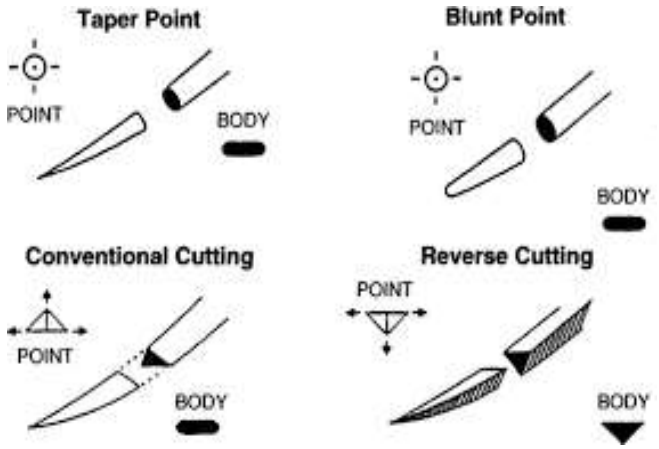


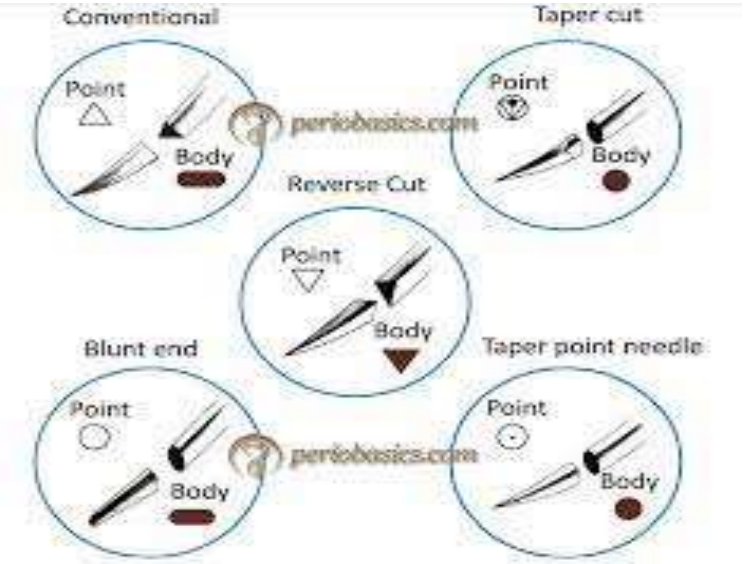
- According to eye:
  1)Eye needle/Traumatic
  2)Eyeless needle/Atraumatic



Classification of needle

- According to cutting edge:
  - 1) Round body
  - 2) Cutting body-
    - a)conventional
    - b)reverse cutting
- According to its tip
  - 1) Triangular
  - 2) Round
  - 3) Blunt





Commonly used suture materials

Polypropylene-

It is synthetic, non absorbable monofilament suture materials.

Polymer of prolypylene.

Uses:

1) General Surgery
2) Plastic Surgery
3) Cardiovascular Surgery
4) Skin Closure

Advantages- 1)Won't loose tensile strength over some time.
2) Good knot security with high plasticity.
3)Very little tissue reaction.

Disadvantage 1) Stretch when pulled
2) Loosens when edema subsides.

Commonly used suture materials

Silk-

It is natural, non absorbable multifilament suture materials.

Made from the filament spun by silkworm larva.

Uses-

1) Opthalmic surgery
2) General surgery
3) Plastic surgery

Advantages- 1) Ease of handling
2) Good knot security
3) Cost effective

Disadvantages - 1)Very reactive
2)Can’t be used in presence of infection

Commonly used suture materials

Vicryl

It is synthetic & absorbable suture material.
Monofilament/multifilament & coated/uncoated.
Available in purple colour/undyed.

Uses:

1) Intra oral suturing
2) Gut anastomoses
3) Vascular Ligature
4) Opthalmic surgery
5) Superficial soft tissue approximation of the skin & mucosa

Advantages- 1) Minimal tissue reactivity
2) Can be used in infected tissues.
3) Stronger than gut; retains strength within three weeks.

Disadvantages- 1) In case of prolong approximation can't be used.
2) Delayed absorption & increased inflammation.

Use of different sizes of sutures

ORAL : 3-0 to 5-0 absorbable

Face : 5-0 to 6-0

Scalp : 3-0 to 5-0

Chest : 3-0 to 4-0

Back : 3-0 to 4-0

Abdomen : 3-0 to 4-0

Extremities : 4-0 to 5-0

Joints : 3-0 to 4-0

Biological response to suture materials

- The early response is a generalized acute aseptic inflammation involving primary polymorphonuclear leucocytes.
- After few days mononuclear cells fibroblast & histiocytes become evident.
- Capillary formation occurs at the end of this initial phase.

Biological response to suture materials

Natural absorbable : Proteolytic degradation

Intense tissue response

Synthetic absorbable : Hydrolysis

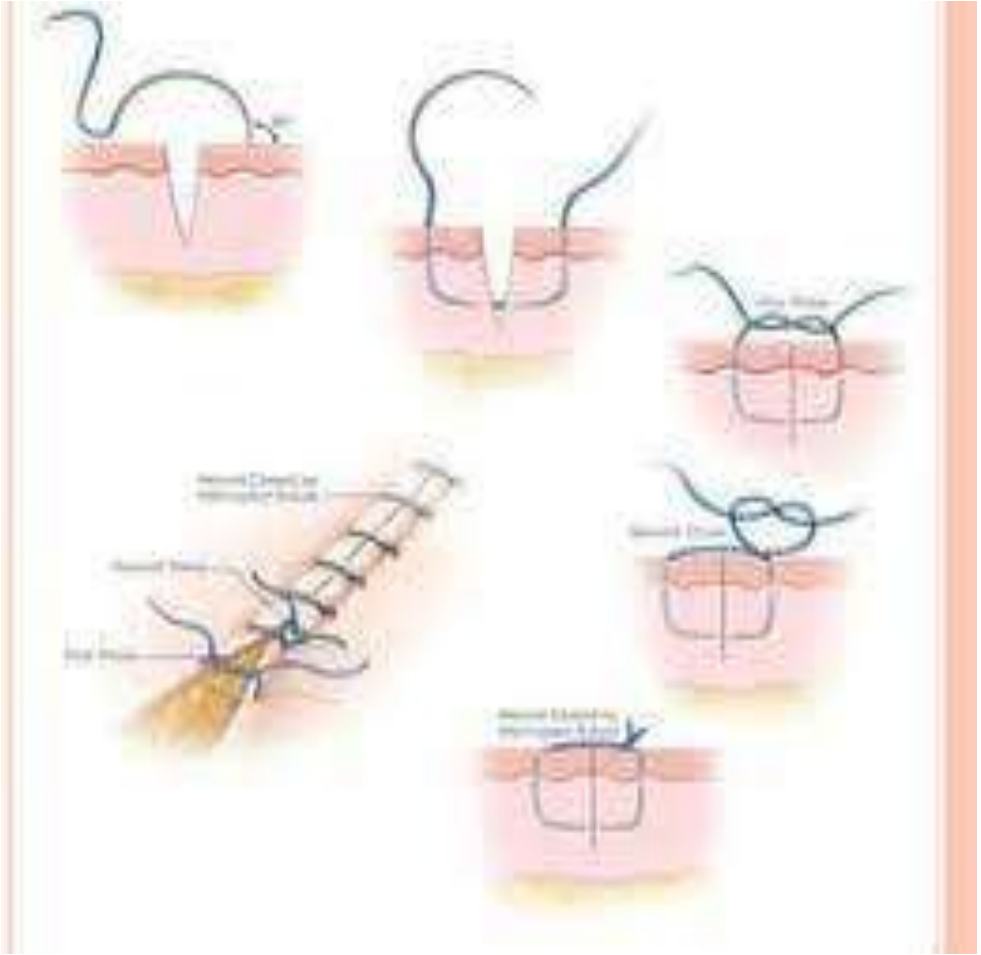
Less intense response

Non absorbable : Encapsulation

Acellular response

PRINCIPLES OF SUTURING

- The needle should be grasped at approximately 1/3rd of the distance from the eye & 2/3rd from point.
- The needle should be pierced the tissue perpendicular to its surface.
- The needle should be place at equidistant (2-3mm) from the incision line.



PRINCIPLE OF SUTURING

The depth of penetration should be equal on both the sides of incision line.

The needle always passes from-

1) The movable tissue to the fixed tissue.
2) Thinner tissue to the thicker tissue.
3) Deeper tissue to the superficial tissue.

The tissue never be closed under tension.

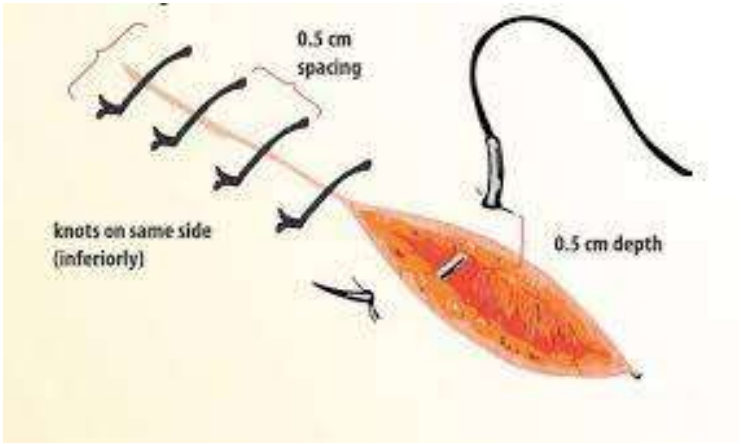
Each suture must be placed 3-4mm apart from the incision line.

SUTURING TECHNIQUES

- Interrupted suture
- Continuous suture
- Mattress suture
- Figure of 8(eight) suture
- Subcuticular suture

Interrupted suture

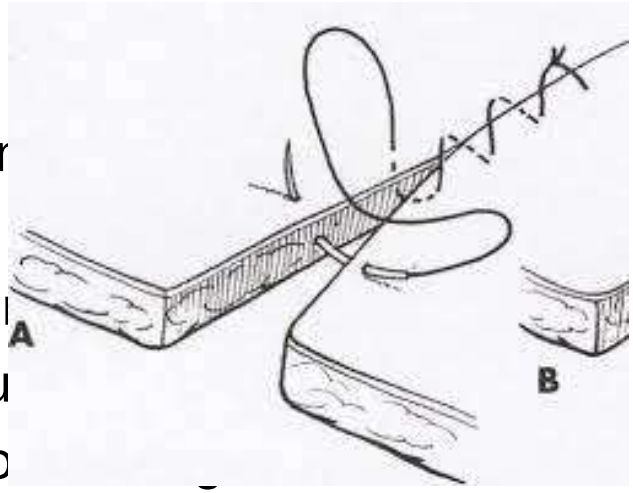
- Use-
  - Single tooth extraction
  - 3rd molar extraction
  - Biopsy
  - Dental implant



- Advantages- 1) simple
  2) Performed in urgent situations
  3) Easy to remove
- Disadvantages- 1) Failed to bring all surfaces in contact
  2) Less supportive for healing

Simple interrupted suture

Simple Continuous Suture



Uses-

Well approximated wounds with minimal tensior

Advantage- 1) Rapid technique for closure

2) Even distribution of tension ove

3) Can be used in swelled up tissu

Disadvantages- 1) Shouldn't be used in areas o

2) Not possible to free a few sutures at a time.

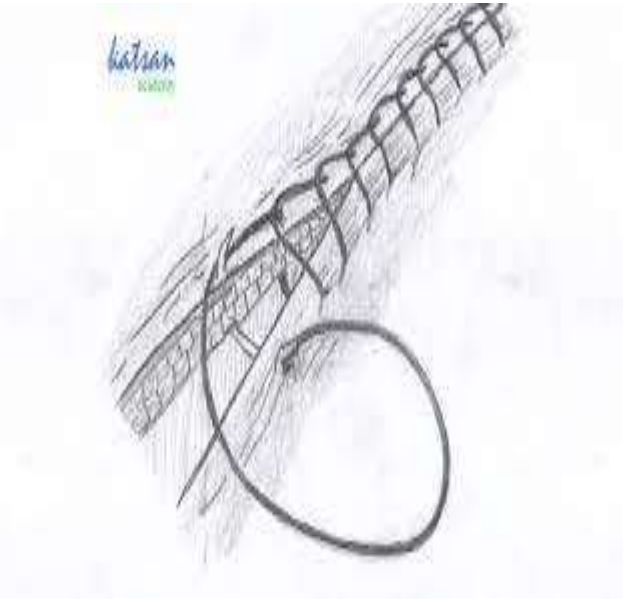
3) When one suture breaks it affects the whole closure.

Simple continuous suture

Locking Continuous Suture

Uses-

- Long edentulous area
- Tuberosites/retromola



Locking continuous suture

Mattress sutures

These suture may be-

- Horizontal
- Vertical

Horizontal mattress suture

Uses - 1) Intraoral bone grafting

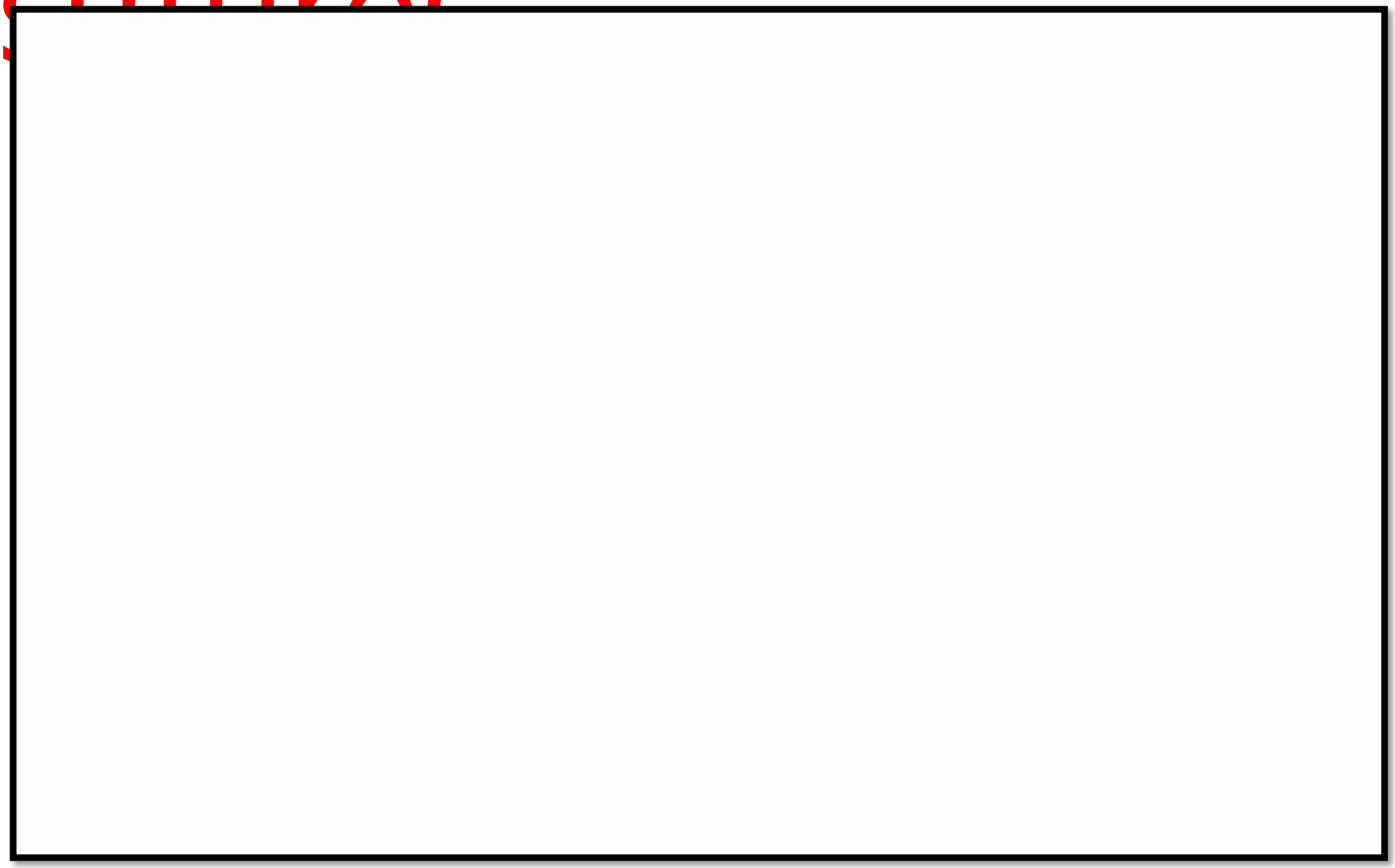
2) Closure of extraction socket

Advantage - 1) Provides a broad contact of the wound margin

2) Provides a water tight closure

Disadvantage - If improperly used bone necrosis & wound dehiscence may occur due to limited blood supply.

Horizontal mattress sutures



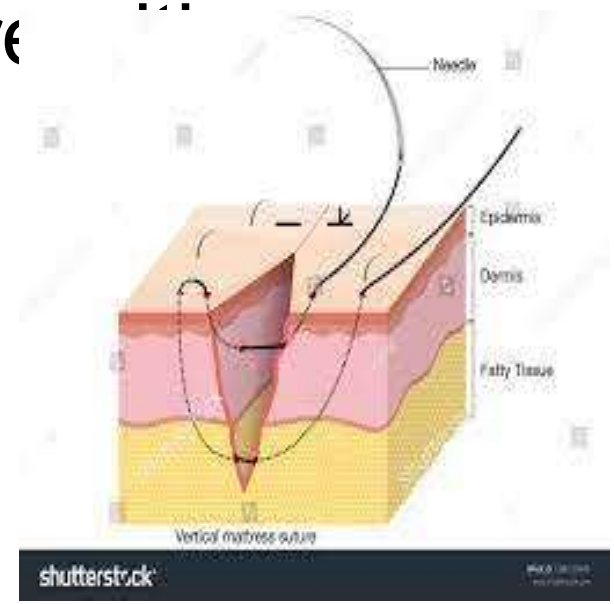
Vertical mattress sutures

Uses- Closing deep wounds abdomen or hip

Advantages : 1) Decreasing the dead space and providing increased strength.

2) Doesn't interfere [illegible] healing

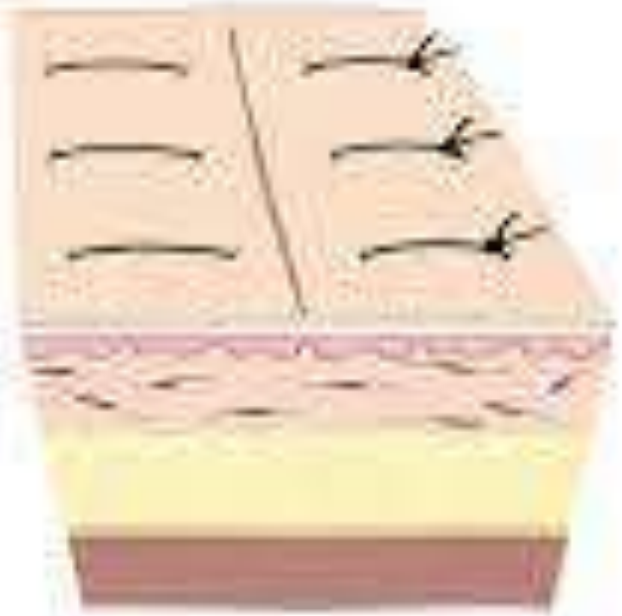
Disadvantages : Approximation



Vertical mattress suture

Wound closure
Vertical vs horizontal mattress

Vertical mattress



Horizontal mattress

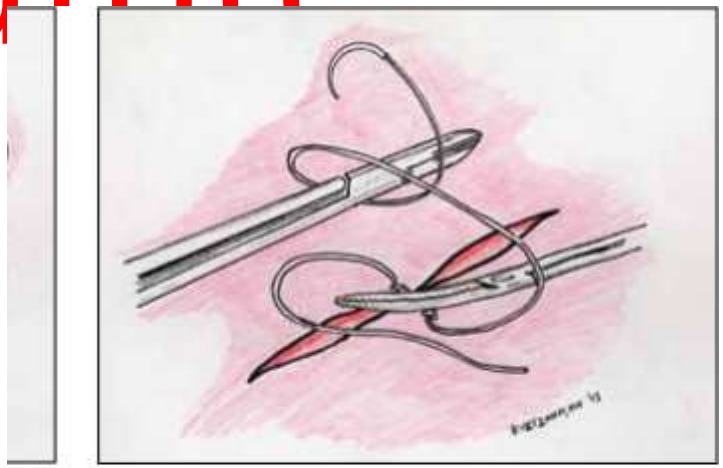
Figure of 8 (eight) suture

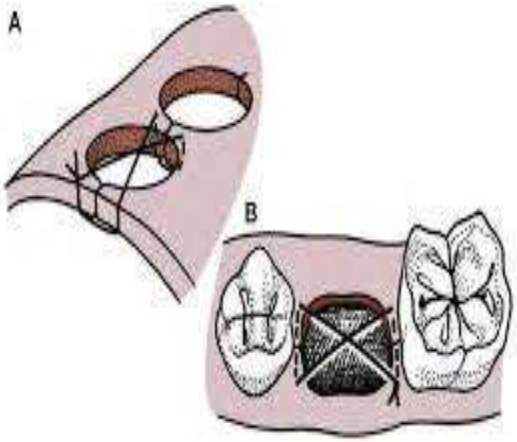
Most commonly used for extraction socket closure as well as adaptation of gingival papilla around the tooth.

Advantage- Rapid closure

Disadvantage - Due to its orientation, it is difficult to remove & it leaves a significant amount of suture threads inside the socket

Figure of 8(eight) suture





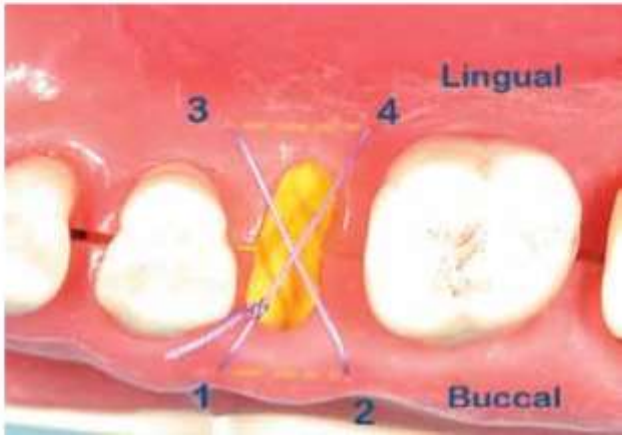
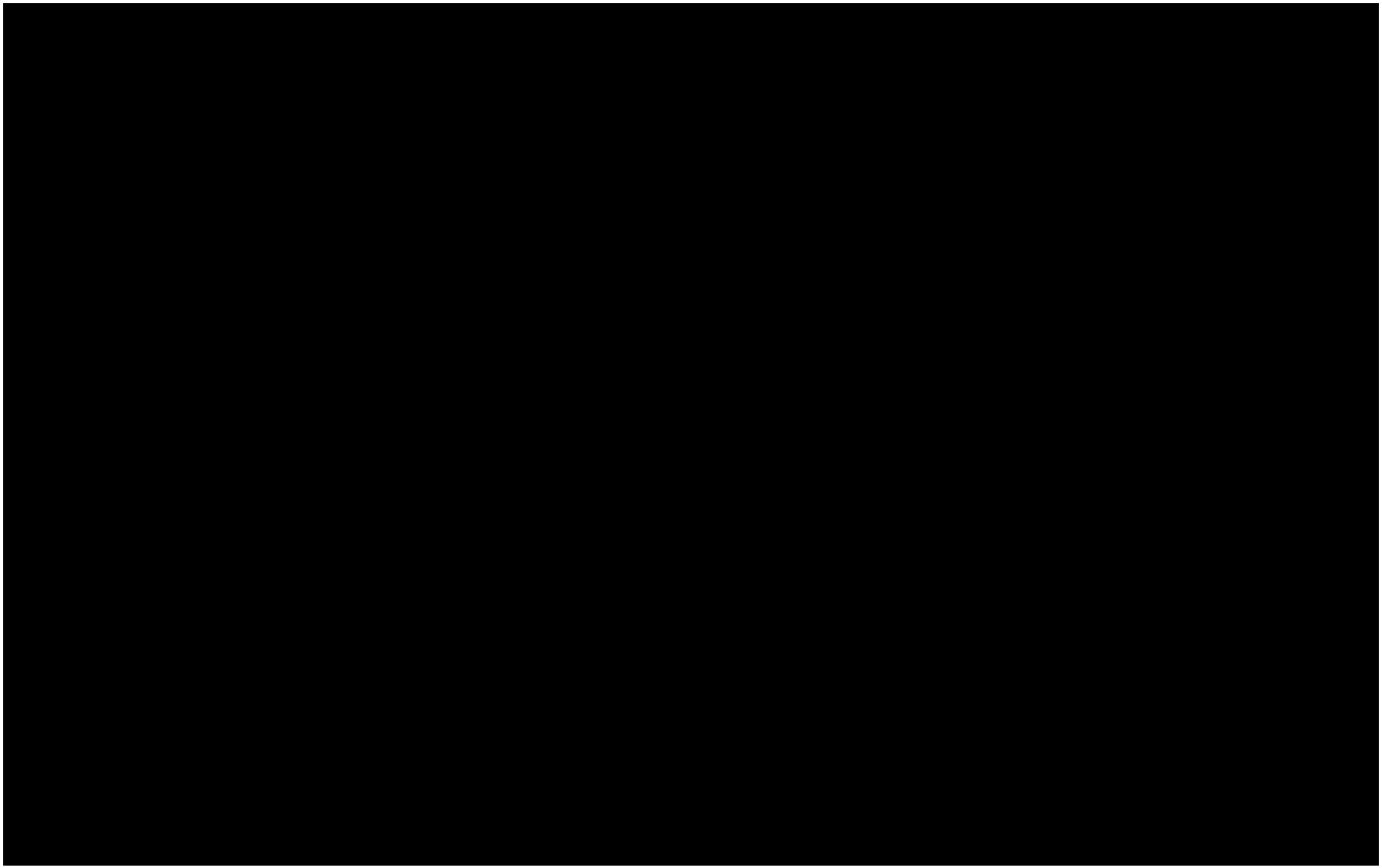


Figure of 8(eight) suture



Subcuticular suture

Usually a running stitch, but can be interrupted

Intradermal horizontal bites

Allow suture to remain for a longer period of time without development of crosshatch scaring

Uses- Simple, uncomplicated wound

Advantages- 1) Excellent cosmetic closure

2) No stitch to remove

Disadvantage- 1) Technically more difficult to master

2) Doesn’t hold in thin skin

Subcuticular suture

SURGICAL KNOTS

Components:

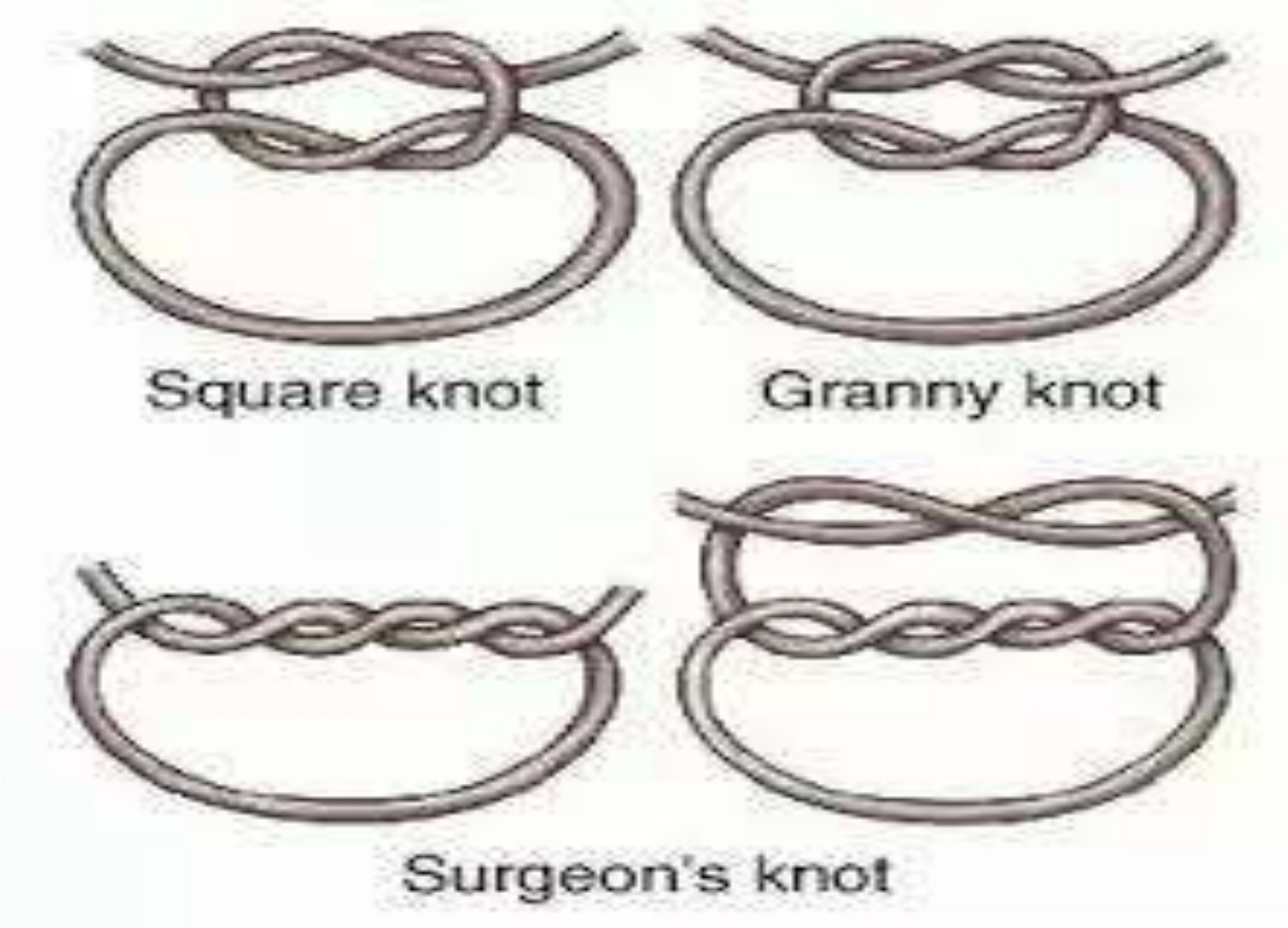
1) Loop- created by knot

2) Knot- itself which is composed of a number of tight throw

3) Ears- which are the cut ends of the suture

Different types of knot

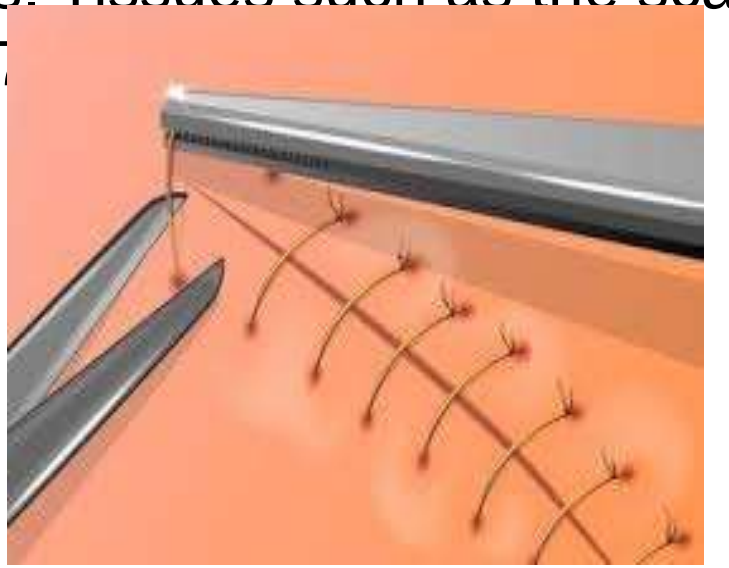
- Secure/square knot
- Surgeons knot
- Granny's knot /slip knot


Square knot
Granny knot
Surgeon's knot

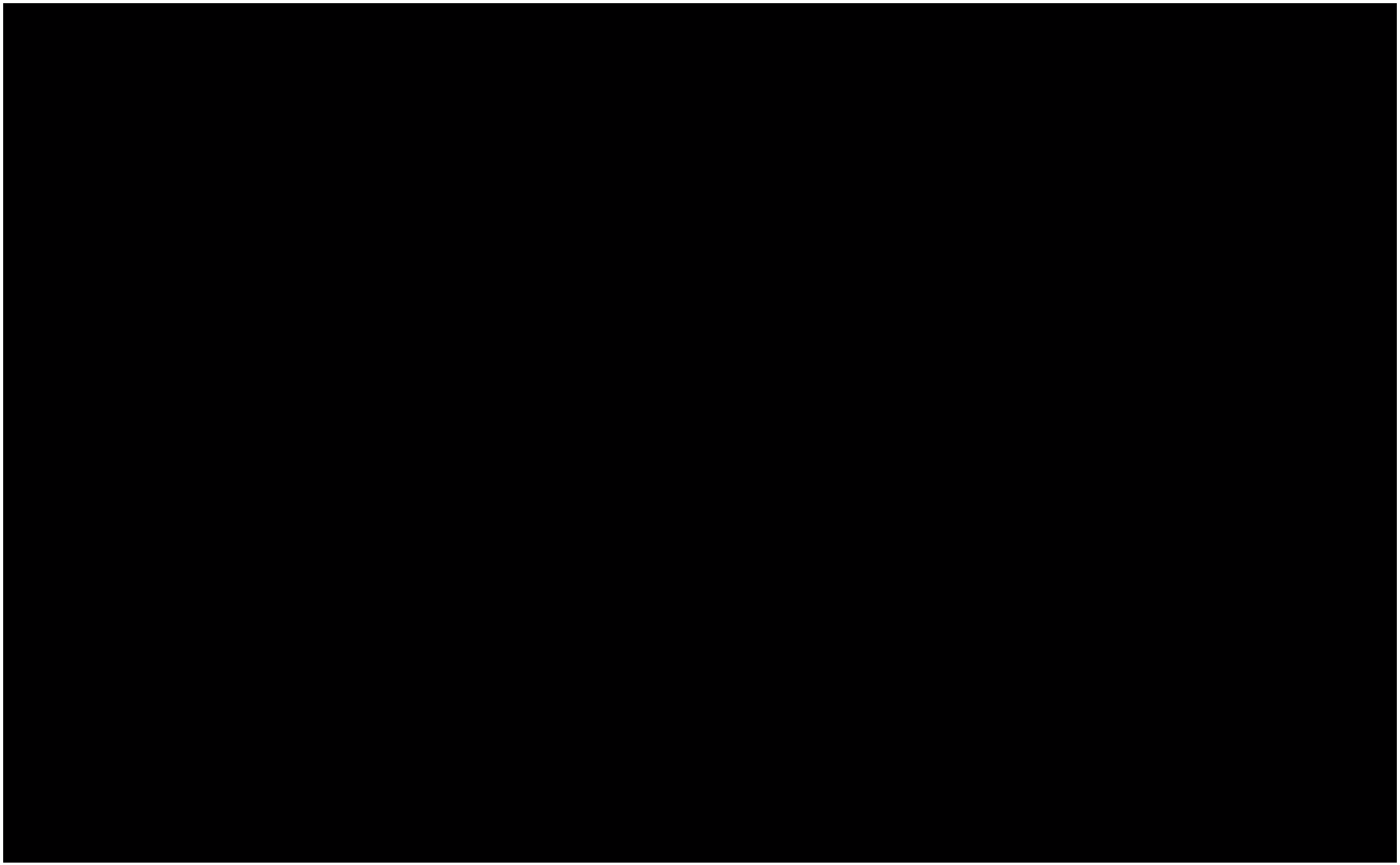
Types of knot

REMOVAL OF SUTURE

- All sutures being foreign bodies cause irritation to the tissues & hence have the potential to cause scarring
- Skin sutures are removed as soon as tissue healing allows
- Non absorbable sutures are best removed from the face after a period of 5-6 days. Tissues such as the scalp may require a longer period (7
- Face : 3-5 days
- Lip : 3-5 days
- Oral cavity : 6-8 days

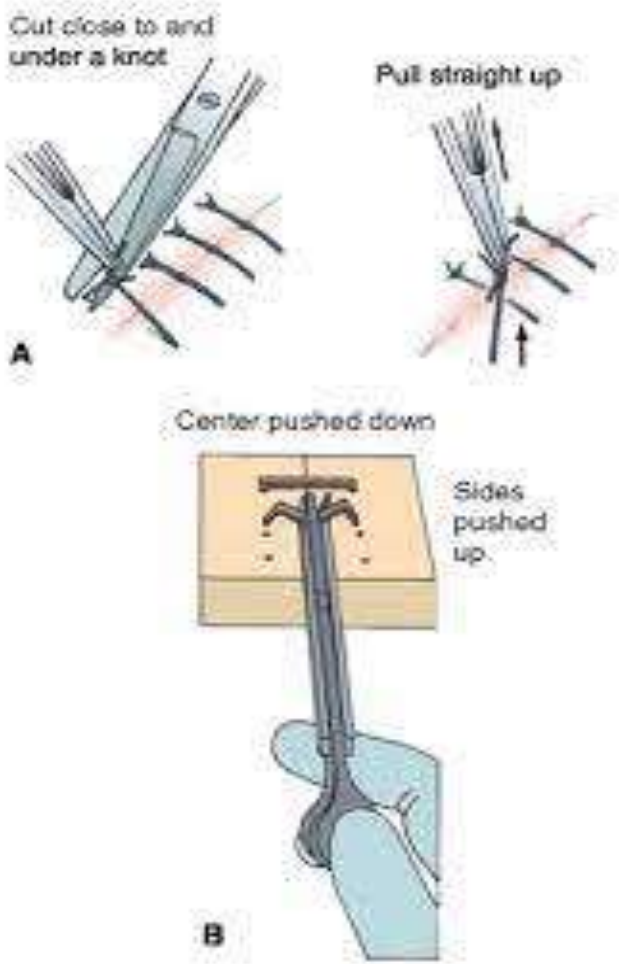


Procedure of suture removal



Reasons for failure of sutures

- Breakage
- Cuts out
- Knot slips
- Extruded suture
- Resorbs too rapidly
- Removed too early



COMPLICATIONS

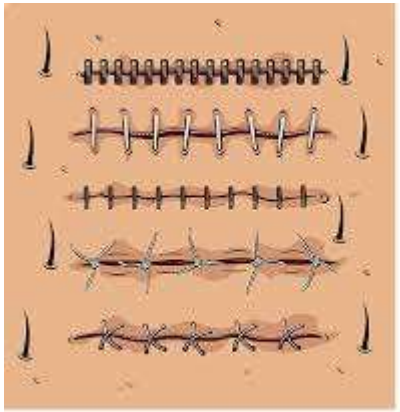
Possible complications of leaving sutures for many days

- Sutural abscess
- Scar or stitch mark
- Dermoid cyst

ALTERNATIVES TO SUTURE

Mechanical wound closing devices

- Staples
- Tissue adhesives
- Tape



Disadvantage:

- Not absolute alternative to mechanical means
- More tissue reaction

THANKYOU !!!