Sutures
INTRODUCTION

- Sutures are the materials used in operation theatre for joining the two edges of the incised surgical or other wound.
- Suture need to be strong & non irritant to skin & body tissues.
- Sutures should be of such materials that can be easily sterilized.
History

2000 B.C: using strings & animal for suturing
Hippocrates: concept of suturing

200 A.D: Gut of sheep intestine was 1st mentioned as suture material

900 A.D: 1st surgical gut (catgut) for suturing abdominal wounds by an Arabian surgeon

1500: French army surgeon developed ligation technique for traumatic war injuries

1901: catgut & Kangaroo gut were available in sterile glam tubes

Many materials used: Gold, Silver, metallic wire, silk wire, gut, silk, cotton, tendon, horsehair, linen
Qualities of a suture material

- Adequate tensile strength
- Functional strength
- Non reactivity
- Non capillary
- Flexibility & elasticity
- Easy to handle
- Knotable
- Easily sterlisable
- Uniformity
- Smooth surface
- Monofilament
- Absorbility
Tensile Strength of Sutures

- Dependent upon
  - Material
  - Size/diameter
  - Condition
    - Wet
    - Dry
    - Knotted
    - Absorption of bodily fluids
      - Hydrophobic
      - Hydrophilic
    - “Abuse”
    - Heat history – “re-autoclaving”
Ideal Suture Material

Achieve its purpose
Disappear as soon as its work was accomplished

Easy to handle
Stretched, **accommodate** wound edema & recoils to original length with wound contraction

Minimal tissue reaction & not predisposed to bacterial overgrowth

Be non-irritant

Capable of **secure Knot** without fraying or cutting
Characteristics of suture material

Physical characteristic

**Physical configuration:** mono or multifilament

**Capillarity:** ability to soak up fluid along the strand

**Fluid absorption ability**

**Diameter:** in millimeters, expressed in USP sizes with zeroes
(no. of 0s’, if increased → diameter decreased → tensile strength decreased)

**Tensile strength:** amount of weight (Breaking load) necessary to break a suture (Breaking Strength)

**Elasticity:** Inherent ability to regain original form & length after being stretched
Characteristics of suture material

- **Handling characteristics**
  - **Pliability**: the material ability to bend
  - **Coefficient of friction**: the material ability to slip through tissues & ties
  - **Knot Strength**: force necessary to cause a given type of Knot to slip, partially or completely
Characteristics of suture material

Tissue reaction characteristics:
- Inflammatory and fibrous tissue reaction
- Absorption
- Potentiation of infection
- Allergic reaction
## Classification of Sutures

<table>
<thead>
<tr>
<th></th>
<th>Monofilament</th>
<th>Multifilament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic</td>
<td></td>
<td>Biological</td>
</tr>
<tr>
<td>Absorbable</td>
<td></td>
<td>Non-Absorbable</td>
</tr>
</tbody>
</table>
Suture Material

- 3 ways of classifying suture material:
  - **Natural** or Synthetic
  - Absorbable or Non-Absorbable
  - Monofilament or Braided/Twisted

**Natural**
- Silk, linen, catgut

**Synthetic polymer**
- Polypropylene, polyester, polyamide

**Absorbable**
- Catgut, polydioxanone, polyglycolic acid
- Used for deep tissues, membranes, & subcuticular skin closure

**Non-Absorbable**
- Polyester, nylon, stainless steel
- Used for skin (removed) & some deep structures (tendons, vessels, nerve repairs – not removed)
Monofilament Suture

- Grossly appears as single strand of suture material; all fibers run parallel
- Minimal tissue trauma
- Resists harboring microorganisms
- Ties smoothly
- Requires more knots than multifilament suture
- Possesses memory
- Examples:
  - Monocryl, PDS, Prolene, Nylon
Mono-filament

- **single strand of material**
- **High** handling characteristics (passes more smoothly through tissues + tie down easily)
- **Less** tissue reaction characteristics (resist harboring organisms which may cause suture line infection)
- **Higher** chance of suture breakage
- **Lower** physical characteristics (lesser tensile strength, pliability & flexibility)
Monofilament

**Advantages**

- Smooth surface
- Less tissue trauma
- No bacterial harbours
- No capillarity

**Disadvantages**

- Handling & knotting
- Ends/knot burial
- Stretch
Multifilament Suture

- Fibers are twisted or braided together
- Greater resistance in tissue
- Provides good handling and ease of tying
- Fewer knots required
- Examples:
  - Vicryl (braided)
  - Chromic (twisted)
  - Silk (braided)
Poly-filament

- several filaments or strands twisted or braided together
- **Lower** handling characteristics
- **More** tissue reaction characteristics
- **Lower** chance of suture breakage
- **Higher** physical characteristics
Multifilament

**Advantages**

- Strength
- Soft & pliable
- Good handling
- Good knotting

**Disadvantages**

- Bacterial harbours
- Capillary action
- Tissue trauma
Synthetic Suture

• Synthetic polymers
• Do not cause intense inflammatory reaction
• Examples:
  – Vicryl
  – Monocryl
  – PDS
  – Prolene
  – Nylon
Synthetic

Advantages

• Non-Absorbables are inert
• Absorbables resemble natural substances
• Absorption by hydrolysis
• Predictable absorption
• Strength

Disadvantages

• Monofilament handling
# Biological

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling &amp; knotting</td>
<td>Tissue reactions</td>
</tr>
<tr>
<td>Economy</td>
<td></td>
</tr>
</tbody>
</table>
Absorbable

- Sutures which are broken down & eventually absorbed by either hydrolysis (Synthetic) or digested by lysosomal enzyme elicited by WBC’s (natural)

Mechanism

- Natural
  - Lysosomal enzyme: Attack & break down strands

- Synthetic
  - hydrolyzed: Water gradually penetrate suture filaments & break down suture polymer chain
Absorbable

**Advantages**

- Broken down by body
- No foreign body left

**Examples:**
- “Catgut”
- Chromic
- Vicryl
- Monocryl
- PDS

**Disadvantages**

- Consideration of wound support time
A) ABSORBABLE SUTURES

- Absorbable sutures are also known as catgut.
- A tough thin cord made from the treated and stretched intestines of certain animals, especially sheep.
- This type of suture are commonly used to suture the inner structure of the body such as:
  - Walls of the organs
  - Rectal sheath
  - Muscles
  - Subcutaneous tissue
  - Peritoneum
  - Intestinal anastomosis
1) Plain catgut

- These sutures are completely digested & absorbed by the tissue.
- Sizes of the absorbable catgut suture vary from 5/0 which is the finest to 2 which is the thickest.
- Catgut has an expensive.
- The raw product of the catgut is submucosal layer of the sheep intestine.
- When these are prepared each pieces is split longitudinally into 3 or 4 ribbons.
- All the fatty & muscle layer are scrapped off in an alkaline bath.
The strands are then dried.

After that catgut is packed in sealed container & is sterilized by cobalt irradiation.

This makes yellow colored plain catgut which is absorbed rapidly & is absorbed earlier than the chromic catgut.
2) Chromic catgut

- an absorbable sterile strand derived from the intestinal submucosa of sheep and fixed in formalin, used as a surgical ligature and suture.
- Surgical catgut that has been treated with chromium trioxide to strengthen it. It is an absorbable suture
- The chromic catgut is of brown color & is absorbed slowly.
- To chromised the catgut, it is soaked in a bath of chromic acid with frequent period of movement of 3 hours.
- The strands are then graded into size
- Then the catgut is packed & sterilized.
3) Atraumatic catgut

- It is another type which is used for ligating small blood vessels.
- Dexon (Polyglycolic acid) is also an absorbable suture synthetically prepared.
- It is available in various sizes such as 3/0 to 2.
- This suture is used as ties for small blood vessels & also for suturing peritoneum, rectal sheath etc.
Non- absorbable

material which tissue enzymes can’t dissolve, remains encapsulated when buried in tissues or removable post-op when used as skin suture

• Examples:
  – Prolene
  – Nylon
  – Stainless steel
  – Silk*

(*not a truly permanent material; known to be broken down over a prolonged period of time—years)
Nonabsorbable

• Retain majority of breaking strength for more than 60 days

• Three classes
  – Class I – silk, monofilament, and sheathed
  – Class II – cotton and linen
  – Class III – metallics

• Classes I and III most common as Class II are prone to contamination and infection
Non-Absorbable

Advantages

• Permanent wound Support

Disadvantages

• Foreign body left
• Suture removal can be costly and inconvenient
• Sinus & Extrusion if left in place
6) Non absorbable sutures

- These types of sutures are not absorbed.
- These sutures are used for closing or suturing outer surface of the body such as skin.
- These sutures are cheaper, easy to handle, easy to sterile, have smooth surfaces & knot securely with the ends cut short.
Cont..........d

- But these kind of sutures are liable to cause stitch infection & stitch sinus.
- The infection cab be arrested by only removing the stitch.
- For this reason sutures on the superficial surface of the skin should always be interrupted suture & never be continuous suture.
- Because the disadvantage of the continuous suture is when infection occurs on one site it is difficult to remove the infected stitch from the site without removing the rest of the stitch.
- While stitching, preferably all knots are to tied at the one side of the surgical wound.
Types of non absorbable sutures

a) Silk suture: these suture are non absorbent. Their sizes vary from 10/0 to 2. These are used for skin closure after abdominal operation.

b) Linen suture: these sutures are also non absorbent. Their sizes vary from 3/0 to 2. These are used for skin closure in hernia operation.
c) **Monofilament Nylon suture (Ethilon)**: These are non absorbable suture. Their sizes vary from 10/0 to 2. These sutures are used as tension sutures in hernia repair.

d) **Stainless steel wire**: These are non absorbent sutures used in areas of known infection.

- It is also used for secondary repair of disrupted wound.
- It is further used for surgery of ligament, tendons.
- It is again used for repair of cleft lip, hair lip, cleft palate, hernia operations, thoracic & orthopedic surgery.
e) Prolene – Ethifex 
mergeline: These non absorbent sutures are used for cardiovascular & plastic surgery.

f) Metal Clips: these non absorbent types of suture are of various types such as:
- Michael clips
- Trazies
- Van petz
The chemical composition of the suture determines the rate of occurrence of skin infection.

Though catgut & silk sutures have been used for centuries throughout the world, amongst the non-absorbable suture.

Silk suture causes increased infection rate.
# Suture Degradation

<table>
<thead>
<tr>
<th>Suture Material</th>
<th>Method of Degradation</th>
<th>Time to Degradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Catgut”</td>
<td>Proteolytic enzymes</td>
<td>Days</td>
</tr>
<tr>
<td>Vicryl, Monocryl</td>
<td>Hydrolysis</td>
<td>Weeks to months</td>
</tr>
<tr>
<td>PDS</td>
<td>Hydrolysis</td>
<td>Months</td>
</tr>
</tbody>
</table>
## Common Nonabsorbable Sutures

<table>
<thead>
<tr>
<th>Type</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monofilament</td>
<td>Polypropylene (Prolene* &amp; Surgilene+)</td>
</tr>
<tr>
<td></td>
<td>Nylon (Ethilon* &amp; Dermalon+)</td>
</tr>
<tr>
<td>Braided</td>
<td>Polyester (Mersilene*)</td>
</tr>
<tr>
<td></td>
<td>Silk</td>
</tr>
<tr>
<td></td>
<td>Nylon (Surgilon* &amp; Nurolon+)</td>
</tr>
<tr>
<td>Braided &amp; Coated</td>
<td>Polyester &amp; Polybuterate (Ethibond*)</td>
</tr>
<tr>
<td></td>
<td>Polyester &amp; Silicone (Tichron+)</td>
</tr>
<tr>
<td></td>
<td>Polyester &amp; Teflon (Tevdek#)</td>
</tr>
<tr>
<td></td>
<td>Silk &amp; Beeswax</td>
</tr>
<tr>
<td>Multifilament Sheathed</td>
<td>Multistrand Nylon &amp; Polyethylene Sheath (Supramid$)</td>
</tr>
</tbody>
</table>

*Ethicon Inc., +Davis & Geck Inc., #Deknatel Inc., $S. Jackson Inc.
Suture Sizes – Two Systems

• United States Pharmacopoeia (USP)
  – Complex relationship between diameter, tensile strength, and knot security
  – Precise criteria vary with suture class, natural or synthetic, and absorbability
  – Whole numbers from 5 to 12-0
  – Allows comparison among different types

• European
  – Diameter in mm
  – Differences in tensile strength of materials make comparisons difficult

• Sutures function best when their strength and tissue strength are similar.
ETHICON Sutures

**BIOLOGICAL**
- VICRYL* rapide Suture
- MONOCRYL* Suture
- Coated VICRYL* Suture
- Coated VICRYL* Plus Suture
- PDS*II Suture

**SYNTHETIC**
- MERSILK* Suture

**NON-ABSORBABLE**
- MERSILENE* Suture
- ETHIBOND* Suture
- PROLENE* Suture
- PRONOVA* Suture
- ETHILON* Suture
- NUROLON* Suture
- Stainless Steel Wire

Monofilament version VICRYL* Suture available for use in ophthamlic surgery
MERSILENE* Suture - trochanter suture is braided
<table>
<thead>
<tr>
<th>C/I</th>
<th>Color &amp; Memory</th>
<th>Knot Security</th>
<th>Handling</th>
<th>Tissue Reactivity</th>
<th>Absorption Rate</th>
<th>Tensile Strength</th>
<th>Raw Material</th>
<th>Absorbable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergy to collagen or chromium</td>
<td></td>
<td>Low</td>
<td>Poor</td>
<td>Fair</td>
<td>Mod.</td>
<td>1-2 weeks</td>
<td>Beef, Flexor Tendon</td>
<td>Collagen</td>
</tr>
<tr>
<td>Allergy to collagen or chromium</td>
<td>Yellowish brown blue dyed</td>
<td>Low</td>
<td>Poor</td>
<td>Fair</td>
<td>Mod. High</td>
<td>5-7 Weeks</td>
<td>Sheep Intestine</td>
<td>Catgut</td>
</tr>
<tr>
<td>Where extended approximate of tissues is needed</td>
<td>Undyed Violet</td>
<td>Low</td>
<td>Fair</td>
<td>Good</td>
<td>Low</td>
<td>60-90 days</td>
<td>Copolymer lactide &amp; glycolide coated with polyglactin3 70 + calcium stearate</td>
<td>Vicryl (polyglactin910)</td>
</tr>
<tr>
<td>Where extended approximate of tissues is needed</td>
<td>Undyed Violet</td>
<td>Low</td>
<td>Fair</td>
<td>Good</td>
<td>Low</td>
<td>90-120 days</td>
<td>Copolymer of glycolide &amp; epsilon caprolactone</td>
<td>Monocryl (poliglecapone25)</td>
</tr>
<tr>
<td>Where extended approximate of tissues is needed</td>
<td>Dyed green</td>
<td>Low</td>
<td>Good</td>
<td>Fair</td>
<td>Low</td>
<td>90-120 days</td>
<td>Polyglycolic acid 1st synthetic (1970)</td>
<td>Dexon (polyglycolic acid)</td>
</tr>
<tr>
<td>Heart valve prosthesis</td>
<td>Clear violet</td>
<td>High</td>
<td>Poor</td>
<td>Fair</td>
<td>Low</td>
<td>180-210 days</td>
<td>Polydioxanone</td>
<td>PDS II (polydioxanone)</td>
</tr>
<tr>
<td>C/I</td>
<td>Color &amp; Material</td>
<td>Memory</td>
<td>Knot Security</td>
<td>Handling</td>
<td>Tissue Reactivity</td>
<td>Absorption Rate</td>
<td>Tensile Strength</td>
<td>Raw Material</td>
</tr>
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<td>------------------------------------------</td>
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<td>---------------------------------------</td>
</tr>
<tr>
<td>Allergy to Silk</td>
<td>Black White</td>
<td>Poor</td>
<td>Good</td>
<td>Good</td>
<td>High</td>
<td>Gradual encapsulation by Fibrous C.T</td>
<td>Good</td>
<td>Organic protein Called Fibroin (silk)</td>
</tr>
<tr>
<td></td>
<td>Clear Black</td>
<td>High</td>
<td>Poor</td>
<td>Poor</td>
<td>Low</td>
<td>Gradual encapsulation by Fibrous C.T</td>
<td>Good</td>
<td>Long chain aliphatic polymers nylon 6</td>
</tr>
<tr>
<td>Permanent tensile strength retention needed</td>
<td>Clear Blue</td>
<td>High</td>
<td>Poor</td>
<td>Poor</td>
<td>Low</td>
<td>Nonabsorbable</td>
<td>High</td>
<td>Isotactic crystalline stereoisomer of polypropylene</td>
</tr>
<tr>
<td></td>
<td>Clear Blue</td>
<td>High</td>
<td>Poor</td>
<td>Poor</td>
<td>Low</td>
<td>Nonabsorbable</td>
<td>High</td>
<td>polybutester</td>
</tr>
<tr>
<td>Not Known</td>
<td>Clear Blue</td>
<td>Low</td>
<td>Poor</td>
<td>Fair</td>
<td>Low</td>
<td>Gradual encapsulation by Fibrous C.T</td>
<td>High</td>
<td>Polyester polyethylene terephthalate</td>
</tr>
<tr>
<td></td>
<td>Clear Dyed</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
<td>Mod.</td>
<td>Gradual encapsulation by Fibrous C.T</td>
<td>High</td>
<td>Polyester polyethylene terephthalate</td>
</tr>
<tr>
<td>Allergy to 316 L Steel</td>
<td>Silver Metallic</td>
<td>Poor</td>
<td>Good</td>
<td>Poor</td>
<td>Low</td>
<td>Nonabsorbable</td>
<td>High</td>
<td>316 L Stainless steel</td>
</tr>
</tbody>
</table>
When a wound has reached maximal strength, sutures are no longer needed.

Foreign bodies in potentially contaminated tissues may convert contamination to infection.

Where cosmetic results are important, close and prolonged apposition of wounds and avoidance of irritants will produce the best results.
PRINCIPLES OF SUTURE SELECTION

Foreign bodies in the presence of fluids containing high concentrations of crystalloids may act as a nidus for precipitation and stone formation.

Use the finest suture size that match with the natural strength of the tissue.

The composition and properties of a suture are the crucial elements in the decision of what type to use.
## SELECTING THE SUTURE MATERIAL

<table>
<thead>
<tr>
<th>Location</th>
<th>Suture Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ligatures</td>
<td>Coated VICRYL, MERSILK, NUROLOM, Catgut: 3/0-0</td>
</tr>
<tr>
<td>Skin</td>
<td>VCRL* rapide, ETHILON, Undyed MONOCRYL, PROLENE: 6/0-2/0</td>
</tr>
<tr>
<td>Subcuticular</td>
<td>Undyed MONOCRYL, Coated VICRYL, clear PDSII, PROLENE with beads &amp; collars: 4/0-2/0</td>
</tr>
<tr>
<td>Fascia under Tension</td>
<td>PROLENE, ETHILON, PDSII: 2/0-1</td>
</tr>
<tr>
<td>Muscle</td>
<td>Coated VICRYL, Dyed Monocryl, PDSII, Catgut: 3/0-2</td>
</tr>
<tr>
<td>Stomach/Bowel</td>
<td>Coated VICRYL, Dyed MONOCRYL, PDSII: 3/0-1</td>
</tr>
<tr>
<td>Tendons</td>
<td>PROLENE, ETHIBOND /EXCEL, Stainless Steel Wire, PDSII: 3/0-1</td>
</tr>
<tr>
<td>Blood Vessels</td>
<td>PROLENE, ETHIBOND EXCEL: 8/0-2/0</td>
</tr>
<tr>
<td>Oculoplastic</td>
<td>VICRYL* rapide, MONOCRYL, ETHILON, Plain Catgut: 5/0-6/0</td>
</tr>
<tr>
<td>Cornea/Scleral</td>
<td>ETHILON, Monofilament VICRYL, Monofilament MERSILENE: 11/0-9/0</td>
</tr>
<tr>
<td>Nerves</td>
<td>ETHILON: 10/0-5/0</td>
</tr>
</tbody>
</table>
Surgical Needle

- Curvature
  - Most common, general use in all tissues
    - \( \frac{1}{4} \)
    - \( \frac{3}{8} \)
    - \( \frac{1}{2} \)
    - 5/8
    - J-shaped

- Conventional Cutting Needle

- Taper Needle (smooth)
Methods of suturing

- The wound edges are brought into close proximity.
- The stitches are then applied with sufficient tightness.
- On the other hand, the stitches should not be too tight because extremely tight stitches may cause ischemia of the tissues that may lead to delayed healing.
- Also for the interrupted & continuous stitches, the distances between stitches should be equal & all the knots in the interrupted stitches are placed at the one side of the surgical wound.
When can I remove the sutures?

- Face: 3-4 days
- Scalp: 5 days
- Trunk: 7 days
- Arm or leg: 7-10 days
- Foot: 10-14 days
Suture classification

Natural
  - Absorbable
    - Collagen (plain, chromic)
    - Catgut (plain, chromic)
  - Non-Absorbable
    - Silk
    - Cotton

Synthetic
  - Absorbable
    - Maxon (polyglyconate)
    - PDS II (polydioxanone)
    - Monocryl (poliglecaprone)
  - Non-Absorbable
    - Dermalon-Ethilon-Monosof (Nylonpolyamide)
    - *prolene-Surgilene-Surgipro (Polypropylene)
    - *Novafil (Polybutester)
    - *Ethibond-Dacron-Mersilene-tocron (Polyester)
    - Stainless steel
  - Multifilament
    - Dexon (polyglycolic acid)
    - Vicryl rapide (polyglactin910)
    - Polysorb (lactomer)
New introduced sutures

- VICRYL (polyelatine- 916)
- PROLENE (Polypropylene)
- POLYSTER (ethibond)
- POLYDIXONE SUTURE

These materials have reduced the rate of infection at the suture sites.
Tissue Adhesives

Before Curing

• Sterilizable
• Easy in preparation
• Viscous liquid or liquid possible for spray
• Nontoxic
• Rapidly curable under wet physiological conditions (pH 7.3, 37°C, 1 atm)
• Reasonable cost

After Curing

• Strongly bondable to tissues
• Biostable union until wound healing
• Tough and pliable
• Resorbable after wound healing
• Nontoxic
• Nonobstructive to wound healing or promoting wound healing
Natural Tissue – Fibrin Glue

- First reported in 1940
- Mimics blood clot – major component fibrin network
- Excellent tissue adhesive but insufficient in amount for larger wounds
- Nontoxic if human protein sources are used to obtain fibrin
Synthetic Systems: Poly-Alkyl-2-Cyanoacrylates

- Discovered in 1951
- “Crazy Glue”
- \( H_2C=C—CO_2—R \)
  - \( R = \text{alkyl group} \)
    - \( \text{CH}_3 \) (methyl)
    - \( \text{H}_3\text{CCH}_2 \) (ethyl)
- Release small amount of formaldehyde when curing
  - amount lessens with length of alkyl chain
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Fibrin Glue</th>
<th>Cyanoacrylate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
<tr>
<td>Set time</td>
<td>Medium</td>
<td>Short</td>
</tr>
<tr>
<td>Tissue bonding</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Pliability</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
<tr>
<td>Toxicity</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Resorbability</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Cell infiltration</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
</tbody>
</table>
Other Experimental Systems

• Gelatin-based adhesives
  – Mimic coagulation but without fibrin

• Polyurethane (-HNOCO-) based adhesives
  – Capped with isocyanate to rapidly gel upon exposure to water
  – More flexible than current cyanoacrylate adhesives

• Collagen-based adhesives
Wound Closure

• Basic suturing techniques:
  – Simple sutures
  – Mattress sutures
  – Subcuticular sutures

• Goal: “approximate, not strangulate”
Simple Sutures

• Simple interrupted stitch
  – Single stitches, individually knotted (keep all knots on one side of wound)
  – Used for uncomplicated laceration repair and wound closure
Mattress Sutures

• Horizontal mattress stitch
  – Provides added strength in fascial closure; also used in calloused skin (e.g. palms and soles)
  – Two-step stitch:
    • Simple stitch made
    • Needle reversed and 2nd simple stitch made adjacent to first (same size bite as first stitch)
Mattress Sutures

• Vertical mattress stitch
  – Affords precise approximation of skin edges with eversion
  – Two-step stitch:
    • Simple stitch made – “far, far” relative to wound edge (large bite)
    • Needle reversed and 2nd simple stitch made inside first – “near, near” (small bite)
Subcuticular Sutures

- 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 scarring
Steri-strips

- Sterile adhesive tapes
- Available in different widths
- Frequently used with subcuticular sutures
- Used following staple or suture removal
- Can be used for delayed closure
Staples

- Rapid closure of wound
- Easy to apply
- Evert tissue when placed properly
Two-Hand Square Knot

- Easiest and most reliable
- Used to tie most suture materials

(click image to start video)
Instrument Tie

- Useful when one or both ends of suture material are short
- Commonly used technique for laceration repair

(click image to start video)