

SUTURES MATERIAL

Dr. Nahed Khalaf

Consultant OB&GYN

AL-Hada Military Hospital

Taif- Saudi Arabia

Suture

A **thread** that either **approximates** and **maintains** tissues until the natural healing process has provided a sufficient level of wound strength or **compresses** blood vessels in order to stop bleeding.

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

History

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

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

Many materials used: Gold, Silver, metallic wire, silk wire, gut, silk, cotton, tendon, horsehair, linen

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

Memory: capacity to return to its former shape after being reformed, such as when tied ; high memory yield less Knot security

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

Potentialiation of infection

Allergic reaction

Classification of sutures

According to Absorption properties:

Absorbable

Non-absorbable

Absorbable

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

❑ Mechanism

❑ Natural
strands


Lysosomal enzyme



Attack & break Down

❑ Synthetic

Hydrolyzed



suture filaments & break down suture polymer chain

water gradually penetrate

Non-absorbable

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

Classification of sutures

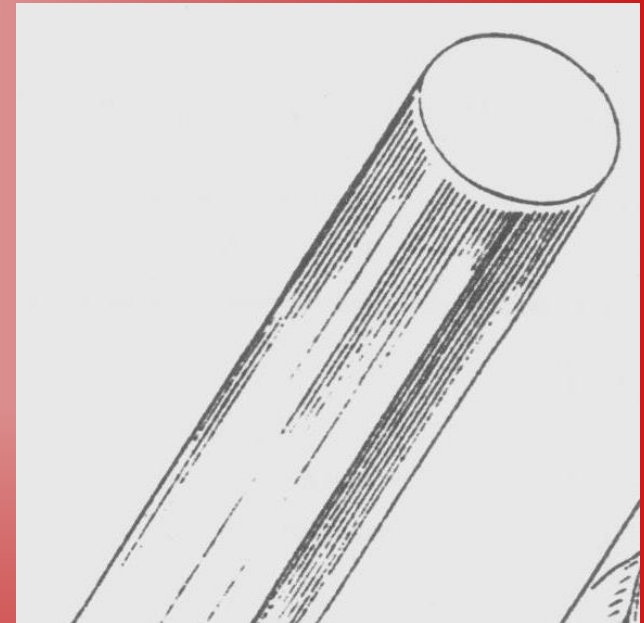
According to number of strands

Poly-filament

Mono-filament

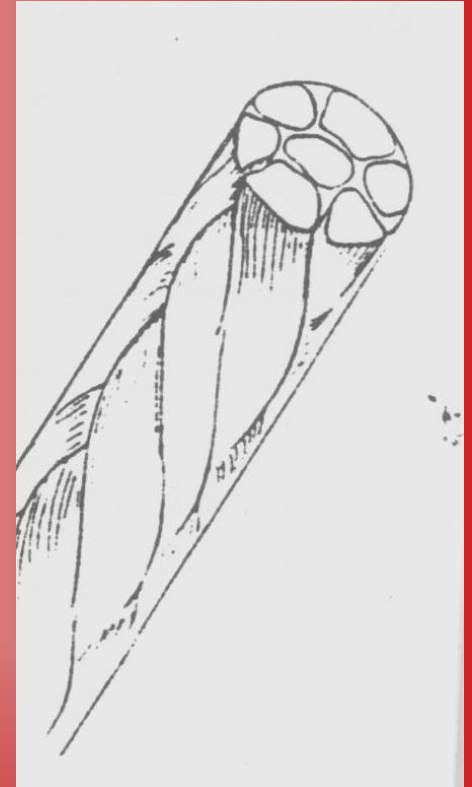
Mono-filament

- *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)



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



<i>Absorbable</i>	<i>Raw Material</i>	<i>Tensile Strength</i>	<i>Absorption Rate</i>	<i>TissReactivity</i>	<i>Handling</i>	<i>Knot Security</i>	<i>Memory</i>	<i>Colors</i>	<i>Cl?</i>
<i>Collagen</i>	<i>Beef Flexor Tendon</i>	<i>0 % 7-10 days</i>	<i>1-2 weeks</i>	<i>Mod.</i>	<i>Fair</i>	<i>Poor</i>	<i>Low</i>	<i>-</i>	<i>Allergy to collagen or chromium</i>
<i>Catgut</i>	<i>Sheep Intestine</i>	<i>0% at 7- 10 days</i>	<i>5-7 Weeks</i>	<i>Mod. High</i>	<i>Fair</i>	<i>Poor</i>	<i>Low</i>	<i>Yellowish brown blue dyed</i>	<i>Allergy to collagen or chromium</i>
<i>Vicryl (polyglactin910)</i>	<i>Copolymer lactide & glycolide coated with polyglactin370 + calcium stearate</i>	<i>50% at 2-3 weeks</i>	<i>60-90 days</i>	<i>Low</i>	<i>Good</i>	<i>Fair</i>	<i>Low</i>	<i>Undyed Violet</i>	<i>Where extended approximate of tissues is needed</i>
<i>Monocryl (poliglecapone25)</i>	<i>Copolymer of glycolide & epslim-caprolactone</i>	<i>50% at 1wk. 20-30% at 2wk. lost at 3wk.</i>	<i>90-120 days</i>	<i>Low</i>	<i>Good</i>	<i>Fair</i>	<i>Low</i>	<i>Undyed</i>	<i>Where extended approximate of tissues is needed</i>
<i>Dexon (polyglycolic acid)</i>	<i>Polyglycolic acid 1st synthetic (1970)</i>	<i>50% at 2-3 weeks</i>	<i>90-120 days</i>	<i>Low</i>	<i>Fair</i>	<i>Good</i>	<i>Low</i>	<i>Dyed green</i>	<i>Where extended approximate of tissues is needed</i>
<i>PDS II (polydioxanone)</i>	<i>Polydioxanone</i>	<i>70% at 2wks 50% at 4wks 25% at 6wks</i>	<i>180-210 days</i>	<i>Low</i>	<i>Fair</i>	<i>Poor</i>	<i>High</i>	<i>Clear violet</i>	<i>Heart valve prosthesis</i>

<i>Non-Absorbable</i>	<i>Raw Material</i>	<i>Tensile Strength</i>	<i>Absorption Rate</i>	<i>Tissue Reactivity</i>	<i>Handling</i>	<i>Knot Security</i>	<i>Memory</i>	<i>Color & Material</i>	<i>C19</i>
<i>Silk</i>	<i>Organic protein Called Fibroin (silk)</i>	<i>Good</i>	<i>Gradual encapsulation by Fibrous C. 7</i>	<i>High</i>	<i>Good</i>	<i>Good</i>	<i>Poor</i>	<i>Black White</i>	<i>Allergy to Silk</i>
<i>Dermalon Ethilon Monosof (nylon)</i>	<i>Long chain aliphatic polymers nylon 6</i>	<i>Good</i>	<i>Gradual encapsulation by Fibrous C. 7</i>	<i>Low</i>	<i>Poor</i>	<i>Poor</i>	<i>High</i>	<i>Clear Black</i>	<i>Permanent tensile strength retention needed</i>
<i>Prolene-Surgilene Surgipro</i>	<i>Isotactic crystalline stereoisomer of polypropylene</i>	<i>High</i>	<i>Nonabsorbable</i>	<i>Low</i>	<i>Poor</i>	<i>Poor</i>	<i>High</i>	<i>Clear Blue</i>	<i>Not Known</i>
<i>Novafil</i>	<i>polybutester</i>	<i>High</i>	<i>Gradual encapsulation by Fibrous C. 7</i>	<i>Low</i>	<i>Fair</i>	<i>Poor</i>	<i>Low</i>	<i>Clear Blue</i>	<i>Not Known</i>
<i>Ethibond Mersilene Dacron Vicron</i>	<i>Polyester polyethylene terephthalate</i>	<i>High</i>	<i>Gradual encapsulation by Fibrous C. 7</i>	<i>Mod.</i>	<i>Good</i>	<i>Good</i>	<i>Fair</i>	<i>Clear Dyed</i>	<i>Not Known</i>
<i>Stainless steel suture</i>	<i>316 L Stainless steel</i>	<i>High</i>	<i>Nonabsorbable</i>	<i>Low</i>	<i>Poor</i>	<i>Good</i>	<i>Poor</i>	<i>Silver Metallic</i>	<i>Allergy to 316 L Steel</i>

PRINCIPLES OF SUTURE SELECTION

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

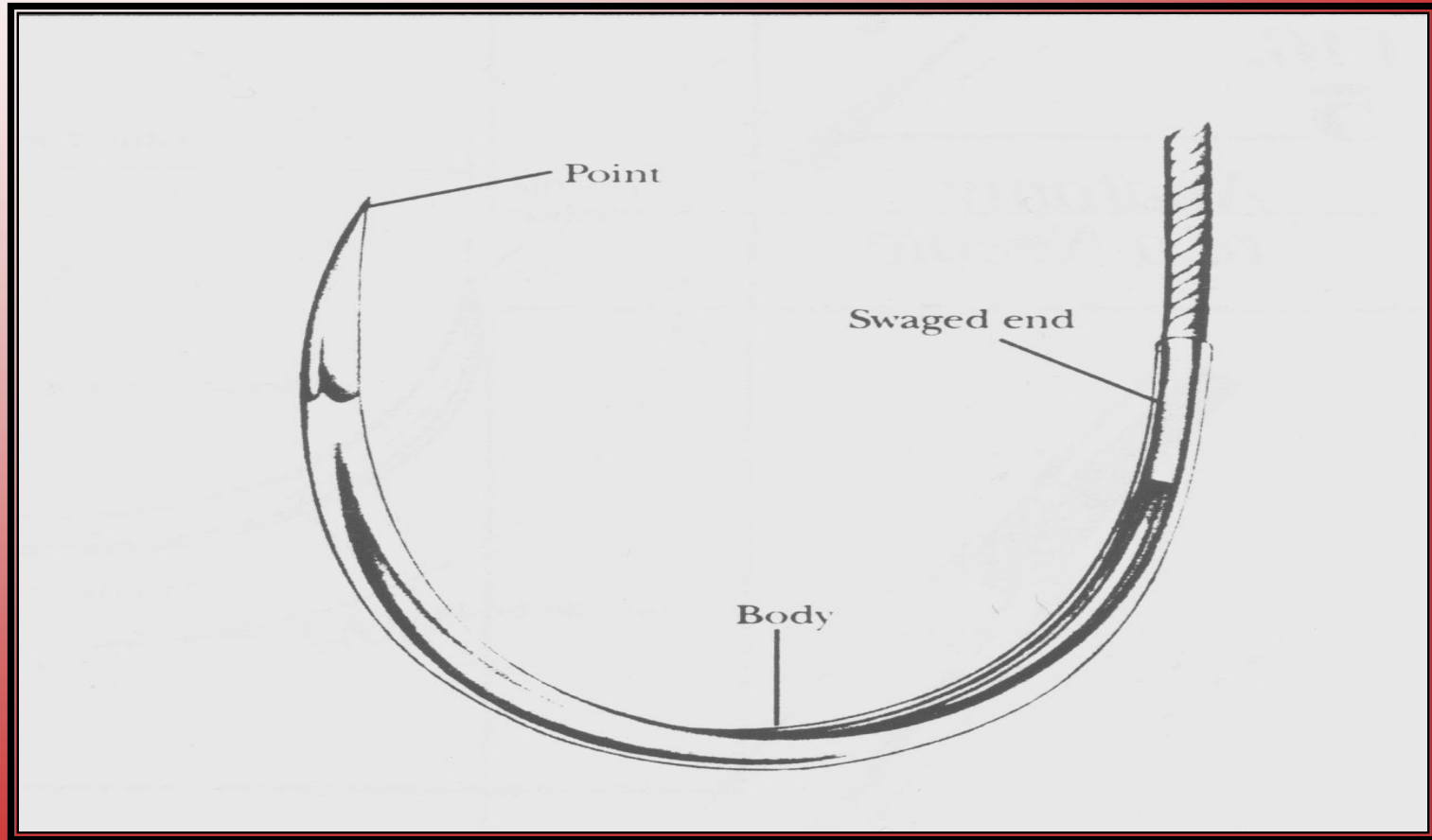
SELECTING THE SUTURE MATERIAL

<i>Ligatures</i>	<i>Coated VICRYL, MERSILEX, MUROLON, Catgut: 3/0-0</i>
<i>Skin</i>	<i>VICRYL* rapide, ETHILON, Undyed MONOCRYL, PROLENE: 6/0-2/0</i>
<i>Subcuticular</i>	<i>Undyed MONOCRYL, Coated VICRYL, clear PDSII, PROLENE with beads & collars: 4/0-2/0</i>
<i>Fascia under Tension</i>	<i>PROLENE, ETHILON, PDSII: 2/0-1</i>
<i>Muscle</i>	<i>Coated VICRYL, Dyed Monocryl, PDSII, Catgut:: 3/0-2</i>
<i>Stomach/Bowel</i>	<i>Coated VICRYL, Dyed MONOCRYL, PDSII: 3/0-1</i>
<i>Tendons</i>	<i>PROLENE, ETHIBOND EXCEL, Stainless Steel Wire, PDSII: 3/0-1</i>
<i>Blood Vessels</i>	<i>PROLENE, ETHIBOND EXCEL: 8/0-2/0</i>
<i>Oculoplastic</i>	<i>VICRYL* rapide, MONOCRYL, ETHILON, Plain Catgut: 5/0-6/0</i>
<i>Cornea/Sclereal</i>	<i>ETHILON, Monofilament VICRYL, Monofilament MERSILENE: 11/0-9/0</i>
<i>Nerves</i>	<i>ETHILON: 10/0-5/0</i>

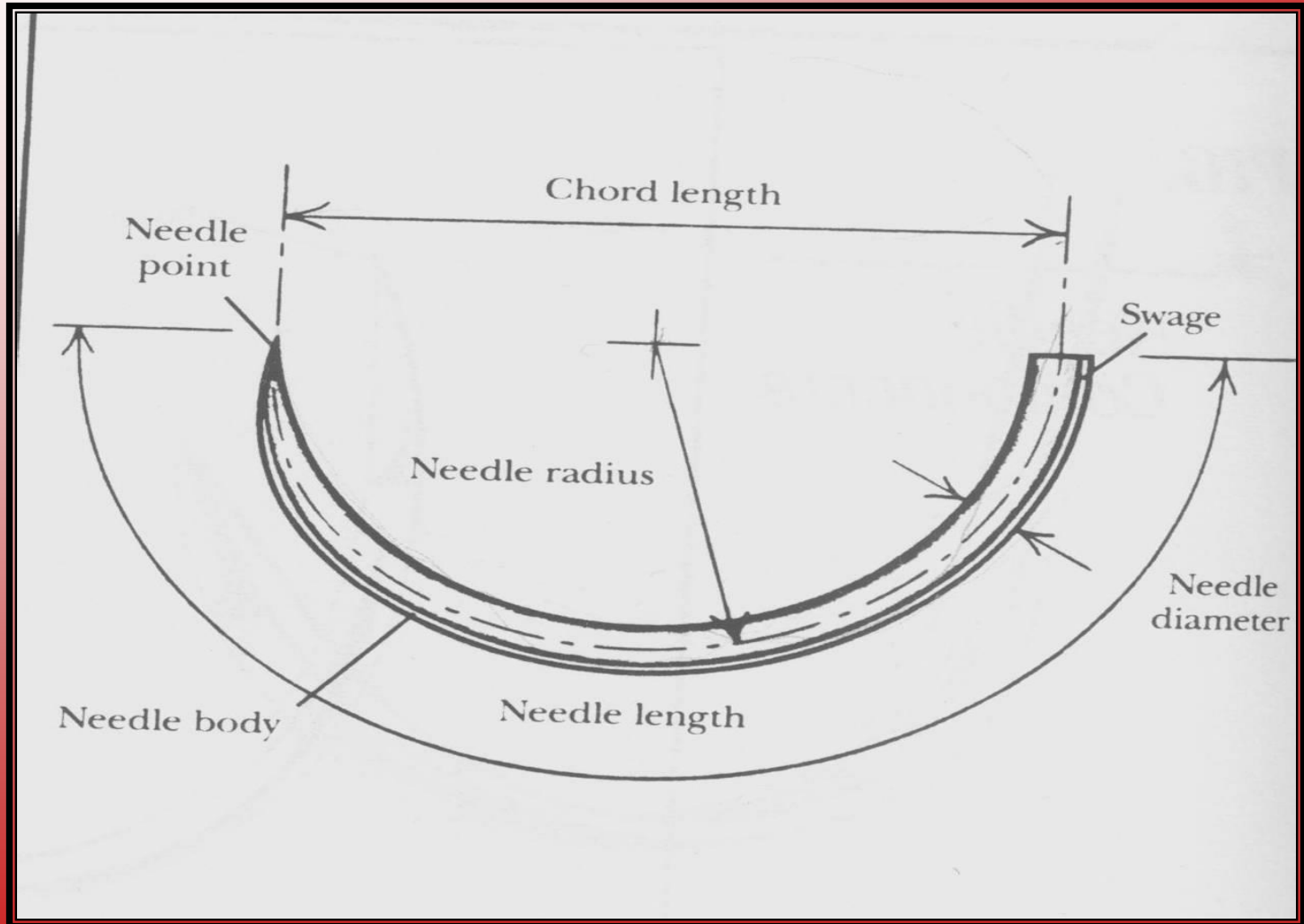
Surgical Needle

variation in needle geometries are just as important as variation in suture sizes & that needle dimensions must be compatible with suture sizes, allowing the two to work in tandem “

Needle Anatomy



Needle Anatomy

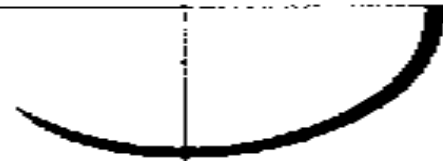


Type of needle

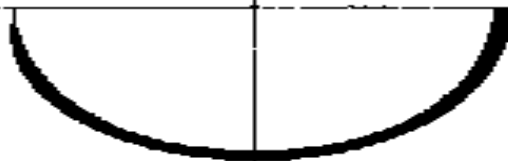
$\frac{1}{4}$ Circle



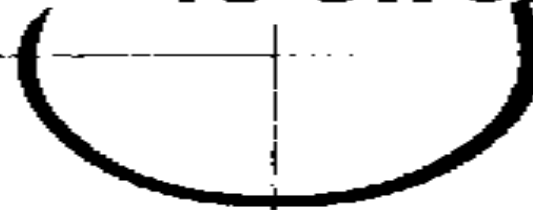
$\frac{3}{8}$ Circle



$\frac{1}{2}$ Circle



$\frac{5}{8}$ Circle



$\frac{1}{2}$ Curve



Straight



Needle Attachment End

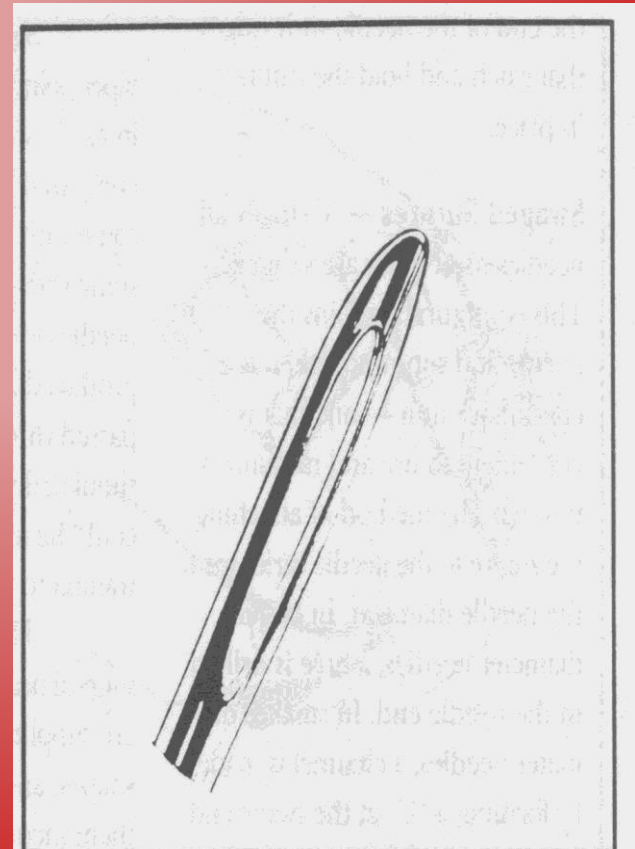
Eyed needle →

Needle threaded with the
suture strand

2 strands should be passed to
tissues

more penetration

more tissue disruption



Needle Attachment End

Swaged (atraumatic)

Handling & preparation are minimized, this maintains the integrity of suture strand

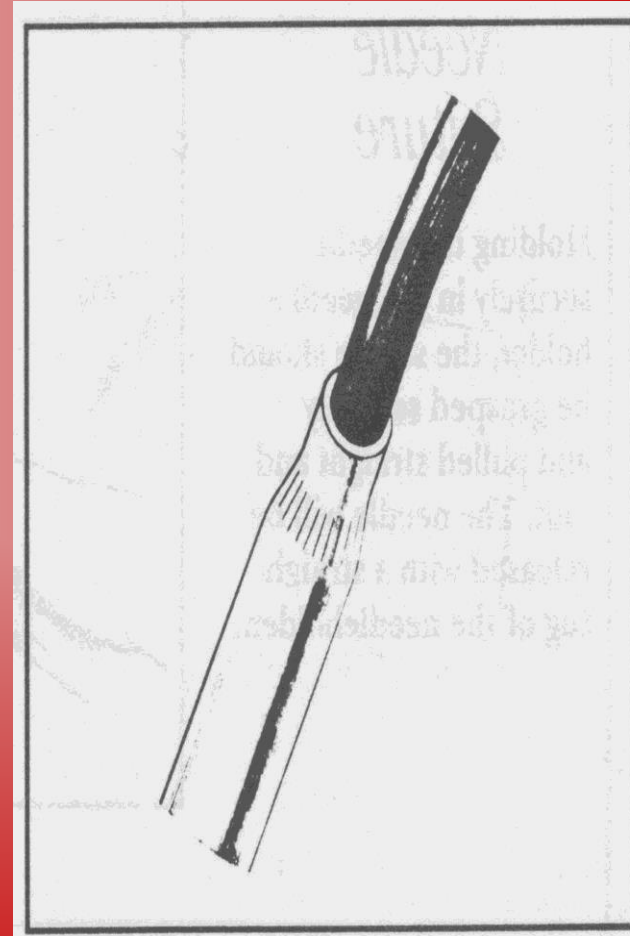
Minimal tissue trauma

Do not unthread prematurely

If a needle is accidentally dropped into cavity, the attached suture strand make it easier to find

Inventory & time spent cleaning, sharpening & sterilizing reusable eyed needles is eliminated

It eliminates suture fraying or damage due to sharp corners in the eye of eyed needle



Needle Point

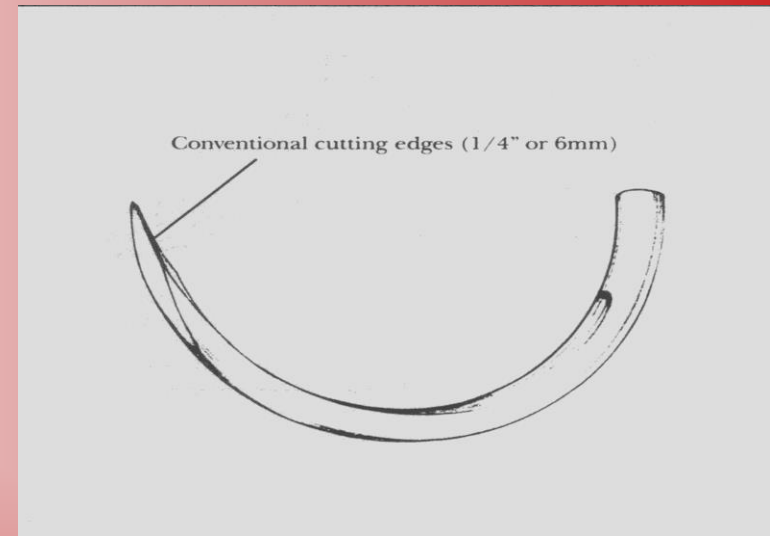
Cutting Needles

Conventional cutting needle:

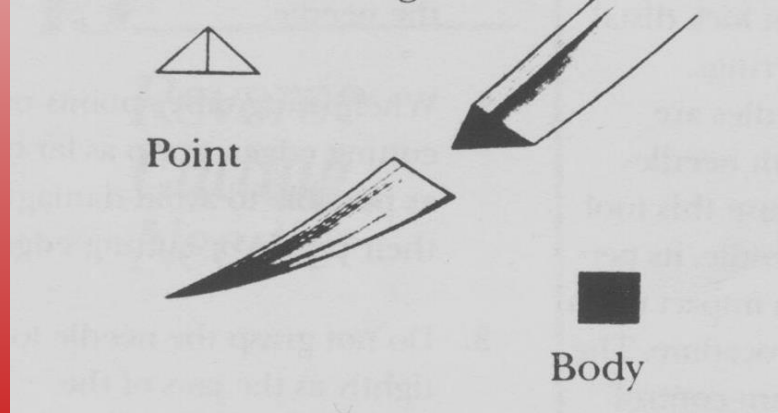
Narrow point, fine wire diameter,
fine taper ratio → superior
penetration of soft tissues

Inside/outside curvatures of body
flattens in the grasping area
→ great stability in the
needle holder

reduces flattened sides bending



Conventional Cutting

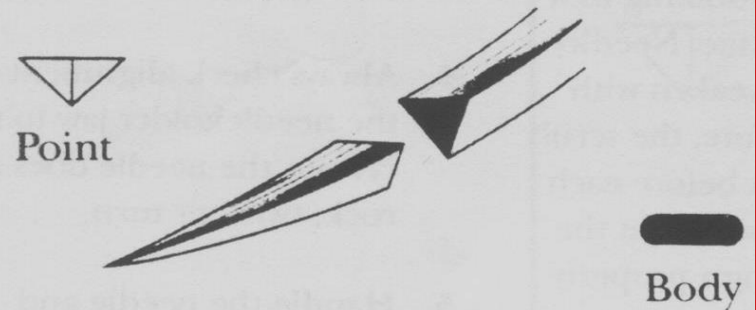


- **Reverse cutting needle:**

- A skin, tendons, ligaments, oral, nasal, pharynx needle
- more strength than similar sized conventional cutting
- the danger of tissue cut out is greatly reduced
- The hole left by the needle leaves a wide wall of tissue against which the suture is to be tied



Reverse Cutting

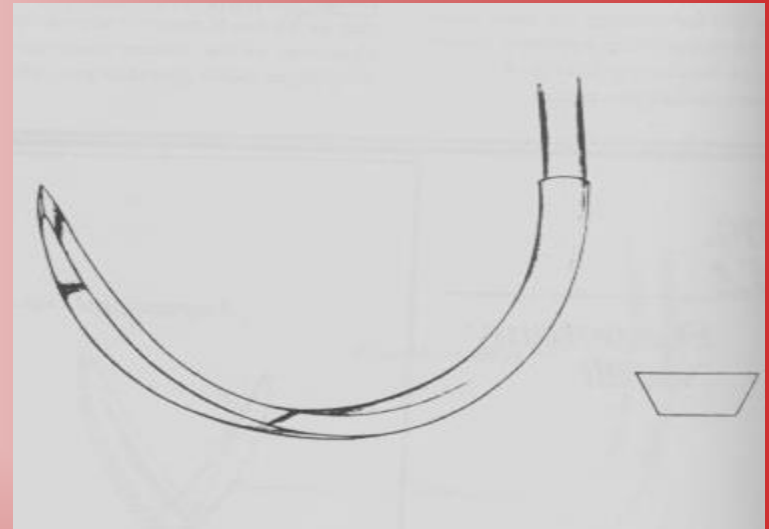


Side cutting (spatula):

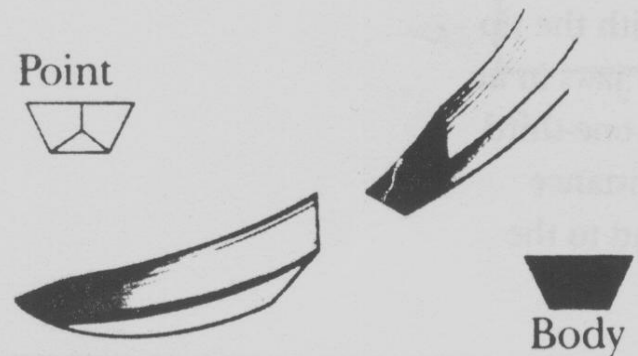
For ophthalmic procedures

It separated or splits
through the thin layers of
scleral or corneal tissue
& travel within the plane
below them

Maximum ease of
penetration + greater
control of needle



Side-cutting Spatula

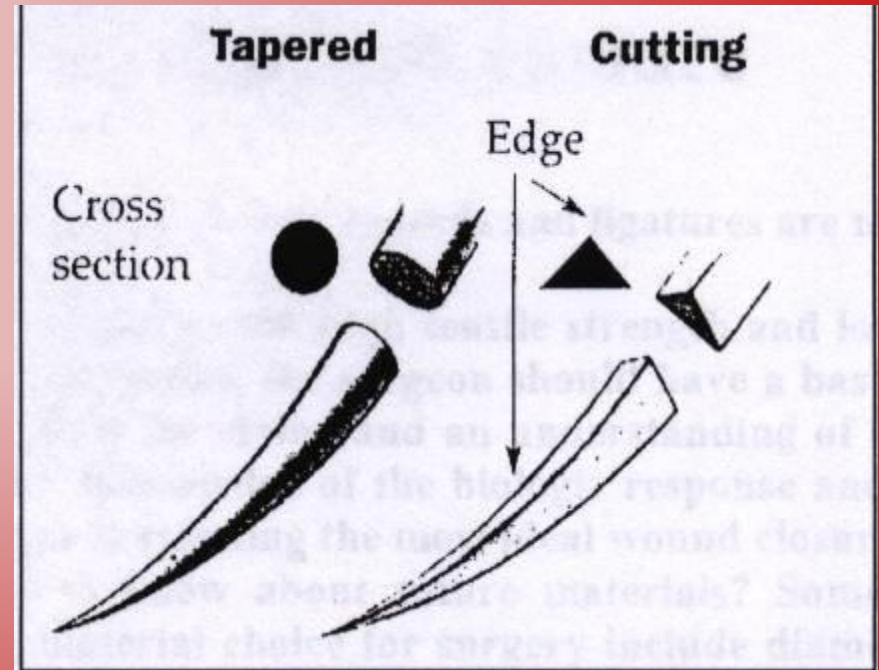


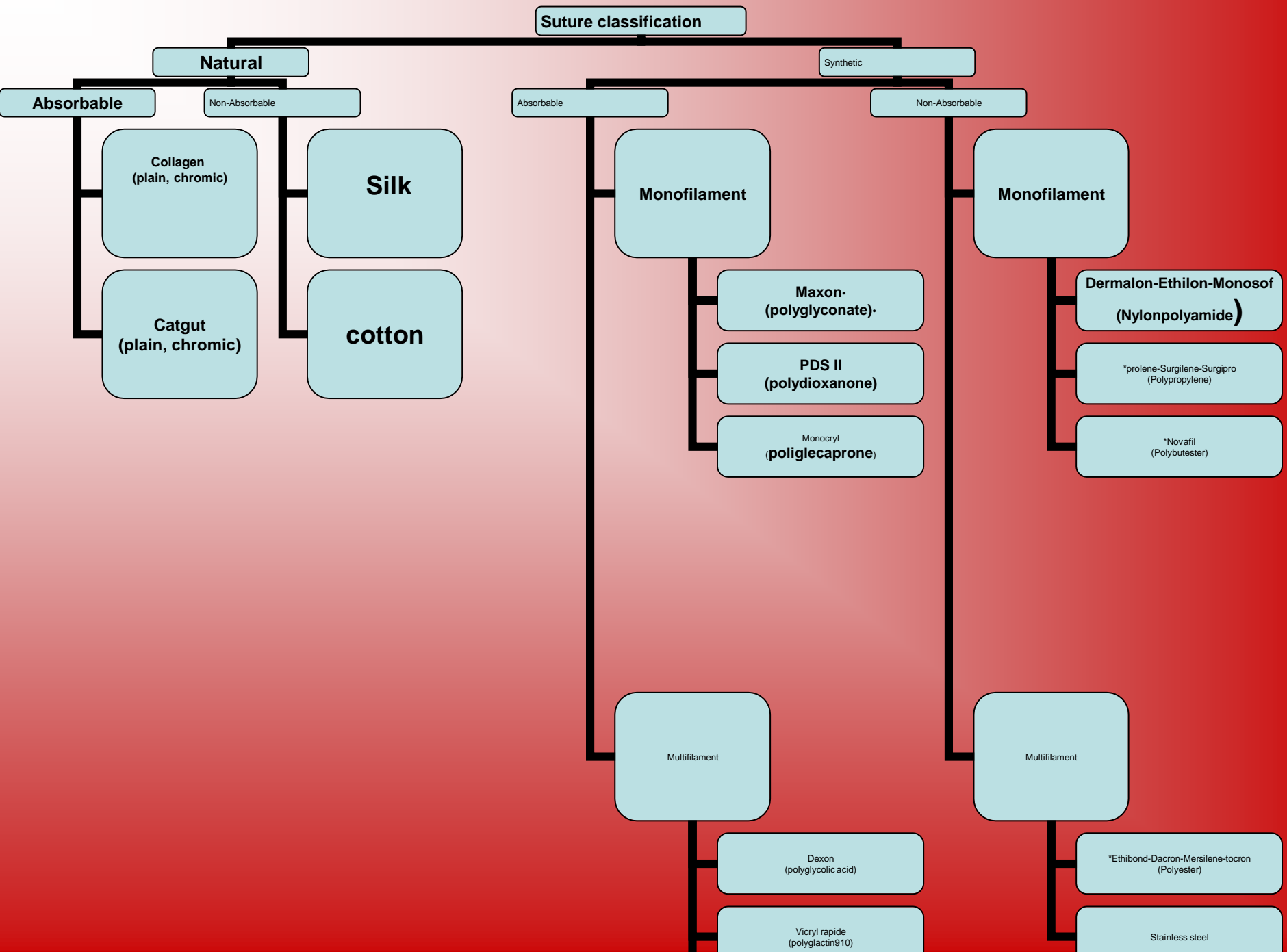
Blunt Point Needle

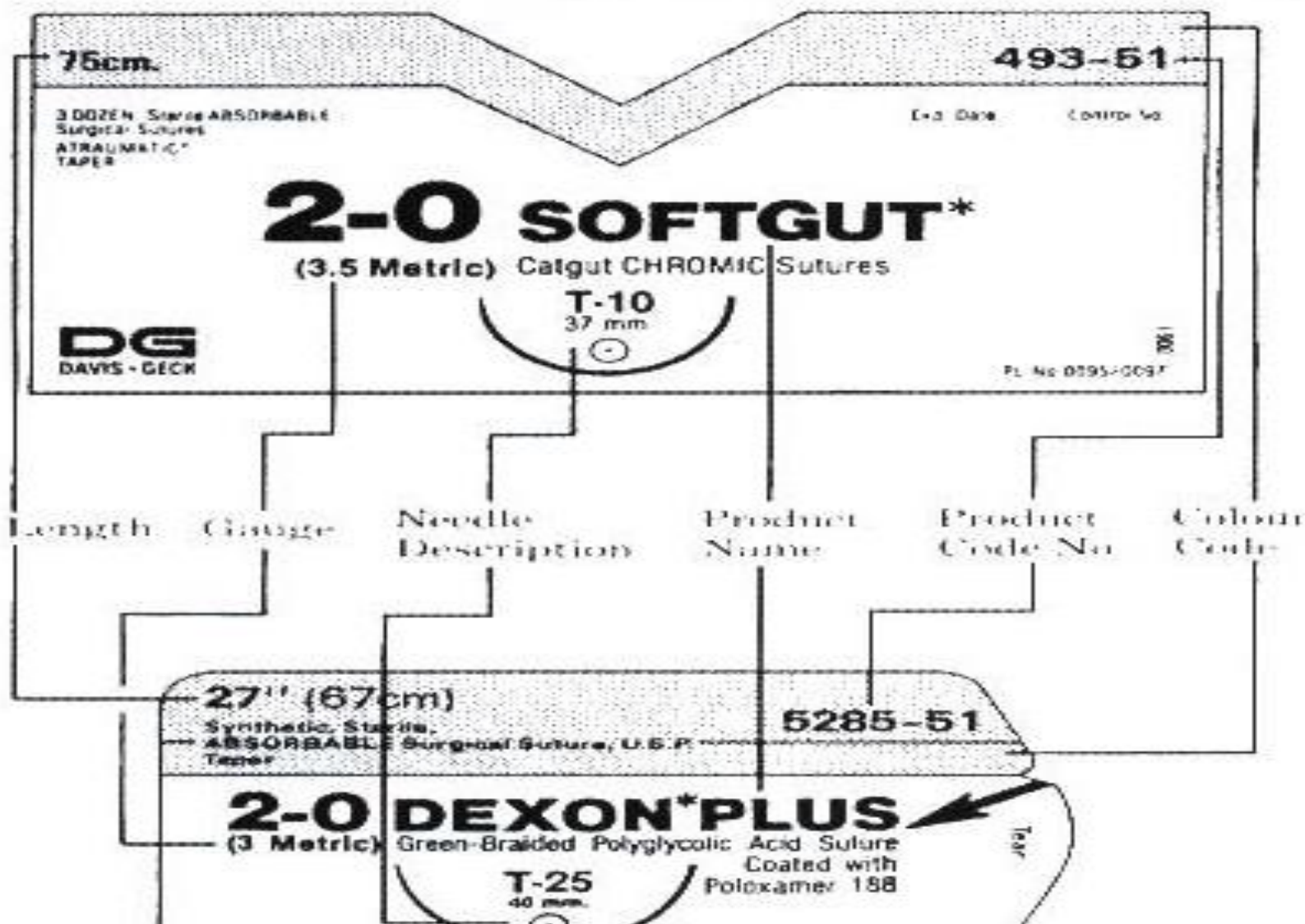
Taper body in rounded blunt point that will not cut through tissue

It dissect friable tissue rather than cutting it

Used for blunt dissection, kidney, intestine, liver, fascia, spleen, cervix (ligating incompetent Cx)







Essential information over typical suture packet

Thank you

