(SKILLS/HANDS-ON) Suturing

Bradley J. Morris, RN, CFRN, PA-C

Physician Assistant, Trauma Service, Intermountain Medical Center, Intermountain Healthcare

Mark H. Stevens, MD, FACS

Trauma Services Medical Director, Intermountain Medical Center, Intermountain Healthcare

Objectives:
- Demonstrate basic and moderately - advanced techniques used to repair traumatic lacerations in an optimum way
- Recognize the characteristics of wounds that are appropriately referred to Plastic Surgery specialists
- Participate in hands-on suturing exercise, instructed by an experienced trauma surgeon
- Discuss techniques which will enhance successful repair of contaminated, necrotic or actively-bleeding traumatic wounds
1. Introduction & Welcome

2. Objectives of course shared with participants
   a. Introduction to sutures and suturing
   b. Anatomical pearls to suturing: 5 min

3. Familiarize with Suture Instruments
   a. Video instruction: 5 min 27 sec
      https://www.youtube.com/watch?v=2HC7zM3D59Q

4. Suture #1 – Simple Interrupted
   a. Video Instruction: 3 min 35 sec - Start at 2:35 of video
      https://www.youtube.com/watch?v=SYNHSDI69kk
   b. Hands on Instruction: 8 min

5. Suture #2 – Simple Running
   a. Video Instruction: 5 min 14 sec
      https://www.youtube.com/watch?v=ODZtJL_gb4E
   b. Hands on Instruction: 10 min

6. Suture #3 – Vertical Mattress
   a. Video Instruction: 3 min 29 seconds
      https://www.youtube.com/watch?v=UV-j1zxckXA
   b. Hands on Instruction: 10 min

7. Suture #4 – Horizontal Mattress
   a. Video Instruction: 2 min 7 sec
      https://www.youtube.com/watch?v=8QYEXw76CPE
   b. Hands on Instruction: 8 min

8. Suture #5 – Deep Dermal Suture
   a. Video Instruction: 1 min 36 seconds
      https://www.youtube.com/watch?v=XE2oz-CtWQw
   b. Hands on Instruction: 8 min

9. Suture # 6 – Running Subcuticular
   a. Video Instruction: 8 min 41 seconds
      https://www.youtube.com/watch?v=iYts9c6Jrx8
   b. Hands on Instruction: 12 min

10. Wrap up
Suture Workshop: Suturing for Professionals
September 25th, 2015
Brad Morris, PA-C / Mark H. Stevens, MD
Suture Workshop

- Objectives:
  - Verbal instruction to the basics of suturing.
  - Video introduction to 5 different suture techniques.
  - Hands-on practicum with the use of instruments, suture material, and tissue samples.
  - Tips, guidelines, and cautions to suturing specific areas of the human body.
Suture Workshop: Sutures to Master

- Simple Interrupted
- Simple Running
- Vertical Mattress
- Horizontal Mattress
- Deep Dermal
- Running Subcuticular
Familiarize with Suture Instruments

- Video instruction: 5 min 27 sec
  - https://www.youtube.com/watch?v=2HC7zM3D59Q
Suture #1 - Simple Interrupted

- Video Instruction: 3 min 35 sec - Start at 2:35 of video  
  - https://www.youtube.com/watch?v=SYNHSDl69kk
- Hands on Instruction: 8 min
Suture #2 - Simple Running

- Video Instruction: 5 min 14 sec
  - https://www.youtube.com/watch?v=ODZjL_gb4E
- Hands on Instruction: 10 min
Suture #3 - Vertical Mattress

- Video Instruction: 3 min 29 seconds
  - https://www.youtube.com/watch?v=UV-j1zxcKXA
- Hands on Instruction: 10 min
Suture #4 - Horizontal Mattress

- Video Instruction: 2 min 7 sec
  - [https://www.youtube.com/watch?v=8QYEXw76CPE](https://www.youtube.com/watch?v=8QYEXw76CPE)
- Hands on Instruction: 8 min
Suture #5 - Deep Dermal Suture

- Video Instruction: 1 min 36 seconds
  - [https://www.youtube.com/watch?v=XE2oz-CtwQw](https://www.youtube.com/watch?v=XE2oz-CtwQw)
- Hands on Instruction: 8 min
Suture #6 - Running Subcuticular

- Video Instruction: 8 min 41 seconds
  - https://www.youtube.com/watch?v=iYts9c6Jrx8
- Hands on Instruction: 12 min
PEARLS OF SUTURING

- Cleanse and irrigate thoroughly
- Wound edges – keep them LEVEL
- “See the needle” – between edges
- Do not strangulate the tissue
- Be good to the tissues – and they will be good to you
Pearls of Suturing: Types of Sutures

Absorbable
- Braided
  - Vicryl
  - Plain gut
  - Chromic gut
- Monofilament
  - PDS
  - Monocryl

Non-Absorbable
- Braided
  - Silk
  - Ethilon
- Monofilament
  - Prolene
  - Nylon
Pearls of Suturing: Plastic Surgery Consultation

- Location:
  face, ear, eye (lacrimal duct), hand

- Depth of Injury:
  layers involved: cartilage (ear, nose), muscle, nerve

- Loss of Tissue:
  avulsion injury - difficult to repair (without tension)
Pearls of Suturing: Suture Removal Guidelines

- Face: 3-4 days
- Scalp: 5-7 days
- Trunk: 7 days
- Arm/Leg: 7-10 days
- Foot/Joint: 10-14 days
Ambrose Pare

“I dress the wounds, God heals them.”
Contents

- History of Wound Closure
- Wound Closure Anatomy
- Suture Selection Criteria
- Absorbable Suture Options
- Non-Absorbable Suture Options
- Surgical Needles
- Suture Packaging
- Topical Skin Adhesives
- Examples of Suture Selection By Tissue Type
History of Wound Closure
History of Sutures

50,000 BC
Eyed needles are invented.

1,600 BC
One of the earliest known references to suture material. Sutures are made from flax, hemp, bark fiber, hair, etc.

20,000 BC
Bone needles are standard.

1,600 BC
One of the earliest known references to suture material. Sutures are made from flax, hemp, bark fiber, hair, etc.

50,000 BC
Eyed needles are invented.

900 AD
Used strings from a kit, a guitar-like musical instrument.

1867-9 AD
Joseph Lister proves that the body absorbs catgut sutures. However, he is most famous for demonstrating the need for antiseptic techniques for sterilization of implanted sutures.

1918 AD
George Merson begins the sale of eyeless needled sutures, where one strand of suture material is attached to the butt of the needle. This type of swaged needle is still in use and is the standard today.

1947 AD
Introduction of Nylon.

1972 AD
First synthetic absorbable suture introduced.

2000 AD
Distribution of gut material ends in many parts of Europe and Japan due to Bovine Spongiform Encephalopathy ("Mad Cow Disease").
A History of Wound Closure Innovations

- 1887: Silk and Cat Gut
- 1947: MERSILENE® Polyester Fiber Suture
- 1958: Nylon
- 1969: PROLENE® Polypropylene Suture
- 1974: ETHIBOND® Polyester Suture
- 1976: VICRYL® (polyglactin 910) Suture
- 1979: Coated VICRYL® (polyglactin 910) Suture
- 1989: PDS® II (poliglecaprone 25) Suture
- 1992: ETHIGUARD® Blunt Point Needle
- 1993: MONOCRYL® Suture
- 1998: VICRYL™ RAPIDE (polyglactin 910) Suture
- 2002: DERMAFLEX® Topical Skin Adhesive
- 2003: High Viscosity Coated VICRYL® Suture
- 2007: STRATAFIX™ Suture Portfolio
- 2012: Coated VICRYL® Plus Antibacterial (polyglactin 910) Suture
- 2007: PDS® Plus Antibacterial (polydioxanone) Suture
Basic Anatomy of Skin and Fascia

- Epidermis
- Dermis
- Subcutaneous tissue (fat)
- Fascia
- Muscle
Wound Closure
Anatomy
Wound Healing Period*

- Skin: 5-7 days
- Mucosa: 5-7 days
- Subcutaneous: 7-14 days
- Peritoneum: 7-14 days
- Fascia: 14-28 days
- Bone: 8-12 weeks
Suture Selection Criteria
What Is Suture?

The word “suture” describes any strand of material used to ligate (tie) blood vessels or approximate (sew) tissues.
The Ideal Suture:

1. Is sterile
2. Is easy to handle
3. Generates minimal tissue reaction/trauma
4. Has high tensile strength retention
5. Provides knot security
6. Is absorbable (when appropriate)
7. Is useful in all tissues
8. Is coated with a microbial barrier
Three Suture Classifications

1. Absorbable / Non-Absorbable
2. Natural / Synthetic
3. Braided / Monofilament
1. Absorbable / Non-Absorbable Sutures

Absorbable Sutures
Undergo degradation in tissues
Lose tensile strength within 60 days

Absorption Rate: Time required for a suture to be fully absorbed into the tissue
Tensile Strength In Vivo: Tension which a suture will withstand before it breaks down inside the tissue

Non-Absorbable Sutures
Not digested by body enzymes or hydrolyzed in body tissue
2. Natural / Synthetic Sutures

Natural Sutures
Made of material that can be found in nature

Absorption method (if absorbable): Enzymatic – of, relating to, or produced by an enzyme

Synthetic Sutures
Made of materials created by man

Absorption method (if absorbable): Hydrolysis – breakdown in the presence of water or moisture
3. Monofilament / Braided Sutures

**Monofilament**
Single strand of material
- Less resistance as it passes through tissue
- Resists bacterial harboring compared to braided

**Braided**
Multifilament sutures that consist of several filaments or strands, twisted or braided together
- Greater tensile strength
- Pliability and flexibility
Understanding Suture Size

Range from 7 to 11-0
Largest: Size 7
Approximately corresponds to the thickness of a human hair
Smallest: Size 11-0
Absorbable Suture Options
Absorbable Suture Types

Natural
- Virtual Monofilament
  - Short
    - Fast Absorbing Surgical Gut Suture
  - Short / Medium
    - Plain Gut Suture
  - Medium
    - Chromic Gut Suture

Synthetic
- Monofilament
  - Short / Medium
    - PDS® II (polydioxanone) Suture, PDS® Plus Antibacterial (polydioxanone) Suture
    - MONOCRYL® (poliglecaprone 25) Suture, MONOCRYL® Plus Antibacterial (poliglecaprone 25) Suture
  - Long
    - VICRYL RAPIDE™ (polyglactin 910) Suture
- Braided
  - Short
    - Coated VICRYL® (polyglactin 910) Suture, Coated VICRYL® Plus Antibacterial (polyglactin 910) Suture
  - Medium
Natural Absorbable Sutures

Ethicon Gut Sutures
- Submucosal or serosal layer of animal intestine
- 97-98% pure collagen
- Clean and purified
- Strands twisted for controlled diameter
- Packaged wet to maintain pliability
- Spun and polished into virtual monofilament strands
Synthetic Absorbable Sutures

VICRYL RAPIDE™ (polyglactin 910) Suture
Short-term wound support¹
  7-10 days
  Rapid strength loss
  Absorption complete in just 42 days
For use in a variety of tissue types
Convenient for patients
  No return visit for suture removal needed
The Suture as a Site of Infection

Foreign materials, such as sutures, lower the number of bacteria required to cause an infection¹

Typical bacterial concentration required for SSI to develop: $10^5$ CFU/g tissue

Bacterial concentration required on implant for SSI to develop: $100$ CFU/g tissue

When implanted, sutures are rapidly coated with tissue protein, which creates sites for bacterial colonization²,³

This colonization can lead to biofilm formation

Biofilm formation increases the difficulty of treating an infection
The Impact and Burden of SSIs

Patients with SSIs are¹,²:

- 5x more likely to be readmitted
- Hospitalized for up to 11 additional days
- 2x more likely to die

Additionally, patients with SSIs experience:

- Increased use of antibiotics and other medications
- Potential pain management complications
- Other health-care-associated risks, such as bed sores and catheter-related infections
- Interruption of work and personal life
Plus Antibacterial Sutures: Product Profiles

A range of Plus Sutures are available for use in various procedures. Plus Sutures retain the same familiar flexibility, tying characteristics, and absorption profiles as the untreated suture materials.\(^1-3\)

<table>
<thead>
<tr>
<th>Construction</th>
<th>Monofilament</th>
<th>Braided</th>
<th>Monofilament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaking strength retention</td>
<td>All sizes 60-70%</td>
<td>All sizes 75%</td>
<td>≤4-0</td>
</tr>
<tr>
<td>7 days:</td>
<td>60-70%</td>
<td>14 days:</td>
<td>60% 80%</td>
</tr>
<tr>
<td>14 days:</td>
<td>30-40%</td>
<td>21 days:</td>
<td>50%</td>
</tr>
<tr>
<td>28 days:</td>
<td>0%</td>
<td>28 days:</td>
<td>25%</td>
</tr>
<tr>
<td>Completely absorbed</td>
<td>91-119 days</td>
<td>56-70 days</td>
<td>182-238 days</td>
</tr>
</tbody>
</table>
Antibacterial Activity of Plus Antibacterial Sutures

Plus Antibacterial Sutures with IRGACARE® MP (triclosan) — the only commercially available sutures with antibacterial protection

Plus Sutures kill bacteria and inhibit bacterial colonization on the suture

Plus Sutures reduce the risk of biofilm formation on the suture

### Spectrum of Activity

<table>
<thead>
<tr>
<th>Spectrum of Activity</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em> (S. aureus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus epidermidis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methicillin-resistant <em>Staphylococcus aureus</em> (MRSA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methicillin-resistant <em>Staphylococcus epidermidis</em> (MRSE)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em> (E.coli)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Antibacterial Sutures

MONOCRYL® Plus Antibacterial (poliglecaprone 25) Suture
Reliable Strength

Consistent absorption rate with a predictable decrease in tensile strength over time
Stronger than gut suture initially and throughout the critical wound-healing period¹
Offers protection for subcuticular closure and soft tissue approximation
Antibacterial Sutures

Coated VICRYL® Plus Antibacterial (polyglactin 910) Suture
Excellent handling and performance

- Knot security and knot snug-down
- First-throw holding security
- Smooth passage with minimal tissue drag
- Virtually no package memory
Antibacterial Sutures

PDS® Plus Antibacterial (Polydioxanone) Suture
Extended monofilament wound support for approximately 42 days¹
Offers protection and strength for slow-healing tissue in:

- Fascial closure
- Orthopedic surgery
- Blood vessel anastomoses
- Patients with diabetes or cancer
Non-Absorbable Suture Options
Two Types of Non-Absorbable Sutures

Natural
- Monofilament
  - Surgical Stainless Steel Suture
- Braided

Synthetic
- Monofilament
  - ETHILON® Nylon Suture
  - PRONOVA® Poly (Hexafluoropropylene - VDF) Suture
  - NUROTON® Nylon Suture
  - PROLENE® Polypropylene Suture
- Braided
  - ETHIBOND EXCEL® Polyester Suture
  - MERSILENE® Polyester Fiber Suture
Natural: PERMA-HAND® Silk Suture

Silk Suture¹
Wax proofed

- Improves surface quality
- Reduces bacterial harboring
- Reduces capillarity

Braided

- Excellent handling and knotting characteristics

Used in a wide variety of surgical procedures
Natural: Surgical Stainless Steel Suture¹

High tensile strength
Reliable and ductile alloy

Made of 316L stainless steel
Optimal compatibility with stainless steel implants

Low tissue reactivity
Multistrand packaging

Eliminates kinking and bending of strands
2 or 4 strands per pack
Synthetic: ETHILON® Nylon Suture

Monofilament nylon suture\textsuperscript{1}
Well suited for skin and retention closure
Finer sizes used in ophthalmic
and microsurgery procedures
May be clear, or dyed green or black for better visibility
Specific codes (sizes 3-0 to 6-0) are “pliabilized”

\textbf{Pliabilization includes pre-moistening the suture to make it more pliable}
Enhances handling and knot-tying characteristics to approximate that of braided sutures
Synthetic: NUROLOON® Nylon Suture

Braided nylon suture¹
Handles like silk
Stronger than silk
Better knot tie-down than silk
Lower tissue reactivity
Less fragmentation
Ideal silk replacement in neurosurgery
Synthetic: MERSILENE® Polyester Fiber Suture

Braided polyester fiber suture
Polyester
Permanent wound support
Braided
Good handling characteristics
Provide precise and consistent suture tension
Synthetic
Less tissue reaction
Synthetic: ETHIBOND EXCEL®
Polyester Suture

Braided polyester suture¹
Specialized CV Needles
Single or Multi-strand
D-Specials
Pledgets – Soft and hard, 2 sizes
In green & white for ease of use
Available in many suture sizes & lengths used in cardiovascular and orthopedic procedures
Synthetic: PROLENE®
Polypropylene Suture

Unique RELAY® Suture Delivery System
Straight pack delivers the suture virtually memory-free
Many options available¹
Available in a variety of sizes and lengths used in different specialties
Specialized cardiovascular needles
Single or multistrand
E-packs and D-specials
(SKILLS/HANDS-ON) Suturing

Bradley J. Morris, RN, CFRN, PA-C

Physician Assistant, Trauma Service, Intermountain Medical Center, Intermountain Healthcare

Mark H. Stevens, MD, FACS

Trauma Services Medical Director, Intermountain Medical Center, Intermountain Healthcare

Objectives:

- Demonstrate basic and moderately - advanced techniques used to repair traumatic lacerations in an optimum way
- Recognize the characteristics of wounds that are appropriately referred to Plastic Surgery specialists
- Participate in hands-on suturing exercise, instructed by an experienced trauma surgeon
- Discuss techniques which will enhance successful repair of contaminated, necrotic or actively-bleeding traumatic wounds
ETCCC14
Suture Education #2

Brad Morris, RN, CFRN, PA-C
Mark Stevens, MD
Surgical Needles
What Makes for the Best Needle?

Made of high-quality stainless steel (or alloy)
As slim as possible without compromising strength
Stable in the grasp of a needleholder
Able to carry suture material through tissue with minimal trauma
Sharp enough to penetrate tissue with minimal resistance
Rigid enough to resist bending, yet ductile enough to resist breaking during surgery
Sterile and corrosion resistant to prevent introduction of microorganisms or foreign materials into the wound
Anatomy of a Needle

All surgical needles have 3 basic components:

- **Point**
- **Body**
- **End (Eyed or Swaged)**
Anatomy of a Needle (continued)
# Needle Shapes

<table>
<thead>
<tr>
<th>Shape</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>Gastrointestinal tract, nasal cavity, nerve, oral cavity, pharynx, skin,</td>
</tr>
<tr>
<td></td>
<td>tendon, vessels</td>
</tr>
<tr>
<td>Half curved</td>
<td>Skin (rarely used), laparoscopy</td>
</tr>
<tr>
<td>1/4 circle</td>
<td>Eye (primary application), microsurgery</td>
</tr>
<tr>
<td>3/8 circle</td>
<td>Aponeurosis, biliary tract, cardiovascular system, dura, eye, gastrointestinal</td>
</tr>
<tr>
<td></td>
<td>tract, muscle, myocardium, nerve, perichondrium, periosteum, pleura, skin,</td>
</tr>
<tr>
<td></td>
<td>tendon, urogenital tract, vessels</td>
</tr>
</tbody>
</table>
# Needle Shapes

<table>
<thead>
<tr>
<th>Shape</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 circle</td>
<td>Biliary tract, cardiovascular system, eye, fascia, gastrointestinal tract,</td>
</tr>
<tr>
<td></td>
<td>muscle, nasal cavity, oral cavity, pelvis, peritoneum, parynx, pleura,</td>
</tr>
<tr>
<td></td>
<td>respiratory tract, skin, tendon, subcutaneous fat, urogenital tract</td>
</tr>
<tr>
<td>5/8 circle</td>
<td>Anal (hemorrhoidectomy), nasal cavity, pelvis, urogenital tract (primary</td>
</tr>
<tr>
<td></td>
<td>application)</td>
</tr>
<tr>
<td>Compound curve</td>
<td>Eye (anterior segment), laparoscopy</td>
</tr>
</tbody>
</table>
# Needle Types

<table>
<thead>
<tr>
<th>Needle Type</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taperpoint Needle</td>
<td>For soft, easily penetrated tissues.</td>
<td>BV, CT, MO, RB, SH, UR, TF</td>
</tr>
<tr>
<td>Conventional Cutting Needle</td>
<td>Two opposing cutting edges, with a third on inside curve. Change in cross-section from a triangle cutting tip to a flattened body.</td>
<td>CCS</td>
</tr>
<tr>
<td>TAPERCUT® Surgical Needle</td>
<td>Cutting tip, taper body. For tough tissue, like 2 needles in one.</td>
<td>CC, V</td>
</tr>
<tr>
<td>Precision Cosmetic-Conventional Cutting PC PRIME® Needle</td>
<td>For delicate plastic or cosmetic surgery. Conventional cutting tip and PRIME geometry for increased sharpness.</td>
<td>PC</td>
</tr>
</tbody>
</table>
# Needle Types

<table>
<thead>
<tr>
<th>Needle Type</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Spatula Needle</td>
<td>Visibility of the point at bottom provides control of depth penetration.</td>
<td>S</td>
</tr>
<tr>
<td>CS ULTIMA® Ophthalmic Needles</td>
<td>Reduced edge-angles provide better penetration. Readily facilitates knot rotation in ophthalmic surgery.</td>
<td>CS, CSB, CTC</td>
</tr>
<tr>
<td>VISI-BLACK™ Surgical Needle</td>
<td>Slim taperpoint needles with a black finish for improved visibility and penetration.</td>
<td>BV-1, C-1, RB-1</td>
</tr>
<tr>
<td>Reverse Cutting MICRO-POINT® Surgical Needle</td>
<td>Cutting edge on outer curve. Extremely smooth. Extremely sharp for ophthalmic surgery.</td>
<td>G</td>
</tr>
<tr>
<td>ETHIGUARD® Blunt Point Needle</td>
<td>Taper body. For blunt dissection and suturing friable tissue.</td>
<td>CTB, SHB</td>
</tr>
</tbody>
</table>
# Needle Types

<table>
<thead>
<tr>
<th>Needle Type</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve Cutting Needle</td>
<td>Cutting edge on outer curve. For tough, difficult-to-penetrate tissues.</td>
<td>C, FS, M, OS</td>
</tr>
<tr>
<td>Precision Point Needle</td>
<td>For delicate plastic or cosmetic surgery. Cutting tip electropolished for added sharpness.</td>
<td>P, PS</td>
</tr>
<tr>
<td>MICRO-POINT® Surgical Needle (Spatula)</td>
<td>Thin, flat profile. Specially designed for ophthalmic anterior segment surgery.</td>
<td>TG</td>
</tr>
<tr>
<td>SABRELOC® Spatula Needle</td>
<td>Side-cutting spatula shaped edges. For layers of scleral or corneal tissue. Spatulated needle point is centered for maximum needle stability in thin sclera. Four equidistant and properly defined edges provide greater control.</td>
<td>S, SM</td>
</tr>
</tbody>
</table>
Topical Skin Adhesives: The DERMABOND® Portfolio
The DERMABOND® Portfolio

Use in combination with sutures when closing short to medium incisions

**DERMABOND ADVANCED™**
- C-section
- Hemia Repair
- Complex Lacerations
- Lacerotomy
- Total Knee Replacement
- Laparoscopic Port Sites
- Simple Lacerations
- Meso Procedures
- Minimally Invasive Procedures

**DERMABOND PRINEO®**
- Breast Reconstruction
- Brachioplasty
- Use as an alternative to subcuticular sutures when closing medium to long incisions

**DERMABOND MINI™**
- Use to close easily approximated, small incisions or lacerations

A complete set of solutions to add strength and protection to an incision
DERMABOND ADVANCED®
Topical Skin Adhesive

- Creates a microbial barrier with 99% protection in vitro for at least 72 hours against organisms commonly responsible for SSIs

- When used in addition to sutures, shown ex vivo to add 75% more strength to the wound closure than sutures alone

- DERMABOND ADVANCED Adhesive demonstrated in vitro inhibition of gram-positive bacteria (MRSA and MRSE) and gram-negative bacteria (E Coli)
DERMABOND ADVANCED®
Topical Skin
Adhesive: Formulated Like No Other Adhesive$^{1-3}$

Only 1 Layer Required
2X Faster Setting Time (95 seconds)*
4X More Viscous*
8 US Patents

*As compared to High Viscosity DERMABOND® Topical Skin Adhesive
How to Apply DERMABOND ADVANCED® Topical Skin Adhesive

1. Hold the applicator away from the patient with the tip pointed downward.

2. Squeeze the bulb to crush the ampoule inside, and then release pressure.

3. Gently squeeze the bulb again to moisten the internal filter with adhesive.

4. Approximate the wound edges with gloved fingers or forceps.

5. Apply DERMABOND ADVANCED Adhesive in a single continuous layer, maintaining steady bulb pressure.

6. Hold skin edges for about 60 seconds. Full polymerization will occur in about 95 seconds.

See Instructions for Use for full prescribing information.
How to Apply DERMABOND® Mini Topical Skin Adhesive

1. Hold the applicator away from the patient with the tip pointing upward.
2. Squeeze the bulb to crush the ampoule inside, and then release pressure.
3. Gently squeeze the bulb again to moisten the internal filter with adhesive.
4. Approximate the wound edges with gloved fingers or forceps.
5. Apply DERMABOND® Mini in a single continuous layer maintaining steady bulb pressure.
6. Hold skin edges and wait approximately 30 seconds. Apply a second coat, full polymerization in about 3 minutes.
DERMABOND® Topical Skin Adhesive
Studied in more than any other adhesive with over 410* publications¹

Largest randomized clinical trial (RCT) database of any adhesive
7x the number of patients studied vs the leading competitor¹

<table>
<thead>
<tr>
<th>Product</th>
<th>Number of RCTs</th>
<th>Total # of Patients Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>DERMAFLEXLINE® QS™</td>
<td>40</td>
<td>4075</td>
</tr>
<tr>
<td>Histoacryl®</td>
<td>6</td>
<td>534</td>
</tr>
<tr>
<td>INDERMIL®</td>
<td>2</td>
<td>150</td>
</tr>
<tr>
<td>LiquiBand®</td>
<td>2</td>
<td>78</td>
</tr>
<tr>
<td>SurgiSeal™</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Derma+Flex® QS™</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>OctylSeal™</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sure+Close® II™</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

¹Based on a comprehensive review of published clinical trials.
Suture Selection By Tissue Type
**Tissue Type:** Joint Capsule (Knee, Hip, Shoulder)

<table>
<thead>
<tr>
<th><strong>Recommended Suture</strong>*</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="PDS Plus" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Needle Options†</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>OS-4, OS-6, OS-8, CT-1, CTX, MO-4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Tissue Characteristics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ligamentous sac surrounding the articular cavity of the joint; consists of vascular, very dense, fibrous tissue. Heals in approximately 3 weeks.</td>
</tr>
</tbody>
</table>
Tissue Type:
Epidermis, Oral (Facial)/Vaginal Mucosa, Perineal Skin

<table>
<thead>
<tr>
<th>Recommended Suture</th>
</tr>
</thead>
<tbody>
<tr>
<td>VICRYL RAPIDE™ (polyglactin 910) Suture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Needle Options*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC-1, PC-3, P-1, P-3, PS-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tissue Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial layer of skin; dense and tough, but thin. It is usually supported by dermal closure.</td>
</tr>
</tbody>
</table>
# Tissue Type: Peritoneum

## Recommended Suture

<table>
<thead>
<tr>
<th>MONOCRYL™ Plus</th>
<th>VICRYL™ Plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibacterial (Poliglecaprone 25) Suture</td>
<td>Antibacterial (Poliglactin 910) Suture</td>
</tr>
</tbody>
</table>

## Needle Options

- SH, CT-1

## Tissue Characteristics

- Thin, membranous lining of the abdominal cavity. Very little fibrosis.
- Heals quickly. Closure is optional, based on surgeon preference.
Tissue Type: Dermis / Subcuticular

<table>
<thead>
<tr>
<th>Recommended Suture*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONOCRYL™ Plus</td>
</tr>
<tr>
<td>Antibacterial (Poliglecaprone 25) Suture</td>
</tr>
<tr>
<td>PDS™ Plus</td>
</tr>
<tr>
<td>Antibacterial (Polydioxanone) Suture</td>
</tr>
<tr>
<td>Coated VICRYL™ Plus</td>
</tr>
<tr>
<td>Antibacterial (Polyglactin 910) Suture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Needle Options†</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC-5, PS-2, PS-1, PS†, PSL, PSLX†</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tissue Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep, vascular, subcuticular layer; 3 times thicker than epidermis; consists of dense connective tissue. Regains tensile strength slowly. Most of the stress placed upon the healing wound is absorbed by fascia. Sutures need only be strong enough to withstand natural skin tension and hold wound edges in apposition.</td>
</tr>
</tbody>
</table>
# Tissue Type: Abdominal Fascia

<table>
<thead>
<tr>
<th>Recommended Suture*</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="PDS Plus" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Needle Options†</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT-1, CT, CTX, TP-1, XLH</td>
</tr>
</tbody>
</table>

## Tissue Characteristics

- Fibrous, sheath-like, connective tissue covering muscle.
- Strongest tissue in abdominal wall; regains 25% - 40% of original strength in 1 month; 55% - 65% in 3 months; 70% - 80% in 9 months.
- Never regains full original strength.
## Tissue Type: Ligament

### Recommended Suture*

![PDS Plus Suture](image)

### Needle Options†

- PS-4, PS-2, OS-4, MO-6, CT-2, CT-1

### Tissue Characteristics

- Very dense, longitudinally arrayed, collagenous tissue.
- Achieves 50% to 70% of original strength in 12 months.
**Tissue Type:** Subcutaneous (Fat) / Superficial Fascia

<table>
<thead>
<tr>
<th>Recommended Suture*</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Coated VICRYL Plus" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Needle Options†</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH, CT-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tissue Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Soft, friable, poorly vascularized tissue; fat does not hold sutures well.</td>
</tr>
<tr>
<td>• The goal of “suturing the fat” is to approximate the superficial fascia (Scarpa’s fascia), which is located in the upper 1/3 of the fatty layer.</td>
</tr>
</tbody>
</table>
# Tissue Type: Vagina

## Recommended Suture*

| VICRYL RAPIDE™ (polyglactin 910) Suture | MONOCRYL Plus Antibacterial (Poliglecaprone 25) Suture | Coated VICRYL Plus Antibacterial (Polyglactin 910) Suture |

## Needle Options†

- V-34, CP-1, CT-1, SH

## Tissue Characteristics

- Tough and vascular.
- Heals completely in 10 days.
# Tissue Type: Tendon

## Recommended Suture†

<table>
<thead>
<tr>
<th>Suture Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDS™ Plus</td>
<td>Antibacterial (Polydioxanone) Suture</td>
</tr>
<tr>
<td>PROLENE®</td>
<td>Blue Monofilament Polypropylene Suture</td>
</tr>
<tr>
<td>ETHIBOND® Excel</td>
<td>White Braided/Green Braided Polyester Suture</td>
</tr>
</tbody>
</table>

## Needle Options††

- OS-4, MO-6, CT-2, CT-1

## Tissue Characteristics

Very dense, longitudinally arrayed, collagenous tissue.
# Tissue Type: Eye, Ocular Muscles

## Recommended Suture

| Prolene* Blue Monofilament Polypropylene Suture | Coated VICRYL™ (Polyglactin 910) Suture |

## Needle Options†

- CS140-6, CS160-6, CS90-6, CSB-6, TG140-8

## Tissue Characteristics

- Cornea is avascular, therefore heals slowly and requires sutures to remain in place for at least 21 days.
- Ocular muscles, conjunctiva, and the sclera have good blood supply and require suture support only for about 7 days.
Tissue Type: Vagina

Recommended Suture*

- **VICRYL RAPIDE™ (polyglactin 910) Suture**
- **MONOCRYL™ Plus Antibacterial (Poliglecaprone 25) Suture**
- **Coated VICRYL™ Plus Antibacterial (Polyglactin 910) Suture**

Needle Options†

- V-34, CP-1, CT-1, SH

Tissue Characteristics

- Tough and vascular.
- Heals completely in 10 days.
# Tissue Type: Tendon

## Recommended Suture†

<table>
<thead>
<tr>
<th>Suture</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDS™ Plus</td>
<td><img src="image1" alt="PDS™ Plus" /></td>
</tr>
<tr>
<td>PROLENE® Blue Monofilament</td>
<td><img src="image2" alt="PROLENE® Blue Monofilament" /></td>
</tr>
<tr>
<td>ETHIBOND® Excel</td>
<td><img src="image3" alt="ETHIBOND® Excel" /></td>
</tr>
</tbody>
</table>

## Needle Options††

- OS-4, MO-6, CT-2, CT-1

## Tissue Characteristics

Very dense, longitudinally arrayed, collagenous tissue.
Tissue Type: Eye, Ocular Muscles

Recommended Suture

| PROLENE® Blue Monofilament | Coated VICRYL™ (Polyglactin 910) Suture |

Needle Options†

CS140-6, CS160-6, CS90-6, CSB-6, TG140-8

Tissue Characteristics

- Cornea is avascular, therefore heals slowly and requires sutures to remain in place for at least 21 days.
- Ocular muscles, conjunctiva, and the sclera have good blood supply and require suture support only for about 7 days.