

Anatomy of a Barbed Suture

A comprehensive guide

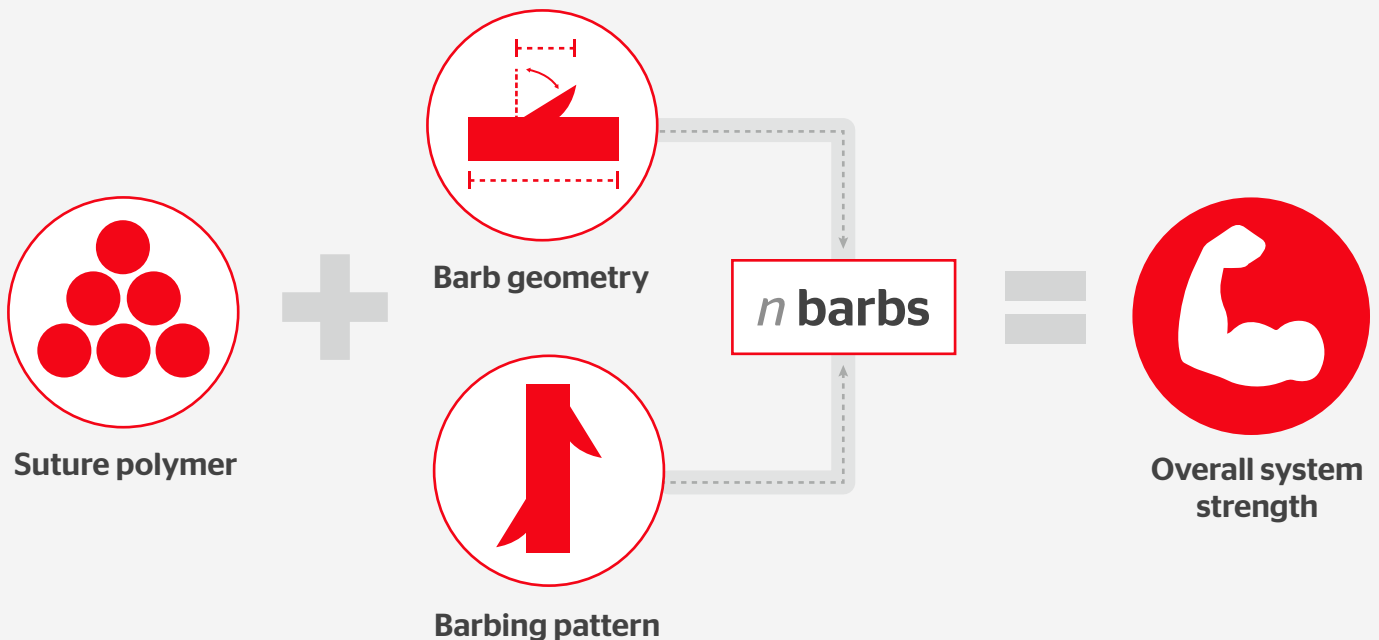
At first glance, choosing the proper barbed suture for a given procedure appears to depend on the same factors as traditional suture—polymer, absorption profile, out-of-package tensile strength, breaking strength retention (BSR), size (diameter), and needle type and length.


While some of the decision criteria used in selecting a traditional suture still apply, it is important to recognize that **barbed suture is a system of complex design features that work together to strike the right balance between strength and smooth tissue passage.**¹

The following is a discussion of the core engineering and design principles that influence the overall performance of a barbed suture—and thus should be weighed when making a selection:

- Suture polymer
- Barb geometry
- Barbing pattern

Barb geometry and barbing pattern dictate the number of barbs, which, together with suture polymer, define the overall strength of the system.¹



 While some suture manufacturers suggest that a barbed suture's strength relies solely on the number of barbs, the overall strength arises from a multi-factorial system of polymer, barb geometry, and barbing pattern.



Suture Polymer

The importance of suture polymer cannot be overstated. The polymer ultimately defines the **short- and long-term strength** as well as the **intraoperative handling** of the barbed suture, just as it does with traditional suture.²

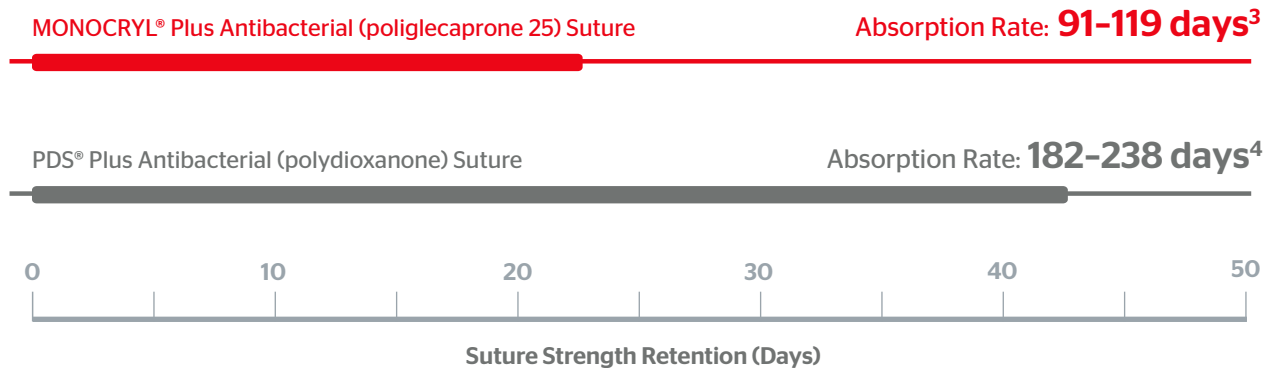
Different polymers have different **breaking strength retention (BSR)** and **absorption profiles** designed to meet the unique healing properties of the tissue layer being closed, as well as the kind of procedure being performed.² For example, a joint capsule closure necessitates a greater BSR and a longer absorption profile than a skin closure.

Breaking strength retention (BSR) = Suture's resistance to breaking under tension *in vivo*

Absorption profile = Rate and amount of time necessary for suture to be absorbed by the body, leaving no detectable trace in tissues

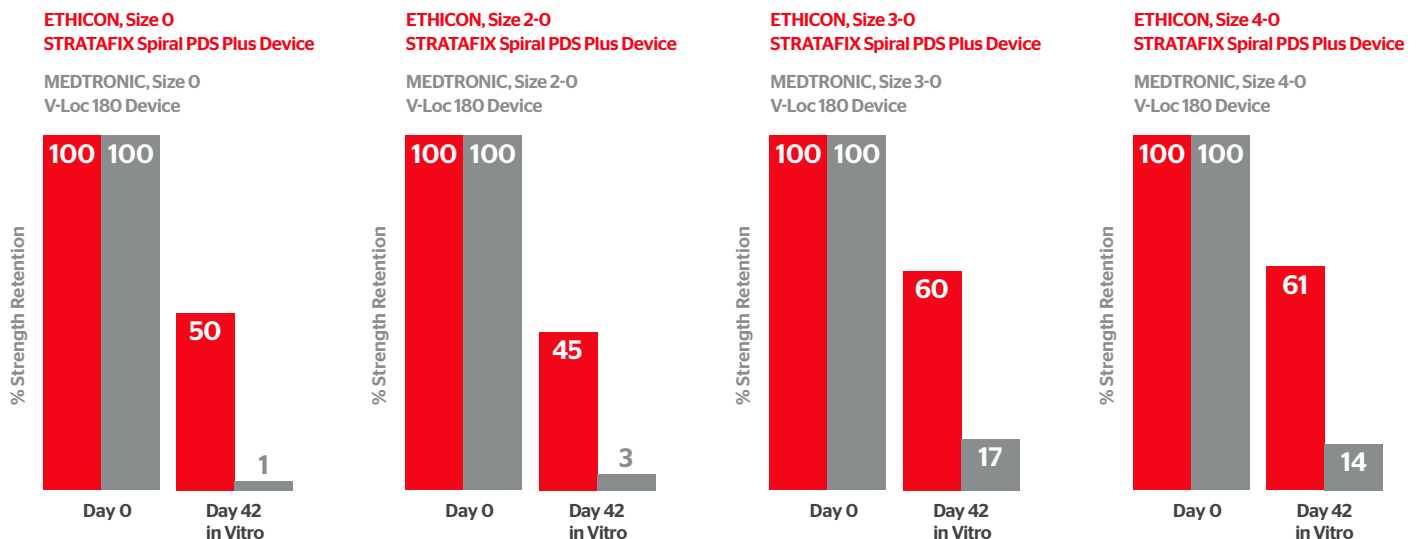
The strength you need for the choices you make

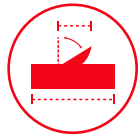
The STRATAFIX™ Knotless Tissue Control Device portfolio offers a variety of polymers of varying BSR and absorption profiles, including the trusted and proven Ethicon polymers MONOCRYL® (poliglecaprone 25) Suture and PDS® (polydioxanone) Suture.



Greater long-term strength retention vs. Medtronic's V-Loc™ 180 Absorbable Wound Closure Device

At an equivalent size, STRATAFIX™ Spiral PDS™ Plus Knotless Tissue Control Device, which is made from PDS (polydioxanone), provides 6 weeks of tissue support while Medtronic's V-Loc™ 180 Device, which is made from Maxon™ Suture, provides support for only 3 weeks.^{5,6}





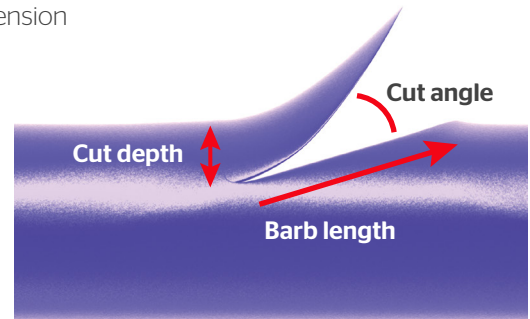
Barb Geometry

The geometry of the individual barbs affects two kinds of strength of a barbed suture:

- **Tensile strength:** the suture's resistance to breaking under tension
- **Tissue-holding strength:** the suture's ability to hold onto tissue under tension

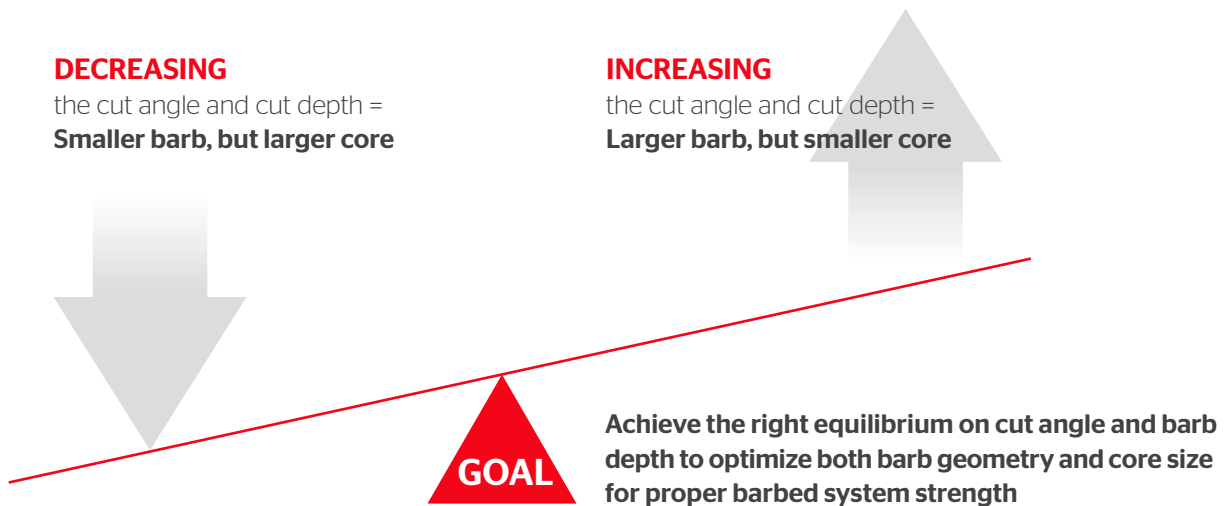
There are three design principles that influence barb geometry— and therefore strength!:

- **Cut depth** - Increasing cut depth increases the barb's tissue-holding strength, but decreases the device's tensile strength because less core remains
- **Cut angle** - Decreasing cut angle makes the barbs thinner and therefore more flexible, for potentially smoother tissue passage
- **Barb length** - Ultimately, barb length is a product of cut depth and angle



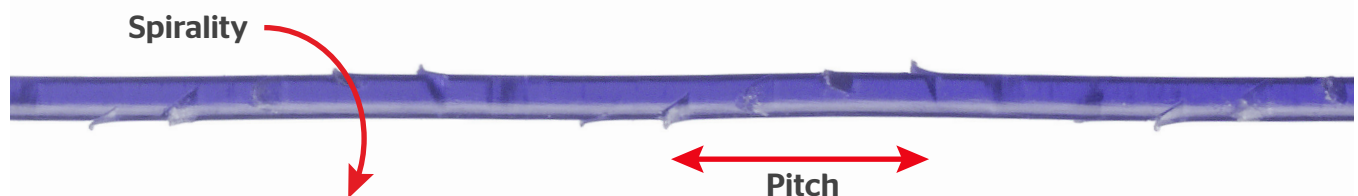
DECREASING
the cut angle and cut depth =
Smaller barb, but larger core

INCREASING
the cut angle and cut depth =
Larger barb, but smaller core



Barbing Pattern

The spirality and pitch of the barbing pattern also influence the overall suture system strength.¹






Spirality is defined as how tight the spiral pattern is around the device, much like threads on a screw

Pitch is the spacing between barbs, represented by barbs per unit length

STRATAFIX™ Knotless Tissue Control Devices

The right balance of polymer, barb geometry, and barbing pattern to deliver optimal system strength

Medtronic claims that the dual-angle cut and the greater number of barbs on V-Loc™ Wound Closure Device result in greater tissue-holding strength. However, the chart below demonstrates the unique combination of factors that allows **STRATAFIX Knotless Tissue Control Devices to provide comparable strength—with fewer barbs.**^{7,8}

	STRATAFIX™ Spiral PDS™ Plus Knotless Tissue Control Device (size 4-0) 	V-Loc™ 180 Absorbable Wound Closure Device (Maxon™ Suture) (size 4-0) 
Tissue-Holding Strength (Time 0)^{7*†}	26.9 lbf	23.4 lbf
Polymer BSR at Day 42 ^{5‡}	61%	14%
Geometry Barb Depth ^{9§}	30% of full-strand diameter	20% of full-strand diameter
Geometry Cut Angle ¹⁰	~ 21°	Angle #1: ~ 45°, Angle #2: ~ 5°
Pitch (Barbs per Unit Length) ¹¹	1.7 barbs per mm	2.3 barbs per mm
	STRATAFIX™ Spiral PDS™ Plus Knotless Tissue Control Device (size 3-0) 	V-Loc™ 180 Absorbable Wound Closure Device (Maxon™ Suture) (size 3-0) 
Tissue-Holding Strength (Time 0)^{8**}	50.9 lbf	61.4 lbf
Polymer BSR at Day 42 ^{5‡}	60%	17%
Geometry Barb Depth ^{9§}	25% of full-strand diameter	18% of full-strand diameter
Geometry Cut Angle ¹⁰	~ 23°	Angle #1: ~ 35°, Angle #2: ~ 6°
Pitch (Barbs per Unit Length) ¹¹	1.2 barbs per mm	1.8 barbs per mm

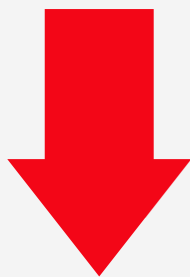
By incorporating proven polymers with an extended BSR and optimized barb depth, STRATAFIX Knotless Tissue Control Devices deliver statistically equivalent tissue-holding strength to Medtronic's V-Loc™ Wound Closure Devices.

^{*}No statistical difference in tissue-holding strength despite the numerical difference.
[†]In porcine subcuticular tissue
[‡]In vitro
[§]3.5 mils for STRATAFIX Spiral PDS Plus Device; 2.4 mils for V-Loc™ 180 Device

STRATAFIX™ Knotless Tissue Control Devices are the only barbed sutures that help address a known risk factor for surgical site infection (SSI)^{12,13*}

This unique benefit is supported by clinical data, benchtop testing, and SSI-prevention guidelines.†

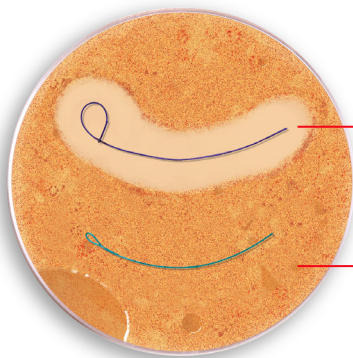
†CDC, WHO, ACS/SIS, and NICE guidelines on reducing the risk of surgical site infections are general to triclosan-coated sutures and are not specific to any one brand.



A recent meta-analysis demonstrated a **28% reduction** in SSI risk with the use of triclosan-coated sutures^{14‡§}

- This effect was demonstrated regardless of whether the wound was classified as clean or non-clean[¶]

Plus Antibacterial Sutures have been shown in vitro to inhibit bacterial colonization of the suture for 7 days or more^{12,13,15-17}



STRATAFIX™ Plus Knotless Tissue Control Devices

- ◀ 17 days against *E. coli*, 23 days against *S. aureus* in vitro (PDS™)¹²
- ◀ 11 days against both *E. coli* and *S. aureus* (MONOCRYL™)¹³

V-Loc™ Wound Closure Device

The petri dish image is for illustrative purposes only, zone of inhibition testing results can vary.

Experts agree

Triclosan-coated sutures are now supported by global health authorities as an evidence-based component for addressing SSI risk[†]

“ Consider the use of triclosan-coated sutures for the prevention of SSI¹⁸ ”

-Centers for Disease Control and Prevention
Guideline for the Prevention of Surgical Site Infection

“ The panel suggests the use of triclosan-coated sutures for the purpose of reducing the risk of SSI, independent of the type of surgery¹⁹ ”

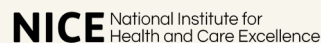
-World Health Organization
Global Guidelines for the Prevention of Surgical Site Infection

“ Triclosan antibacterial suture use is recommended for wound closure in clean and clean-contaminated abdominal cases when available²⁰ ”

-American College of Surgeons & Surgical Infection Society
Surgical Site Infection Guidelines

“ When using sutures, consider using antimicrobial triclosan-coated sutures, especially for pediatric surgery, to reduce the risk of surgical site infection²¹ ”

-National Institute for Health and Care Excellence
Surgical Site Infection Prevention and Treatment

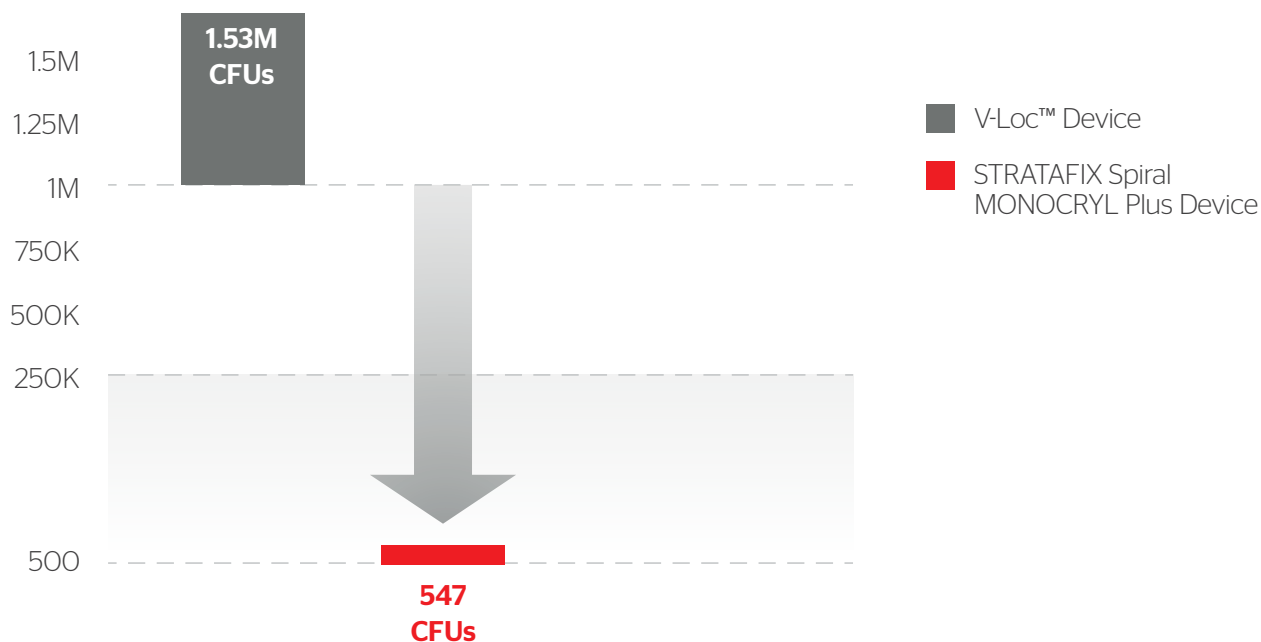


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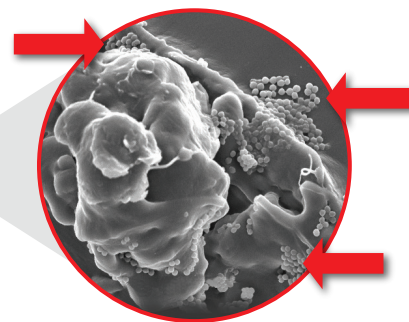
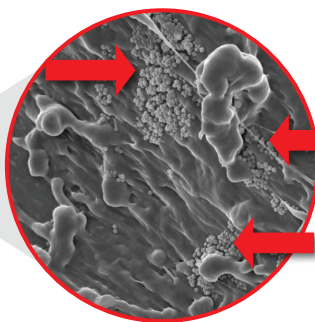
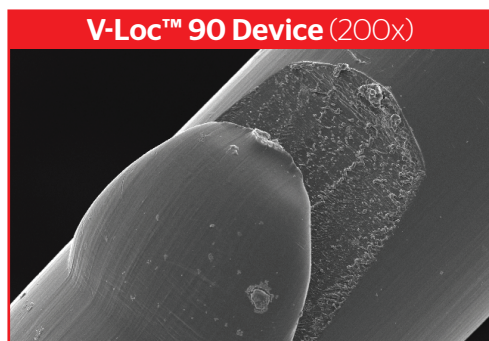
*Refers only to STRATAFIX™ Symmetric PDS™ Plus Knotless Tissue Control Device, STRATAFIX™ Spiral PDS™ Plus Knotless Tissue Control Device, and STRATAFIX™ Spiral MONOCRYL™ Plus Knotless Tissue Control Device
¹²21 RCTs, 6,462 patients, 95% CI:(14, 40%), P<0.001
¹³All triclosan-coated sutures in these RCTs were Ethicon Plus Antibacterial Sutures (MONOCRYL® Plus Antibacterial (poliglecaprone 25) Suture, Coated VICRYL® Plus Antibacterial (polyglactin 910) Suture and PDS® Plus Antibacterial (polydioxanone) Suture).
¹⁴Clean wounds-10 RCT, 2,842 patients 95% CI (11-43%), P=0.003; non-clean wounds-14 RCT, 3,620 patients, 95% CI (7 - 42%)

A head-to-head in vitro study showed **99.96% less surface bacteria** were present on STRATAFIX™ Spiral MONOCRYL™ Plus vs V-Loc™ 90²²

Following inoculation of 1,000,000 colony-forming units (CFUs) and a 24-hour incubation period in vitro, **1,530,000 CFUs were recovered from the V-Loc™ Device**, and **547 CFUs were recovered from the STRATAFIX™ Spiral MONOCRYL™ Plus Knotless Tissue Control Device**.²²



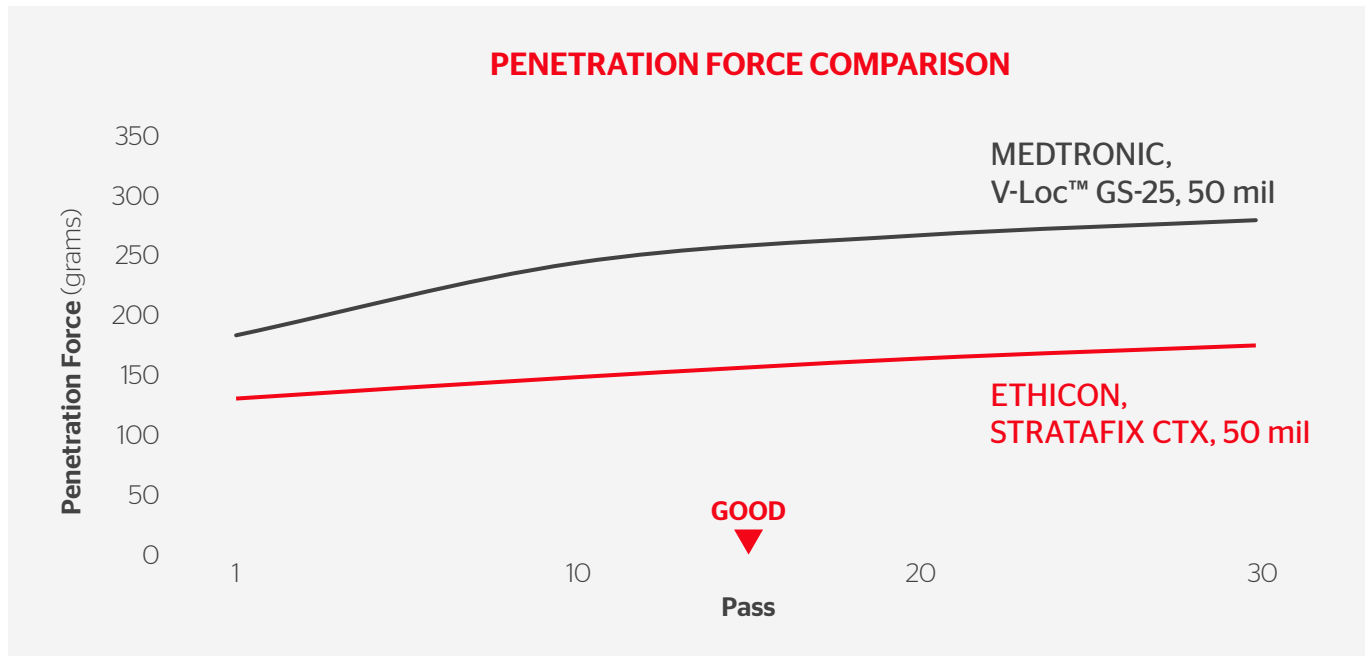
Scanning electron microscope (SEM) images show bacterial attachment on the V-Loc™ 90 Device



STRATAFIX™ Knotless Tissue Control Devices

Paired with premium Ethicon needles^{23,24}

- Superior penetration and strength compared to V-Loc™ and Quill™ needles
- Resistant to bending and breaking
- Penetrate tissue smoothly

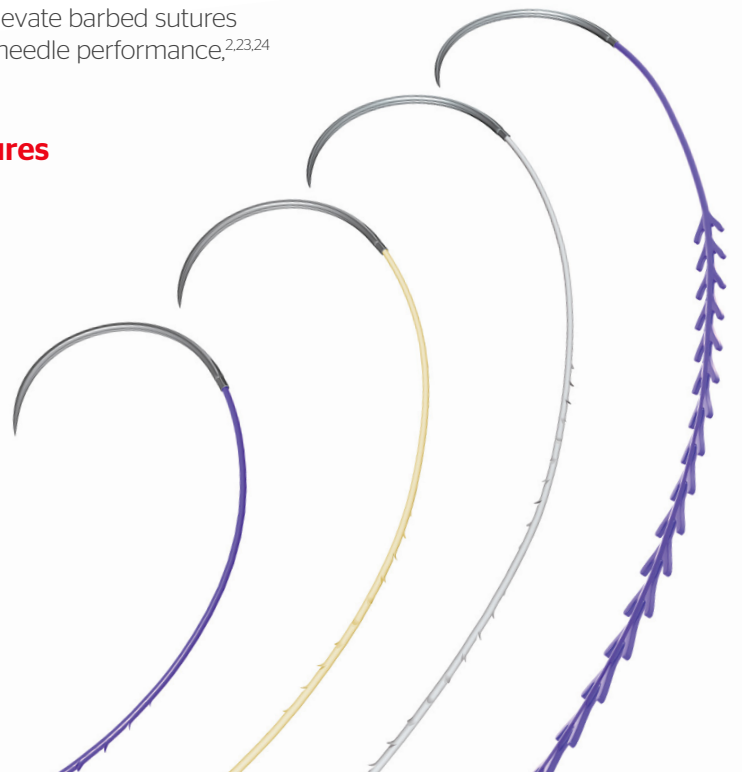


Everything you expect from the leader in Wound Closure

Only Ethicon's 130-year legacy of proven innovation can elevate barbed sutures to the next level—with trusted Ethicon polymers, superior needle performance,^{2,23,24} and exclusive Plus Antibacterial Technology.

Most comprehensive portfolio of barbed sutures

- 220+ codes in a variety of lengths and sizes for open, laparoscopic, and robotic procedures
- Three anchor technologies (unidirectional spiral, bidirectional spiral, and symmetric) for maximum versatility
- Only barbed suture appropriate for closing high-tension areas, such as fascia^{25,26*}
- Available in short-term, long-term, and non-absorbable polymers to suit multiple tissue types



*Applies only to STRATAFIX™ Symmetric PDS™ Plus Knotless Tissue Control Device.

For complete indications, contraindications, warnings, precautions, and adverse reactions, please reference full package insert.

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