Barbed Suture Performance: V-Loc™ 180 v. STRATAFIX ™* Spiral PDS Plus-Comparative In-vitro Evaluation

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Introduction

The adoption of robotic assisted surgery (RAS) has significantly advanced the field of minimally invasive procedures, providing surgeons with enhanced precision, dexterity, and visualization. These technological enhancements have enabled more complex interventions across a wide range of specialties, including gastrointestinal (GI) and endoscopic surgery.

Advancements in RAS have significantly increased the use of barbed sutures for wound closure. The performance of barbed sutures in RAS closure relies on hundreds of tiny barbs that securely anchor tissue and evenly distribute tension along the wound. The barb design, shape, and placement along the suture play a critical role in defining the device and contributing to its performance.◊, ‡,1,2

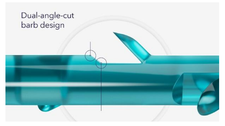
Objective

This study aims to compare and evaluate the barb design features of the V-Loc™ 180 Absorbable Wound Closure Device (Fig. 1) with Ethicon's STRATAFIX™* barbed suture, focusing on their *in vitro* performance and unique design characteristics. Testing methodologies adhere to industry-standard best practices for assessing key in vitro performance metrics of barbed devices.

Methods

Barb geometry—including cut angle, depth, length, width, prominence, pitch, and helicity—were measured microscopically with Keyence 7000 software measurement tools at 80X.

Figure 1. V-Loc™ 180 Barb Design



V-Loc™180

Device strength performance was evaluated using mechanical testing with the Instron system. Barb Holding Force testing measures the strength of individual barbs under controlled tensile force using media that mimics ex-vivo subcutaneous tissue. Suture Tensile Strength testing determines the force needed to break the suture strand under sustained tension. *In vitro* suture strength retention was assessed by measuring the breaking force after incubation at 37°C for 2 and 3 weeks (Fig. 2).

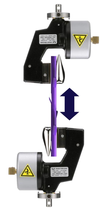


Figure 2. Straight Pull Force test method

Results

Microscopic analysis of the products revealed distinct design differences. V-Loc™ barbs are distributed circumferentially around the strand, completing a helix every 1.8 mm, whereas STRATAFIX™* Spiral PDS forms a helix every 5.7 mm (Fig. 3). As a result, approximately two-thirds of the STRATAFIX™* Spiral strand cross-section lacks barbs, in contrast to the continuous barb coverage seen in V-Loc™ ‡,§,1 (Fig. 4).

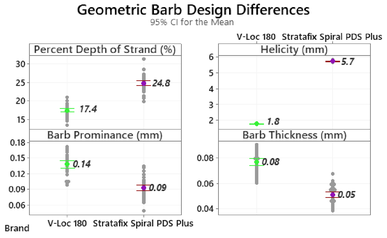


Figure 3. Barb Geometry metrics comparison.

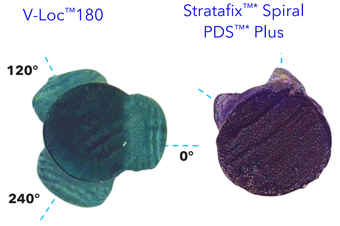


Figure 4. Cross sectional microscopic images of the devices taken for 1.8 mm length .

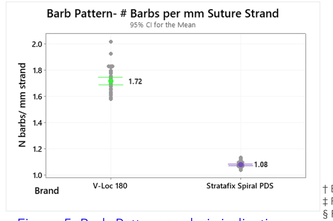


Figure 5. Barb Pattern analysis indicating number of barbs per mm strand

V-Loc™ dual angle cut barbs, are larger—being 49% more prominent, 50% thicker, 54% longer, and 30% shallower—than the single angle STRATAFIX™* Spiral PDS barbs‡,1 (Fig. 6).

† Based on benchtop studies. Bench test results may not be indicative of clinical performance.
‡ For size 3-0
§ For all sizes
◊ V-Loc 180 size 3-0 and Quill PDO size 2-0
¶ As compared to conventional sutures
# As compared to a locking stich with a conventional sutures during a urological procedure.
Δ Animal data may not correlate with human clinical outcomes
∞ Based on preclinical data; preclinical results may not correlate with clinical performance in humans

Design differences directly impact performance, resulting in V-Loc™ 180 having significantly greater barb holding force and pull strength than STRATAFIX™* Spiral PDS in all sizes[2] (Fig. 7).

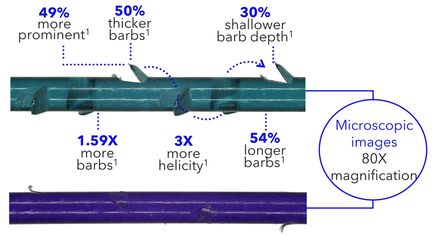


Figure 6. Keyence Microscope Images of A) V-Loc™ 180, dual angle barb design B) STRATAFIX ™* Spiral PDS Plus, single angle barb design.

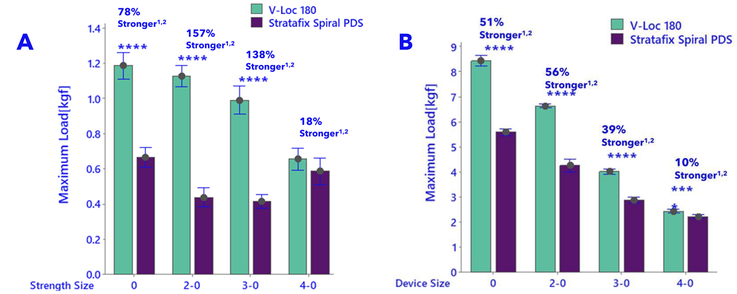


Figure 7. Benchtop testing at initial timepoint for A) barb holding force and B) straight pull force.

V-Loc™ 180 demonstrated significantly greater straight pull strength than STRATAFIX™* Spiral PDS during the first three weeks of *in vitro* testing.[3]

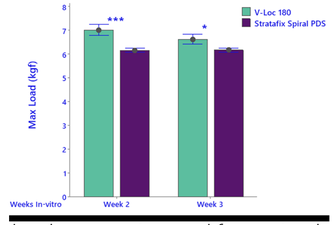


Figure 8. Invitro Straight pull Force Testing over time.

Conclusion

V-Loc™ features a unique dual angle barbed technology, engineered for optimal performance. This design maximizes barb strength while maintaining suture integrity, delivering superior *in vitro* device performance.[4]

The circumferential barb pattern delivers uniform barbs creating a 360° helix every 1.8mm, for unmatched traction and anchoring across the tissue.¶,#,Δ,1,4-9

The V-Loc™ device isn't just stronger at first use – it stays strong during the critical early stages of wound healing.†, ¶,∞,9-12

1. Based on internal test report #RE00516332, Design Differences of V-Loc™ 180 vs Stratafix™* Spiral PDS and Quill PDO™*. August 2024. **2.** Based on internal test report #RE00515133, V-Loc™ 180 vs Competitive Devices – Benchmarking Report. August 2024 **3**. Based on internal report # RE00527862 - Competitive Product Testing Report (v2.0). August 2024 **4.** Nambi Gowri K, King MW. A Review of Barbed Sutures-Evolution, Applications and Clinical Significance. Bioengineering (Basel). 2023 Mar 27;10(4):419. **5.** Wang M, Mu X, Yang F, Niu Y, Xing N. Self-retaining barbed suture reduces warm ischemia time during laparoscopic partial nephrectomy. Minim Invasive Ther Allied Technol 2018; 27(5):272–7 **6.** Zorn Trinh Q, Jeldres C, et al. Prospective randomized trial of barbed polyglyconate suture to facilitate vesicourethral anastomosis during robot-assisted radical prostatectomy: time reduction and cost benefit. BJU International. 2011;109:1526-1532. **7**. Koide S, Smoll NR, Liew J, Smith K, et al. A randomized 'N-of-1' single blinded clinical trial of barbed dermal sutures vs. smooth sutures in elective plastic surgery shows differences in scar appearance two-years post-operatively. J Plast Reconstr Aesthet Surg. 2015;68(7):1003-1009. **8.** Fouda Barbed Versus Conventional Suture: A Randomized Trial for Suturing the Endometrioma Bed After Laparoscopic Excision of Ovarian Endometrioma **9.** Zaruby J, Gingras K, Taylor J, Maul D. An in vivo comparison of barbed suture devices and conventional monofilament sutures for cosmetic skin closure: biomechanical wound strength and histology. Aesth Surg J. 2011;31(2):232-240 **10.** Sull A, Inceoglu S, et al. Comparison of Barbed Sutures in Porcine Flexor Tenorrhaphy. Hand (N Y). 2016;11(4):475-478. **11.** Brown, S. Utilization of a Porcine Model to Demonstrate the Efficacy of an Absorbable Barbed Suture for Dermal Closure, UTSW, June 2009. **12.** Sato M, Matsumura H, Gondo M, Shimada K, et al. Flexor tendon repair with barbed suture: an experimental study. Eur J Orthop Surg Traumatol. 2014;24(8):1421-4.)

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