VENOSTENT

SelfWrap: A Novel Bioabsorbable Wrap to Improve AVF Maturation and Patency

Presented by: Ellen Dillavou, MD

2024 VEITH Symposium, New York, NY
November 23rd, 2024

Disclosures

- Speaker for WL Gore, SAB member
- Speaker for Merit Medical
- Dialysis Access section editor for UpToDate
- PI for VenoStent Trial (VenoStent), Steering committee member
- PI for InnAVasc Trial (Gore)

The Problem

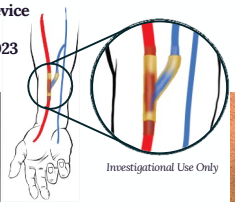
- **5 Million Patient Lives** put at risk every year by:
  - **60% 1-Year Failure Rates** of AVFs and AVGs[a]
  - 20% 1-Year Failure Rates of Vein Grafts in bypass grafting
- **$3B Direct Cost** to Medicare for AVF failures[b]

[a] Lee et al. JASN. 2019 Nov; 30:2209–2218.
[b] Thamer et al. Am J Kidney Dis. 2018 Jul; 72(1):10-18.

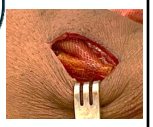
SelfWrap® Bioabsorbable Perivascular Wrap

Received Breakthrough Device Designation May 2022
+ IDE Approval in May 2023

Vascular Wrap made of Bioabsorbable Polymers

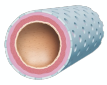


Investigational Use Only



How It Works

Biomimetic Mechanical Support



Artery-like mechanical support to help vein first "behave" and then "become" like an artery

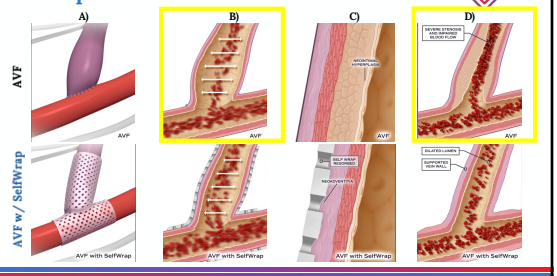
Regulated Flow

Imparts hemodynamic benefits (e.g. reduced turbulence)

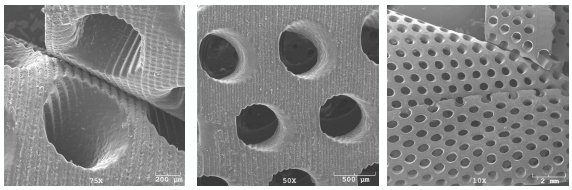
Outward Growth

Promotes outward migration of vascular smooth muscle cells and downstream expansion

SelfWrap in Action



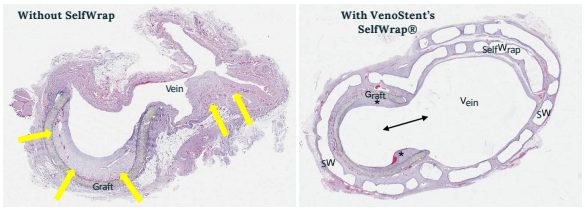
Novel 3D-Printed, Slowly Absorbing Design



SEM images of layer-by-layer 3D printed devices

Porosity optimized in multiple animal models to promote neovascularization with minimal inflammatory response (hypothesized to reduce neointimal hyperplasia)

Preventing the Primary Reason for >50% Failure Rates in Vascular Surgery



In every large animal model tested – arteriovenous fistulas (AVFs), arteriovenous grafts (AVGs), and bypass grafts over 5 years and 3 different centers – our advanced materials approach that "arterializes" veins **significantly reduces** the primary reason for >50% failure rates in vascular surgery: Neointimal Hyperplasia

Feasibility Study Design

Objective	Demonstrate feasibility, and evaluate the safety and performance of the SelfWrap device
Study Design	20 Participants; Single-Center, Prospective, Single-Arm (1, 2, 3, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60 month follow ups)
Clinical Site	Sanatorio Italiano. España esq. Zanotti — Asunción, Paraguay
PI/Coordinator	Adrian Ebner, MD; Santiago Gallo, MD
Key Collaborators	Jamie Dwyer, MD, Jon Bath, MD, Eric Peden, MD
Sponsor	VenoStent, Inc.

Feasibility Study Key Entry Criteria

Inclusion

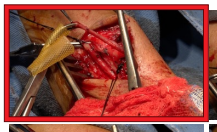
- **Adults (≥ 18 years) on HD referred for a new AVF**, with triphasic arterial flow and intact venous outflow, and a nonpathological modified Allen test for radial AVFs;
- **Target cephalic vein inner diameter ≥ 2.5 mm** and target artery ≥ 2.0 mm as measured via duplex ultrasound with a tourniquet applied;
- **Catheter being used for HD** either contralateral to planned AVF or in the groin. If ipsilateral, catheter will be moved to other arm prior to AVF creation.

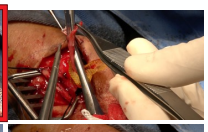
Exclusion

- **≥ 12 months with a catheter ipsilateral to the planned AVF**, or if there has been any previously failed ipsilateral AVF/AVG;
- Planned index procedure to revise or repair an existing fistula;
- Significant (> 50%) stenosis at the target vein on the side of surgery, as diagnosed by preoperative ultrasound;
- Known central venous stenosis > 50%;
- Amputated limb;
- Use of a peripherally-inserted central catheter (PICC) line;
- Comorbidities such as Abnormal cardiac rhythm; Known coagulation disorder; Known or suspected active infection at the time of surgery; Congestive heart failure NYHA class 4; Prior steal on the side of surgery

Surgical Procedure and Implantation

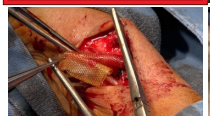
1. Prior to anastomosis construction (and after vein mobilization), thread vein through SelfWrap

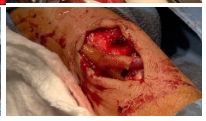




2. Prepare to suture vein to artery

3. After constructing anastomosis, slide device down over AVF





4. With SelfWrap positioned around the AVF, close incision

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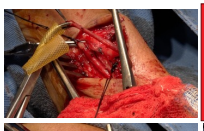

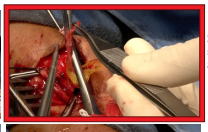

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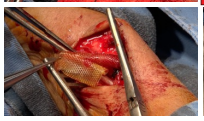

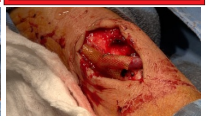

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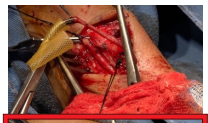

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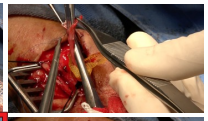

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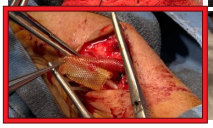

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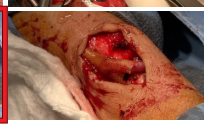

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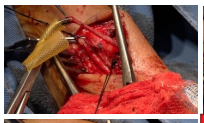

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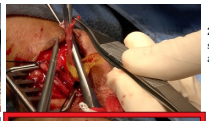

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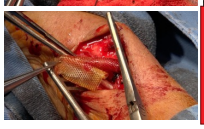

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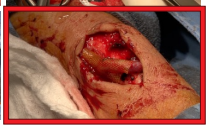


Results: 100% Technical Success in 20 AVFs

- 29 patients screened, 20 enrolled
  - Screen outs due to inability to comply with study follow up schedule (5), confounding comorbidity (1), referral for AVG (1), amputated limb (1), vein ID < 2.5 mm (1)
- Three SelfWrap sizes employed, selection based on vein size

Fistula Type	Total
Brachiocephalic Fistulas (BCFs)	13 (65%)
Basilic Vein Transpositions (BVTs)	2 (10%)
Radiocephalic Fistulas (RCF)	5 (25%)

High Risk Patient Population (Lok criteria)

- Lok Criteria (race, elderly status, PAD, and CAD status) **predicts that >42% of subjects in this study would fail to mature**
  - Doesn't take into account more female than male, all ESRD, on HD, and smaller than average vessel sizes

Baseline Characteristics	Frequency (%)	Mean ± SD
Female	11 (55%)	
Hispanic Latin Race	20 (100%)	
Age (years)		55.2 ± 14.1
Elderly (≥ 65 years old)	6 (30%)	
BMI (kg/m²)		26.7 ± 5.3
Obese (BMI ≥ 30.0 kg/m²)	5 (25%)	
Hypertension (%)	20 (100%)	
Type 2 Diabetes Mellitus	12 (60%)	
COPD or pulmonary hypertension	3 (15%)	
NYHA Class II	9 (45%)	
CAD (previous CABG / PCI / MI)	2 (10%) and 1 unknown	
PAD	1 (5%) and 1 unknown	
Severe Aortic Disease (prosthetic aortic valve)	1 (5%)	
Previously diagnosed with COVID-19	2 (10%)	
Ex-smoker	5 (25%)	
Hyperlipidemia	4 (20%)	
Hypothyroidism	1 (5%)	
Thrombocytosis	3 (15%)	
Thrombocytopenia	2 (10%)	
Untreatable Allergy to Anticoagulation therapy	1 (5%)	
Previously infected with Dengue virus	1 (5%)	

CKD Status	Frequency (%)	Mean ± SD
eGFR		7.7 ± 3.1
ESRD (eGFR < 15)	20 (100%)	
Pre-hemodialysis	1 (5%)	
CVC used at time of screening	19 (95%)	
Time on CVC prior to AVF creation (months)		5.5 ± 4.1
On CVC ≥ 6 months prior to AVF creation	8 (40%)	
History of catheter use on AVF side	5 (25%)	

[6] Lok et al. J Am Soc Nephol. 2006; 17: 3204 – 3212.

No Device-Related Adverse Events

Primary Safety Endpoint:

Freedom from the following through 6 months:	Result
Device-related infection	100% (13/13)
Device-related thrombosis	100% (13/13)
Device-related aneurysm	100% (13/13)
Device-related pseudoaneurysm	100% (13/13)
Device-related major bleeding	100% (13/13)
Device-related rehospitalization	100% (13/13)

Secondary Safety Endpoints:

Freedom from the following through 1, 2, 3, 12, 18, 24, 30, and 36 months:	Results							
	1-M	2-M	3-M	12-M	18-M	24-M	30-M	36-M
Device-related infection	100% (20/20)	100% (20/20)	100% (20/20)	100% (15/15)	100% (10/10)	100% (9/9)*	100% (7/7)	100% (7/7)
Device-related thrombosis	100% (20/20)	100% (20/20)	100% (20/20)	100% (15/15)	100% (10/10)	100% (9/9)*	100% (7/7)	100% (7/7)
Device-related aneurysm	100% (20/20)	100% (20/20)	100% (20/20)	100% (15/15)	100% (10/10)	100% (9/9)*	100% (7/7)	100% (7/7)
Device-related pseudoaneurysm	100% (20/20)	100% (20/20)	100% (20/20)	100% (15/15)	100% (10/10)	100% (9/9)*	100% (7/7)	100% (7/7)
Device-related major bleeding	100% (20/20)	100% (20/20)	100% (20/20)	100% (15/15)	100% (10/10)	100% (9/9)*	100% (7/7)	100% (7/7)
Device-related rehospitalization	100% (20/20)	100% (20/20)	100% (20/20)	100% (15/15)	100% (10/10)	100% (9/9)*	100% (7/7)	100% (7/7)

*One patient at 24 months did not attend in-person follow up, but continued AVF use, patency, and freedom from AEs confirmed by dialysis center; patient was not reconsented at 24 months, withdrawn

No adverse events probably or definitely related to the device through 36 months

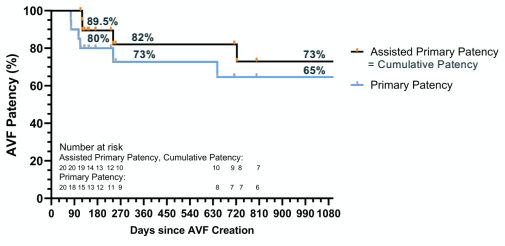
Adverse Events Summary

No Device-Related Adverse Events, Device Deficiencies, nor Adverse Device Effects

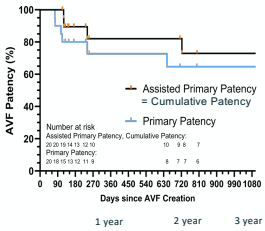
AE	# (Per Patient-Yr)	Cause, as determined by PI		
		Device-related	Procedure-related	Other
Death (Day 114 – 713)	8 (0.24)	No	No	Sepsis (5), Cardiac (1), Diabetes (1), Neurogenic (1)
Upper arm stenosis (Day 71)	1 (0.03)	No	No	Anatomy-related
Successfully-treated stenosis (Day 77)	1 (0.03)	Possible	Possible	N/A
AVF abandonment (Occlusion) (Day 120, 121, 241, 723)	4 (0.12)	No	Two probably due to PTA[1]	Two due to cannulation injury

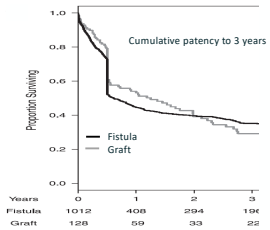
[1] Original stenosis possibly due to device and/or procedure

Primary Endpoint – High Patency



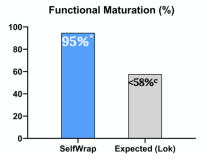
Venostent vs Historic Control (HFM study)





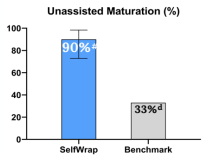
Allon, et al. Am J Kidney Dis 2018;71(5):677-689

High Maturation in 20-Patient Study



Two-needle cannulation for more than 75% of dialysis sessions w/in 4 consecutive weeks

*18/19 (95%), one excluded due to death at 142 days. 17 of 18 prior to 180 days, one at 242 days (due to edema from superficialization and cannulation injury)

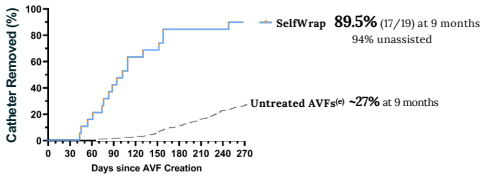


Two-needle cannulation without requiring an intervention (excluding superficialization and 1 collateral ligation) to do so

*18/20 (90%). Median time-to-cannulation: 59 days (inc. 4 superficialized) 17 of 18 prior to 180 days, one at 187 days (due to edema from superficialization)

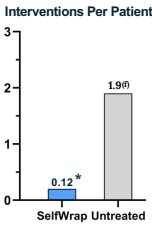
(c) Lok et al. J Am Soc Nephol. 2006; 17: 3204 - 3212. (d) Lee et al. JASN. 2019 November; 39(11): 2209 – 2218.

High Catheter Removal Rate



(e) Clarke et al. Can J of Kidney Health. 2016; 6: 1 – 10.

Low Rate of Interventions



- 4 Total Interventions to date (2 on premature AVFs)
  - 3 PTA for juxta/anastomotic stenosis
  - 1 surgical revision + stent placement for upper arm cephalic vein stenosis
- Currently at 0.12 interventions per patient year (PPY)
  - Compared to 1.9 interventions PPY for standard of care(f)(g)

*Excludes superficializations (4), ligation of a collateral (1), and banding of a high flow fistula (1)

(f) Litchfield et al. Endovascular Today. 2019; 18:64-66.
(g) Lok et al. JASN. 2019 Nov; 30(11):2040-2042.

SW-AVF Summary

- Safety and effectiveness of SelfWrap preliminarily demonstrated in 20-patient trial (33+ patient-years)
  - 100% freedom from device-related infection, thrombosis, aneurysm, pseudoaneurysm, major bleeding, and rehospitalization
  - No adverse events probably or definitely related to the device through 36 month follow ups
- 95% functional maturation for a challenging patient population (expected < 58% maturation)
- 90% unassisted maturation, where typically this is 30 – 50%
- Low intervention rates (0.12 interventions per-patient year, vs. typically 1.9)
- High rate of catheter removal (e.g. 90% of catheters removed by 9 months, vs. ~27%)
- Maturation, patency, and intervention rates appear better than standard of care
- If translated to IDE Study, these results would be very impactful for CKD/ESRD patients requiring HD

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SAVE-FistulaS

Trial Update as of October 31st, 2024

SAVE-FistulaS RCT Design

Design: Prospective, multi-center, randomized, double-arm, single-blind clinical study for chronic kidney disease (CKD) patients referred for creation of a new AVF.

Follow Ups: 14, 30, 90, 180, and 365 days for market approval. Additional post-market follow ups through 36 months.

Study Size: 200 subjects (100 treated, 100 control) w/ ≥ one-third radiocephalic (remainder brachiocephalic) and ≥ two-thirds on hemodialysis at randomization, ~20 sites.

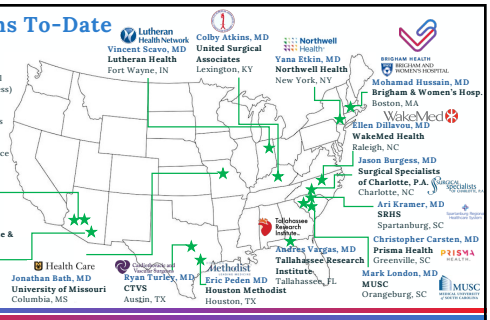
Primary Efficacy Endpoint: Unassisted Maturation by 180 days

Funded in part by NIH SBIR Phase II Award #2R44HL151025-02A1 NIH

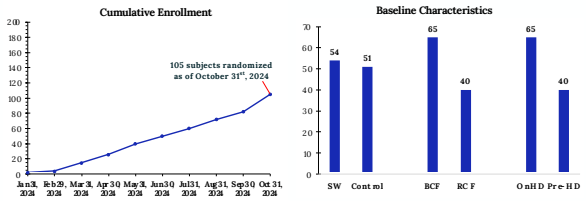
Activations To-Date

Criteria for initiation order:

1. Experienced in clinical research (esp. AV access)
2. Volume of AVFs & projected enrollment
3. Timeliness & readiness for site initiation
4. Proximity without biasing diversity (reduce travel costs, ease of monitoring)



Enrollment & High-Level Baseline Characteristics



THANK YOU!

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Contact Information

Ellen Dillavou, MD
edillavou@wakemed.org

Mark Barakat, MD – Director of Clinical Affairs
mark.barakat@venostent.com
(760) 450-5795

Tim Boire, PhD – CEO
tim.boire@venostent.com
(603) 930-9407

