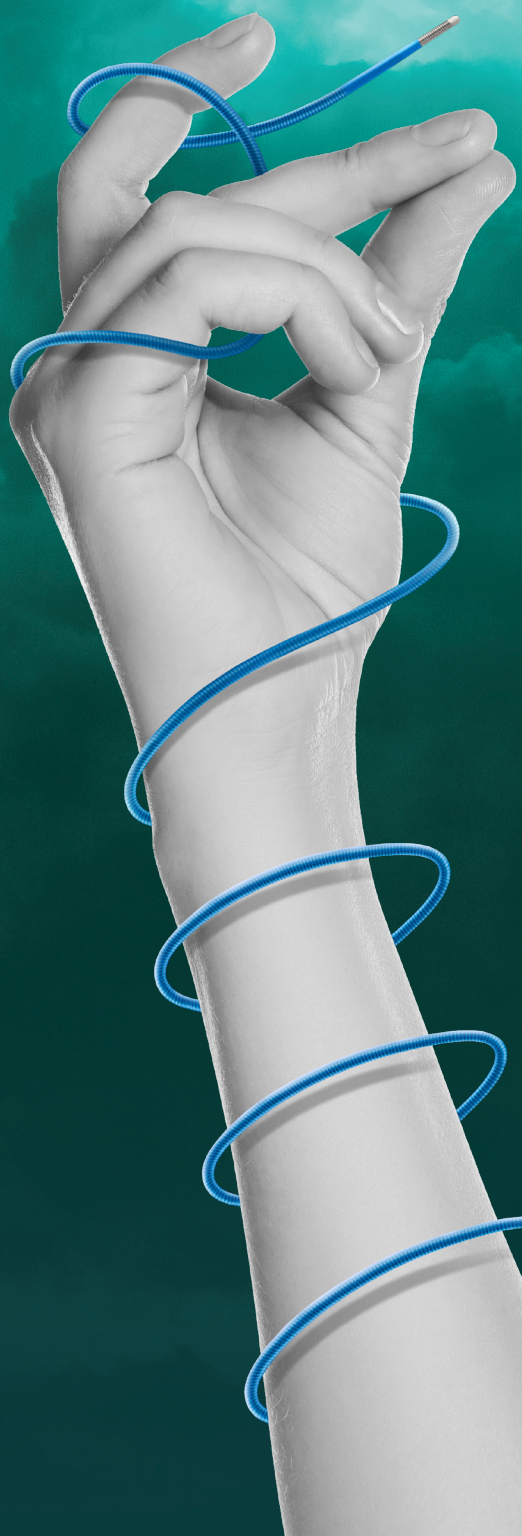
SUPPLEMENT TO

NOVEMBER 2025

Endovascular TODAY



UNCROSSABLE LESIONS.

Sublime™ Microcatheters cross tough lower extremity lesions from radial, femoral, or pedal access.

"For the most complex or challenging lesions, I now find myself reaching for the Sublime™ Microcatheter." Dr. Henry D. Hirsch (page 9)

Proximal SFA occlusion crossed with Sublime™ Microcatheter. Photo courtesy of Dr. Henry D. Hirsch.

Eric C. Smuclovisky, MD

Henry D. Hirsch, MD, FACS, FSVS

Ahmad S. Khraisat, MD

Aravinda Nanjundappa, MBBS, MD

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Doing the Twist: There's More to Microcatheter Torqueability Than Meets the Eye

By John Bridgeman

Physicians who perform complex peripheral interventions are well aware of the value of microcatheter torqueability for navigating through challenging vessel anatomy. Applying rotational torque to a catheter—if the catheter can transmit it—reduces frictional resistance, improving crossability of tight lesions and enhancing the catheter's ability to track through tortuous vessels (spin-deliverability).[1,2] Peripheral interventions, no less than coronary, require robust crossing tools: 40% to 50% of femoropopliteal interventions involve total occlusions.[3] For the Sublime™ Microcatheter, Surmodics sought to provide the key features of spin-deliverable, high-performance coronary crossing catheters in a device purpose-built for complex peripheral interventions. Adding to the challenge, the Sublime™ Microcatheter platform specifications called for device working lengths up to 200 cm, available in .014, .018, and .035 guidewire compatible platforms. Achieving these goals was a daunting task.

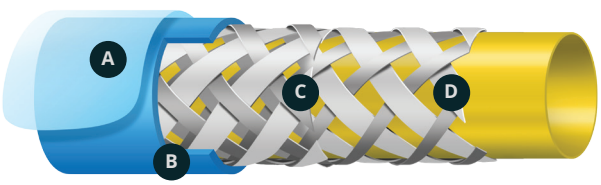
Highly torqueable microcatheters, as compared to nontorqueable or "push-only" microcatheters, ensure that rotation put into the hub translates to the tip. Engineering torqueability into a catheter requires structural support, often achieved with metallic braids or coils.

> "Torqueability refers to a catheter's ability to transmit rotational force (torsion) without yielding. Importantly, it also refers to the ability of a catheter to avoid storing torsion as it is being rotated."

The Sublime™ Microcatheter is engineered to optimize torqueability, flexibility, pushability, and kink resistance (Figure 1). Specifically, the microcatheter's proprietary braid structure allows for individually optimized performance elements with much greater freedom from typical trade-offs, such as sacrificing torque or push to gain flexibility or increasing wall thickness to improve kink resistance.

Torqueability refers to a catheter's ability to transmit rotational force (torsion) without yielding. Importantly, it also refers to the

MICROCATHETER CROSS-SECTION



Shaft Construction

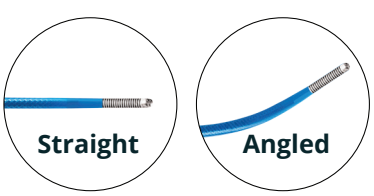
A. Pristyne™ hydrophilic coating designed to minimize vessel damage and spasm while optimizing trackability through distal tortuosity

B. Polymer outer jacket provides uniform device structure

C. Proprietary dual stainless steel, locked-braid layers work in unison to offer maximum torque control, push transmission, and deliverability

D. PTFE-lined inner lumen provides smooth device tracking over guidewires and when telescoping microcatheters

Tip Configurations:



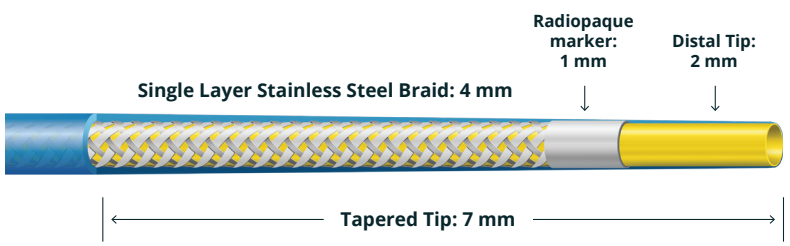


Figure 1. Structural design of the Sublime™ Microcatheter. PTFE, polytetrafluoroethylene.

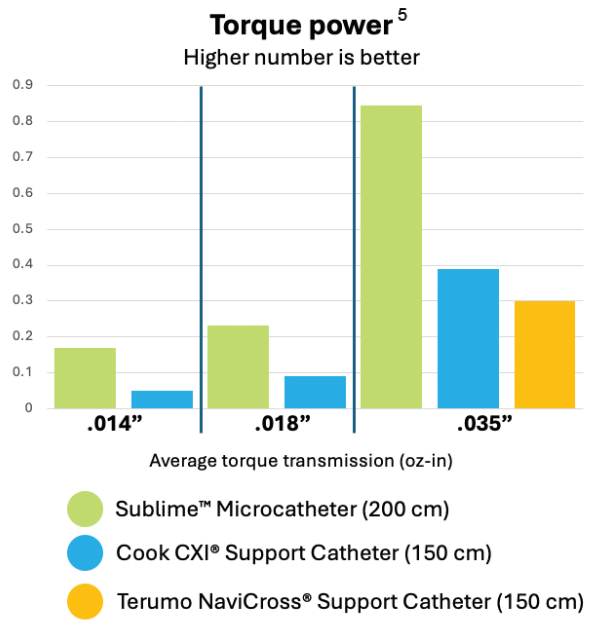


Figure 2. Sublime™ Microcatheter torque power testing versus competitors (2021). Bench testing may not be representative of actual clinical performance.

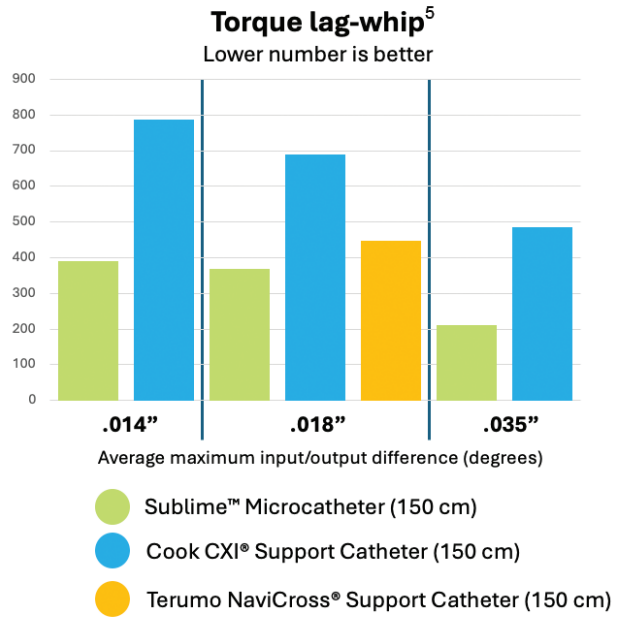


Figure 3. Sublime™ Microcatheter torque lag-whip (control) testing versus competitors (2021). Bench testing may not be representative of actual clinical performance.

ability of a catheter to avoid storing torsion as it is being rotated.[4] Understanding these two different aspects of torque is useful for interventionalists seeking the right microcatheter for their needs.

TORQUE POWER VERSUS TORQUE CONTROL

Torque power refers to the amount of rotational force a catheter can deliver from hub to tip (ounce-inch). While increased catheter shaft length generally makes efficient torque transmission between hub and tip more difficult, the 200 cm Sublime™ Microcatheter showed superior torque transmission against shorter 150 cm competitors (Figure 2).

On the other hand, torque control refers to the catheter's ability to efficiently and accurately translate proximal rotation at the catheter hub into corresponding, predictable rotation at the distal tip. Inefficient translation of this rotational force can cause the catheter tip to lag behind the hub, hindering accurate control of the tip and allowing torque energy (torsion) to build up within the catheter shaft. This built-up energy can be released unpredictably, causing the distal tip to "whip." As Dr. Hirsch emphasizes (see page 9), this unpredictability can make delicate adjustments, such as fine-tuning guidewire angles or tip positions, far more difficult. In bench testing, Surmodics quantified torque control by measuring the degree of lag at the distal tip relative to hub rotation (Figure 3).

Important as it is, enhancing torqueability is only one aspect of engineering high-performance crossing catheters. Optimizing pushability, trackability, tip profile, and lubricity with hydrophilic coatings each play a critical role. This engineering is focused on a single goal: enabling interventionalists to precisely deliver and manipulate their instruments to restore blood flow in blocked vessels in the most demanding conditions of tortuosity, tight strictures, and working length. We are proud of what peripheral interventionalists are telling us about the Sublime™ Microcatheter. After reading this supplement, you'll understand why. ■

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5. Surmodics data on file.

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Disclosures: Employee of Surmodics, Inc.

Spin It to Win It: Using the Sublime™ Microcatheter to Facilitate Recanalization of Chronically Thrombosed Veins

A conversation with Dr. Eric C. Smuclovisky.

Eric C. Smuclovisky, MD, is an interventional radiologist affiliated with Elkhart General Hospital in Elkhart, Indiana. He completed a Harvard Medical School fellowship in Vascular and Interventional Radiology at Massachusetts General Hospital and Early Specialization in Interventional Radiology at the Baylor College of Medicine in Houston, Texas. Dr. Smuclovisky's practice encompasses the full scope of interventional radiology, including advanced arterial and venous interventions; aortic and carotid endovascular therapy; venous and arterial thromboembolism management; and comprehensive hepatobiliary, genitourinary, oncologic, and musculoskeletal/pain procedures. We spoke with Dr. Smuclovisky about his approach to treating chronic lower extremity venous thrombosis and his use of the Sublime™ Microcatheter (Surmodics, Inc.).

How do you manage patients with chronic venous disease who present with acute symptoms?

Patients with long histories of venous disease and lower extremity interventions often present with acute symptoms of deep vein thrombosis (DVT), but they may require recanalization to restore blood flow through their chronically occluded and fibrosed veins in addition to thrombus removal.[1] In these cases, their acute symptoms are typically secondary to thrombosis of a lower extremity collateral or centrally located pelvic outflow vein.[2] If we simply perform thrombectomy in the deep veins in these patients and do nothing more, we may be overlooking outflow or inflow issues that put patients at risk of rethrombosis and persistence or recurrence of symptoms.[3,4] Femoral and/or iliac venous recanalization can substantially improve quality of life, especially for patients suffering from life-limiting symptoms of venous insufficiency or chronic venous wounds.[3]

How do you cross chronically thrombosed veins?

To open scarred, fibrotic veins densely obstructed by synechiae, you need support from a crossing catheter to place your guidewire at the site of treatment. This requires a catheter with robust pushability and torqueability to navigate these diseased vessels, as well as the ability to steer the catheter into the true lumen of native vessel and away from parallel collaterals or perforators.

"To open scarred, fibrotic veins densely obstructed by synechiae, you need support from a crossing catheter to place your guidewire at the site of treatment."

Can you describe your experience with the Sublime™ Microcatheter?

I've found the Sublime™ Microcatheter to be second to none. At first touch, the catheter feels remarkably compliant and malleable, but the device has powerful capabilities embedded in its technology. Once you start spinning this catheter, it delivers exceptional torque and pushability, more so than any other crossing catheter I've used to date. I attribute this to its distinctive double-braided design (see page 3). Compared with other crossing catheters I've used, the Sublime™ Microcatheter's pushability and torqueability make it easier for me to reach and cross difficult crossing points. In fact, I can reach these points without necessarily having to use an extra-long sheath, which allows me to keep my primary access very low-profile until I have secured wire access across the segments I want to treat. I can then escalate my access appropriately for treatment with other devices.

In long-segment chronic occlusions, a catheter must contend with a tremendous amount of friction along its length. That's where the Sublime™ Microcatheter really shines—as one of my mentors used to say, you can "spin it to win it" to decrease the coefficiency of friction and get a catheter to advance. When I turn this catheter

"I've found the Sublime™ Microcatheter to be second to none."

clockwise or counterclockwise, it turns efficiently, with minimal lag between the distal end of the catheter and the hub.

This controlled torqueability also gives the Sublime™ Microcatheter excellent steerability, particularly with the angled tip. Ordinarily, steering in patients with chronic disease can be really challenging; for example, when you're trying to steer through an open vessel distal or central to a chronic occlusion you've just crossed. Other catheters I've used just don't translate the torque you apply with your hands into tip deflection the way the Sublime™ Microcatheter does. We've been able to make do with other crossing catheters, but the Sublime™ Microcatheter makes life easier.

Regarding the case you provided for this supplement, what was the patient's clinical background and progression prior to recanalization?

This was a patient with a history of pulmonary embolism (PE) and multiple prior interventions to treat DVT in his right leg. I had previously seen him for a PE, at which time he also presented with a typical diagnosis of DVT in his right leg. After we performed thrombectomy for his PE, I decided to treat his leg in supine with frog-legged position. When I obtained popliteal access, I quickly realized we were dealing with a chronically occluded lower extremity deep venous system rather than acute DVT. Ultimately, I was unable to negotiate wire access via the true lumen in native vessel through the chronically occluded iliac venous system. Given procedure time and the unlikelihood that prolonging the intervention would mitigate any further PE risk, I decided to conclude the procedure—his PE was definitively treated, and I felt that his right lower extremity was unlikely to be the source of the thromboembolic PE. The contralateral limb was negative for DVT on Doppler exam.

Sometime later, he again presented to our practice and in the interim had developed a wound on his anterior shin. It was clear that revascularization was now imperative for limb preservation.

"Other catheters I've used just don't translate the torque you apply with your hands into tip deflection the way the Sublime™ Microcatheter does."

In my experience, thrombectomy or lysis alone does not lead to a good clinical outcome for this kind of patient.

Why did you use the "body flossing" technique described in the case?

The patient's venogram again demonstrated chronic occlusion of his popliteal and femoral veins. This time I knew the challenges that awaited in the pelvis; therefore, I achieved right internal jugular (RIJ) vein access, advanced a sheath as far down into the native right iliac vein as I could, and then placed that patient into the prone position for planned through-and-through wire access if needed. I used the Sublime™ Microcatheter to navigate from popliteal access through that long-segment chronic disease to meet up with the sheath I'd advanced from RIJ access. Intravenous ultrasound demonstrated true lumen wire access and mixed eccentric thrombus and synechiae occupying the lumen. ■

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Disclosures: None.

CASE REPORT

Long-Segment Iliofemoral Venous Recanalization Facilitated by the Sublime™ Microcatheter

By Eric C. Smuclovisky, MD

PATIENT PRESENTATION

A man in his mid-70s with history of pulmonary embolism (PE) and multiple prior right lower extremity (RLE) venous interventions presented with RLE leg swelling and an above-ankle venous wound.

DIAGNOSTIC FINDINGS

Ultrasound-guided access was first achieved via the right internal jugular vein (RIJV) and secured with an 8 Fr, 70 cm guiding sheath advanced into the right common iliac vein (RCIV) (Figure 1). A generous length of the RIJV sheath was left externalized to ensure continued operator access when repositioning the patient from supine to prone. With the patient in prone position, right popliteal venous access was achieved using a microaccess system and sheath. The microaccess was then exchanged for a 6 Fr, 23 cm introducer sheath. Venography performed from popliteal and IJ access demonstrated pronounced flow limitation in the right common femoral vein (RCFV) (Figure 2A) and RCIV (Figure 2B). A true lumen channel was identified medial to extravascular contrast in the pelvis (Figure 2C).

TREATMENT

From popliteal access, the chronically diseased iliofemoral venous system was successfully traversed using a .035, 90 cm Sublime™ Microcatheter (angled tip) in combination with a .035 stiff hydrophilic wire. With support from the catheter, the guidewire was advanced to within proximity of the guidewire placed via IJ access (Figure 3). A wire externalization ("body flossing") strategy between the two access sites was used to secure wire access and enhance device pushability for reestablishing inline flow. Plain balloon angioplasty from popliteal access was performed to 10 mm in the right femoral vein, 12 mm in the RCFV, and 14 mm in the RCIV and right external iliac vein. Contrast injection from

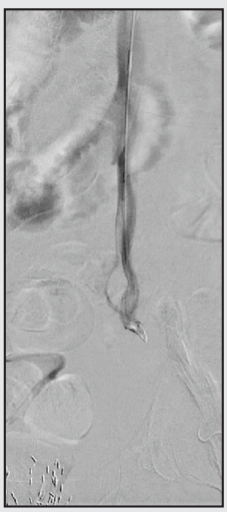

Figure 1. Guiding sheath positioned into the RCIV via RIJV access.

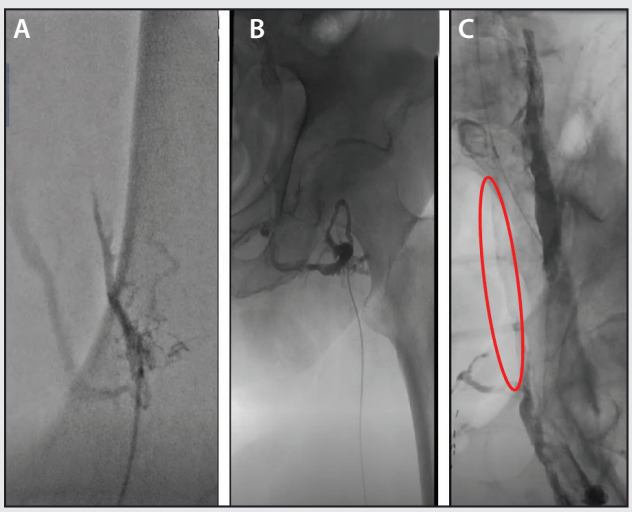

Figure 2. Venography performed from popliteal and IJ access demonstrated pronounced flow limitation in the RCFV (A) and RCIV (B). A true lumen channel was identified medial to extravascular contrast in the pelvis (C).

Figure 3. Guidewire supported by Sublime™ Microcatheter advanced from popliteal access to within proximity of the guidewire placed via IJ access.

popliteal access showed reestablishment of inline flow across the femoral vein (Figure 4A and 4B) and the entire iliofemoral system (Figure 4C), although with an atretic and diminutive iliac venous system. Self-expanding venous stents were deployed across the right iliofemoral venous system from the RCIV to RCFV. Final imaging of the iliac veins demonstrated a recanalized system with adequate luminal gain and no flow limitation (Figure 5).

PHYSICIAN OBSERVATIONS

The patient remained hospitalized after the procedure for monitoring and transition to oral anticoagulation. The Sublime™ Microcatheter was instrumental in securing guidewire placement through a chronically diseased iliofemoral venous system, leading to restoration of inline flow. ■

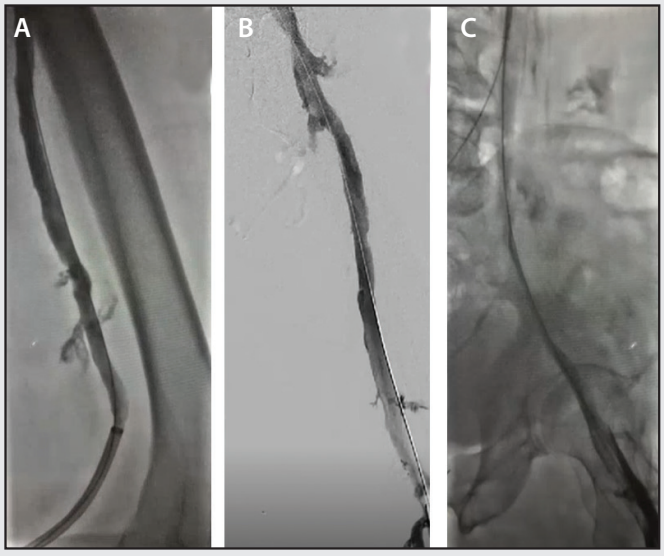

Figure 4. Contrast injection after balloon angioplasty demonstrated reestablishment of inline flow across the femoral vein (A, B) and the entire iliofemoral system (C), although with an atretic and diminutive iliac venous system. Panel A shows reestablishment of inline flow across the femoral vein with adequate luminal gain and no flow limitation, while panel B shows imaging of the femoral vein more centrally, again demonstrating a recanalized vessel without flow limitation.

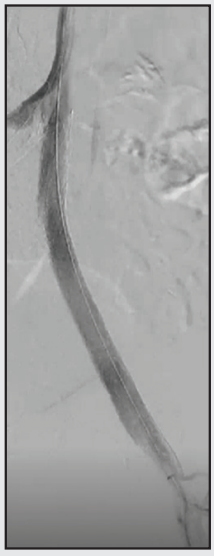

Figure 5. Final imaging of the iliac veins demonstrated a recanalized system with adequate luminal gain and no flow limitation.

Reliable Crossing of Complex Arterial Lesions With the Sublime™ Microcatheter

A conversation with Dr. Henry D. Hirsch.

Henry D. Hirsch, MD, FACS, FSVS, is a fellowship-trained vascular and endovascular surgeon at Main Line Health in Philadelphia. He specializes in aortic aneurysm repair, transcarotid artery revascularization, and complex limb salvage and chronic limb-threatening ischemia (CLTI) interventions using both endovascular and open surgical approaches. Dr. Hirsch and his colleagues perform a high volume of advanced procedures while maintaining a commitment to educating surgical residents and cardiology fellows at multiple hospitals. Given the complexity of his peripheral artery disease (PAD) interventions, Dr. Hirsch uses high-performance, torqueable microcatheters in almost every PAD case. We spoke with Dr. Hirsch about his peripheral microcatheter tool kit and his experience with the Sublime™ Microcatheter (Surmodics, Inc.).

How would you describe your PAD patient population and your microcatheter requirements for these patients?

Most of my patients have CLTI with rest pain or wounds, and they usually have multilevel disease—iliac plus femoral, femoral plus tibial, or all three levels. There's often a chronic total occlusion (CTO) with a tapered stenosis leading into it, followed by reconstitution beyond.

Sometimes I'm able to get through lesions with just a wire, but in most cases, I'll need catheter support to cross. Beyond crossing the lesion itself, it's very difficult to confirm proper reentry or verify that you're truly in the vessel lumen beyond the lesion without advancing a catheter. Even if crossing the lesion seems simple, I will still place a catheter and take an angiogram distal to the lesion to confirm that I am exactly where I think I am and to avoid any surprises.

Navigating those tapered stenoses can create a lot of friction. That's where microcatheters with good lubricious coatings, pushability, and torqueability become really valuable. For the most complex or challenging lesions, I now find myself reaching for the Sublime™ Microcatheter.

What is your current microcatheter tool kit?

I use various workhorse microcatheters for straightforward applications, such as aortic cannulations, where there isn't really a lesion to cross and I just need the catheter for wire exchange or simple cannulation. For contralateral diagnostics, such as crossing over from the left to the right leg, I generally use a Soft-Vu® Omni™ Flush Angiographic Catheter (AngioDynamics, Inc.) because its shape is suited for that purpose.

> "For the most complex or challenging lesions, I now find myself reaching for the Sublime™ Microcatheter."

For crossing challenging lesions, we have a broad selection available, including NaviCross® Support Catheters (Terumo Interventional Systems), Rubicon™ Control Support Catheters (Boston Scientific Corporation), Trailblazer™ Support Catheters (Medtronic), the CXI® Support Catheter (Cook Medical), the Quick-Cross™ Support Catheter (Philips), and now the Sublime™ Microcatheter platform, which I've been using with increased frequency.

What do you like about the Sublime™ Microcatheter?

With the Sublime™ Microcatheter, I've found excellent balance between push, flexibility, and torqueability. I find it handles well—it's flexible yet it retains torqueability. It also has a very good crossing profile with its tapered tip.

In addition, I find it easy to use in the sense that when rotating the proximal end of the microcatheter, the distal end of the microcatheter rotates with the proximal end with minimal lag. The efficient transfer of rotation through the shaft prevents energy from being stored in the shaft during torquing, avoiding the unpredictable release of that energy. This makes the Sublime™ Microcatheter predictable and pleasant to work with.

Why is predictable rotation of the catheter beneficial?

Sometimes when you twist a catheter from the proximal end and the rotation of the distal end lags behind the proximal end, the

Revascularization of proximal SFA occlusion (Figure 1) and heavily diseased SFA with friable and heavily beaded plaque proximal to existing stents (Figure 2) aided by the Sublime™ Microcatheter.

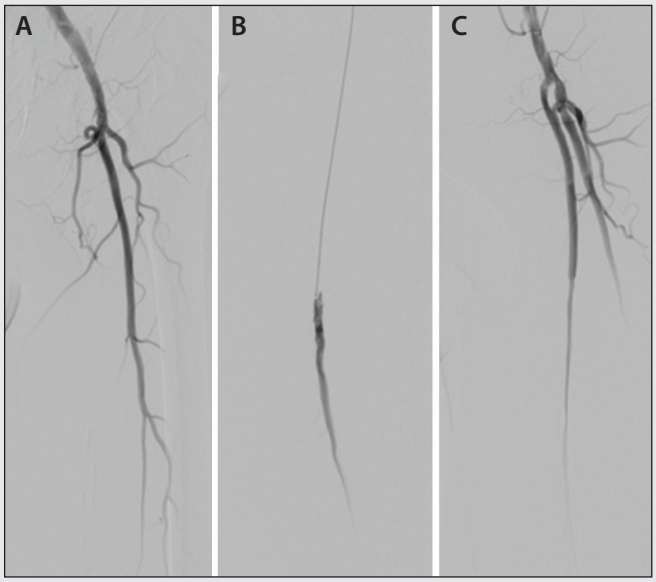

Figure 1. Preprocedure angiogram (A), deployment of the Sublime™ Microcatheter (B), and postprocedure angiogram (C).

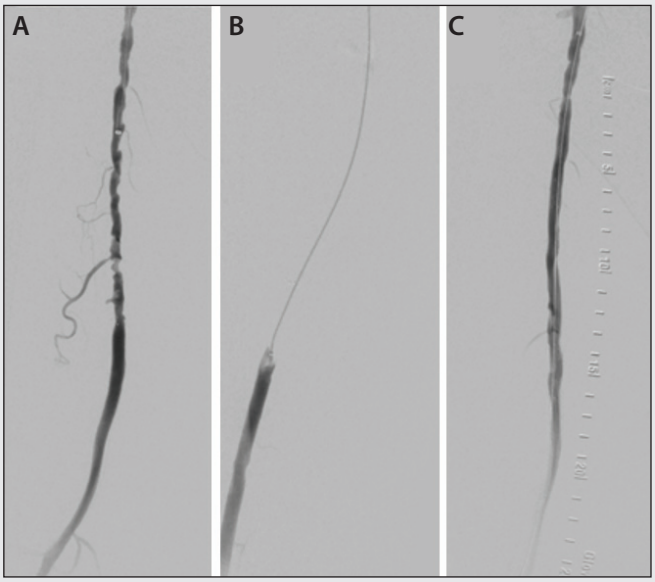

Figure 2. Preprocedure angiogram (A), deployment of the Sublime™ Microcatheter (B), and postprocedure angiogram (C).

stored energy in the catheter can be suddenly released, causing the distal tip to spin too fast or whip around. You might be turning quickly to get through something or carefully trying to finesse the wire angle. In my experience, the Sublime™ Microcatheter provides excellent torque control between the proximal end and the distal tip with minimal lag, so it doesn't release that twisting energy in a "whipping" manner (see page 3).

I haven't really seen the theoretical risk of artery injury or dissection from catheter twisting. It's more an annoyance. When a catheter stores a lot of energy, you might start advancing the catheter and the unpredictable release of that energy causes the catheter to suddenly jump. If you're using a floppy-tip wire and only have a short segment inside the vessel, stored energy can flip the wire tip out since there's not much grip. That's where the Sublime™ Microcatheter is great—I find it behaves predictably.

Can you determine your choice of tools with preprocedural imaging?

Almost everyone I take to the lab has a preprocedure ultrasound, so I usually have a sense of where and how much disease to expect and how long the affected segment might be. I start the case by crossing over and performing a complete runoff angiogram of the whole leg to map it out. Based on the angiogram and disease pattern, I decide on the sheath size—for example, whether I'll need something different for atherectomy versus stenting. Then I pick the wires and sheaths from my stockroom based on that plan.

In terms of microcatheter selection, I usually start with tip shape, almost always reaching for an angled catheter as my general starting point. If I'm facing a CTO and want to cross straight through the lumen using a CTO wire, a straight catheter is more useful. But generally, I prefer the navigability of an angled catheter to start.

For lesions above the knee, like a superficial femoral artery (SFA) lesion with reconstitution in the popliteal artery, I usually start with a .035 wire system and see how it goes. If I have trouble, I may switch to a .018 system.

In delicate cases—such as arterial dissections after knee replacement—I start with a .014 wire and a .018 catheter. Below the knee, I almost always start with a .014 system or use a .018 catheter with a .014 wire. If I think I might need to deliver a larger device, I may start with a .018 catheter to allow for upsizing and easy wire exchanges. ■

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Transradial Crossing and Treatment of Complicated Peripheral Lesions With the Sublime™ Radial Access Platform

A conversation with Dr. Ahmad S. Khraisat.

Ahmad S. Khraisat, MD, an interventional cardiologist at Aurora Health Care in Milwaukee, Wisconsin, specializes in endovascular interventions for coronary and peripheral artery disease, with a strong preference for radial access in both scenarios. His radial-peripheral toolkit includes Sublime™ guide sheaths (5 and 6 Fr, 120 and 150 cm), RX PTA Dilatation Catheters (250 cm, .014 and 220 cm, .018), and Microcatheters (.014, .018, and .035; ≤ 200 cm) (Surmodics, Inc.). We spoke with Dr. Khraisat about his use of the Sublime™ Radial Access Platform for transradial peripheral interventions.

"The Sublime™ Microcatheter is flexible and has excellent torqueability. In terms of torque control, I find the Sublime™ Microcatheter to be highly responsive to my movements..."

Why did you begin using Sublime™ Microcatheters?

The availability of the torqueable 200 cm Sublime™ Microcatheter made radial-peripheral cases much easier for me. Before I had these microcatheters, I was unable to reach some distal lesions, especially below the knee, from the radial access site using the shorter 150 cm support catheters available at the time. Instead, I relied on long chronic total occlusion (CTO) wires or percutaneous transluminal angioplasty (PTA) balloons for radial-peripheral crossing. But then I couldn't infuse contrast to confirm the true lumen position of the distal wire or steer the wire.

Not only does the 200 cm Sublime™ Microcatheter reach these lesions, but it also provides better support and guidance of the wire than these old approaches, along with the ability to infuse contrast. You need to be able to steer the wire to stay in the lumen and in the true target vessel.

Still, there is a perception among some interventionalists that you can't cross difficult lower extremity occlusions from the radial approach. In my opinion, the issue really comes down to the equipment available in your cath lab. Without a 200 cm torqueable peripheral microcatheter, you won't be able to reach and cross many of these distal occlusions. With the right tools in place, I can only think of one time when I've failed to cross a lower extremity lesion in the past 2 or 3 years using radial access.

How often do you use a torqueable microcatheter for radial-peripheral cases?

Almost always, even with my claudicant patients. There will be a lot of switching wires, switching balloons, and you'll still run into tight lesions. If you want to use a 200 cm over-the-wire drug-coated balloon in the lower extremity, you'll need a microcatheter to switch to a 400 cm or longer guidewire.

Aside from length, what do you like about the Sublime™ Microcatheter?

The Sublime™ Microcatheter is flexible and has excellent torqueability. In terms of torque control, I find the Sublime™ Microcatheter to be highly responsive to my movements, particularly with the .018 catheter. This comes in handy when I need to redirect the wire to different angles; for example, when I'm dealing with a fractured stent. I also find the kink resistance and lubricity of Sublime™ Microcatheters to be very good.

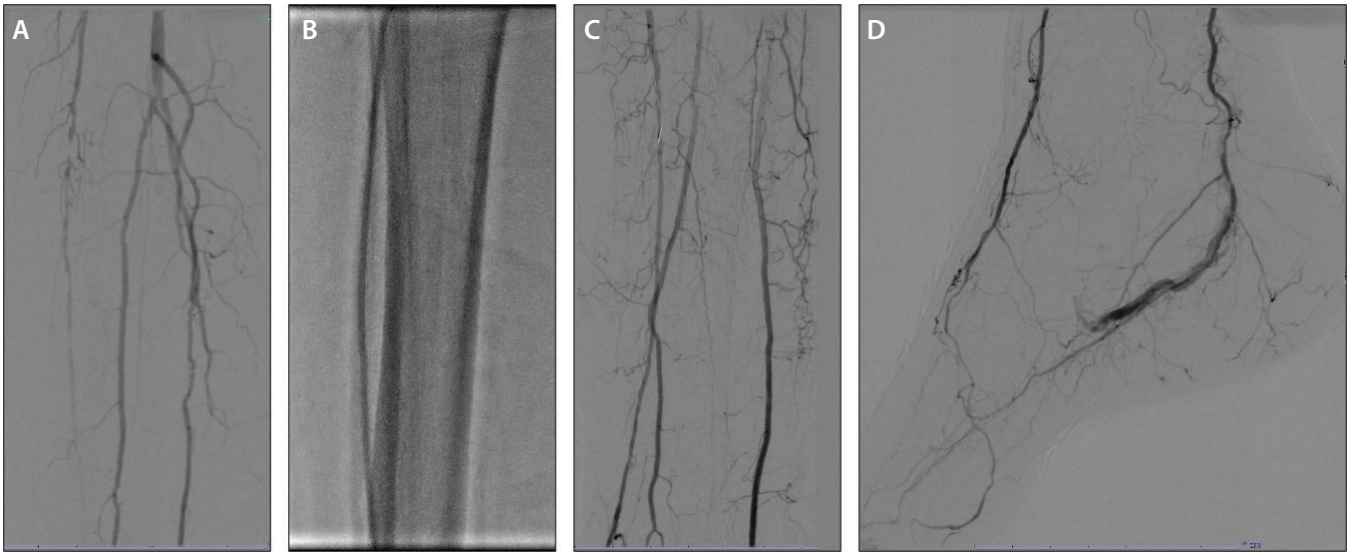

Figure 1. Transradial revascularization of anterior tibial artery aided by the Sublime™ Guide Sheath, Sublime™ Microcatheter, and Sublime™ RX PTA Catheter. A woman in her late 60s with a nonhealing ulcer on her right shin and a history of end-stage renal disease, hypertension, hyperlipidemia, and coronary artery bypass grafting presented for angiography and possible intervention. Initial angiography showed a CTO of the right anterior tibial artery (A). Right radial access was obtained. Following placement of a 5 Fr, 150 cm Sublime™ Guide Sheath, an angled 200 cm, .018 Sublime™ Microcatheter was used to facilitate guidewire crossing of the occlusion, with subsequent dilation with 250 cm, 2.5 X 150 mm Sublime™ .014 RX PTA Catheter (B) and subsequent flow in tibial (C) and pedal (D) vessels. Healed ulcer and no reported patient symptoms at 6-month follow-up.

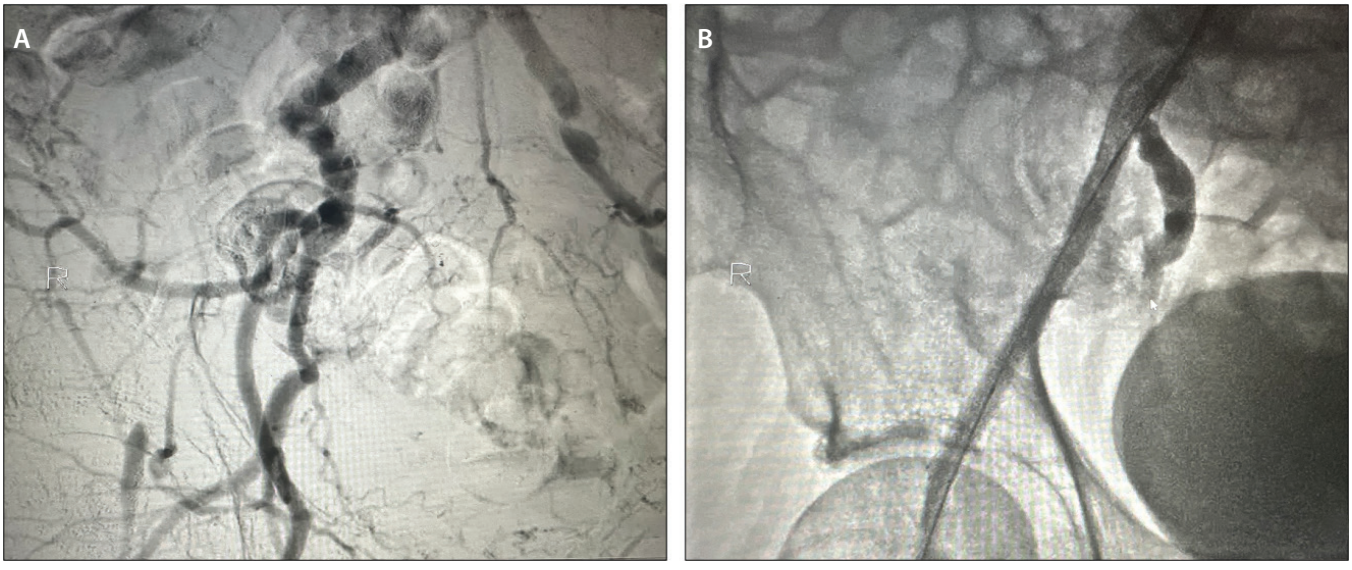

Figure 2. Transradial revascularization of an iliac artery CTO aided by the Sublime™ Guide Sheath and Sublime™ Microcatheter. A man in his early 70s with foot ulceration and history of peripheral artery disease and post right fourth toe amputation presented for bilateral lower extremity angiography and possible PTA and stenting. Initial angiography showed a CTO of the right iliac artery (A). Radial access was achieved. Following placement of a 6 Fr, 120 cm Sublime™ Guide Sheath, an angled 150 cm, .018 Sublime™ Microcatheter was used to facilitate guidewire crossing of the occlusion, with subsequent stenting (B). Healed ulceration and no reported patient symptoms at 2-year follow-up.

Do you prefer to use the straight- or angled-tip Sublime™ Microcatheter?

I use an angled tip for nearly all my cases involving this device (Figures 1 and 2). I find it better for directing the wire.

How would you describe the other tools you use from the Sublime™ Radial Access Platform?

Sublime™ Guide Sheaths provide very good support. In my opinion, they have better support than the sheaths I've used from other companies, more body to them. The availability of the 5 Fr Sublime™ Guide Sheath also adds value, especially for treating female patients with smaller arteries (Figure 1).[1]

The pushability and crossability of Sublime™ .014 RX PTA Catheters are excellent, and having a 250 cm, .014 balloon that

"Since 2022, when I began using these Sublime™ Sheaths and PTA Catheters, we've had excellent success with radial-peripheral interventions, and these tools have played a major role."

can reach as far as the ankle from radial access is very useful (Figure 1). Whenever I work below the knee, I'm typically using a Sublime™ RX PTA Catheter.

Since 2022, when I began using these Sublime™ Sheaths and PTA Catheters, we've had excellent success with radial-peripheral interventions, and these tools have played a major role. I'd still like to see more options for dedicated radial-peripheral covered stents and longer intravascular ultrasound catheters, but the tools available today have afforded us excellent success. There are still a lot of interventionalists who prefer femoral access, but I honestly believe radial access is the future of peripheral vascular interventions. ■

1. Minor R. Radial to peripheral in women with small radial arteries: 5 French access for endovascular therapy in femoral, iliac, renal, subclavian and carotid artery disease. *Cath Lab Digest*. Accessed October 6, 2023. https://www.hmpgloballearningnetwork.com/site/cathlab/radial-access-technique/radial-peripheral-women-small-radial-arteries-5-french-access

Ahmad S. Khraisat, MD
Interventional Cardiologist
Aurora Health Care
Milwaukee, Wisconsin
Disclosures: Consultant to Terumo Medical.

Treating From Wrist to Foot With the Sublime™ Radial Access Platform

A conversation with Dr. Aravinda Nanjundappa.

Interventional cardiologist **Aravinda Nanjundappa, MBBS, MD**, serves as the Director of Peripheral Interventions in the Cardiology Department at the Cleveland Clinic Main Campus. He is passionate about treating critical limb ischemia and is dedicated to advancing techniques that reduce vascular access complications. To this end, he favors radial artery access over the femoral approach for peripheral as well as coronary interventions.[1] Dr. Nanjundappa credits distinguished mentors such as Dr. John Ly, Dr. Mark Bates, and Dr. Ali AbuRahma for shaping his multidisciplinary approach to vascular disease, which combines medical as well as interventional treatment and collaboration with vascular surgeons to best serve each patient's needs.

We spoke with Dr. Nanjundappa about the benefits and limitations of the radial-peripheral approach and his use of guide sheaths, microcatheters, and RX PTA catheters from the Sublime™ Radial Access Platform (Surmodics. Inc.).

> "I find that the Sublime™ Microcatheter has excellent torqueability for lesion crossing. At the same time, it has the flexibility required for navigating iliac angles and tortuous segments all the way down to the popliteal."

How do you select peripheral patients for radial access?

When evaluating a patient with peripheral artery disease for potential intervention via radial access, we begin with a comprehensive physical examination in the clinic. Peripheral pulses are assessed at the femoral, popliteal, dorsalis pedis, and tibial arteries, supplemented by handheld Doppler evaluation of arterial flow. Radial and brachial pulses are also examined to determine suitability of the upper extremity as an access site. Noninvasive vascular studies such as the ankle-brachial index and pulse volume recordings are obtained, but these are typically followed by advanced imaging to guide procedural planning. Mostly commonly we use CTA, unless contraindicated due to impaired renal function.

The CTA scan is crucial because it gives us a clear picture of any inflow disease, such as blockages in the aorta or iliac arteries. In cases where there's serious disease in those large arteries, such as aortic or common iliac occlusions, the radial approach alone might not be safe or sufficient. That's because large stents may be needed, and if a complication arises, it could be risky and difficult to manage solely through radial access. For those patients, even if we can use the radial artery, we still prefer to have femoral access available as a backup for safety.

However, if the patient does not have significant aortoiliac disease, or if the disease is isolated to areas such as the common or external iliac artery and we can work through a 6 or 7 Fr sheath, then we favor the radial approach. That said, most of the disease we treat typically involves the common femoral artery and vessels below it. Using the long microcatheters now available to us, we can navigate lower extremity lesions more easily using the top-down approach afforded by radial access compared with femoral access.

Do you treat below the knee via radial access?

Yes. In fact, we've treated tibial and peroneal artery lesions entirely from radial access without needing a separate pedal puncture. This was possible because of the Sublime™ Radial Access Platform. The long working lengths of Sublime™ RX PTA Catheters (.014/250 cm and .018/220 cm) make them very helpful for treating below the knee, either from left or even right radial access.* The lengths and performance of Sublime™ Radial Access Guide Sheaths (5-6 Fr/120-150 cm) and Sublime™ Microcatheters (.014/65-200 cm; .018/65-200 cm; .035/90-200 cm) are also excellent.

"We've treated tibial and peroneal artery lesions entirely from radial access without needing a separate pedal puncture. This was possible because of the Sublime™ Radial Access Platform."

That said, in more complex interventions or very tall patients, additional access—usually pedal access—may still be required. We only use a small, 2.4 Fr micropuncture and don't try to deliver much treatment through the pedal access.

How often do you use high-performance, torqueable microcatheters for radial-peripheral interventions?

I use them in almost every case. A torqueable peripheral microcatheter helps facilitate guidewire advancement and exchange and provides a conduit for contrast injection to help confirm the wire's position within the vessel.

What qualities are you looking for in peripheral microcatheters?

Low profile, torqueability, and ability to cross lesions. If the catheter is too stiff, it won't flex sufficiently to navigate through tortuous or curved vessel segments or lesions, but if it's too flimsy, it will buckle. It should have intermediate stiffness and good braiding to prevent kinking or bending and be durable enough to resist fracturing in hard lesions. It should also have a good lubricious coating for deliverability.

I find that the Sublime™ Microcatheter has excellent torqueability for lesion crossing. At the same time, it has the flexibility required for navigating iliac angles and tortuous segments all the way down to the popliteal. At 200 cm, the microcatheter can reach as far as the tibial vessels in some patients. Notably, Sublime™ 200 cm Microcatheters are available in .018 as well as .035 guidewire compatibility. We can use the .018 microcatheter to support crossing with .018 or .014 wires in tibial or pedal vessels and then use Sublime™ RX PTA Catheters to treat those areas. These balloons track very well and have excellent pushability with their long rapid-exchange segments.

In addition to Sublime™ Microcatheters and RX PTA catheters, you also use Sublime™ Guide Sheaths. What has been your experience with these devices?

The long lengths of Sublime™ Radial Access Guide Sheaths (120 or 150 cm) are helpful. Based on the height of the patient, you can choose the 120 cm sheath to treat iliac, femoral, or proximal superficial femoral artery segments or the 150 cm to get down into the superficial femoral artery. These sheaths also have a good lubricous coating, allowing them to advance through small or tortuous radial arteries. Another advantage is the long, smoothly tapered dilator tip.

Once the sheath is positioned in the iliac artery, I find it has the advantage of staying in place. We have seen more flexible, softer sheaths move back into the aorta during balloon dilatations or catheter exchanges. A sheath should not move back and forth in the aortoiliac segment. ■

**The average working length from left and right radial access to the pedal loop ranges between 200-230 cm for left, 210-240 cm for right.*[2-4]

1. Nanjundappa A, Dieter EG, Dieter RS. Transradial access for peripheral endovascular interventions: a leap toward improved patient safety and improved clinical outcomes. *J Soc Cardiovasc Angiogr Interv*. 2023;2(6 Part A):101179. doi: 10.1016/j.jscai.2023.101179
2. Fanaroff AC, Rao SV, Swaminathan RV. Radial access for peripheral interventions. *Interv Cardiol Clin*. 2019;9:53-61. doi: 10.1016/j.iccl.2019.08.005
3. Chowdhury M, Secemsky EA. Contemporary use of radial to peripheral access for management of peripheral artery disease. *Curr Treat Options Cardio Med*. 2021;23:17. https://doi.org/10.1007/s11936-020-00895-x
4. Mustapha JA. When do I spare the common femoral and access the radial artery? Presented at: Vascular InterVentional Advances (VIVA) annual conference; October 8-11, 2013; Las Vegas, Nevada.

Aravinda Nanjundappa, MBBS, MD
Cleveland Clinic
Cleveland, Ohio
Disclosures: Consultant to Abbott, Medtronic, Penumbra, Philips, Recor Medical, Shockwave, and ZOLL.

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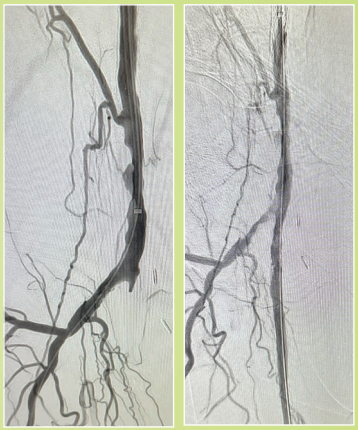
Revascularization of Femoropopliteal and Tibiopedal Total Occlusions Facilitated by Use of the Sublime™ Microcatheter

CASE HIGHLIGHTS:

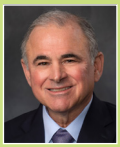
- Male in mid-70s presented with severe PAD and ischemic rest pain
- Dx of severe right SFA, popliteal, AT, and DP arteries occlusions
- .035 Sublime™ Microcatheter crossed 50 cm ATK occlusion
- .035 Sublime™ Microcatheter, with .018 microcatheter inside, transversed the DP, facilitating pedal loop reconstruction

PHYSICIAN OBSERVATIONS:

The Sublime™ Microcatheter played a pivotal role in securing access to treatment by crossing a 50 cm total SFA occlusion and assisting with crossing total occlusion in the DP artery.



SFA before (L) and after (R) revascularization assisted with the Sublime™ Microcatheter.



Craig Walker, MD
Interventional Cardiologist
Cardiovascular Institute of the South
Gray, LA

Dr. Walker is not a consultant for Surmodics.

Scan QR code to view complete case and disclosures

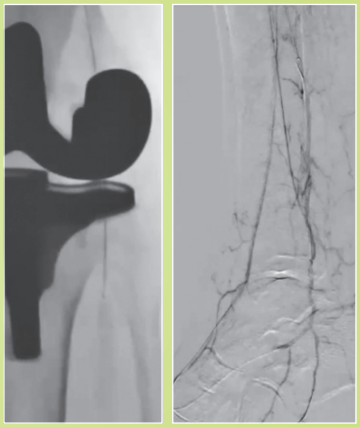
Transradial Revascularization of the Foot Using the Sublime™ Platform

CASE HIGHLIGHTS:

- Male in mid-70s presented with multiple nonhealing wounds of the left foot
- Dx of severe multilevel SFA, popliteal, AT artery disease
- Transradial use of .018 x 200 cm Sublime Microcatheter advanced to distal popliteal aided wire passage through the pedal arch and pedal angioplasty with .014 x 250 cm Sublime PTA catheter

PHYSICIAN OBSERVATIONS:

Following the successful intervention, arteriography showed revascularization into the pedal arch with good flow into the heel and blush flow into the toes.



200 cm Sublime™ Microcatheter advanced radial to distal popliteal (L). Successful foot revascularization (R).

Ramzan M. Zakir, MD
Interventional Cardiologist
Cardiac & Vascular Interventions of New Jersey
Brunswick, NJ

Dr. Zakir is not a consultant for Surmodics.

Scan QR code to view complete case and disclosures

Transradial Revascularization of Near-Total Peroneal Artery Occlusion Assisted by the Sublime™ Microcatheter

CASE HIGHLIGHTS:

- Male in mid-70s presented with nonhealing toe ulcer
- Dx of RLE occlusion in all 3 tibial vessels
- Transradial crossing of peroneal stenosis using .035 x 200 cm Sublime™ Microcatheter, followed by atherectomy and angioplasty

PHYSICIAN OBSERVATIONS:

This radial-first approach allowed for same-day patient discharge without the need for femoral access in a patient with chronic back pain and difficulty lying on his back for extended periods.

PA before (L) and after (R) crossing near-total occlusion with Sublime™ Microcatheter, followed by atherectomy and angioplasty.

Matthew C. Hann, MD
Interventional Cardiologist
Singing River Health System
Gulfport, MS

Dr. Hann is not a consultant for Surmodics.

Scan QR code to view complete case and disclosures

Sublime™ .014, .018, and .035 Microcatheters

INDICATIONS FOR USE
The Sublime Microcatheter is intended to access the peripheral vasculature in order to facilitate the placement and/or the exchange of guidewires. The Sublime Microcatheter is also intended to provide a conduit for the delivery of saline solutions or diagnostic contrast agents.

CAUTION: Federal (US) law restricts these devices to sale by or on the order of a physician. Please refer to Instructions for Use for indications, contraindications, warnings, and precautions.

CONTRAINDICATIONS
None known.

Sublime™ Radial Access Guide Sheath

INDICATIONS FOR USE
The Sublime Guide Sheath is intended to introduce therapeutic or diagnostic devices into the vasculature, excluding the coronary and neurovasculature.

CAUTION: Federal (US) law restricts these devices to sale by or on the order of a physician. Please refer to Instructions for Use for indications, contraindications, warnings, and precautions.

Sublime™ Radial Access 014 RX PTA Dilitation Catheter

INDICATIONS FOR USE
The Sublime™ Radial Access 014 RX PTA Dilatation Catheter is indicated for Percutaneous Transluminal Angioplasty (PTA) dilation of peripheral vasculature stenoses in the iliac, femoral, ilio-femoral, popliteal, infrapopliteal, and renal arteries, and for the treatment of obstructive lesions of native or synthetic arteriovenous dialysis fistulae.

CAUTION: Federal (US) law restricts these devices to sale by or on the order of a physician. Please refer to Instructions for Use for indications, contraindications, warnings, and precautions.

CONTRAINDICATIONS
No contraindications known for PTA procedure. The 014 Rx PTA Balloon Catheter is contraindicated for use in the coronary arteries and the neurovasculature.

Sublime™ Radial Access 018 RX PTA Dilitation Catheter

INDICATIONS FOR USE
The Sublime™ Radial Access 018 RX PTA Dilatation Catheter is indicated for Percutaneous Transluminal Angioplasty (PTA) dilation of peripheral vasculature stenoses in the iliac, femoral, ilio-femoral, popliteal, infrapopliteal, and renal arteries, and for the treatment of obstructive lesions of native or synthetic arteriovenous dialysis fistulae.

CAUTION: Federal (US) law restricts these devices to sale by or on the order of a physician. Please refer to Instructions for Use for indications, contraindications, warnings, and precautions.

CONTRAINDICATIONS
No contraindications known for PTA procedure. The 018 Rx PTA Balloon Catheter is contraindicated for use in the coronary arteries and the neurovasculature.

The opinions, clinical and otherwise, presented here are informational only. The opinions are those of the presenter only and do not necessarily reflect the views of Surmodics. Results discussed from use of Surmodics or other products may not be predictive of all patients and may vary depending on differing patient characteristics.

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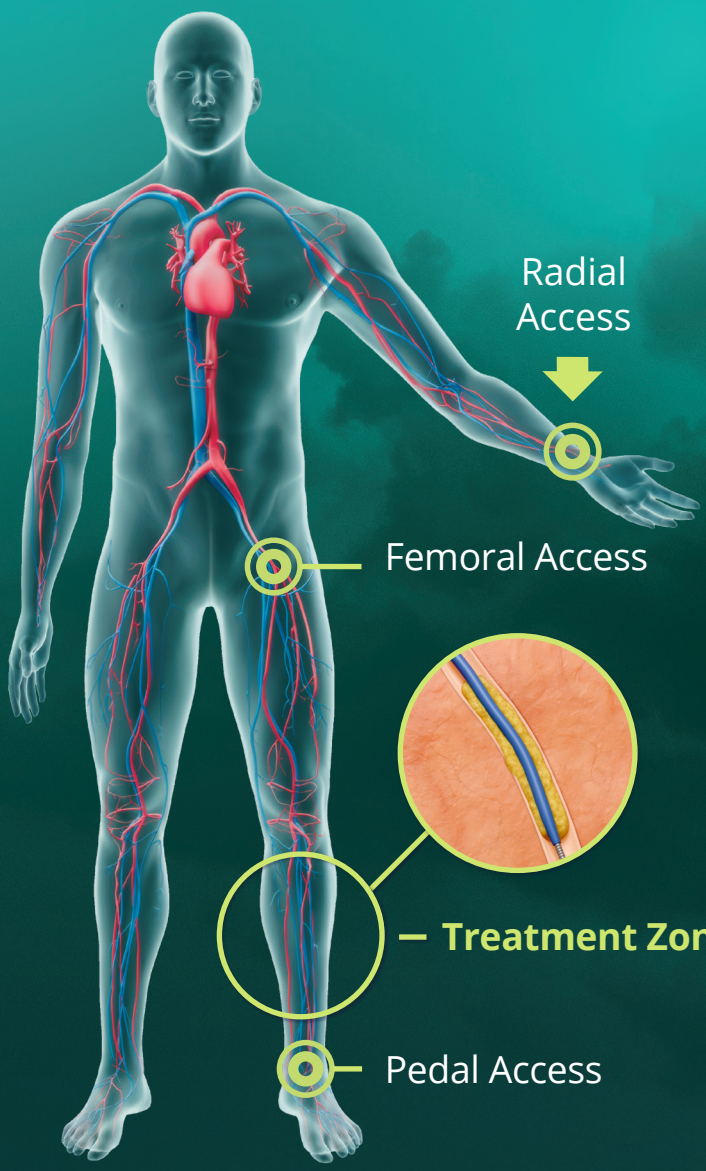
POWER MEETS PRECISION

LEARN MORE

You can't treat what you can't reach—and cross. **Sublime™ Microcatheters** cross tough lesions and total occlusions from your access site of choice.



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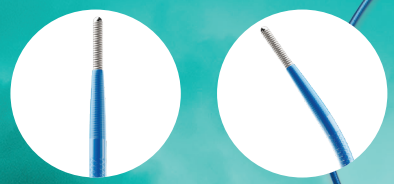


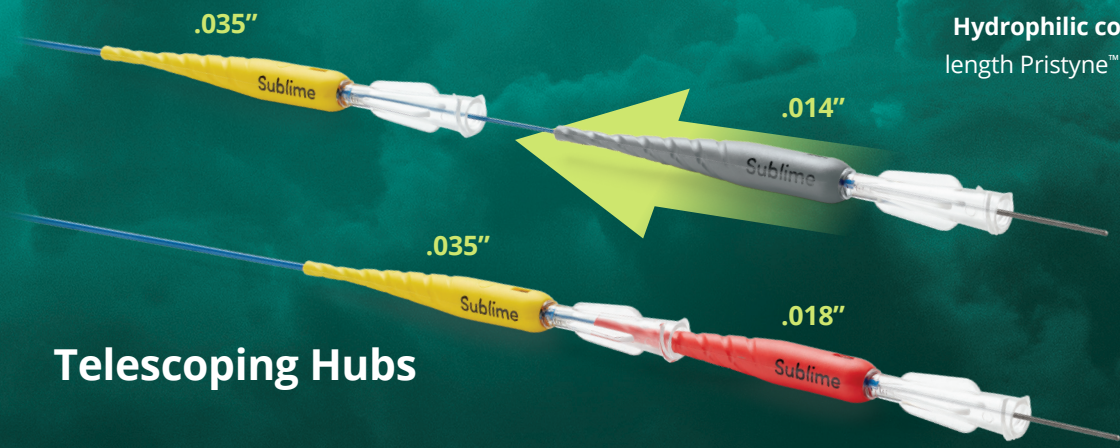
Tip configurations:
straight and angled

Tapered tip length: 7 mm

Guidewire compatibility: .014", .018", .035"

Working lengths:
65, 150, 200 cm (.014", .018" guidewire compatible)
90, 135, 150, 200 cm (.035" guidewire compatible)

Hydrophilic coating: distal 40 cm length Pristyne™ hydrophilic coating



Telescoping Hubs

Sublime™ 014 MICROCATHETER

Model Number	Guidewire Compatibility (in)	Catheter Length (cm)	Tip Configuration
SRA-MC14-STR065	.014	65	Straight
SRA-MC14-ANG065	.014	65	Angled
SRA-MC14-STR150	.014	150	Straight
SRA-MC14-ANG150	.014	150	Angled
SRA-MC14-STR200	.014	200	Straight
SRA-MC14-ANG200	.014	200	Angled

Sublime™ 018 MICROCATHETER

Model Number	Guidewire Compatibility (in)	Catheter Length (cm)	Tip Configuration
SRA-MC18-STR065	.018	65	Straight
SRA-MC18-ANG065	.018	65	Angled
SRA-MC18-STR150	.018	150	Straight
SRA-MC18-ANG150	.018	150	Angled
SRA-MC18-STR200	.018	200	Straight
SRA-MC18-ANG200	.018	200	Angled

Sublime™ 035 MICROCATHETER

Model Number	Guidewire Compatibility (in)	Catheter Length (cm)	Tip Configuration
SRA-MC35-STR090	.035	90	Straight
SRA-MC35-ANG090	.035	90	Angled
SRA-MC35-STR135	.035	135	Straight
SRA-MC35-ANG135	.035	135	Angled
SRA-MC35-STR150	.035	150	Straight
SRA-MC35-ANG150	.035	150	Angled
SRA-MC35-STR200	.035	200	Straight
SRA-MC35-ANG200	.035	200	Angled

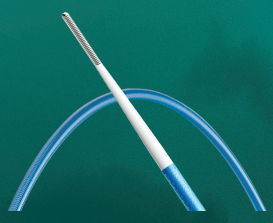
Caution: Federal (US) law restricts this device to sale by or on the order of a physician. Please refer to Instructions for Use for indications, contraindications, warnings, and precautions.

Sublime™ Microcatheter
.014" .018" .035"

SURMODICS

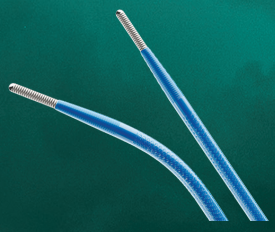
GO WRIST TO FOOT–**WITH CONFIDENCE**

The **Sublime™ Radial Access Platform** makes radial-to-peripheral treatment of peripheral artery disease (PAD) practical, not just possible.



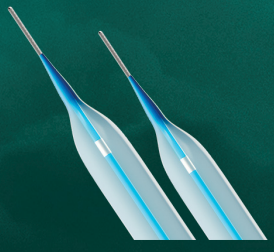
Sublime™ Guide Sheath

5 Fr and 6 Fr,
120 cm and 150 cm



Sublime™ Microcatheter

.014, .018, .035 Peripheral Microcatheters, 65 cm – 200 cm lengths*



Sublime™ RX PTA Dilatation Catheters

250 cm (.014) and
220 cm (.018)

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Caution: Federal (US) law restricts these device(s) to sale by or on the order of a physician. Please refer to Instructions for Use for indications, contraindications, warnings, and precautions.

*The .035" Sublime Microcatheter is available in 90–200 cm lengths.

Sublime™ Radial Access

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