

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.”

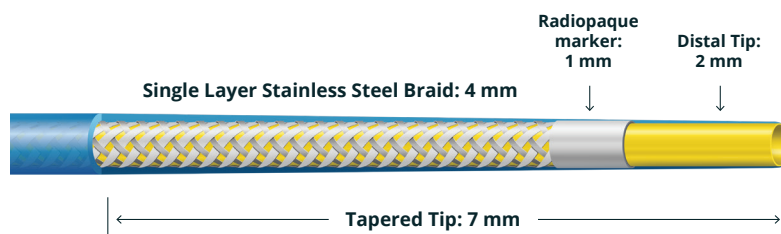
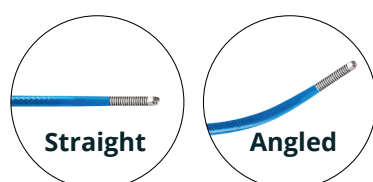
The Sublime™ Microcatheter is engineered to optimize torqueability, flexibility, pushability, and kink resistance (Figure 1). Specifically, the microcatheter's proprietary braid structure allows for individually optimized performance elements with much greater freedom from typical trade-offs, such as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

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MICROCATHETER CROSS-SECTION



Tip Configurations:



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

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

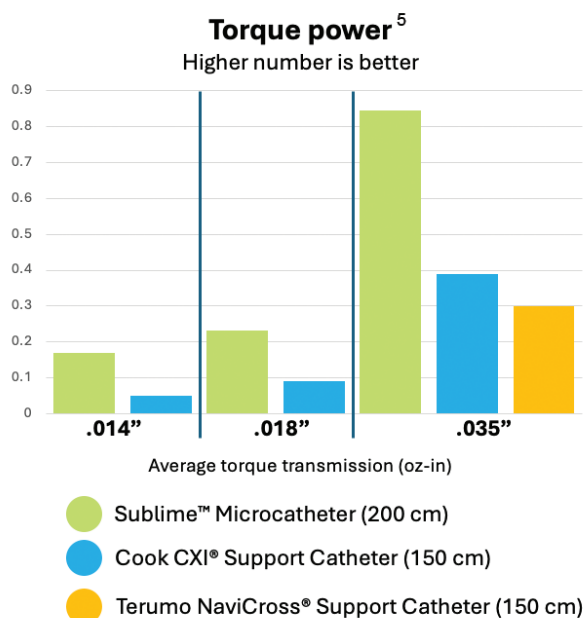


Figure 2. Sublime™ Microcatheter torque power testing versus competitors (2021). Bench testing may not be representative of actual clinical performance.

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).

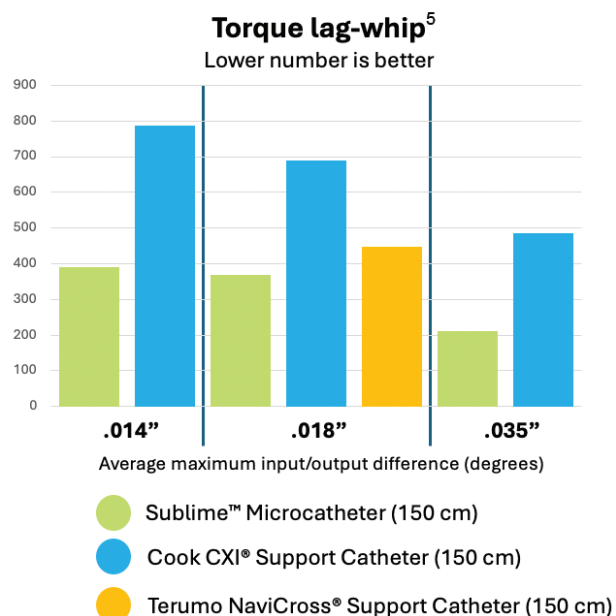


Figure 3. Sublime™ Microcatheter torque lag-whip (control) testing versus competitors (2021). Bench testing may not be representative of actual clinical performance.

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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