Next-generation sutures can deliver drugs, prevent infections and monitor wounds

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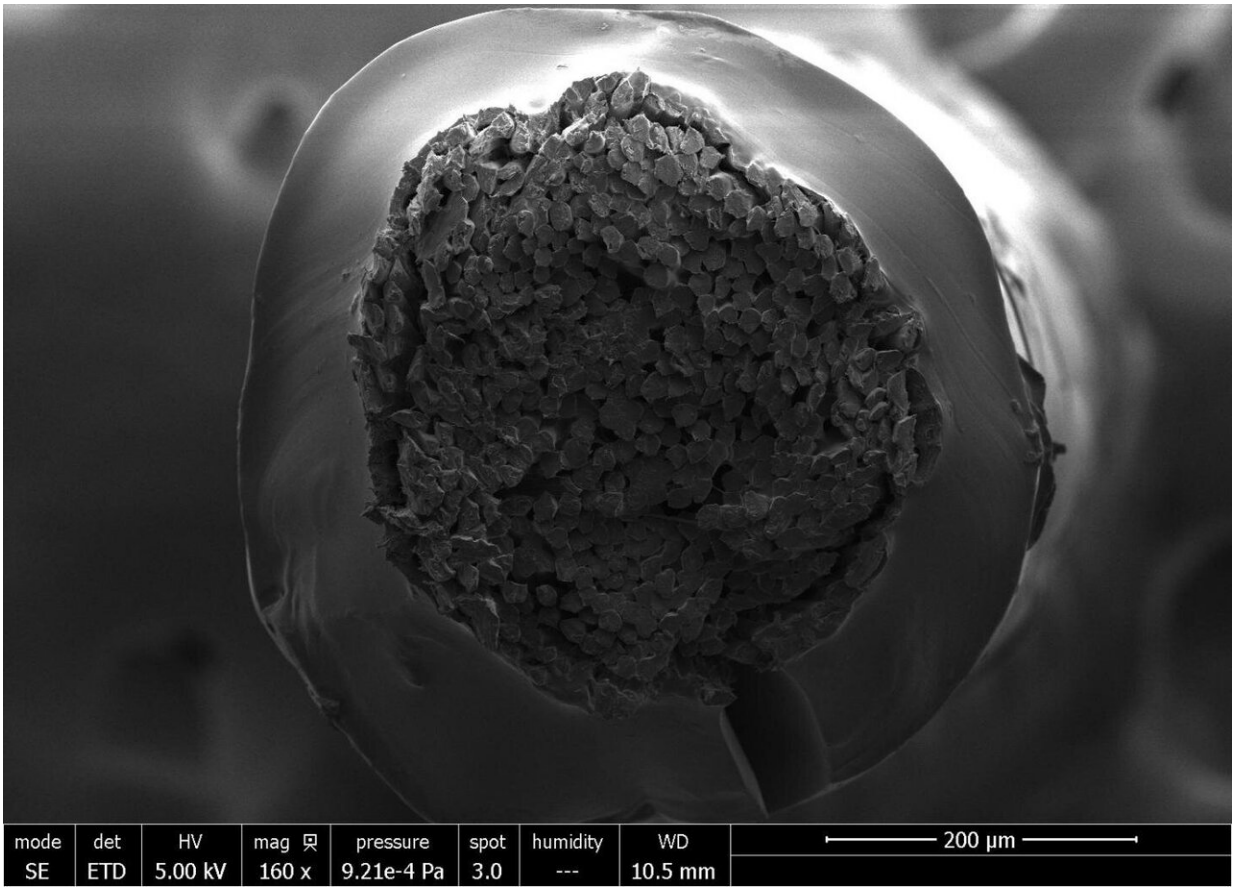

Scanning electron microscope image of the cross-section of TGS suture. Credit: Zhenwei Ma, McGill University

Sutures are used to close wounds and speed up the natural healing

process, but they can also complicate matters by causing damage to soft tissues with their stiff fibers. To remedy the problem, researchers from Montreal have developed innovative tough gel sheathed (TGS) sutures inspired by the human tendon.

These next-generation sutures contain a slippery, yet tough gel envelop, imitating the structure of soft connective tissues. In putting the TGS sutures to the test, the researchers found that the nearly frictionless gel surface mitigated the damage typically caused by traditional sutures.

Conventional sutures have been around for centuries and are used to hold wounds together until the healing process is complete. But they are far from ideal for tissue repair. The rough fibers can slice and damage already fragile tissues, leading to discomfort and post-surgery complications.

Part of the problem lies in the mismatch between our soft tissues and the rigid sutures that rub against contacting tissue, say the researchers from McGill University and the INRS Énergie Matériaux Télécommunications Research Centre.

Inspired by the tendon

To tackle the problem, the team developed a new technology that mimics the mechanics of tendons. "Our design is inspired by the human body, the endotenon sheath, which is both tough and strong due to its double-network structure. It binds collagen fibers together while its elastin network strengthens it," says lead author Zhenwei Ma, a Ph.D. student under the supervision of Assistant Professor Jianyu Li at McGill University.

The endotenon sheath not only forms a slippery surface to reduce friction with surrounding tissues in joints, but it also delivers necessary

materials for tissue repair in a tendon injury. In the same way, TGS sutures can be engineered to provide personalized medicine based on a patient's needs, say the researchers.

Personalized wound treatment

"This technology provides a versatile tool for advanced wound management. We believe it could be used to deliver drugs, prevent infections, or even monitor wounds with near-infrared imaging," says Li of the Department of Mechanical Engineering.

"The ability to monitor wounds locally and adjust the treatment strategy for better healing is an exciting direction to explore," says Li, who is also a Canada Research Chair in Biomaterials and Musculoskeletal Health.

More information: Zhenwei Ma et al, Bioinspired tough gel sheath for robust and versatile surface functionalization, *Science Advances*. DOI: 10.1126/sciadv.abc3012

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