Washington University in St. Louis
Office of Technology Management

DEEP TISSUE DIAGNOSTICS WITH DISPOSABLE FIBER-OPTIC DEVICE

Hu, Song, Ling, Jingwei, Yang, Shuo

Maland, Brett

T-020656

T-020656 – Deep Tissue Diagnostics with Disposable Fiber-Optic Device

Technology Description

Researchers from the laboratory of Song Hu has developed a miniaturized fiber-optic device capable of minimally invasive measurements of deep-tissue biomechanical properties. The device can be readily integrated into clinically used injection or biopsy needles, and is designed to be disposable, autoclavable, and mass-producible (**Figure 1**

Precisely controlled micrometer-level (<0.001 inch) indentations of the fiber-optic probe can be generated by the device to palpate local muscle with predefined displacements and frequencies. The gentle probe-tissue interaction deforms the probe's soft cavity and modulates the reflected light signal. Real-time monitoring and analysis of the light readouts allows for the derivation of tissue's biomechanical properties, such as stiffness and viscosity. The device also integrates optical-proximity sensing for real-time tracking of the probe position relative to the tissue surface near the needle tip.

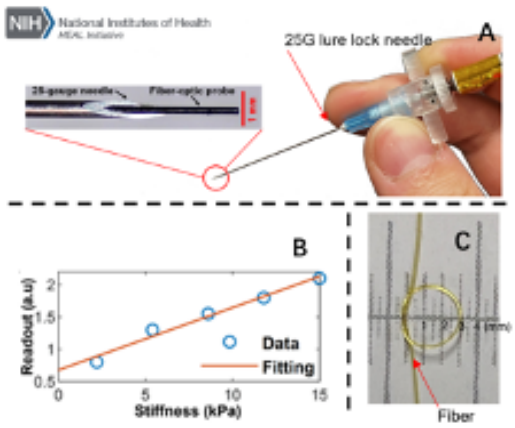

Figure 1. (A) Photo of the fiber-optic device. (B) The device can quantitatively measure stiffness, as demonstrated in standard phantoms. (C). The fiber probe is highly flexible.

Figure 2. Clinical deployment of the fiber-optic device in a myofascial pain patient.

Stage of Research

The fiber-optic device is fully developed and rigorously tested in standard phantoms and animal models *in vivo*, providing accurate measurements of muscle stiffness and enabling the differentiation of muscle states (e.g., stretched *vs.* relaxed). It is currently applied in a phase 1 clinical quantitative assessment of myofascial pain in the trapezius muscle (NIH HEAL initiative).

The team has optimized the probe for clinical deployment (**Figure 2**), which allows robust and quantitative measurements of muscle biomechanical properties in both healthy volunteers and enrolled patients. The team will use the device to evaluate the efficacy of pain treatments and clinical outcome prediction in an upcoming Phase II trial starting Fall 2025.

Applications

- **Clinical diagnosis of myofascial pain syndrome (clinical trial ongoing) and liver fibrosis (potential).**

Key Advantages

- **Small and simple device capable of highly localized assessments.**
- **Compatible with existing clinical protocols for needle insertion.**
- **Can be easily adopted/expanded for other types of fiber-based medical imaging and sensing.**

Patents & Publications

Provisional patent filed. Publications in submission. Presentation at Photonics West 2024

Related Web Links – Song Hu