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Researchers use needle-thin probe to get first look at working muscle fiber

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Using an unusual microscope with a tip the size of a needle, Stanford researchers are now able to look at tiny fibers of working muscles in live humans, with minimum discomfort to the patient—a development patients are sure to welcome.

This microendoscopy technique for viewing sarcomeres—microscopic lengths of muscle fiber about 3 millionths of a meter long—has advantages over the uncomfortable alternative, a muscle biopsy in which a portion of the muscle is removed for examination.

Sarcomeres are the basic contracting engines of muscle. They generally pull in a coordinated fashion, allowing us to walk down the sidewalk or throw a sinking curveball from the pitcher's mound. But out-of-sync sarcomeres are implicated in muscular dystrophy and other diseases of diminished muscular control. It is thought that disease may change the length of sarcomeres and cause havoc with muscle control because the force exerted by muscle is critically dependent on length.

To observe sarcomeres in action, researchers from Stanford's Bio-X program have devised a needle-thin probe, which is inserted through the skin into muscle. When a flash of finely tuned laser light is sent through the probe, the sarcomeres respond with light of their own to form a snapshot of muscle in action.

The researchers see the images in real time on a display screen. A change in the depth of focus of the rapidly scanning device can provide a

three-dimensional movie.

"This is a method that does not require any operative procedures," said Mark Schnitzer, an assistant professor of biology and of applied physics. For the first time, "it allows us to view individual sarcomeres in live humans."

The breakthrough was reported online in the journal *Nature* on July 6.

The technology could prove useful in understanding how muscles are altered by spinal cord injuries or strokes as well as muscular diseases, according to another of the researchers, Scott Delp, a professor of bioengineering and of mechanical engineering and, by courtesy, of orthopedic surgery.

Other areas of interest include biomechanics, orthopedic reconstructions, prosthetic devices and tendon transfers, in which tension adjustments are a crucial element for patients relearning how to walk or grasp. "If you measure the length of the sarcomeres during surgery, then you can adjust them to work at their optimal length, giving maximum muscle strength," Delp said.

Source: Stanford University