A less painful colonoscopy: Researchers could have answer to problem known as 'looping'

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Colonoscopy is regarded as the most thorough way to screen for colon cancer but the potentially life-saving procedure can also be painful. Scientists and engineers are continually researching new methods of screening to reduce patient discomfort while also ensuring the accuracy of the exam. Researchers at Tufts University's School of Engineering led by Associate Professor of Mechanical Engineering Caroline G.L. Cao, Ph.D., have developed a device that could potentially do both.

Tufts endoscopic fiber optic shape tracker (EFOST) technology is a possible solution to the problem that occurs when the endoscope is inserted into the colon during routine screening. As an endoscopist navigates the scope through the bends and turns in the colon, its tip can impinge against the colon wall.

When this happens, the tip becomes stationary and is unable to move forward. As the physician applies more pressure, a loop can form in the length of scope behind the tip. Because the traditional endoscope provides only a frontal view during the procedure, the doctor cannot see the loop, much less easily maneuver the scope to remove it. Not surprisingly, looping can be a major source of pain during a colonoscopy .

But by outfitting an endoscope with fiber optic bend sensors and digital electronics that display its position and shape on a video monitor, the

Tufts engineers have built a system that could serve as a visual navigation tool, says Cao

"Doctors will have a way to see in real-time how the scope is moving inside the patient's body," says Cao. "If the scope begins to loop, they will see it instantaneously and then be able to make adjustments to straighten it out."

Bend Sensors to Create a Visual Image

Cao and Mechanical Engineering Research Associate Professor Peter Y. Wong, Ph.D, described their concept in a paper titled "Localized Active-Cladding Optical Fiber Bend Sensor" in June 2010 in the journal Optical Engineering.

Using a prototype, the Tufts engineers embedded quantum dots -- nano-sized crystals of semiconductor material -- circumferentially at intervals along the length of an optical fiber. The researchers stretched the fiber around a metal cylinder to create a bending effect. They then injected a laser light beam into the fiber's inner core from one end.

The fiber's core released light as it is bent. This activated the quantum dots. Instantly, the dots reemitted light signals of varying intensity to a spectrometer. With this data, the researchers were able to measure the degree of curvature in the fiber. From the position of the activated dots, the researchers were also able to calculate the direction of the bend. "The greater the bend, the more intense the light emissions," says Cao.

In a separate experiment, the team used an inanimate model colon made of polyurethane foam.. They inserted the modified fiber inside an endoscope and then threaded the device into the model. The researchers were able to produce a video image by sending the data through a digital processor which created a real-time image of the scope in the model

colon.

Cao notes, "Physicians can use the image on the monitor to guide them. They'll know exactly where the end of the point is, as well as the shape of the scope inside the colon."

Colorectal cancer is the third leading cause of cancer-related deaths in the United States, with 102,900 new cases diagnosed in 2010, according to most recent estimates from the American Cancer Society.

Colon cancer has a high cure rate provided it is detected early. Most men and women are advised to undergo periodic colonoscopies beginning at age 50.

The commercialization of EFOST is being managed by Tufts University's Office for Technology Licensing and Industrial Collaboration. There are currently patents s pending in the USA, Canada, Europe, Japan and Australia. The next step, Cao says, is to acquire funding to launch a start-up company and then move on to further development of the technology, including eventual clinical trials.

Provided by Tufts University