Medical Xpress

UMaine assists podiatrist with electronic tuning fork invention

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An Orono podiatrist is on the cusp of a technological breakthrough with a new medical instrument — an electronic tuning fork — that he's developing with assistance from students and staff at the University of Maine's Advanced Manufacturing Center.

Tuning forks are considered one of the most accurate measures of human sensitivity to touch, and are commonly used by physicians to diagnose early signs of diabetic peripheral neuropathy, or damaged or deteriorating nerves in the feet of diabetics. The condition all too often can lead to foot ulcers and eventual foot amputation, according to Orono resident Dr. Todd O'Brien, a podiatric surgeon at a Health Access Network practice and Penobscot Valley Hospital in Lincoln, Maine.

Tuning forks, however, are subjective in application, O'Brien explains, since the person administering the tuning fork test and the patient work together to estimate the time in which the patient loses awareness of the diminishing vibrations.

O'Brien's prototype electronic tuning fork removes at least half of the guesswork. The user of the device presses an actuation button while in contact with the patient's skin. This simultaneously starts the vibrations and a built-in timer. The user then releases the button when the patient indicates they can no longer feel the vibrations thereby stopping the timer. The amount of time elapsed is how long the patient was able to sense the vibrations. The user then reads the time elapsed on an LED display on the device. It standardizes the procedure, says O'Brien, who

has applied for a provisional patent on the device and has begun testing a prototype at his practice.

“It’s kind of taking this old-fashioned device and basically upgrading it with 21st century components,” he says. “What I hope it will be able to do is screen patients more accurately to see if they are developing neuropathy.”

Early detection of diminishing foot sensitivity, he says, can allow remedial intervention such as special shoes, an insert or other foot-care options. Foot sensitivity affects an individual’s proprioception, or neurological awareness of the position of parts of the body, including the feet, which affects balance. Identifying a loss of foot sensitivity can indicate a predisposition to falling, an affliction that has spawned a whole cottage industry devoted to the problem, O’Brien says.

“If you can identify someone who is prone to falling, you can recommend training programs,” he says. “Beyond that, it’s just a better version of the tuning fork that you can use anywhere on the body” for other medical applications, he says.

As much as eight percent of the nation’s population is diabetic, and health studies show an alarming increase of the disease. Almost half of O’Brien’s patients, he says, are diabetic. With an affordable electronic tuning fork, O’Brien says patients could help monitor their conditions at home.

After researching whether such a device already exists, O’Brien concluded one does not. He has been working on the design and components of his invention, which is about 8 inches long and an inch in diameter, for about a year. With Maine Technology Institute grant funding, O’Brien contacted UMaine’s Advanced Manufacturing Center about making a prototype.

James Bryant, the AMC's project manager who's been overseeing the development of O'Brien's prototype, says staff, mechanical, and electrical engineering technology students have been working to build a device that O'Brien can eventually have mass-produced and marketed.

"We welcome these sorts of projects," Bryant says. "They give our students real experiences solving problems and helping Maine businesses improve their operations. In this case, Dr. O'Brien's invention can also help people."

AMC Director John Belding adds that an increasing number of projects the AMC helps with are healthcare oriented.

"We've been developing devices, equipment and tools that can make a difference in people's lives, in addition to those who look after them — whether it's family caregivers or professionals," Belding says.

O'Brien, who holds patents on several other medical innovations he has designed for commercialization under a private company, O'Brien Medical, LLC, says he is grateful for the accessibility of the university's AMC.

"Being up here in Central Maine, it's hard for me to be able to do things like this," O'Brien says. "There are not a lot of resources available. If I didn't have these guys, I'd have to work down south or out of state. I think it's a really valuable program."

Provided by University of Maine