Piezoelectric Fingers Key in New Breast Cancer Detector

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(PhysOrg.com) -- Researchers at Drexel University are developing a new portable, low-cost, radiation-free breast cancer detector that can potentially be used in a doctor's office as a first-line to detect breast cancer.

Researchers at Drexel University are developing a new portable, low-cost, radiation-free breast cancer detector that can be used in a doctor's office as a first-line to detect breast cancer in younger women and in women over 40 with mammographically dense-tissue breasts. The detector is based on piezoelectric fingers (an elastic and shear modulus sensor) developed at Drexel. In evaluations on tumor specimens, it has positively identified a 3mm tumor previously missed by mammography, ultrasound and the physician's palpation.

The researchers, Dr. Wan Y. Shih, a breast cancer survivor and an associate professor in Drexel's School of Biomedical Engineering, Science and Health Systems, Dr. Wei-Heng Shih, a professor in Drexel's materials science and engineering department and Dr. Ari D. Brooks, an associate professor of surgery at the Drexel University College of Medicine, expect to develop a portable, radiation-free, breast-scanning device that is not only capable of locating small tumors of any type, but also able to predict tumor malignancy. The proposed screening tool will be positioned as an early breast cancer screening tool to be used by physicians and gynecologists in the clinical setting in conjunction with the physical examination. It supplements mammography to screen early for breast cancer in women with dense-tissue breasts. In countries such

as China and India, where mammography is not readily available due to cost, the PEF device can be used as a primary screening tool.

To date the only FDA-approved breast cancer screening system in the U.S. is mammography beginning at age 40 for women. The effectiveness of this screening device is lessened in women with dense breasts. A mammogram provides no information on the stiffness or mobility of a tumor and has a typical sensitivity of 85 percent, which decreases to 65 percent in radio-dense breasts. Meanwhile, data show that in 2005 alone more than 200,000 American women were diagnosed with breast cancer and 40,000 deaths occurred from the disease.

The PEF device consists of a hand-held probe and small electrical measurement units that can be operated by a laptop computer and eventually will be a standalone device. The PEF probe measures tissue elasticity and mobility—breast cancers are both stiffer and less mobile than surrounding tissue—and uses elasticity and mobility contrast to detect breast cancer.

The innovations of the PEF sensor include:

• Palpation-like tissue stiffness imaging both under shear and under compression with less than one-millimeter spatial resolution up to a depth of several centimeters.
• Use of the shear modulus/elastic modulus ratio to measure tumor mobility to screen for malignancy.
The key advantages of PEF are:
•The proposed PEF has better detection size sensitivity than all existing technologies -- has positively identified a 3 mm tumor missed by mammography, ultrasound, and the physician’s palpation.
•It has demonstrated more than 90 percent correlation between the shear/elastic modulus ratio and tumor malignancy -- a capability all existing technologies lack.

•With a single or double 1.5 cm wide PEF of depth sensitivity of 3 or 6 cm, it can probe for breast cancer for almost all body-types.
•Patients are in a supine position which poses no discomfort to patients.
•The PEF is gentle. It only works with less than 1 percent strain, which would cause minimal discomfort to the patient.
•It is portable and can be low cost for both physicians and patients.

According to the researchers the PEF device is as simple to use as the breast self-examination and the clinical breast examination as a cost-effective pre-screening system. Although several breast cancer detection technologies exist such as ultrasound, Magnetic Resonance Imaging (MRI) and Nuclear Medicine Tests, these procedures are relatively expensive and require trained medical personnel. They may also carry risks from radiation exposure (such as with mammography or PET scan) and they may also be quite uncomfortable (such as with mammography and MRI). The PEF device will fill a need for a pre-screening tool for early and accurate breast cancer detection with no risk or discomfort to patients, according to the researchers.

The next step in the project's development is to build a hand-held PEF probe prototype and a simple electrical measurement unit to carry out in vivo measurement in patients before surgery. The researchers envision an ultimate calculator-size electrical measuring unit and a less than 5" x 5" x 5" 3-D automation unit will be developed to operate the PEF. This imaging tool will help the physician locate smaller breast tumors than the current technologies and screen for tumor malignancy at the same time to save lives.

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Provided by Drexel University