New imaging technology helping detect oral cancer more accurately

November 5 2015, by Ryan Garcia

A noninvasive device that enables doctors to quickly and accurately identify cancerous tissue in a person's mouth could result in more effective diagnosis and treatment of the disease, says a biomedical

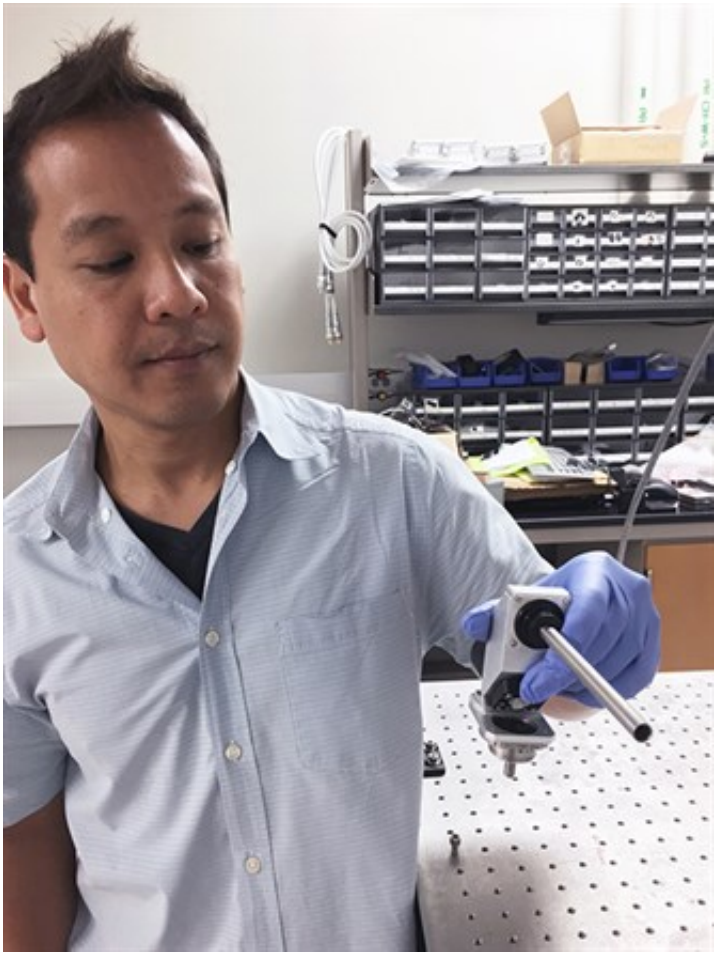
engineer at Texas A&M University who is developing the instrument.

The potentially life-saving tool makes use of technology known as "fluorescence lifetime imaging (FLIM)" to measure and visualize the biochemical changes that occur in oral epithelial tissue as it turns cancerous, says Javier Jo, associate professor in the university's Department of Biomedical Engineering. Measuring these specific changes, the technology, Jo says, can assist physicians in differentiating precancerous, cancerous and benign lesions in patient's mouth.

The research, which is supported by the National Institutes of Health (NIH), was presented at this year's World Molecular Imaging Congress, a venue where scientists and clinicians discuss cutting-edge advances in molecular imaging.

With the number of oral cancer cases reportedly on the rise in recent years, Jo's advance in oral cancer detection technology couldn't come at a better time. NIH estimates more than 8,000 people in the United States will die from the disease and another 37,000 new patients will be diagnosed this year alone.

Early detection, Jo notes, is key. When oral cancer is diagnosed before it spreads, the five-year survival rate is about 80 percent, but only about 30 percent of patients are diagnosed at this early stage, he says. That's partially due to the fact that diagnosing oral cancer is not always easy.



Doctors typically rely on the naked eye to look for problematic areas in a patient's mouth that warrant a biopsy, but identifying these areas can be difficult because a patient's mouth can manifest lesions that may be both benign and precancerous/ cancerous. These different types of lesions are indistinguishable to the naked eye, and even some imaging tools experience difficulty distinguishing between them, resulting in false positives and triggering unnecessary and painful biopsies, Jo says. Furthermore, tissue from a biopsy may register as benign, but the surrounding tissue that was not biopsied can be cancerous and remain undiagnosed. In short, diagnosing oral cancer is somewhat of an

educated guessing game that Jo is hoping to improve upon through the use of optical imaging technology.

Jo's device, which is essentially a small, handheld microscope, employs the FLIM technique to noninvasively evaluate tissue for the structural and molecular changes that serve as key indicators in determining if tissue is precancerous or cancerous. With the tool, Jo can observe distinct fluorescence signatures – fingerprints of a sort – that are specific to benign, precancerous and cancerous tissue.

Using FLIM, Jo explains, the fluorescence spectrum (the color content of the fluorescence light) and the fluorescence lifetime (related to the time a molecule emits fluorescence light after being excited) can be detected. Previous implementations of FLIM imaging have been too cumbersome and slow to be used for clinical applications, but Jo's lab has developed some of the fastest FLIM systems that are being adapted for different clinical diagnosis applications, including oral cancer detection. Another advantage, Jo says, is that there is no need to use any external contrast agent, as only the natural fluorescence of the tissue is being measured.

Specifically, Jo is examining the fluorescent emissions generated from three molecules present in tissue: collagen, nicotinamide adenine dinucleotide (NADH) and flavin adenine dinucleotide (FAD). Collagen, Jo explains, has a stronger signal in normal and benign tissue, but in cancerous or precancerous tissue collagen signals weaken and NADH and FAD signals increase. This is because NADH and FAD are related to the energy cells use, and malignant cells use more energy as they rapidly multiply, he explains.

Most standard imaging technology, Jo notes, measures the fluorescence intensity of the tissue and is able to detect oral lesions based on the loss of fluorescence intensity relative to healthy tissue. This loss in

fluorescence intensity, however, is not specific to precancerous and cancerous conditions, Jo explains. As a result, such tools can't distinguish benign, precancerous or cancerous tissue.

"Using FLIM we can see a reduction in the fluorescence lifetime in precancerous tissue and changes in the fluorescence spectrum in malignant tissue that are not apparent in benign tissue," Jo says. "We then feed this information into a computer where it is processed by an algorithm that essentially color codes the images of the oral cavity; if the tissue is benign it shows up green. If it is cancerous or precancerous, it shows up red."

Preliminary results from almost 20 patients, Jo notes, already suggest the potential of his FLIM technology for distinguishing a variety of benign lesions from dysplasia and squamous cell carcinoma in the human oral cavity. In the coming year Jo plans to continue testing his device in medical centers in Dallas, Brazil and Qatar in order to collect more data before moving to in-depth clinical trials and licensing of the technology.

Provided by Texas A&M University

Citation: New imaging technology helping detect oral cancer more accurately (2015, November 5) retrieved 23 April 2024 from https://medicalxpress.com/news/2015-11-imaging-technology-oral-cancer-accurately.html