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Lasers ID deadly skin cancer better than doctors

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High-resolution images from a laser-based tool developed at Duke University could help doctors better diagnose melanoma, the deadliest form of skin cancer, while potentially saving thousands of lives and millions of dollars in unnecessary healthcare costs each year.

The tool probes skin cells using two lasers to pump small amounts of energy, less than that of a laser pointer, into a suspicious mole. Scientists analyze the way the energy redistributes in the skin cells to pinpoint the microscopic locations of different skin pigments.

For the first time, scientists have the ability to identify substantial chemical differences between cancerous and healthy skin tissues, said Thomas Matthews, a Duke graduate student who helped develop the new two-laser microscopy technique.

The Duke team imaged 42 skin slices with the new tool. The images show that melanomas tend to have more eumelanin, a kind of skin pigment, than healthy tissue. Using the amount of eumelanin as a diagnostic criterion, the team used the tool to correctly identify all eleven melanoma samples in the study. The results appear in the Feb. 23 *Science Translational Medicine*.

The technique will be further tested using thousands of archived skin slices. Studying old samples will verify whether the new technique can identify changes in moles that eventually did become cancerous. Even if the technique proves, on a large scale, to be 50 percent more accurate

than a biopsy, it would prevent about 100,000 false melanoma diagnoses, said Warren S. Warren, director of Duke's Center for Molecular and Biomolecular Imaging and a chemistry professor. Warren oversaw the development of the new melanoma diagnostic tool.

Melanoma is the fifth-most common cancer for males and sixth-most common for females. In 2010, U.S. doctors diagnosed nearly 115,000 new cases of the disease, with nearly 8,700 resulting in death. The cancer is also one of the few where the death rate is increasing.

Doctors typically use a light and a magnifying glass or tissue biopsy, where a pathologist removes suspicious skin cells and looks at them under a microscope, to spot signs of disease. But using a lens and a light is a "17th century" technique that is only 85 percent accurate, at best, and tissue biopsy is not much more reliable, Warren said.

In 14 percent of biopsy diagnoses, pathologists would disagree on whether or not the sampled cells were cancerous, according to a 2010 study published in the Journal of American Academy of Dermatology. The statistic implies that two pathologists would have opposing diagnoses on 214,000 to 643,000 melanoma cases each year, Warren said.

When studying biopsied tissue, doctors typically follow the "when in doubt, cut it out" philosophy. If they are not sure about the health of the skin tissue, doctors remove additional skin around the diseased cells. The first and second tissue biopsies can cost thousands of dollars. If the melanoma is thought have spread, patients may then have lymph nodes in their arms removed or undergo chemotherapy, which dramatically adds to treatment costs.

But not all of the extra treatment is necessary because not all of the biopsied tissues are actually cancerous. Doctors need a more accurate

way to diagnose melanoma, Warren said.

In 2009, he received a $1 million Challenge Grant from the National Institutes of Health, which was part of the American Recovery and Reinvestment Act of 2009, to develop the imaging tool.

The highly specialized lasers are currently commercially available and would only need to be added to the microscopes pathologists already use to diagnose melanomas. The cost for the added instrumentation is about $100,000, which may sound like a lot of money, but if each false positive melanoma diagnosis costs thousands of dollars, having such an instrument available for questionable cases could considerably reduce health care costs overall, Warren said.

He added that suspicious moles would still have to be removed from a patient and then imaged to detect cancer. But, Matthews and Simpson are working on imaging skin cancers grafted on to mice to see if the tool could become a device dermatologists could use to scan a mole without removing it. A device like that would be much more expensive and would not be ready for a few years, Warren said. However, pathologists could begin using the lasers to study biopsied tissue now.

Provided by Duke University