Shining light on diabetes-related blindness

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A group of scientists in California is trying to develop a cheaper, less invasive way to spot the early stages of retinal damage from diabetic retinopathy, the leading cause of blindness in American adults, before it leads to blindness. As described in the special Interactive Science Publishing (ISP) issue of *Optics Express*, the Optical Society's (OSA) open-access journal, the scientists are using beams of light to measure blood flow in the back of the eye.

"The more severe the retinopathy, the lower the blood flow to the retina," says David Huang of the Keck School of Medicine at the University of Southern California in Los Angeles. This observation may lead to better ways to diagnose the condition early.

Diabetic retinopathy is caused by damage to blood vessels in the eye's retina. According to the U.S. Centers for Disease Control and Prevention, 5.5 million people over the age of 40 suffered from this condition in 2005, and this number is expected to triple by 2050 as the number of people with diabetes continues to increase. But there's hope; vision loss is preventable if retinal damage is detected early enough.

Affecting everyone who has type 1 diabetes and most people with type 2, diabetic retinopathy progresses in two stages. It begins when the small vessels that carry blood to and from the eye swell and leak, which can lead to slow vision loss as the health of the retina degenerates. In 20 percent of patients, the disease then progresses to advanced "proliferative" retinopathy. The oxygen-starved retina calls out to the circulatory system for help, which responds by forming new, abnormal

blood vessels. These fragile vessels have thin walls that tend to scar and hemorrhage, causing sudden vision loss.

Huang and colleagues have adapted a spectroscopic technology called optical coherence tomography (OCT) -- normally used take cross-sectional pictures of the retina -- to directly detect the amount of blood flowing through retinal blood vessels. A diode on the OCT instrument beams infrared light into the blood vessel of interest. The frequency of light that bounces back is shifted slightly by the fast-moving blood, a Doppler effect similar to the pitch shift in the sound of a train as it rushes by.

Using this technique, the team estimated the total amount of blood flow in the retinal veins of two people with diabetes, to within 10 percent. They detected less blood flowing in the person who had advanced proliferative retinopathy. Further unpublished results in six more patients support this finding, but the next step, according to Huang, will be a larger clinical trial to verify this observation with statistical significance.

The most common method currently used by ophthalmologists to detect retinopathy is a fluorescein angiography, an injection of dye into retinal veins used to spot leaks. This moderately invasive technique can cause nausea and vomiting and, in rare cases, severe allergic reactions.

OCT may provide a more quantitative, less invasive way to diagnose the condition, says Huang. It may also cut costs by circumventing the expensive equipment required for flourescein angiography. "It just requires special scanning software that could easily be put on the OCT machines that most retinal specialists have," he says. He hopes that this combination of factors will give ophthalmologists an easy way to check for problems early and often.

Detecting leaky blood vessels early helps patients choose between different treatment options. "People with poor blood flow don't respond well to some of the laser treatments used for retinopathy, and they are at a higher risk for proliferative retinopathy," says Huang.

More information: "Retinal blood flow detection in diabetic patients by Doppler Fourier domain optical coherence tomography," Yimin Wang et al., Optics Express, Vol. 17, Issue 5, Mar. 2, 2009.

Source: Optical Society of America (news : web)