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S.D. researchers testing wireless contact lens

BY **KEITH DARCÉ** REPORTER - BIOTECH
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The contact lens that David Grau wore for a day in April was unlike any other he had placed on his eyes.

It didn't improve the retired San Diegan's vision, and it didn't provide any cosmetic benefits. What the lens does might seem like something straight out of the pages of a science-fiction book.

Circling the edge of the silicon wafer is a tiny ring of circuitry containing a gauge and a microprocessor. The electronics measure the slightest change in the shape of the cornea caused by pressure fluctuations inside the eye.

An antenna embedded in the ring transmits the data to a receiver.

The experimental device, which is being tested in the San Diego area in advance of a review by regulators, is among a new generation of technology that promises to revolutionize the way doctors track and treat chronic illnesses that can cause serious medical problems.

Health care reform, skyrocketing insurance costs and an aging population are forcing doctors and policy makers to find ways to deliver medical care more efficiently and at a lower cost. Many of them believe wireless devices will play an important role in that process.

Doctors at Scripps Health in San Diego have tested a pocket-size ultrasound device on heart patients. Scientists at the West Wireless Institute in La Jolla



Jacqueline Grau
David Grau of San Diego wears a high-tech Triggerfish contact lens in his right eye. The silicon wafer is ringed with circuitry that measures pressure changes in the eye and transmits the data to a receiver worn next to the ear.

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heart rate of an unborn baby and the mother's contractions. Other researchers are developing smart pills that send out a signal when they have been taken and a sensor that measures pressure levels in the pulmonary artery.

In this latest case, the Triggerfish lens offers around-the-clock monitoring of the intraocular pressure that can lead to glaucoma, which damages the optic nerve and can cause blindness.

More than 4 million Americans suffer from glaucoma, but only half of them know they have it, according to the Glaucoma Research Foundation. The condition is the second leading cause of blindness in the world.

Close monitoring of the disorder is crucial in order to minimize nerve damage. The condition can be treated with prescription eye drops or surgery.

As with diabetes and hypertension, traditional methods for tracking eye pressure produce a single snapshot that doesn't tell the full story of what is happening in the eye over time, said Dr. Robert Weinreb, director of the Hamilton Glaucoma Center at the University of California San Diego, where the Triggerfish is being tested.

"It's like being shown a single frame of a full-length motion picture, and then being asked to talk about the plot," he said. "You can't really do that."

The UCSD center tried to get around that challenge by setting up the only overnight laboratory in the world for monitoring eye pressure. Patients who spend the night there are awakened every hour or two for brief eye exams.

"It's not the most enjoyable experience," Grau said.

Wearing the high-tech lens was far less intrusive, he said.

The device was placed on Grau's right eye at the center, and he was able to return home and go about normal activities. An adhesive strip held a receiver in place near his ear.

"This was a heck of a lot more comfortable than being woken every hour," he said. "It's definitely worth it."

Perhaps the biggest value lies in the huge amount of data gathered by the device.

"Eye pressure varies from minute to minute, hour to hour and day to day," Weinreb said.

Doctors know that it rises during sleep hours in most patients because of hydrodynamic changes that occur in the eye while the body is lying down.

Because most eye exams are done during daylight hours, they can miss important fluctuations.

The Triggerfish is made by Sensimed of Lausanne, Switzerland. The lens has been sold in Europe since regulators there approved the device in March 2009.

Researchers at UCSD have tested the device on about 40 patients, and they plan to study about 40 more over the coming weeks, Weinreb said.

The lead investigators are Dr. Kaweh Mansouri and Dr. Felipe Medeiros. Mansouri helped Sensimed develop the Triggerfish while he was working at the University of Lausanne and before he began working as a fellow at the Hamilton center a year and a half ago.

Weinreb said he didn't know how much the device might cost if it becomes commercially available in the United States, but it will be less expensive than hospitalizing a patient overnight to undergo more conventional hourly eye pressure checks.

It also wasn't clear when the device might become available for general use in the United States if the results of the UCSD study are positive.

Medicine is quickly moving toward a time when a whole range of physiological conditions will be monitored constantly through wireless devices that send a steady flow of data from patients to their physicians, said Dr. Joseph Smith, chief medical and science officer of the nonprofit West Wireless Institute.

"My car does a good job of telling me how fast I'm going and how much gas I've used," he said. "We're familiar with this concepts. We just haven't applied it to our bodies very well."

Triggerfish represents a "new era" in health care, Weinreb said.

"We've been hearing about personalized medicine for a number of years now," he said. "This really is the future."

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