“Smart Contact Lens” Provides New Insights Into Glaucoma
Clinical trials launched at UC San Diego for device that continuously measures internal eye pressure

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Doctors and researchers at the University of California, San Diego Shiley Eye Center have launched the first large-scale clinical trials in the United States of a futuristic “smart contact lens” that measures internal eye pressure – a key risk factor for glaucoma, the second leading cause of preventable blindness in the world.

Though the causes of glaucoma remain murky, high intraocular pressure (IOP) or excessive pressure within the eye appears to be causal in many individuals, promoting deterioration of the optic nerve and progressive loss of vision eventually leading to blindness.

Doctors can slow or prevent the progression of glaucoma by reducing IOP with drugs, but their working knowledge of their patients’ conditions traditionally has been limited to an occasional pressure reading obtained during an office visit. “It’s a snapshot in time,” said Robert N. Weinreb, MD, chair of the department of ophthalmology at the UC San Diego School of Medicine and director of the Shiley Eye Center at UC San Diego. “Current treatments are based on these one-time readings even though they provide limited information.”

But recent research, much of it produced by Weinreb, John H.K. Liu, PhD, and colleagues at Shiley’s sleep laboratory, show that intraocular pressure rises and falls throughout the day and night. It is often lowest during waking hours when doctors typically see patients, and highest at night when patients are usually asleep.

The new smart contact lens is being tested in collaboration with Felipe Medeiros, MD, PhD, professor of ophthalmology at UC San Diego and Kaweh Mansouri, MD, a fellow at the UCSD Hamilton Glaucoma Center, who worked with Sensimed, the Swiss-based maker of the lens, while he was at the University of Lausanne in Switzerland. Mansouri was named medical director at Sensimed in May.

The lens is designed to provide ophthalmologists with a much more accurate, longer-term assessment of the IOP. Called the “Triggerfish,” it consists of a clear, silicone contact lens ringed by a strain gauge and a microprocessor and antenna that transmits data to an external receiver. The gauge continuously monitors the shape of the cornea, indicating greater or lesser intraocular pressure. Information about IOP fluctuations is immediately transmitted via radio frequencies from the lens’ microprocessor to a recording receiver. The microprocessor is powered by an induction loop which uses a magnetic field around the eye to generate the tiny amounts of required electricity. (Induction loops are also used to power hearing-aid implants.)

The Triggerfish is intended to be worn for just 24 hours, then discarded. Glaucoma patients would wear the device once every six or so months. From these brief periods of monitoring, Weinreb said doctors would likely obtain a detailed description of the patient’s IOP and eye health.

“It’s the difference between seeing a single movie frame and watching a full-length motion picture,” Weinreb said. “With more information, we better understand what is happening to the eye. We can provide earlier and more accurate diagnoses. We can detect changing conditions more quickly. We can adjust or alter treatments more effectively. The benefits are transformative. This is personalized medicine for the eye.”

The clinical trials for the Triggerfish are the first in this country. Shiley is the only center in the U.S. to have already treated glaucoma patients with the smart contact lens. A similar device was recently approved for use in Europe. Sensimed officials hope for U.S. approval by the Food and Drug Administration by the end of this year.

Weinreb said he and colleagues are also pursuing a second IOP-monitoring device. This one would be implantable and permanent. It would provide continuous measurements over the lifetime of the patient.

About glaucoma
After cataracts, glaucoma is the second leading cause of preventable blindness in the world. It is a group of diseases that involve painless deterioration of the optic nerve, resulting in gradual vision loss and eventual blindness. Current treatments can slow the progression of the disease, but cannot cure it. Any vision loss is permanent

Roughly 70 million people worldwide suffer from glaucoma; 4 million in the United States. One in 200 people age 50 and older have glaucoma, an incidence rate that rises to 1 in 10 for people 80 years and older. Glaucoma is sometimes called the “silent thief of sight.” It’s estimated that half of people with the condition do not know they have it.

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