"All the News That's Fit to Print"

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Today, sunny, cooler, high 62. Tonight, clear, light winds, low 47. Tomorrow, sunny, pleasant, high 62. Weather map is on Page 24.

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NOVELTIES

ANNE EISENBERG

Plugging Into the Eye, With a New Design

WHEN disease destroys vital parts of the eye, causing degrees of blindness, scientists can sometimes replace damaged tissue with electronic implants that help patients see lines and basic shapes.

But as with any electrical connection, these implants must fit snugly and not jiggle or shake loose after a few months, like a drooping plug in a wall socket.

Now groups of scientists have demonstrated retinal implants that they say will resist the jarring of daily use. The implant contains a tiny array of electrodes whose tips slide into a snug berth just beneath the retina, the nerve tissue lining the back of the eye, and are held in place by natural suction.

The electrodes prompt the remains of retinal circuits to transmit signals to the brain, said John L. Wyatt, a professor of electrical engineering at the Massachusetts Institute of Technology and co-founder of the Boston Retinal Implant Project, one of the groups that has developed a prototype of the new design. The research team includes scientists from the Massachusetts Eye and Ear Infirmary, the VA Boston Health Care System and Cornell University.

A camera that is worn on eyeglasses supplies images to the implant wirelessly. The implant is intended for people with retinitis pigmentosa, a disease that damages the rods and cones in the eye, and for macular degeneration, which also affects these photoreceptors, Dr. Wyatt said.

Most retinal prostheses being developed for these diseases have a different design: they tack the electronic arrays to the inside surface of the retina for a tight fit, said Dr. Jay S. Duker, professor and chairman of ophthalmology at Tufts Medical Center in Boston. But using a metal tack may have disadvantages, he said. "The tack can cause bleeding, or shake loose during the life of the implant," Dr. Duker said.

"The tight contact in this design matters," he said. "A retinal implant is like any other electrical connection. You don't want it to shake loose."

Brian Mech, vice president for business development at Second Sight Medical Products of Sylmar, Calif., which makes retinal prostheses that use a metal tack, said the tacks had not posed problems.

"We've implanted 38 people so far with a retinal prosthesis,' he said, "and the tack has never caused bleeding in any of them." Some of the people have been wearing the devices for more than five years, he said.

The company has had three instances of tacks coming loose, but all were repaired without incident, he said.

The Boston project team has used its subretinal prototype in animals but not in humans, although it expects to have a device for human patients to present to the Food and Drug Administration in about two years, Dr. Wyatt said.

In Europe, a group of scientists has implanted a subretinal prosthesis in 11 people, said Dr. Eberhart Zrenner, director of the Center for Ophthalmology at the University of Tüebingen in Germany. With the prosthesis, patients blind from retinitis pigmentosa could find and recognize items like forks and knives, Dr. Zrenner said. Retina Implant A.G. in Reutlingen, Germany, is commercializing the technology.

To insert the implant, surgeons in the Boston group rotate the eye and make an incision in the back of it, said Dr. John I. Loewenstein, vice chairman for education in the ophthalmology department at Harvard Medical School and a retinal surgeon at the Massachusetts Eye and Ear Infirmary; he helped to develop the surgical procedure.

The method is delicate, he said.

"Surgical access is difficult," he said. "You have to go through a rich layer of blood vessels beneath the retina to get the prosthesis in contact with the nerve tissue." But once the tips of the electrodes are in place beneath the retina on its outside surface, the implant may provide a rich signal.

"Even if the rods and cones are dead, many of the other cells are still there," he said of the layers of cells in the retina that receive the signal from the implant. "And these cells are not just passing on the information like a baton. They are modifying it."

Only the tips of the electrode array slide under the retina, said Douglas Shire, the engineering manager of the project, who is based at Cornell University, where the electrode parts are fabricated. The rest of the array and a titanium case enclosing other electronic parts are stitched in place at the back of the eye, where they can't be seen.

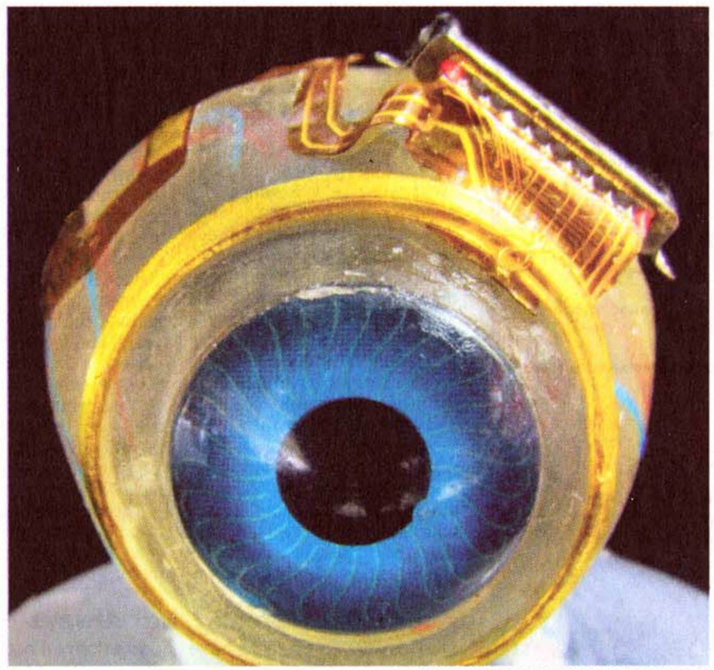
JOSEPH F. RIZZO III, co-founder of the project and director of the Center for Innovative Visual Rehabilitation at the Boston VA and director of the Neuro-Ophthalmology Service at Harvard Medical School, said the eyes of test animals had tolerated the implants well.

"The eye adapts," he said, just as it has with another device, the scleral buckle, which has been placed in human eyes for decades without problems. The device squeezes the eye to bring the back of the eye closer to a detached retina.

The vision that people regain with retinal implants will not be like normal vision, Dr. Loewenstein cautioned. Most retinal prostheses seem to function to let people detect light and dark, he said, helping them find the edges of objects, for example.

He expects that patients will adapt to the new input.

"We are learning that the brain, especially the visual cortex, is much more adaptable than we thought," he said. "Even if our devices don't perfectly mimic the information that the brain usually gets from the retina, it may be able to learn to use the input in new ways." □



SHAWN KELLY/BOSTON RETINAL IMPLANT PROJECT

A model of an eye with a newly designed implant from a Boston group of researchers. The tips of the implant's electrodes, which help replace the work of diseased rods and cones, slide into a snug berth just below the retina.

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