SPECIAL REPORT

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The Next Frontiers

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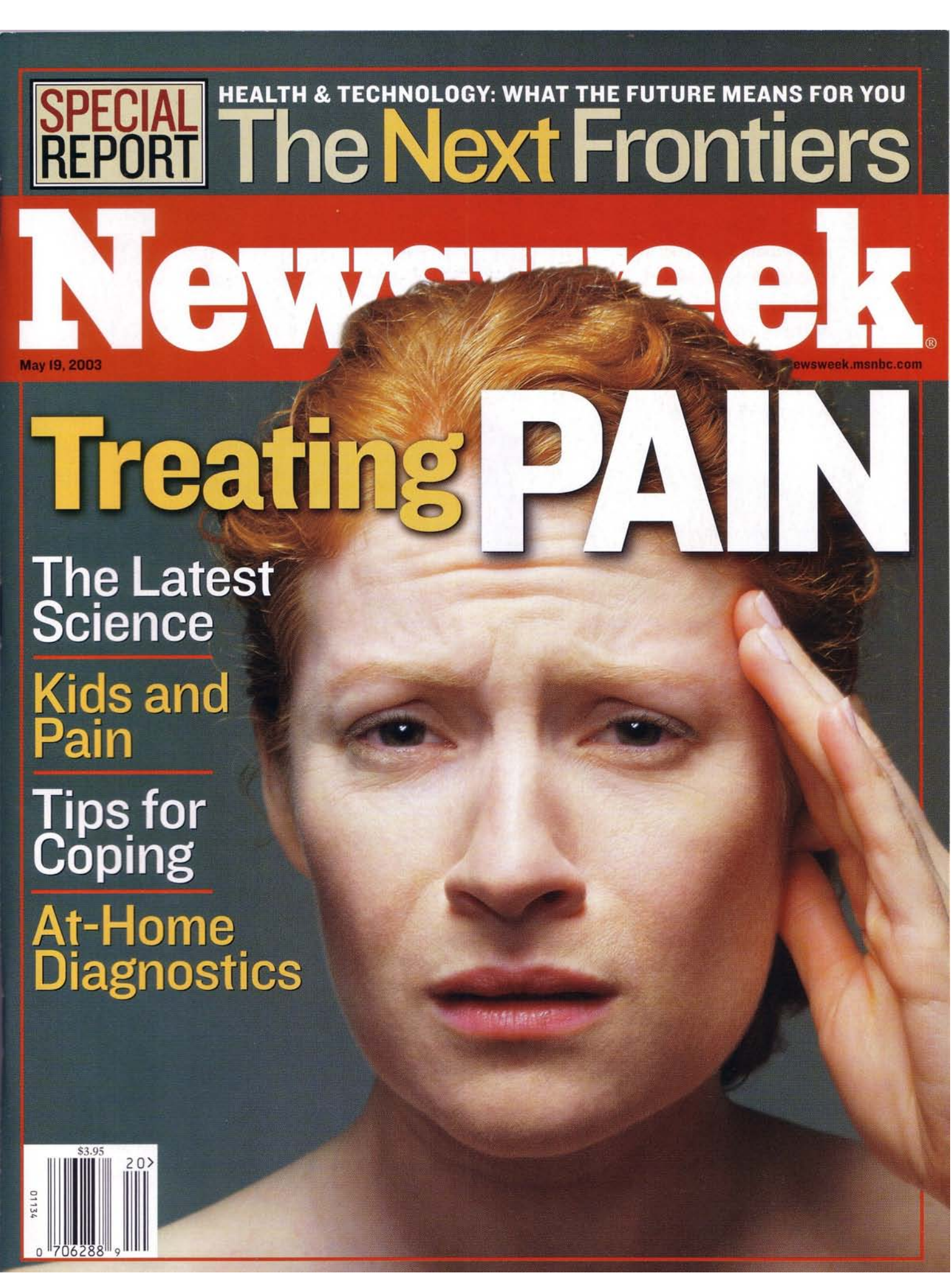

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BIONIC EYE: The Implantable Miniature Telescope could enhance eyesight for 11 million Americans with age-related macular degeneration

Seeing Is Believing: Hope for the Blind

New treatments, microchips and electronic implants show promise for millions with impaired vision

BY BRAD STONE

PAUL LADIS CAN'T SEE HIS three daughters or his wife of 15 years, Beth. The former machinist from Roselle, Ill., has been legally blind for a decade. He was born with a hereditary disease called retinitis pigmentosa, a gradual decaying of the retina which affects 100,000 Americans and can lead to total blindness. Last year Ladis's brother told him of a company called Optobionics whose doctors were implanting the first artificial retinas. Ladis, 45, applied to be a test subject and, a few months later, walked into the Rush-Presbyterian-St. Luke's Medical Center in Chicago.

Today, a silicon chip two millimeters across sits in his eye, converting light into electrical signals that travel through the optic nerve to his brain. The technology is still in its infancy and offers no hope of a total cure. But Ladis says he now notices shapes, lights and motion instead of an inky gray darkness, and can function better around the house. "If I want to reach out and hug my kids, I can see them walking by me now," he says happily.

Ten years ago, the idea of placing a tiny electronic device into the human eye seemed more suited to sci-fi than reality. Compared with the ear, where cochlear implants have been effectively converting sound into electrical impulses since the mid-'80s, the eye is a more sensitive and complex piece of human anatomy. But today, a dozen teams of scientists around the world are pursuing the goal of artificial eyesight for those who spend their days in darkness. They're proving that such technology is safe, and that it can improve the quality of life for the vision-impaired. Like Paul Ladis's bionic implant, the new devices do not cure ocular disease, and none are approved by the FDA for general use. Yet early promising results have spurred cautious optimism among ophthalmologists that the age of combating blindness has finally begun. "The concept is no longer laughable," says Gerald Chader, the chief scientist for the advocacy group Foundation Fighting Blindness. "There are patients living with implants that seem to work."

The most prevalent disease researchers are targeting is macular degeneration. The affliction, which affects an estimated 11 million (mostly elderly) Americans, leaves a foggy black splotch at the center of the field of vision. Patients often must use huge closed-circuit TVs to magnify newspapers or books, or big, unwieldy head-mounted telescopes.

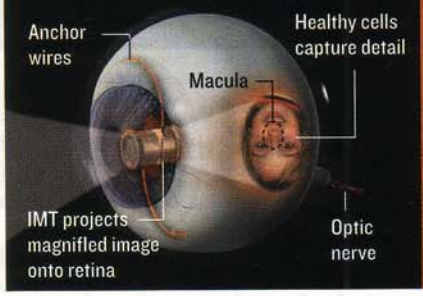
A surgeon implants the IMT

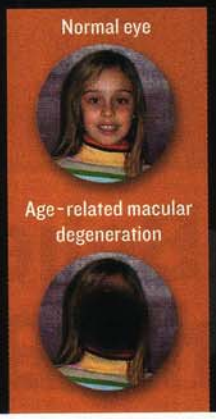
New Hope for Restoring Deteriorating Eyesight

Age-related macular degeneration and other ocular diseases affect millions. Two devices show promise.

Implantable Miniature Telescope

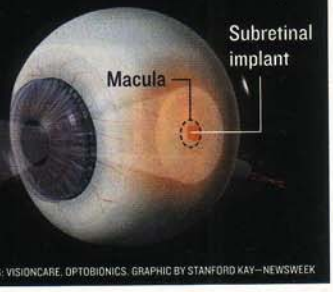
IMT transmits an enlarged image to the unaffected cells outside the macula. The untreated eye is used for peripheral vision.





Artificial Silicon Retina

A chip containing 5,000 solar cells implanted in the retina converts light to electric impulses, stimulating weakened receptors.



SOURCES: VISIONCARE, OPTOBIONICS. GRAPHIC BY STANFORD KAY—NEWSWEEK

The Saratoga, Calif.-based VisionCare wants to lighten their load. The IMT (Implantable Miniature Telescope) evolved out of Israeli research into optics and is roughly the size of a pea. Inserted into one eye like the intraocular lens in cataract surgery, it projects a magnified image over a wide field of the retina. After an hourlong procedure, patients must undergo extensive training to learn to use the implanted telescope for central vision and the other untreated eye for mobility and peripheral vision. The device, now in FDA trials, has been implanted in more than 70 patients, and VisionCare scientists are very optimistic about early results. "For an 80-year-old to sit and watch TV or read headlines in a newspaper or pay their bills, it's a godsend," says Robert Kershner, a Tucson ophthalmologist involved in the trials.

The IMT only augments eyesight in those with damaged retinas. Artificial implants that replace retinas, like the kind Paul Ladis received, are farther behind. Brothers Alan and Vincent Chow of Optobionics have implanted their microchips in 10 patients. The chips aren't actively powered; each contains 5,000 solar cells that convert light into electric impulses that stimulate weakened cells in the retina. Optobionics patients, Alan Chow says, are reporting "moderate to substantial improvement in vision." One patient, blind for decades, remarked to doctors that modern automobiles look ugly.

Researchers at the Doheny Retina Institute at the University of Southern California are exploring a variation of the same idea. In the Doheny system, a camera on the patient's eyeglasses captures and transmits images to an implant. Patients also wear a battery pack that transmits power magnetically to a receptor behind the ear, which then sends electricity to the implant to stimulate nerve cells. Chader, of the Foundation Fighting Blindness, says he witnessed an evaluation of one of the Doheny Institute's three test patients: the man, blind for 30 years, was able to make out two of the big letters on the eye chart.

Perhaps the most exciting aspect of all these devices is that they should get better quickly, now that medical researchers have hitched their wagon to ongoing improvements in microchips and miniaturization. For example, the Doheny chips currently include 16 electrodes, but professors there talk of next-generation implants that could include up to 100. Scientists at VisionCare theorize about one day allowing patients to control their implanted telescopes, zooming and changing focus like "The Six Million Dollar Man." The technology will take years to develop, but until gene researchers can locate and replace the chromosomes responsible for ocular disease, the devices will offer the best hope for the severely vision-impaired. Paul Ladis, for one, is enthusiastic. "I would love to see my kids' faces," he says. "I would love to read books to them. That would be fantastic." ■

"The concept is no longer laughable. There are patients living with implants that seem to work."

—GERALD CHADER, scientist