MedicalXpress

Vision researchers see unexpected gain a year into blindness trial

August 12 2009

Scientists have discovered that even in adults born with extremely impaired sight, the brain can rewire itself to recognize sections of the retina that have been restored by gene therapy.

The discovery of the brain's surprising adaptability comes a year after three blind volunteers received doses of corrective genes to selected areas of their retinas at Shands at the University of Florida medical center.

Now, more than a year later, researchers say tiny portions of the patients' retinas that have received gene therapy have kept their restored function, as much as 1,000-fold increases for day vision and 63,000-fold for night vision.

But in an unexpected finding, scientists writing in Thursday's (Aug. 13) *New England Journal of Medicine* say the treated parts of the retinas may have acquired enough image-processing strength to rival the retina's normal center for visual perception, called the fovea, for the brain's attention.

The discovery suggests that even in adults with mature visual circuitry, the brain can find new ways to process optical information, say researchers with the UF Powell Gene Therapy Center and the Scheie Eye Institute at the University of Pennsylvania.

"When one patient came back for her 12-month visit, she said she could

read the digital clock in her parents' car with her treated eye — something she was never able to do before," said William W. Hauswirth, Ph.D., a professor in the ophthalmology department at the UF College of Medicine. "That prompted us to measure where her gaze was fixed while looking at a variety of dim targets. This showed that she now has two preferred centers of vision rather than one, depending on the brightness of the object."

The new region is more sensitive to light, but it is not as precise as the fovea for making bright images sharp.

"Her brain tells her to use the best part of retina she can, depending on the situation, so she automatically shifts back and forth between the usual region and the region we supplied to her," said Hauswirth, who is associated with the Powell Gene Therapy Center and the UF Genetics Institute.

The patients have a rare, incurable form of blindness called Leber congenital amaurosis type 2, the most common cause of blindness in infants and children. In the type 2 form, photoreceptor cells cannot respond to light because a gene called RPE65 does not properly produce a protein necessary for healthy vision.

In the study led by Samuel G. Jacobson, M.D., Ph.D., a professor of ophthalmology at the University of Pennsylvania, and supported by the National Eye Institute, researchers used an apparently harmless virus that already exists in most people to deliver RPE65 to a small area of the retina.

In October 2008, researchers reported that the study volunteers — one woman and two men ranging from 21 to 24 years old — could see brighter areas and perhaps some images.

In the current New England Journal of Medicine report, scientists say vision in volunteers' treated eyes remains slightly improved in dim lighting conditions. But the "excursions of fixation" from the usual focal point of the retina to the treated area nearby in one of the patients was a welcome surprise.

"This finding required her to tell us she was seeing these objects," Hauswirth said. "What's truly astounding is the brain even in an adult is still adaptable enough to learn to use these regions of the retina."

The viral vectors used to deliver the gene therapy were manufactured by the Powell Gene Therapy Center, directed by Barry J. Byrne, M.D., Ph.D., a professor of molecular genetics and the principal investigator for the trial at UF.

"What's truly been remarkable so far, beyond the gene therapy to the retina, is how well the visual parts of the brain are adapting to the treated eye," said John G. Flannery, Ph.D., a professor of vision science, and neurobiology at the Helen Wills Neuroscience Institute at the University of California, Berkeley, who did not participate in the research. "You could almost say the patients' brains are getting better at paying attention to the gene-therapy treated area, because it is functioning at a higher level."

Source: University of Florida (news : web)