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Vision chip restores man's sight

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A man left blind by a devastating eye disease has been able to read letters, tell the time and identify a cup and saucer on a table after surgeons fitted him with an electronic chip to restore his vision.

Miika Terho, 46, began losing his eyesight as a teenager and was completely blind when he joined a pilot study to test the experimental eye chip at the University of Tübingen in Germany.

Terho was one of three patients who had the chip inserted under part of the retina called the macula, where the highest concentration of light-sensitive cells are found. Terho performed particularly well after the implant.

Terho, who lives in Finland, developed a condition called retinitis pigmentosa, a hereditary disease that causes light-sensitive cells in the eye steadily and irreversibly to die off. His night vision began to fail when he was 16 and he was severely blind in both eyes by 35. Unaided, he now has just enough peripheral vision to tell night from day.

“I’ve been completely blind in the central area for about 10 years. I had no reading ability and no way of recognising anybody any more. When the chip was first turned on, I just saw flashes and flickering. It didn’t make any sense. But in a matter of hours, everything started to get clearer and clearer,” Terho said.

“When I looked at people for the first time, they looked like ghosts. I knew it was a person, but they were hazy. Then things got sharper. It was such a good feeling to be able to focus on something, to see something right there, and maybe even reach out and grab it. I wasn’t able to identify what was in front of me on the street, but I knew when something was there, so I didn’t walk into it,” he added.

The technique is potentially suitable for a range of conditions that affect rod and cone cells, the cells which detect light and convert it into electrical signals that are relayed to the brain via the optic nerve. Retinitis pigmentosa, choroideraemia and age-related macular degeneration are all conditions that affect these cells while leaving other components of the eye relatively untouched.

However it would not work for other eye diseases in which, for example, the optic nerve is damaged.

Surgeons spent six hours operating on each of the patients, first cutting a small flap in the delicate retina, and then inserting the chip, which measures 3mm by 3mm. The chip was connected via thin wire to a battery that each patient wore on a necklace. It contains 1,500 light-sensitive elements that replace the defunct cells in a blind patient’s retina.

When an image hits the chip, it is converted into electrical pulses that stimulate healthy cells in the retina. These cells send signals to the brain, where the image is reconstructed.

Eberhardt Zrenner, director of the institute for ophthalmic research in Tübingen, gave the patients a series of eye tests to assess their ability to read letters, distinguish between plates, mugs and cutlery and

to discern one colour from another. Although the patients could only see in black and white, they could discern different hues by how bright or dark they appeared.

The patients, two men and a woman, were aged 40, 44 and 38 at the time, and each had the implant for three months. They began to see basic shapes within days and gradually learned to see more clearly. The results are published in the Proceedings of the Royal Society B.

“This is a proof of concept,” said Zrenner. “In 1900, nobody knew if we would ever have powered flight, but then the Wright brothers flew a couple of hundred metres and showed it was possible. We are in the same situation.

“We have not achieved the optimum that is possible, but we have shown that with this approach we can give patients some ability to see things like a table, the shape of a face or a sunflower.” Zrenner has begun a second trial that uses an implantable and rechargeable battery, so patients do not need to wear it around their neck.

Terho has told doctors he wants to have the eye chip implanted permanently if future trials are successful.