Bionic eyes restore sense of sight in Australian patients

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Four patients in a Melbourne clinical trial have been implanted with Australian-designed 'bionic eyes'.

The devices don't restore sight, but they can help people navigate the world and distinguish objects.

Guests:

Associate Professor Penny Allen

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Reporter:

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IMAGE: ANOTHER STEP FORWARD FOR BIONIC EYE RESEARCH IN AUSTRALIA (PIXABAY: INTOGRAPHICS)

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Norman Swan: Now to a similar story actually but it involves people with a progressive and genetic cause of blindness. Here's Diane's experience with an early version of what's being called the bionic eye.

Dianne: Every week I used to come to the cafe around the corner and have lunch, and so I got to know the barista very well, and this day I was standing behind, I had the gear on and I could see him. I knew when he was walking away because I could see the movement. And there's a picture they took of me and apparently I've got the biggest smile on my face because it connected my world.

Norman Swan: Four patients in a Melbourne clinical trial has now been implanted with a new version of the Australian it designed bionic eyes. The devices don't restore sight but they can help people navigate the world and distinguish objects. Associate Professor Penny Allen from the Centre for Eye Research Australia leads the project, and she's speaking here to the science unit's Carl Smith.

Carl Smith: I guess the first question is what is a bionic eye and how does it work?

Penny Allen: A bionic eye aids patients who have profound visual loss. The majority of these devices have a small camera which takes digital images, and that information is processed and passed to an array either within the eye or the brain, and that will electrically stimulate either the residual tissue in the retina or cortical neurons in the brain to generate flashes of light that can be interpreted and give a sense of vision.

Carl Smith: I've seen one of these up close and personal before, at least the early prototypes of them. We are talking a backpack computer, a camera mounted on a pair of glasses, and then literally an implant at the back of someone's retina.

Penny Allen: That's right. And further development of these devices means that, for example, the camera becomes smaller, the vision processing unit becomes a bit larger than a mobile phone, something that is held on a belt or in a handbag, and the information is usually transferred to stimulators that are underneath the skin.

Carl Smith: Now, this doesn't restore sight in the sense that people with sight understand it.

Penny Allen: The theory behind using these devices in the eye is that if you stimulate a particular area of the retina, then that will be very reproducible. So the phosphines, the little flashes of light, do give some visual information that the patients can learn to interpret and then use to navigate to avoid obstacles, to detect edges, to identify objects on a table, for example.

Carl Smith: These are 44-channel devices. The original was a 24-channel device. As I understand it, that means you've sort of got a grid of 44 now points we can see these little flashes, and by combining those flashes or phosphines together you can figure out roughly what might be in front of you or might be moving in front of you.

Penny Allen: It's not completely grid-like. Every patient has individual phosphines. So an area of stimulation will be different for each particular patient, and that's why a lot of lab work is done to identify that for the individual patients, and that is then built into the vision processing algorithms that allow the digital image to be translated into electrical stimulations.

Carl Smith: We now have four people who you've implanted with this new model, and they are taking these home, they are taking them into their lives. What have been the early results from people?

Penny Allen: It's actually all very exciting. The early results are that the patients have gone through the training period, they are using the devices for navigation and starting to use them in the home. It's important to identify with the patients tasks that they wish to be able to use the device for at home, and we are working on that at the moment.

Carl Smith: These prototypes are only being used for people with very specific vision impairments. We are talking here retinitis pigmentosa. Give me a sense of what this vision impairment is and whether this technology could be used for other vision impairments.

Penny Allen: Retinitis pigmentosa is a term that is used for a number of inherited retinal diseases. There are many, many mutations, more than 200, in the photoreceptors, the cells that turn the light into vision within the retina. And unfortunately these genetic abnormalities mean that the photoreceptors progressively die throughout the patient's lifetime, and they progressively lose peripheral vision and then eventually central vision. But it does mean that there are residual nerve cells within the retina that can be stimulated.
Carl Smith: And the remaining part of the visual system from the retina back into the brain is still intact for these patients.
Penny Allen: For those patients, yes, so that if those residual pathways were not intact, then another approach would need to be taken. So, for example, severe glaucoma, severe trauma, then obviously these devices would not be helpful for that.
Carl Smith: Even though this device is only designed at this point for people with retinitis pigmentosa, it is quite a debilitating condition that affects quite a few people.
Penny Allen: Realistically, if you were walking in the street and you saw a patient with a guide dog or a cane, the most likely diagnosis is that they have RP. There's 1.5 million people with profound visual loss due to RP in the world. The reality is that the loss is progressive and we have no treatment for it. Anything that we can do to help provide these patients with further visual information is obviously a really positive thing.
Carl Smith: And how safe is this?
Penny Allen: That's why it takes quite a long time to develop these devices, not only do the constituents have to be shown to be safe, and in our case we've used materials that have a safety profile that has been shown over many, many years, but we also have to show that the stimulation is safe and that the design of the device means that it will be stable within the eye.
When we have all of that information, if the surgical and clinical team feel that the results are worthwhile, then we put that to a human research and ethics committee to ask for obviously their opinion about safety before proceeding with the trial.