RETINAL IMPLANT

Restoring some visual function to patients with advanced photoreceptor degeneration

by Dermot McGrath in Paris

The pilot clinical trial of a subretinal electronic implant (Retina Implant AG) indicates that the device is safe, well tolerated and is capable of restoring some measure of useful visual function in blind retinitis pigmentosa patients, reported Eberhart Zrenner MD at the 10th EURETINA Congress.

"It is still early days and we still have to improve on the device, but I think we have established proof of concept and shown that our subretinal approach can give these patients the ability to distinguish shapes and identify objects, which is already huge progress for these patients. We have now started a second trial of the device in Germany and will be expanding the trials to other centres in Europe in 2011," said Prof Zrenner, director of the Institute for Ophthalmic Research in Tubingen, Germany.

Prof Zrenner explained that electronic prostheses currently represent the best hope of restoring some visual function to patients with total photoreceptor degeneration.

"The aim is to restore useful visual process by implanting a subretinal electrode implant in patients that are blind from uterine retinal degeneration, and to give them back the possibility of recognizing or localising objects and achieving self-sustained mobility," he said.

Discussing the properties of the device, Dr Zrenner explained that the core of the implant is a microchip, approximately 3.0mm x 3.0mm in size and 0.1mm thick, in which 1,500 pixel fields are arranged, including circuitry for amplification, brightness adjustment and safety switching. The size of one pixel is 70 µm x 70 µm. This produces a field of view of 12 degrees, a window of the size of a laptop screen in one meter distance which is already sufficient to enable mobility and the orienting recognition of objects.

Each pixel cell is assigned one photodiode, an amplification circuit and a stimulation electrode. Each photocell takes the light entering the eye and converts it into the electrical energy that is required to stimulate the intact nerve cells in the retina next to the electrode. The nerve impulses from these cells are relayed to the brain via the optical nerve and ultimately lead to visual perception.

Prof Zrenner explained that the implant is placed in the subretinal space in the area where the light-sensitive sensory cells are located in healthy persons.

"We have taken this approach because we think that photodiodes and electrodes correspond to the proper retinotopic localisation and we can also use the remaining information processing network of the retina there. Fixation is also easier in the subretinal space. Another plus is that natural eye movement helps to localise objects because the image received by the implant moves exactly with the eye, including the microsaccades, which help to refresh the image," he said.

In the pilot study of the implant, 11 patients were successfully implanted with the device under general anaesthesia. A subdermal cable was put in place from a small skin incision behind the ear and a small opening with a flap was made laterally near the equator of the eye. A small incision was then made into the choroid and the chip was then carefully advanced through these openings together with the tiny power line under the retina until it reached its destination near the fovea.

"The implantation surgery went well and the chip was located where it should be in the posterior pole, with no problems of retinal detachment, haemorrhage, inflammation or vitreous traction," he said.

Triggering electric stimulation enabled patients to perceive light in particular shapes and patterns, said Prof Zrenner. Visual acuity tests showed that patients were able to recognise foreign objects and in some cases read letters in order to form words. In some cases, bright objects set in some cases read letters in order to form words. In some cases, bright objects set

Prof Zrenner explained that the core of the implant is a microchip, approximately 3.0mm x 3.0mm in size and 0.1mm thick, in which 1,500 pixel fields are arranged, including circuitry for amplification, brightness adjustment and safety switching. The size of one pixel is 70 µm x 70 µm. This produces a field of view of 12 degrees, a window of the size of a laptop screen in one meter distance which is already sufficient to enable mobility and the orienting recognition of objects.

Each pixel cell is assigned one photodiode, an amplification circuit and a stimulation electrode. Each photocell takes the light entering the eye and converts it into the electrical energy that is required to stimulate the intact nerve cells in the retina next to the electrode. The nerve impulses from these cells are relayed to the brain via the optical nerve and ultimately lead to visual perception.

Prof Zrenner explained that the implant is placed in the subretinal space in the area where the light-sensitive sensory cells are located in healthy persons.

"We have taken this approach because we think that photodiodes and electrodes correspond to the proper retinotopic localisation and we can also use the remaining information processing network of the retina there. Fixation is also easier in the subretinal space. Another plus is that natural eye movement helps to localise objects because the image received by the implant moves exactly with the eye, including the microsaccades, which help to refresh the image," he said.

In the pilot study of the implant, 11 patients were successfully implanted with the device under general anaesthesia. A subdermal cable was put in place from a small skin incision behind the ear and a small opening with a flap was made laterally near the equator of the eye. A small incision was then made into the choroid and the chip was then carefully advanced through these openings together with the tiny power line under the retina until it reached its destination near the fovea.

"The implantation surgery went well and the chip was located where it should be in the posterior pole, with no problems of retinal detachment, haemorrhage, inflammation or vitreous traction," he said.

 Triggering electric stimulation enabled patients to perceive light in particular shapes and patterns, said Prof Zrenner. Visual acuity tests showed that patients were able to recognise foreign objects and in some cases read letters in order to form words. In some cases, bright objects set

Prof Zrenner explained that the core of the implant is a microchip, approximately 3.0mm x 3.0mm in size and 0.1mm thick, in which 1,500 pixel fields are arranged, including circuitry for amplification, brightness adjustment and safety switching. The size of one pixel is 70 µm x 70 µm. This produces a field of view of 12 degrees, a window of the size of a laptop screen in one meter distance which is already sufficient to enable mobility and the orienting recognition of objects.

Each pixel cell is assigned one photodiode, an amplification circuit and a stimulation electrode. Each photocell takes the light entering the eye and converts it into the electrical energy that is required to stimulate the intact nerve cells in the retina next to the electrode. The nerve impulses from these cells are relayed to the brain via the optical nerve and ultimately lead to visual perception.

Prof Zrenner explained that the implant is placed in the subretinal space in the area where the light-sensitive sensory cells are located in healthy persons.