



# Subretinal microchip placement

**R**etinitis pigmentosa (RP) affects approximately one in 3,000 to 4,000 people in the UK, making it the leading cause of inherited blindness. RP is a degenerative condition with signs and symptoms often first appearing in childhood with severe vision problems typically developing in early adulthood. At present there are no approved or commercially available treatment options that can restore vision or even slow the progression of the disease.

It is recommended sufferers wear sunglasses to protect the retina from harmful UV light which may help preserve vision. There is some controversial research which suggests that treatment with antioxidants (such as vitamin A) may prevent the disease from progressing, and the pharmaceutical industry continues to develop drugs for this purpose. Treatment with vitamin A-based drugs however, cannot restore previously lost vision so it is only a potential option for patients in the early stage of the disease.

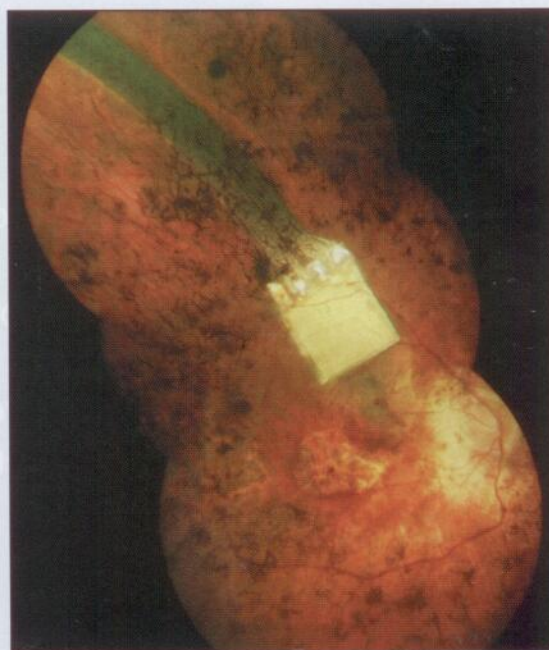
There are several clinical trials currently under way to investigate new treatments for RP. Perhaps one of the most exciting and promising in the field is the development of retinal implants that can restore vision to a functional level for blind patients. Leading the way in this discovery is German developer Retina Implant.

## Implant location

Retina Implant's technology is based on a subretinal implant which is implanted underneath the retina, specifically in the macular region and replaces the light receptors lost in RP retinal degeneration. The microchip works like a digital film camera, with a 3mm x 3mm array of 1,500 photodiodes sending pulsed electrical signals to the adjoining nerve cells, which relay the messages to the brain.

There is a growing consensus among researchers that the subretinal (versus epiretinal) approach yields more positive results for patients. It is believed that this is due in part to the subretinal placement of the implant in the macular region which is considered to be the ideal location as it houses the light-sensitive photoreceptor cells responsible for producing clear images in normal-sighted people. The subretinal location is also thought to provide

A new advance in retinal implant technology offers hope to retinitis pigmentosa patients. *Optician* reports



The microchip contains an array of 1,500 photodiodes which send signals to the adjoining nerve cells

greater security in terms of preventing the implant from dislodging.

The epiretinal implant requires several parts to work: a camera and transmitter mounted on the patient's spectacles, an implanted receiver, electrodes secured on top of the retina with a tack to keep the device in place, and a battery pack worn on the patient's belt which powers the entire system. The camera captures images which are processed by the transmitter and receiver and turned into electrical pulses. The desired result is for the retina to respond to the pulses by perceiving them as patterns of light and dark spots which patients learn to interpret as meaningful images. Clinical trial results have yielded some success but have reported several adverse events.

The subretinal approach, on the other hand, only requires an energy source in addition to the implant and this is inserted under the skin and thus requires no external equipment. Furthermore, the subretinal implant is designed to emit substantially more electrodes: 1,500 versus 64. This increased number of electrodes allows for the light and dark images to appear more vibrant. Because the light hits

the implant directly, instead of through a camera, patients only need to move their eyes in order to scan objects rather than moving their head.

## Evidence base

Clinical trials of Retina Implant's technology began in Europe in November 2005 by implanting 11 patients who have RP. The implant was left in the eye for three months and patients received training in the optimal way to use the vision they obtained. Even without training, the participants were able to distinguish objects such as windows, a knife, fork, and spoon and in some cases to identify letters and read.

A study in Proceedings of the Royal Society B discussing the technical and clinical results obtained during their first human clinical trial was published in November 2010. The research was led by Professor Eberhart Zrenner, MD, director and chairman, Institute for Ophthalmic Research at University Eye Hospital Tuebingen, Germany. Commenting on the research, Professor Zrenner said: 'The results of this pilot study provide strong evidence that the visual functions of patients blinded by a hereditary retinal dystrophy can, in principle, be restored to a degree sufficient for use in daily life.'

Retina Implant is expanding the trial to other countries including the UK where the first long-term trial is expected to begin this summer. Patients will receive the 1,500 electrode implant permanently. If this second trial supports the earlier results, Retina Implant will submit the device for CE mark approval. Leading the trial in the UK is Professor Robert Maclaren, professor of Ophthalmology at the University of Oxford and a consultant retinal surgeon at the Oxford Eye Hospital and Mr Tim Jackson, a consultant retinal surgeon at King's College Hospital in London.

Retina Implant's research represents an important step towards artificial vision that could greatly enhance the quality of life for people with an incurable, blinding disease.

● To learn more visit: [www.retina-implant.de/en/about/default.aspx](http://www.retina-implant.de/en/about/default.aspx)