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Therapy restores visual field lost to brain injury in some patients

A type of physical therapy for sight may benefit some patients with homonymous hemianopias.

Michael Piechocki

A novel treatment that employs patterns of visual stimuli is helping some patients restore visual field lost to damage to certain areas of the brain, researchers say.

The treatment, called NovaVision VRT (Vision Restoration Therapy), is being marketed in the United States and Germany by Boca Raton, Fla.-based NovaVision Inc.

According to the company, after a stroke or traumatic brain injury, there remains a zone of residual vision that exists among regions in the brain's vision processing areas. VRT is a computer-based therapy that helps diagnose and improve visual function in such patients.

Norman J. Schatz, MD, a neuro-ophthalmologist at Bascom Palmer Eye Institute and a member of NovaVision's scientific and medical advisory board, told *Ocular Surgery News* that VRT is based on the concept of neuroplasticity, or the ability of the brain to restructure and recover pathways after suffering injury.

A patient fixates on the center light stimulus as she prepares to initiate treatment with Vision Restoration Therapy.

Photo courtesy of Norman J. Schatz, MD.

He explained that about 70% of the human brain is associated with vision, and many pathways are duplicated or unused. In patients who have suffered certain brain injuries, such as victims of stroke, disconnection arises at the calcarine cortex, resulting in incomplete vision or visual field defects.

VRT is intended to stimulate the brain to facilitate the functioning of remaining, undamaged neural networks. As reconnections are made, the remaining neurons begin functioning to improve the visual field when VRT is started, he said.

"We have gait training for patients who are unsteady, and hemiplegic training for patients who have arm and leg weakness. Now there seems to be some hope that we will have visual field restoration therapy that will expand visual fields," he said.

"We see it all the time in physical therapy for patients who have paralysis of arm and leg," he said. "We do not give them their brain back, but we give them pathways to bypass their deficit."

Dr. Schatz said patients treated with VRT have shown on average a 30% increase in visual field, a statistically significant improvement.

Vision restoration possible

The efficacy of VRT has mainly been demonstrated through research done by Bernhard Sabel, PhD, and colleagues at the University of Magdeburg, Germany.

Work on the system began in 1992 and was evaluated in clinical trials during the 1990s, with approval in Germany received in 1998. The U.S. Food and Drug Administration cleared the therapy in April 2003.

In Germany, the system is mainly being used on patients who have suffered strokes or other brain injuries that cause homonymous hemianopias.

Dr. Schatz explained such defects are related to the way the brain interprets visual information. The left hemisphere interprets information gathered from the right visual field, and the right hemisphere interprets information gathered from the left visual field. By stimulating the remaining neural networks, the brain can be taught to use its undamaged areas to interpret the visual information still being gathered and transmitted by the intact visual pathways.

Prof. Sabel, a neuropsychologist and a member of the scientific and medical advisory board to NovaVision, told *Ocular Surgery News* that brain plasticity is generally not well appreciated by ophthalmologists because it is at the forefront of neuroscience.

“There is what is like a self-healing process in the brain that includes the visual system,” he said. “We are identifying areas of partial damage. You can find out where to train the brain to improve its function.

“I think [ophthalmologists] need to know … that [VRT] helps patients to restore some of their visual capacity, that subjectively [patients] feel they benefit from it significantly in about 70% of the cases and that in most patients you can achieve … a visual field enlargement or a change in the brain to be able to better see visual stimuli again,” Prof. Sabel said.

Residual vision needed

Before therapy is initiated, a patient is screened to determine if he has a homonymous visual field defect and is a candidate for treatment.

“What is important is that there is some residual vision. You could not do the training if … the person is completely blind. As long as there is some residual vision, there are neurons that will respond to the training,” Prof. Sabel said.

According to Dr. Schatz, VRT works by having a patient fixate on an object displayed on a flat computer screen. Patterns of light then stimulate the edges of the patient’s visual fields identified as having partial vision loss.

The therapy is administered by the patient at home for 1 hour a day over 6 months, with progress evaluated monthly. Dr. Schatz noted that the light patterns are flickered only if the patient is fixating properly, which is monitored and recorded by the system. As patients improve, the devices are periodically recalibrated to focus on remaining areas with potential for improvement.

Future applications

At present, VRT is only indicated for patients with homonymous field defects due to damage of visual pathways in the geniculocalcarine system. In the future, though, the therapy may benefit patients with optic nerve injuries, who could have more potential for plasticity because there is no injury to the brain, Dr. Schatz said.

“The retinal cells have many ways to go from one cell to another through horizontal retinal pathways. The future of VRT may include patients with more than just strokes and brain trauma,” Dr. Schatz said.

However, Prof. Sabel stressed such research is very preliminary and at a stage where he does not feel it would be appropriate for comment.

“You do not report individual cases if you want to be a credible scientist. You want to make sure it works. You want to tell the story when you have the story, not when you are just looking for it,” he said.

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