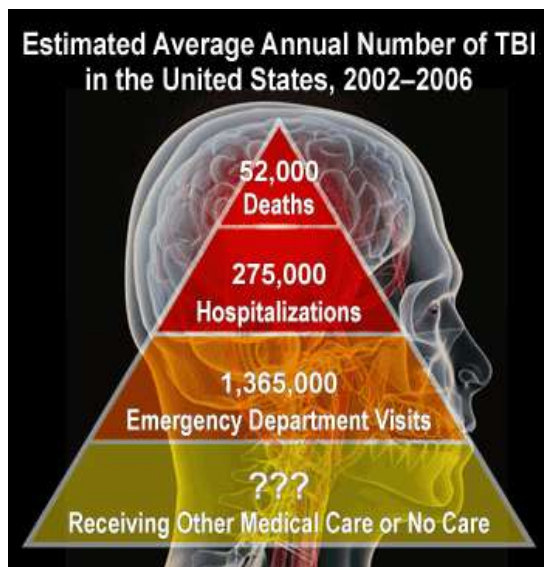


Neurological Vision Impairment – A critical part of rehabilitation for brain injury.

Acquired Brain Injury is a silent epidemic sweeping the world and it does not discriminate on age, gender, ethnicity or socio-economic status.

The primary cause of acquired brain injury is **stroke** or **trauma (TBI)**.

Each year in the US 2.5 Million people will suffer a brain injury and the numbers are growing.



Every year in the US

- Each year 1.7 million Americans sustain a TBI - one every 21 seconds.
- Medical and indirect costs of TBI totaled \$60 billion in year 2000.
- 80% are treated and released from an emergency department

IN ADDITION

- Each year 795,000 Americans will have a stroke (ABI) - one every 40 seconds
- Stroke is the number three killer and leading cause of severe, long-term disability in the US.
- Annual stroke related services in the US equate to \$62.7 billion

Between **30–35%** of the population diagnosed with acquired brain injury suffer from associated **Neurological Vision Impairment**.

Neurological Vision Impairment can seriously impede best outcomes and increase length of hospital stay for a person undergoing a rehabilitation program following a brain injury.

Due to the hidden nature of vision impairment, and the fact that patients are often unaware of the extent of their vision loss, difficulties often go undetected.

“50% of patients in a head trauma rehabilitation centre show visual system disorders not assessed before although most of the patients were chronic and had been treated in other hospitals previously.” Gianutsos, Neuropsychologist

Despite the key role that vision plays in all aspects of a rehabilitation program, a **Vision Rehabilitation Program** is currently not part of the standard rehabilitation provided by an interdisciplinary team.

Damage to the visual processing areas of the brain often results in a condition called a **homonymous hemianopsia**.



Illustration of the effects of Left Homonymous Hemianopsia – A person experiencing this would not see a 'black' left field, rather a view restricted to the right side of the scene.

Despite these significant changes to how much someone is seeing, these losses may not be obvious to the person. The person can express surprise and annoyance that people keep bumping into them on their affected side or they fail to notice that there is still food on one side of their plate. They may be at risk of serious injury when attempting to cross roads as they are not aware of cars moving towards them from their affected side.

In addition, people affected by homonymous hemianopsia can also have problems with everyday activities such as finding objects, dressing themselves and reading. This can lead to confusion and a loss of confidence.

Without an awareness or understanding of the vision problem patients are unlikely to correct for it.

How does the NVT Vision Rehabilitation System address these problems?

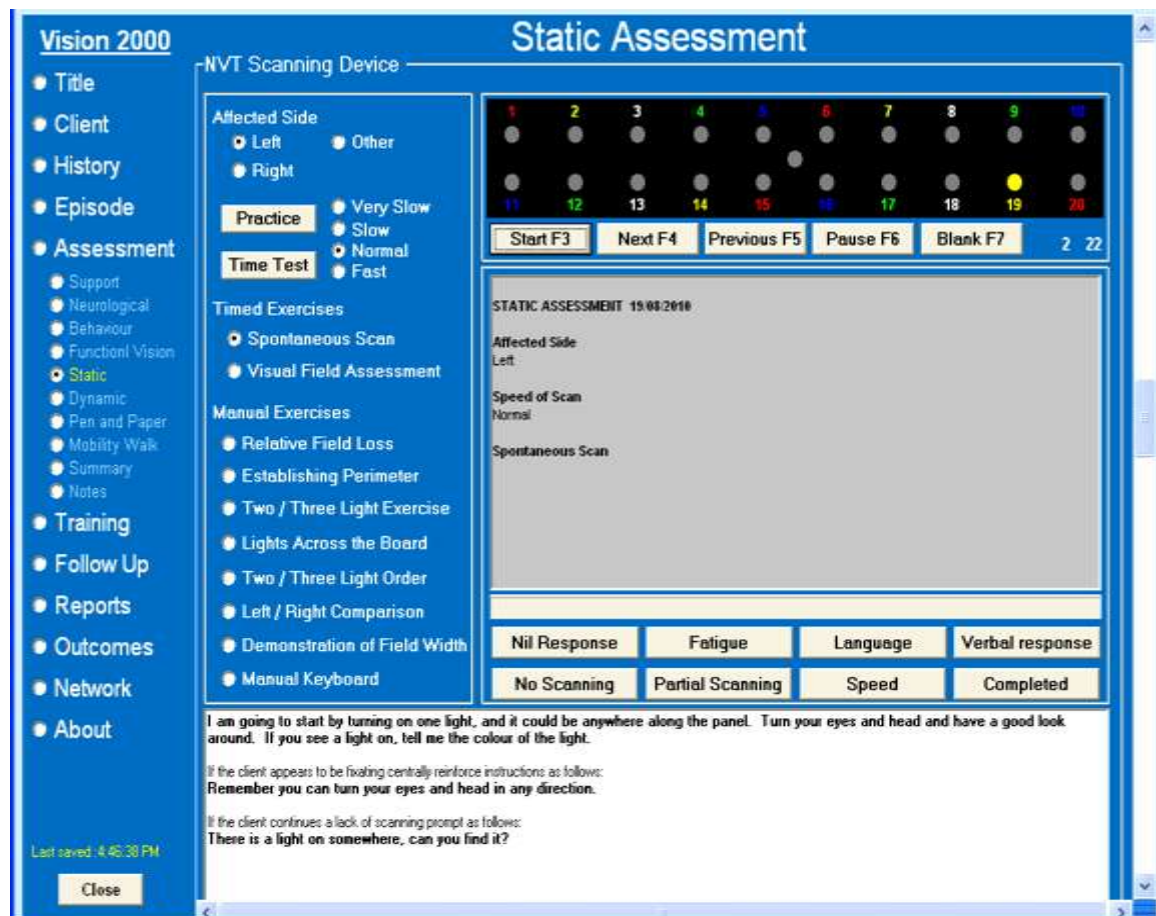
- ✓ Enhances use of residual vision to compensate for loss of visual field.
- ✓ Guides the operator through a structured assessment protocol that addresses every aspect of vision that can be affected by brain injury.
- ✓ Teaches a systematic scanning strategy that covers the width of visual field necessary for safe mobility.

- ✓ NVT System includes the training tools to actively transfer these scanning strategies to a range of tasks, from dynamic mobility to reading.
- ✓ Combines these into one program that covers all the skills required for activities of daily living (ADL's).



The NVT Scanning device:

- An **assessment tool** designed to simulate the degree of scanning required for mobility tasks. The light sequences used can highlight a patient's difficulty with slow visual processing, unsystematic scanning patterns and difficulties with spatial reasoning and visual memory.
- A **training tool** designed to provide scanning exercises that encourage use of residual vision in compensatory scanning techniques. The device is portable to allow training to be carried out in the acute hospital, rehabilitation hospital or patient's home.
- A **research tool** that provides the necessary standardization of intervention to record and compare progress of an individual patient and between patients.



The Vision 2000 Software program:

- **A standardised operating system** that delivers the required light sequences for all assessment and training exercises using a hierarchical protocol. It guides the operator through a comprehensive sequence of assessment tasks that cover all aspects of visual functioning.
- **A powerful database for research** that provides a means of recording all client demographic details, including a comprehensive medical history and neurological sequelae related to presenting Acquired Brain Injury. Any additional cognitive and physical deficits that need to be considered when providing mobility training can also be documented.
- **A patient management system.** One of the many features of the patient management system is the automatic generation of reports. It ensures that all staff, no matter what their level of experience, will be capable of delivering a high quality intervention program.

Training programs for professionals working in Low Vision or Brain Injury Rehabilitation.

We are committed to assisting clinicians working with people with brain injury and vision loss to build their skills and knowledge in this challenging area of rehabilitation.

NVT Systems Pty Ltd draws upon the expertise of Vision Therapists that have worked in the area of Neurological Vision Loss for over 20 years. We have developed assessment and training protocols for visual perceptual deficits that have proved successful for a large number of patients.

A sound knowledge of brain structure, function and the impact of brain injury on visual processing is required when working with these often complex cases. On Line course material has been developed to cover all these aspects of background learning that would enable the clinician or teacher to understand the nature of Neurological Vision Loss.

The best way to learn a new therapy program is with your own service users, in your own setting, so we include in the purchase cost of the NVT System an intensive training program for you and your staff to provide hands on experience is provided in the implementation of the NVT Program.

Where is the NVT System being used?

Brain Injury Rehabilitation Centers

Veterans Affairs Medical Facilities in the US.

One sobering statistic that reflects the nature of the conflict in Iraq and Afghanistan is the extremely high proportion of those injured who have sustained a traumatic brain injury.

The first significant difference between the client group with traumatic brain injury and those who have had strokes was the complex nature of injuries sustained by soldiers

'Head and limb injuries are the signature wounds of this war because Iraqi insurgents have made the IED their weapon of choice. Modern armour and rapid care mean that most of the injured survive, but many live with traumatic brain injuries and amputations'.

National Geographic, December 2006 issue

Many of the patients undertaking NVT Scanning training who had been exposed to improvised explosive devices (IEDs) present with a combination of visual field, ocular motor and visual perceptual deficits. The

complexity of their vision impairments highlighted the need for comprehensive screening of all aspects of their functional vision outlined in the NVT assessment protocols.

The first US Veterans Hospital to recognise the need for specialist vision rehabilitation services to these veterans was the **Western Blind Rehabilitation Center in Palo Alto, USA**. Since its implementation in 2006 the NVT training package has been provided to many of the Blind Rehabilitation Outpatient Specialists (BROS) and Occupational Therapists working in the Polytrauma Unit.

The success of this program has been recognised by the MOD in the form of an exemplary award in CALFs evaluation. Articles published in the Journal of Eye and Brain and Journal of Vision Impairment and Blindness give more details as to the benefits of the NVT Program.

The NVT System has also been implemented within VA Facilities in Tampa, Florida, with plans for the NVT vision therapy program to be made available to other VA Polytrauma Units who are also struggling to provide suitable strategies for those patients with extremely complex visual perceptual deficits.

The Low Vision Service Providers

Fife Society for the Blind, near Edinburgh, Scotland, was the first Blindness Agency in the UK to adopt the NVT System as part of their community based rehabilitation programs for people with low vision.

“My rehabilitation staff had often received referrals for patients with a field loss resulting from stroke but didn’t have the effective interventions in their ‘toolkit.’ The problem was they understood the eye but not the brain. We were delighted to work with NVT to deliver the first service in the UK which has been widely accepted by colleagues in the stroke service.”

Alan Suttie, CEO Fife Society for the Blind, Scotland, UK.

The growth in referrals for this innovative program has been phenomenal, with high demand for assistance from local hospital stroke units and rehabilitation facilities.

Visibility, located in Glasgow has extended the Neurological Vision Therapy service into the west of Scotland and has been acknowledged by the UK Ministry of Defence for the success of the NVT program in supporting British War Blinded with vision loss through stroke and TBI. The Sealladh project built around the Neuro Vision Rehabilitation and Training program was a winner of at the Innovation in Service Development Awards presented at the second annual Military and Civilian Health Partnership Awards.

Guide Dogs Association of SA.NT, Adelaide Australia has acknowledged the benefits of a structured approach to the assessment and training of their clients with Neurological Vision Impairment. Whilst the precursor of the current system has been in use for over 25 years in Guide Dogs Associations throughout Australia, it is now recognized that this earlier manually operated product does not allow for the gathering of evidenced based outcome measures. Use of the NVT software program has allowed Guide Dogs SA.NT to carry out research into the most effective method of intervention and further build on our understanding of the visual perceptual deficits commonly associated with acquire brain injury.

Royal Society for the Blind, Adelaide, Australia has also decided to broaden their eligibility to include clients with neurological vision loss.

“As a leading blindness agency we want to continually be at the front of vision related rehabilitation processes and solutions. The NVT System has enabled our OT staff to up-skill in assessing and training patients with NVI, and provide a standardised service which is otherwise not available. We have noticed reduced training times and increased client safety and confidence. ”

Andrew Daly, CEO, Royal Society for the Blind, Adelaide, Australia.

The Education Sector

It may come as a surprise to learn that the most common cause of vision loss in children and young adolescents is Brain Injury. Whilst many of these cases are congenital in nature there are growing numbers of young people who suffer from transport or recreational injuries.

Implementation of the NVT System has now spread to the include schools and colleges in Scandinavia, (IBOS in Copenhagen) and West of England School and College in Exeter, UK. The implementation of the structured program looks to capitalise on **the brain plasticity of the young** and assist in the development of compensatory and adaptive mechanisms that will help a person overcome the difficulties presented by vision loss for education and vocational endeavours.

Case studies:

Excerpt from: **Scanning training in neurological vision loss: case studies**

Authors: Paul Koons, Scott Johnson, John Kingston, et al

Journal: Eye and Brain. Published Date May 2010, Volume 2010:2 Pages 47 - 55 DOI 10.2147/EB.S9188

Case study: AS

AS was a 22 year old female, active duty Air Force Captain based in Italy who experienced a TBI as a result of a rollover motor vehicle accident in June 2006. She was initially treated at a local hospital and then transferred to the National Naval Medical Center, Bethesda, Maryland. AS was then transferred to the Department of Veterans Affairs Palo Alto Health Care System for TBI care and acute/post-acute rehabilitation. Imaging showed bilateral parietal and temporal contusions, right frontal contusion, and post-occipital injury. A CT scan showed hypodensities in the bilateral frontal and occipital lobes, and 'patchy' hyper densities in the bilateral parietal lobes.

The initial optometric examination found her visual acuities were 20/60 right eye and 20/400 left eye with left hemiplegia and left neglect.

Her presenting complaints to the optometrist were that her vision made her feel off-balance and overall things looked blurry. She reported being startled by objects suddenly 'appearing' and lack of visual information on her left side. Her primary complaint was of feeling 'slower' in her processing of information.

Functional visual assessments indicated:

- Left visual neglect (with no evidence of left side body neglect), as shown by missing the left side of all printed columns, even with strong cueing from her therapist.
- Difficulty with orientation, path finding and verbalizing basic routes on ward.
- Right/left laterality issues and poor ability to verbalize reverse route just traveled.
- Reduced reasoning skills, visual-spatial and visual memory issues, and lack of insight into her deficits.

Psychological testing found deficits in short term memory, motor planning, visual memory, working memory, and reasoning skills.

A multidisciplinary treatment plan was developed including: physical therapy for mobility, strengthening, balance and endurance; occupational therapy for safety, activities of daily living, and range of motion; speech therapy for aphasia; and vision rehabilitation for visual field loss, left visual neglect, and orientation and mobility needs. In conjunction with AS the rehabilitation team developed an initial goal for AS which was to live independently with supportive care from her family.

AS was one of the first patients to undergo the NVT assessment and training of skills for activities of daily living and mobility. AS's NVT scanning training began with the patient seated 16–20 inches in front of the device and consisted of programmed exercises designed to improve scanning with improved head

turning and eye saccades, visual processing and left/right side awareness. Often occupational therapy and physiotherapy (OT/PT therapies) would co-treat to monitor AS's standing balance and range of motion while she performed static and dynamic scanning training.

Specific steps in the NVT training program included:

- Patient worked up to full scanning in static training (NVT Scanning Device) while seated and standing, commencing with shorter sessions and increasing attention span.
- NVT training included static visual scanning exercises designed to pattern scanning abilities to patient's left side due to visual neglect, increase speed of visual scanning, training for visual-spatial deficits, increase visual memory, visual processing, and gradually increase attention to multiple visual stimuli.
- Transfer of skills to pen and paper tasks, improved column and reading scanning, and increased speed and accuracy of reading and comprehension.
- The NVT device was often used at the beginning of each training session to reinforce degree of head/eye scan, and then apply skills to various environments and pen and paper tasks.
- Dynamic NVT training included orientation to room and ward, path finding to all therapies, target location in quiet and busy hallways, then progressed outdoors to sidewalk route travel, residential travel, supermarket, street analysis and crossing strategies and light business areas.
- As each environment and mobility aid changed e.g., wheelchair to walking frame to support cane, scanning was reinforced to ensure gait and balance of the patient was not compromised.

AS was extremely motivated and there was a strong carryover of skills learned in NVT training to other therapies including OT, PT, and independence in daily living activities. Inpatient and outpatient therapy lasted 28 weeks broken down by 10 weeks inpatient therapy and 18 weeks outpatient therapy.

AS outcomes

Following outpatient therapy AS improved markedly in paper and pencil tests and was able to read without losing her place with consistently good reading speed and comprehension.

In static tests using the NVT or chalkboard she was able to use eye and head scans to locate objects in her left visual field. Her greater scanning ability transferred to improve her mobility and she only infrequently bumped into door frames or other objects. By completion of outpatient mobility she traveled independently using a support cane and traveled using public buses to get from her apartment to outpatient appointments.

During her rehabilitation she took two driving evaluations to regain a driver's license. She did not pass either evaluation due to her proprioceptive deficits, impaired multi-tasking abilities, slowed reaction times, and problem solving skills. However, post-discharge AS received private driving lessons and passed the state driving test. AS stated she drives on a daily basis but 'things are different now', for example, she drives on well-known routes and avoids unfamiliar routes. She stated that when driving she tries to lessen distractions and consistently manage multi-tasking.

She stated her vision scanning became 'automatic' due to her NVT training program. AS's initial treatment goal was to live independently with support from family, however follow-up contact indicates that she now lives independently and thus has exceeded the initial goal.

Other articles on the NVT System

An Orientation and Mobility Program for people with Neurological Vision Loss – A case study. Margaret Brown, Royal Society for the Blind. Conference Proceedings: The 9th International Conference on Low Vision. Montreal, 7-11 July 2008

Abstract: Neurological vision loss has been described as the “third wave” of vision loss; with the first being blindness and the second low vision. The main causes of neurological vision loss are an acquired brain injury (ABI) or stroke. It is estimated that each year 1.5 million Americans sustain an acquired brain injury (ABI) and of these between 30 – 35% have an associated vision deficit. Unfortunately vision loss due to ABI is often not diagnosed and there is no standard intervention or agency that provided rehabilitation. Community based rehabilitation agencies do not have the specialized skills, equipment and knowledge to deal with the vision loss and blindness agencies are ambivalent about providing rehabilitation to people with ABI's who are not necessarily “blind”.

The Royal Society for the Blind (RSB) has partnered with Neuro Vision Technology to conduct a research project to determine whether the Neurological package is more effective than a traditional approach to training for people with ABI. The training is delivered by a combination of Occupational Therapist and an Orientation and Mobility Instructor, beginning with static scanning and moving on to dynamic scanning used in mobility. The research results will be compared with other studies done by the US Department of Veterans Affairs and the Fife Society for the Blind.

Prior to commencing the research, a pilot study was conducted with a small group of young women. This presentation will describe the progress of the women through training and their outcomes. Based on the results of this small group, the package is good at demonstrating and explaining what the visual deficits are to the individual and their family. This meant that the women were less fearful and more confident at the commencement of their mobility training, thus reducing the time required. Also carers became actively involved in training and reinforced strategies. Some of the group met their mobility goals, others did not but intervention improved mobility skills.

Neurological Vision Rehabilitation: Description and Case Study

John Kingston, Jennifer Katsaros, Yurika Vu, and Gregory L. Goodrich

Abstract: The wars in Afghanistan and Iraq have been notable for the high rates of traumatic brain injury (TBI) that have been incurred by the troops. Visual impairments often occur following TBI and present new challenges for rehabilitation. We describe a neurological vision rehabilitation therapy that addresses the unique needs of patients with vision loss that is due to TBI. *Full text in Journal of Visual Impairment & Blindness*, October 2010 603-612

The Future

At NVT Systems Pty Ltd we are looking towards a future where vision rehabilitation forms part of a minimum standard in health services to people with vision impairment from a Stroke or other Acquired Brain Injury.

We know that Vision Therapists can contribute to successful rehabilitation outcomes as part of the multi-disciplinary team.

NVT can assist you to:

- ***broaden your client base to include the growing number of people who suffer strokes or head injury, with associated vision loss***
- ***improve the functional independence of your clients who have a Neurological Vision Impairment***
- ***improve your staff expertise and knowledge of strategies to assist clients with a NVI.***
- ***become part of an international collaborative partnership with a commitment to research.***

Contact details

For More information about this innovation approach to vision loss from acquired brain injury contact:

NVT Systems Pty Ltd

Phone +61 8 8354 2004

Email: ahayes@nvtsystems.com.au

Website: www.nvtsystems.com.au