POST STROKE CONSEQUENCES ON VISION AND BALANCE AND ITS MANAGEMENT THROUGH NEURO-OPTOMETRIC REHABILITATION THERAPIES : A CASE REPORT

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Introduction

Stroke is one of the leading cause of long-term disability globally, with survivors frequently experiencing persistent neurological sequelae. While motor and cognitive impairments are commonly recognized, visual dysfunctions are often underdiagnosed, despite affecting up to 60% of stroke survivors. These visual consequences may involve ocular motility disturbances, binocular dysfunction, visual field deficits, visual perceptual impairments, and photosensitivity.

Impaired oculomotor and binocular control can compromise reading, spatial awareness, balance, and mobility. Furthermore, post-stroke visual motion sensitivity and disrupted visual–vestibular integration frequently lead to dizziness and instability, increasing fall risk. These factors collectively reduce independence and participation in daily activities.

Neuro-optometric rehabilitation therapy (NORT) provides targeted interventions to restore visual efficiency and functional integration. By engaging neuroplasticity through repetitive, graded, and multisensory tasks, NORT aims to optimize recovery beyond spontaneous restitution. This case report presents the comprehensive evaluation and therapeutic management of a young stroke survivor with debilitating visual and balance deficits, highlighting the clinical impact of individualized neuro-optometric rehabilitation.

Case Summary

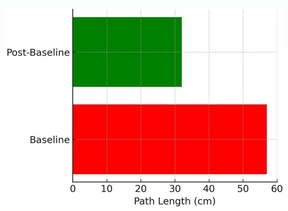
Patient Information

- **Age/Gender:** 31-year-old male
- **Medical History:** Left hemispheric cerebral infarction (6 months prior), managed with pharmacological therapy and standard physiotherapy, Hypotension(2 months), Supraventricular Tachycardia(2 months), Cerebral Stroke Syndrome(2 months)
- **Surgical History:** Dissection of cerebral artery → Trans-catheter intravascular stent placement.
  Post-surgical Complications: Slurred speech, facial weakness.
  Imaging Findings: MRI: Ischemic lesions; CT Scan: Lesion in Right Basal Ganglia and Internal Capsule.
- **Lifestyle/Occupation:** Previously employed as an IT professional, currently unable to resume work due to visual and balance limitations.
- **Presenting Symptoms:**
  - Photophobia
  - Blurred vision (distance and near)
  - Dizziness and unsteadiness during ambulation, worsened by head movement
  - Reading difficulties with reduced fluency and comprehension
  - Avoidance of visually busy environments (supermarkets, traffic)

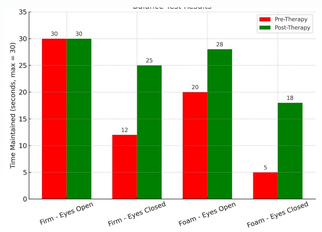
Clinical Findings

Comprehensive neuro-optometric assessment included the following:

Domain	Findings
Visual Acuity	OD: 6/60, <N36, OS: 6/6, N6
Pupils	RAPD positive (OD), OS(negative)
Retinal Findings	CRAO (OD) with macular edema
NPC	20 cm
Vergence Facility	Poor facility with BO
Accommodation	Reduced facility
Visual Motion Sensitivity	Marked dizziness with moving stimuli
Balance Testing	Postural instability during dual-task conditions
Ocular Motility	Full
Functional Visual Field	Left Temporal Hemianopia, Right eye test not possible (due to inability to open eye, discomfort)



Balance and Fall Risk Test



CTSIB Test

Methodology

Phase	Goals	Therapies & Equipment	Methodology (How it was done)	Achieved Outcomes
Phase 1 – Initiation: Phototherapy & Peripheral Awareness	- Improve visual comfort - Stimulate retinal function - Increase awareness of visual field - Facilitate opening of OD	- Syntonics Phototherapy (coloured filters + light exposure) - Peripheral Field Awareness Training (McDonald's chart on SVI)	- Patient exposed to specific wavelengths via Syntonics lamp under guided protocol - Peripheral awareness tasks on Sanet Vision Integrator (tracking, identifying targets on McDonald's chart)	- Patient reported reduced photophobia - Improved ease of opening OD - Increased awareness of periphery
Phase 2 – Oculomotor Accuracy (Monocular → Binocular)	- Reduce latency in eye movements - Improve saccadic accuracy - Enhance pursuit smoothness - Increase reading potential	- Marsden Ball (saccadic/pursuit training) - Pegboard Rotator (hand-eye coordination & pursuits) - Saccadic Fixator (fixation & quick shifts) - SVI Eye Movements Protocol (computerized feedback) - Metronome (rhythm-based timing)	- Monocular saccades/pursuits initiated - Progressed to binocular eye movement drills - Metronome pacing integrated for speed and rhythm - Marsden ball swings → patient tracks & calls out letters/numbers - Pegboard Rotator for fine pursuits and motor integration	- Reduced latency - More accurate saccades - Improved binocular pursuit control - Faster reading speed
Phase 3 – Binocularity & Fusion Development	- Restore sensory fusion - Develop peripheral → central fusion - Eliminate diplopia	- VTS4 Software (fusion training) - Tranaglyphs & Vectograms - Brock String (convergence & diplopia awareness) - Diplopia Awareness Training	- Began with large, peripheral fusion targets - Gradually increased difficulty to central targets - Used red-green/polarized filters for vectograms - Brock string used for near-point convergence with awareness of suppression	-Reduced Diplopia - Better sensory and motor fusion
Phase 4 – Visual-Vestibular Integration & Balance Training	- Enhance visual-vestibular coordination - Improve postural control - Integrate balance with eye movements	- Visual Vestibular Training Protocols - Four Corners Room Fixation with Rotation - Soft Foam Board (instability training) - Bernell Balance Board - Tandem Walk with Fixation	- Patient performed fixation tasks with head/body rotation - Eye movements (saccades/pursuits) integrated with unstable surface (foam board, Vernell board) - Four corners fixation drills with head rotation to train orientation and balance	- Improved spatial orientation - Reduced fall risk - Better postural balance - Enhanced coordination between eye movements & body control
Phase 5 – Fixation Stabilization & Nystagmus Reduction	- Establish central steady fixation - Improve gaze stability - Reduce nystagmus amplitude - Build confidence in visual balance tasks	- Laser-guided Multi-axial Head Rotation with Gaze Stabilization Chart	- Training began with larger target sizes → progressively smaller targets - Integrated head rotation in multiple planes while maintaining fixation on chart - Gradual increase in speed and complexity of task	- Steady central fixation achieved - Significantly reduced nystagmus - Extended fixation span - Markedly improved balance confidence and visual endurance

At the end of 16 weeks, the following improvements were documented:

Domain	Pre-VT Findings	Post-VT Findings	Clinical Significance / Improvement
Visual Acuity (OD)	6/60 (distance aided), Near <N36	6/18, N24	Major improvement in clarity and near vision → functional central vision recovering
Visual Acuity (OS)	6/6, N6	6/6, N6	Stable, maintained good vision
Ocular Alignment (Cover Test)	Constant Exotropia OD (large angle)	Intermittent Exotropia	Deviation reduced; better binocular control achieved
Pupils	RAPD +ve OD, -ve OS	OD: Sluggish reacting to light	functionally recovering
Visual Fields	Left Homonymous Hemianopia; OS reduced functional field; OD not testable	OS: +10° increase in functional visual field; Total field ~35°	Expanded peripheral awareness → better mobility & orientation
Eye Movements (Saccades & Pursuits)	Reduced saccadic accuracy, increased latency, poor pursuit control	Accurate saccades, reduced latency, smoother binocular pursuits (with metronome, SVI, Marsden ball, pegboard)	Faster, accurate reading & tracking skills
Reading Speed	73 WPM	Significantly faster, Words per minute improved to 123 sustained reading without fatigue	Functional literacy and comprehension improved
Binocularity / Fusion	Diplopia present; poor sensory & motor fusion	Diplopia reduced; improving sensory & motor fusion	Improving Binocularity
Fixation & Nystagmus	Poor fixation; evident nystagmus	Central, steady, & better fixation achieved; nystagmus amplitude reduced	Much Stable fixation in multiple gazes, increased fixation span
Functional Complaints	Could not open OD fully; photophobia; imbalance	Comfortable opening right eye, photophobia reduced, confident mobility	Functional daily activities improved
Balance & Postural Control	Posturography: impaired visual-vestibular integration, fall risk	Balance and confidence improved (foam board, Bernell board, tandem walk)	Reduced fall risk, safer ambulation, better stability
Overall Functional Outcome	Severe monocular functional vision loss OD, binocular field loss, impaired reading, instability	Functional gain in vision OD, expanded visual field OS, fluent reading, improving binocularity, we may plan prism glasses in future, & improved balance	Holistic recovery with measurable QOL improvements

Discussion

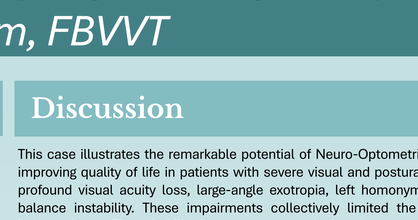
This case illustrates the remarkable potential of Neuro-Optometric Rehabilitation Therapy (NORT) in restoring functional vision and improving quality of life in patients with severe visual and postural deficits following neurological insult. The patient presented with profound visual acuity loss, large-angle exotropia, left homonymous hemianopia, reduced pursuit control, as well as significant balance instability. These impairments collectively limited the patient's reading, independent mobility, and overall functional independence. The rehabilitation program was designed to systematically target the primary visual and oculomotor deficits while integrating balance and postural control strategies. The initial application of Syntonics phototherapy and peripheral awareness training played a pivotal role in enhancing residual visual field perception, thereby reducing visual discomfort and improving the patient's tolerance to opening the right eye. Oculomotor retraining demonstrated measurable gains in pursuits, saccadic accuracy and fixation stability. These improvements translated into greater reading speed and fluency, addressing one of the most disabling aspects of the patient's visual dysfunction. Binocular and vergence training helped in reducing diplopia, strengthening binocularity. Integration of visual, vestibular, and balance rehabilitation improved the postural instability and fall risk associated with hemianopic field loss. The resulting improvements in spatial orientation, ambulation confidence, and balance suggest that NORT helps beyond visual function, extending into mobility and safety in daily living. Fixation stabilization exercises contributed to reduced nystagmus amplitude, enhancing gaze holding ability and visual endurance. The cumulative outcomes of expansion of functional visual field by 10 degrees, improved clarity in the right eye, enhanced fixation and eye movement control, and improved reading speed highlight the multidimensional recovery that can be achieved through a structured, evidence-based rehabilitation protocol. Overall, this case reinforces the value of NORT in promoting neuroplasticity and functional recovery following neurological injury. By addressing both visual and non-visual sequelae such as balance and mobility, the therapy facilitated a transition from severe visual disability to improved independence and quality of life.

Conclusion

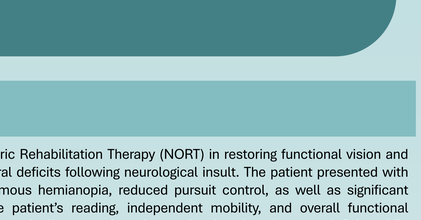
This case demonstrates the efficacy of a structured neuro-optometric rehabilitation program in restoring functional vision and improving quality of life in a patient with complex post-neurological visual deficits. Through targeted interventions addressing vision, ocular alignment, binocularity, functional visual field, oculomotor control, and visual-vestibular integration, the patient progressed from profound impairment to functional independence, reduced diplopia, improved mobility and reading speed, and enhanced confidence. The findings reinforce the importance of comprehensive neuro-optometric rehabilitation in managing acquired brain injury–related visual dysfunction. Early identification of visual deficits and individualized therapy protocols can yield substantial improvements not only in visual parameters but also in broader domains of balance, mobility, and daily living. This case underscores the role of vision therapy as a critical component of interdisciplinary neurorehabilitation, highlighting its potential to meaningfully reduce disability and improved quality of life.

Letter Saccades (Pre-Vt)

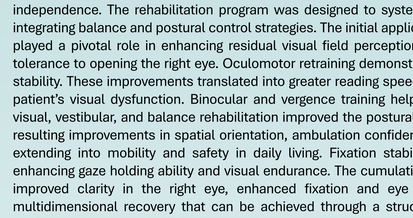
Letter Saccades (Post-VT)



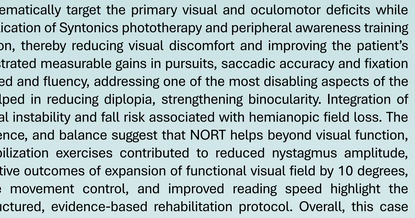
Reading (Pre-Vt)



Reading (Post-VT)



Pursuits (Pre-Vt)



Pursuits (Post-VT)

References