VISUAL RECOVERY AND FUNCTIONAL GAINS THROUGH VISION REHABILITATION IN HEMIANOPIA PATIENTS- A CASE SERIES

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Introduction

Visual field defects such as homonymous hemianopia and peripheral visual field constriction are common sequelae of acquired neurological injury, including cerebrovascular accidents and traumatic optic neuropathy[1–3]. Homonymous hemianopia most frequently results from lesions involving the post-chiasmal visual pathways, particularly the occipital cortex supplied by the posterior cerebral artery[2]. Similarly, intraparenchymal hemorrhage and traumatic optic nerve injury can disrupt visual transmission, leading to persistent field deficits and long-term functional impairment[3,4].

The reported prevalence of homonymous hemianopia following stroke ranges between 8–25%[2,5], with many patients experiencing chronic disability. Importantly, visual field loss is rarely an isolated deficit. Patients frequently present with associated dysfunctions such as impaired visual scanning, oculomotor instability, convergence insufficiency, reduced peripheral awareness, motion sensitivity, diplopia, visual fatigue, and compromised spatial judgment[6–8]. These combined deficits significantly affect activities of daily living, including reading fluency, navigation, mobility safety, occupational performance, and overall independence[7,9].

Although spontaneous neurological recovery may occur during the acute and subacute phases after injury, visual field restoration often plateaus within the first few months[2,10]. Conventional management strategies have historically emphasized compensatory adaptations (e.g., scanning techniques) rather than active neuro-rehabilitative stimulation[9,11]. However, contemporary neuro-rehabilitation research highlights the brain's capacity for experience-dependent neuroplasticity, even beyond the early recovery window[12,13].

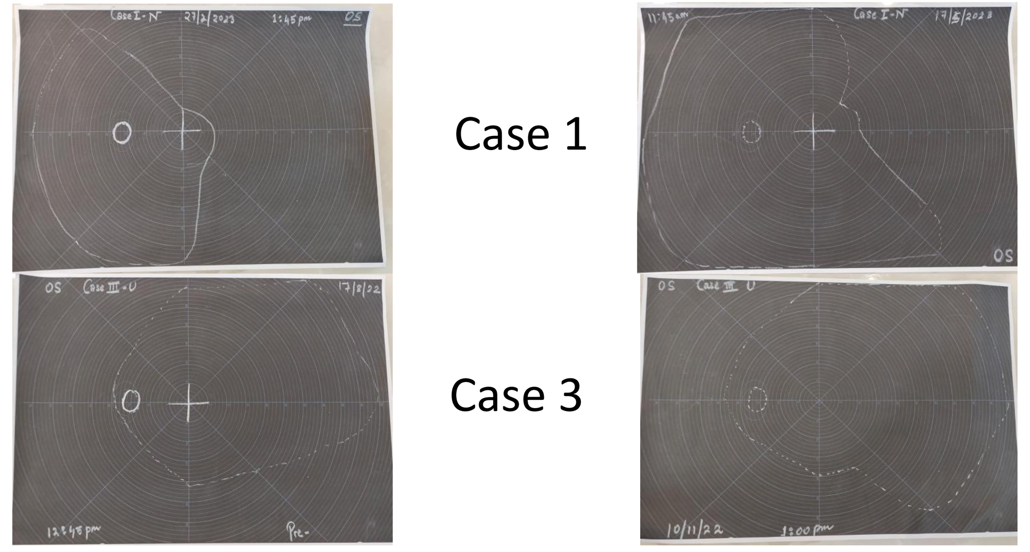
Neuro-Optometric Rehabilitation is a structured, individualized therapeutic approach designed to address visual dysfunctions associated with neurological injury. It integrates peripheral visual stimulation, oculomotor retraining, binocular stabilization, visual-vestibular integration, spatial localization training, and functional task simulation[6,14]. Rather than focusing solely on isolated visual acuity or field parameters, this model targets the dynamic interaction between sensory input, motor coordination, and cognitive-visual processing required for effective real-world performance.

Therefore, the purpose of this interventional case series is to evaluate quantitative and functional outcomes following structured Neuro-Optometric Rehabilitation in three patients with acquired visual field loss secondary to stroke and traumatic optic neuropathy

Pre Post

Case 1

Case 3



Functional Visual Tester

Methodology

This prospective interventional case series included three patients aged between 25 and 31 years presenting with acquired neuro-visual field defects secondary to cerebrovascular accident and traumatic optic neuropathy. All patients underwent a comprehensive neuro-optometric evaluation before initiation of therapy. The assessment protocol included Best Corrected Visual Acuity (BCVA), Functional visual filed test, HVF for central and peripheral visual field analysis, detailed oculomotor evaluation assessing saccades, pursuits, and fixation stability, and binocular vision testing, including vergence ranges and suppression status. The convergence function was evaluated using Near Point of Convergence and vergence facility testing, where indicated. Symptom burden was quantified using the Brain Injury Vision Symptom Survey (BIVSS), and functional visual performance was assessed through evaluation of reading endurance, scanning efficiency, spatial localization, and mobility confidence.

Following baseline assessment, each patient underwent an individualized Neuro-Optometric Rehabilitation program tailored to their specific deficit profile. The intervention incorporated peripheral visual field stimulation exercises, saccadic and pursuit retraining, convergence and vergence therapy when indicated, anti-suppression therapy in cases with binocular instability, vestibular–visual integration training, motion sensitivity desensitization protocols where required, spatial localization training along with eccentric fixation exercises, structured reading proficiency training strategies, and functional mobility simulation. Therapy duration varied according to clinical need, with Case 1 receiving three months of therapy, Case 2 undergoing two months of intervention, and Case 3 completing forty structured rehabilitation sessions. Post-therapy assessments were conducted using the same baseline evaluation protocol to determine pre- and post–changes.

Case 1 – PCA Infarction (Right Homonymous Hemianopia)
Clinical Outcome Table

Parameter	Pre-Therapy	Post-Therapy
Visual Acuity (OU)	6/6	6/6
Visual Field Status	Right Homonymous Hemianopia	Functional improvement in awareness & scanning
Symptom Score (BIVSS)	65	12
Visual Strain	Present	Significantly reduced

Therapy Components

Therapy Domain	Equipment/ Procedure used
Peripheral vision awareness	Peripheral chart, Marsden ball
Oculomotor training	Fine saccades drills
Fusional vergence training	VTS-4
Reading proficiency training	Dynamic reader
Syntonic Photo-therapy	Filter used- Alpha Delta- Mu Delta
Spatial Localization	Saccadic Fixator

Case 2 – Intraparenchymal Hemorrhage (Left Homonymous Hemianopia)
Clinical Outcome Table

Parameter	Pre-Therapy	Post-Therapy
Visual Acuity (OU)	6/6	6/6
Visual Field Status	Left Homonymous Hemianopia	Improved scanning efficiency
Diplopia	Large diplopia	Reduced diplopia
Visual Strain	Severe	Reduced

Therapy Components

Therapy Domain	Equipment/ Procedure used
Peripheral vision awareness	Peripheral chart, Marsden ball
Oculomotor training	Fine saccades drills
Reading proficiency training	Dynamic reader
Syntonic Photo-therapy	Filter used- Alpha Delta- Mu Delta
Spatial Localization	Saccadic fixator

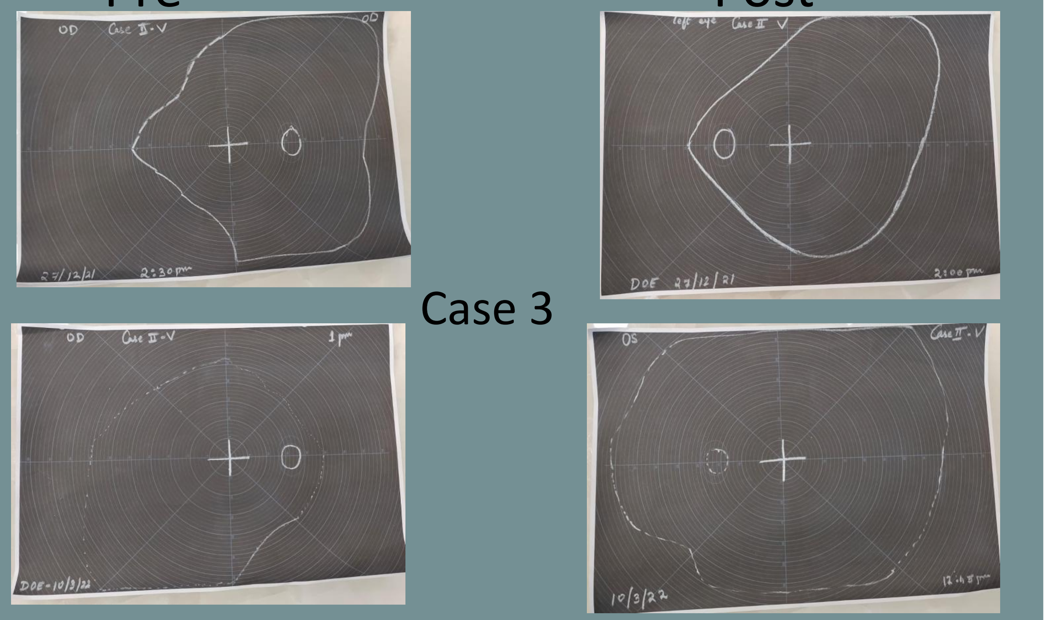
Case 3 – Traumatic Optic Neuropathy
Clinical Outcome Table

Parameter	Pre-Therapy	Post-Therapy
Visual Acuity	OD- 6/6 OS-6/12+2	OD- 6/6 OS-6/7.5
Visual Field Status	Constricted OS	+10° field expansion
Visual Strain	Severe	Reduced

Therapy Components

Therapy Domain	Equipment/ Procedure used
Peripheral vision awareness	Peripheral chart, Marsden ball
Oculomotor training	Fine saccades drills
Anti-Suppression Therapy	Visual scan, Visual search
Syntonic Photo-therapy	Filter used- Alpha Delta- Mu Delta
Spatial Localization	Reaction time with peripheral awareness

Pre Post



Case 3

Statistical interpretation

Although this case series included only three patients (N = 3), clear and meaningful improvements were observed when comparing pre- and post-therapy findings.

In Case 3, visual acuity improved and the functional visual field expanded by approximately 10 degrees, indicating a measurable improvement in usable vision. Case 1 showed a marked reduction in symptoms, with the BIVSS score decreasing from 65 (severe symptoms) to 12 (within normal limits), reflecting significant symptomatic relief. Case 2 demonstrated steady improvement in visual scanning and a reduction in the frequency of diplopia, suggesting better binocular coordination and improved eye movement control.

Because this was a within-subject pre–post design with a very small sample size, formal statistical testing is not appropriate. However, the degree and consistency of improvement across different areas—visual field use, visual acuity, symptom reduction, eye movement control, and confidence in mobility—indicate strong clinical relevance.

Future studies with larger sample sizes and standardized outcome measures such as Mean Deviation (MD), Visual Field Index (VFI), and reading speed assessments would help confirm these findings statistically and strengthen the evidence base.

Discussion

This interventional case series demonstrates that structured Neuro-Optometric Rehabilitation (NOR) may facilitate meaningful functional improvement in patients with acquired visual field deficits secondary to cortical and optic nerve injury. The improvements observed occurred beyond the commonly reported spontaneous recovery window of approximately 3–6 months following neurological insult[2,10], supporting the concept of experience-dependent neuroplasticity. Repetitive, task-specific, and graded visual stimulation has been shown to promote adaptive cortical reorganization even in chronic stages of injury[12,13].

Visual field loss is frequently accompanied by oculomotor instability, binocular dysfunction, impaired scanning efficiency, and reduced spatial awareness[6–8]. Addressing these associated deficits is critical, as they substantially influence reading performance, navigation, mobility safety, and overall quality of life[7,9]. Evidence supports the role of structured saccadic and scanning training in improving visual search behavior and reading speed in hemianopia[11,16], while vergence and accommodative therapy have demonstrated efficacy in reducing symptoms related to binocular dysfunction[15]. These mechanisms likely contribute to improved functional performance even when structural field loss persists.

Although true visual field restitution remains debated, studies suggest that repetitive visual stimulation may enhance sensitivity in areas of residual vision and facilitate recruitment of alternative cortical networks[17,18]. Even modest improvements in peripheral awareness or visual stability may yield clinically meaningful gains in real-world functioning.

Syntonic phototherapy was incorporated as an adjunctive component within the multimodal rehabilitation program. While high-level clinical evidence specific to syntonics remains limited, light exposure is known to modulate cortical activity and autonomic regulation through retinohypothalamic and thalamocortical pathways[19,20], providing a plausible neurophysiological rationale for its inclusion within a comprehensive rehabilitation strategy.

Overall, the integration of peripheral stimulation, oculomotor retraining, binocular stabilization, and functional task simulation appears essential for translating clinical improvements into functional independence. These findings support the incorporation of Neuro-Optometric Rehabilitation into comprehensive neuro-ophthalmic management protocols, while underscoring the need for larger controlled studies to further define treatment parameters and long-term efficacy.

Results

Overall Clinical Findings

- Measurable functional improvement was observed in all three patients.
- Functional visual field expansion was documented in Case 3 (~10°).
- Significant symptom reduction was observed in Case 1 (BIVSS reduced from the severe range).
- Diplopia reduction and motion tolerance improvement were observed in Case 2.
- Oculomotor control improved consistently across all cases.
- Functional scanning efficiency and real-world mobility improved in all patients.

Parameter	Case 1	Case 2	Case 3
Diagnosis	PCA Infarction (Right Homonymous Hemianopia)	Intraparenchymal Hemorrhage (Left HH)	Traumatic Optic Neuropathy
Therapy Duration	3 months	2 months	40 sessions
Pre BCVA	6/6(OU)	6/6(OU)	6/12+2 (OS)
Post BCVA	6/6(OU)	6/6(OU)	6/7.5 (OS)
VA Improvement	—	—	+2 Snellen lines
Pre Visual Field	Right homonymous hemianopia	Left homonymous hemianopia	Constricted peripheral field (OS)
Post Visual Field	Improved functional utilization	Improved scanning efficiency	~10° expansion (OS)
Symptom Score (Pre)	BIVSS = 65 (Severe)	Diplopia & motion sensitivity	Visual strain & spatial difficulty
Symptom Outcome	BIVSS= 12 (WNL)	Reduced diplopia frequency	Reduced visual strain
Oculomotor (Pre)	Delayed rightward saccades	Impaired left tracking	Reduced peripheral detection
Oculomotor (Post)	Improved latency	Improved tracking accuracy	Improved spatial detection
Functional Reading	Improved endurance	Improved speed & comfort	Stable
Mobility Confidence	Improved	Improved	Markedly improved

Conclusion

This case series demonstrates that structured Neuro-Optometric Rehabilitation can produce meaningful functional improvements in patients with acquired visual field deficits secondary to stroke and traumatic optic neuropathy. Across all three cases, improvements were observed in visual field utilization, symptom burden, oculomotor control, reading efficiency, and mobility confidence. Objective gains, including visual acuity improvement and measurable visual field expansion in one case, further support the therapeutic benefit of targeted neuro-optometric intervention. These findings highlight the importance of incorporating Neuro-Optometric Rehabilitation into comprehensive neuro-ophthalmic management to enhance functional independence and quality of life in individuals with post-stroke and traumatic visual disorders.

References