

INTRODUCTION

- Nearly 1.5 to 2 million people are diagnosed with concussion of which 20-25% are caused by falls(1). The rehabilitation needs are increasing annually. This case report focuses on Labyrinthine concussion (LC) and effectiveness of vision therapy (VT) in such cases.
- Labyrinthine concussion is defined as damage to the inner ear due head trauma with no well-defined injury associated with/without vestibular component.(3) Changes in hearing or the incidence of nystagmus must be present for the diagnosis of labyrinthine concussion.
- Labyrinthine concussion can occur in conjunction with post-concussion syndrome or whiplash syndrome, making the differentiation more difficult to discern.
- TBI generally affects interaction between signals from sensory, cognitive, motor and emotional systems and signals transmitted via both visual and non-visual retinal fibre pathways. Symptoms of disequilibrium, vestibular and balance problems are commonly a result of VOR disturbance secondary to an inner ear problem and an unstable binocularity.(6)
- The combination of neuro-optometric rehabilitative therapy will result as an effective treatment for reducing or resolving these symptoms (7)The goal would be to make the patient to maximize the functional ability in multisensory environment.
- In our case the patient suffered post-concussion disorder along with labyrinthine concussion causing him severe visual symptoms which led to facing difficulty in his day-to-day activities.

CASE HISTORY

CHIEF COMPLAINT: 37-year-old male, a Doctor by profession and cyclist / sportsman visited our **Caring Vision Centre at Chennai** with diagnosis of Mild TBI / Concussion. The patient had met with accident while cycling downhill had suffered mild head injury and broken his collar bone 2 years back.

OCULAR COMPLAINT: The patient complained of having difficulty in his day-to-day activities such as doing near work, blurred vision, mild photosensitivity, headache, occasionally double vision, nystagmus in lateral gazes, experienced dizziness and nausea with all the symptoms increased at the end of day.

OCULAR HISTORY: Physiological optic nerve head cupping with normal IOPs, slit lamp findings, corneal topography (OD: 627 OS: 611), USG bilateral orbits and 24-2 HVF.

GENERAL HEALTH: WNL and under no medications.

DIPLOPIA CHARTING: Done after the accident noted diplopia in the levo-elevation and levo-version gaze and mild nystagmoid movements noted during abduction movement on lateral gaze.

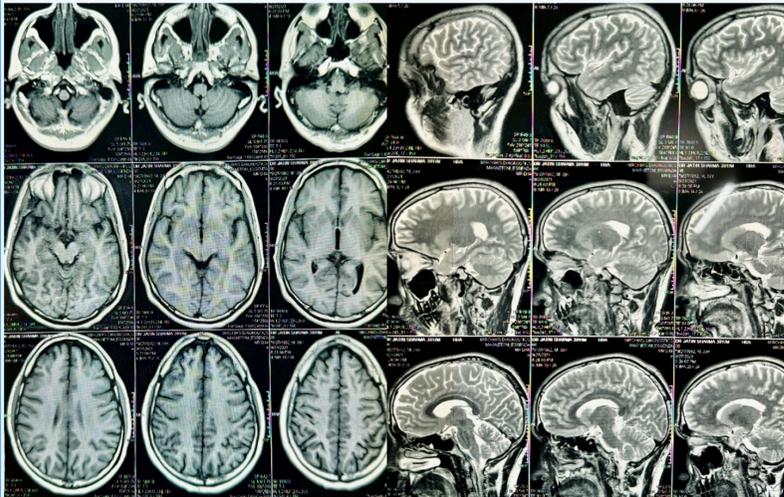


FIGURE 1. MRI Reports Post Injury shows Normal Brain Imaging

INITIAL ASSESSMENT

BCVA: 20/20 for distance and near
 BV ASSESSMENT: Showed reduced BI and BO values with reduced accommodative facility failing minus and receded NPC
 The patient's COVD Quality of life score was 57 and Brain injury symptom survey score was 70.
 The patient was further referred for video nystagmography (VNG) testing where he was diagnosed with labyrinthine concussion.
 Advanced Romberg test was grade 3 to 4
 Eye movements testing showed reduced oculomotor movement with nystagmus noted in extreme gazes noted during pursuits eye movement.

TEST	PRE- VT DATA	
	DISTANCE	NEAR
COVER TEST	ORTHOPIORIA	ORTHOPIORIA
WORTH 4 DOT TEST	FUSION DARK AND LIGHT	FUSION AT DARK AND LIGHT
STEREOPSIS		50 SECONDS OF ARC
NPC		14 TO 15 CM RECEDED
ACCOMMODATIVE FACILITY		OD: 6 CPM OS : 4 CPM, OU 3 CPM (DIFFICULTY WITH MINUS)
MONOCULAR ESTIMATION METHOD		OD:+0.75DS OS:+0.75DS
SMOOTH VERGENCE RANGES	BO:6/10/8 BI: X/8/2	BO:X/16/10 BI: X/8/2
EOM		FULL AND FREE NYSTAGMUS AND DIPLOPIA NOTED IN EXTREME LEFT GAZE

Table 1 – Initial Evaluation (Pre- VT Data)

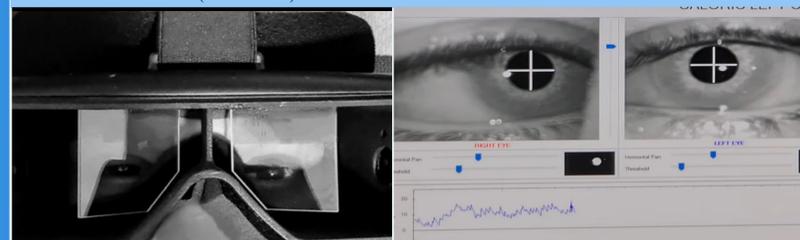
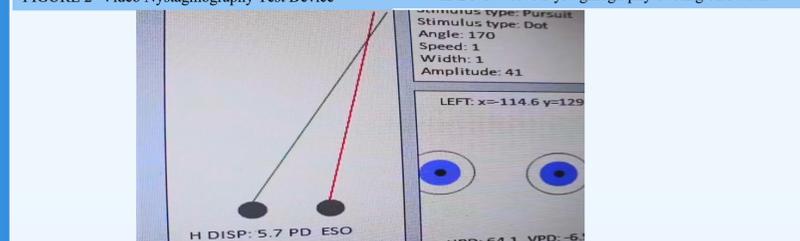
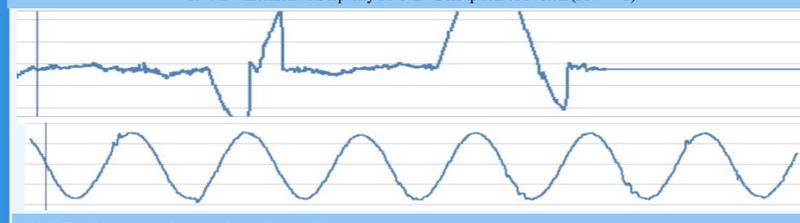


FIGURE 2- Video Nystagmography Test Device VIDEO 1- Video Nystagmography Testing on Patient



Video 2 – Horizontal Disparity Present -Disruption of Fusion (Pre -VT)



Pre VT: - Nystagmus jerks noted during Pursuits Eye movements

TREATMENT PLAN

- Post examination we started with our Neuro-Optometric Rehabilitation treatment protocol.
- The goal was to improve the patient's fusional vergence, normalize accommodation, oculomotor control and improve vestibular oculomotor reflex integration with our Visuo-Vestibular Rehabilitation Therapies.
- The patient was prescribed 1 prism diopter prisms with FL-41 filter.
- The patient underwent 45 minutes in office therapy sessions on regular basis with 30 minutes of syntonics phototherapy.

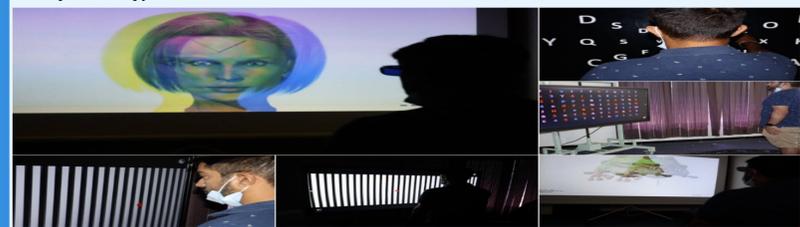


FIGURE 4. Various Vision Therapy Activities

METHODS

ACTIVITIES	PURPOSE
Sanet vision integrator (eye hand, rotator, saccades)	SVI a multi-sensory system incorporating eye hand coordination with cognitive processing and balance tracking to help enhances pursuits, saccades, fixation stability, eye-hand coordination, visual reaction time, speed and span of recognition, automaticity.
4-saccadic chart and rotational charts	The objectives of the charts are to increase the speed and accuracy of saccadic fixation saccadic tracking
Flippers +/- 2.00 DS	Flippers help to train the accommodative system in our eyes, which is responsible for changing focus from distance to near. Specifically, to improve accommodative facility - the ability to increase and decrease focus on demand.
Loose lens rock (plus and minus)	Helps to restore normal monocular accommodative amplitude.
Marsden ball tracking	Marsden ball has numbers or letters printed over its surface. It has a string attachment point. It helps hand-eye coordination and tracking exercises and also improve peripheral vision The goal of the brock string exercise is to improve binocular vision (convergence insufficiency and fusional vergence range), eye teaming and eye coordination, at all distances.
Brock string	
Tranaglyphs	The goal is to increase the fusional vergence ranges and improve the velocity and latency of fusional vergence response
VTS-4 MANUAL	VTS 4 computer orthoptic helps in training, fusional ranges (using RDS, vergence and rotational vergence parameter) at different distances.
VOR TRAINING	Tandem walk with rotational chart, balance board with hart chart, eye movement saccadic training with trampoline jump, gaze stabilization training The patient was advised to undergo sytonic phototherapy with filters of upilon omega for 10 minutes and 10 minutes of break and 10 minutes of mu upilon.
Syntonics phototherapy	

RESULTS

- Post 60 sessions eye movements also improved drastically with almost nil nystagmus movement in all gazes
- The patient BVA parameters improved drastically as shown in table 2.
- The COVD Quality of Life survey was 17 (70 percent reduction)
- BIVSS score was 24 (65 percent reduction).

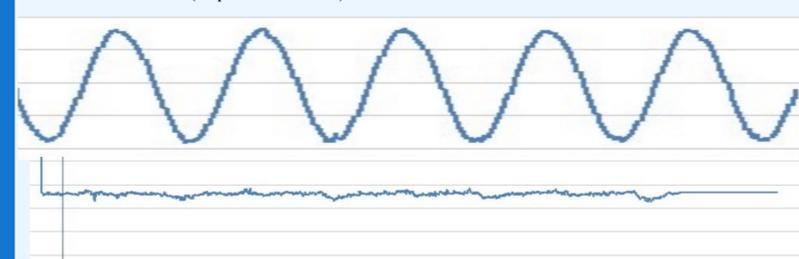
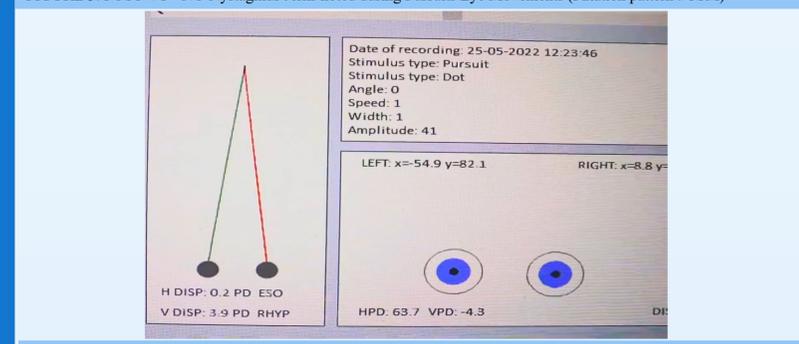


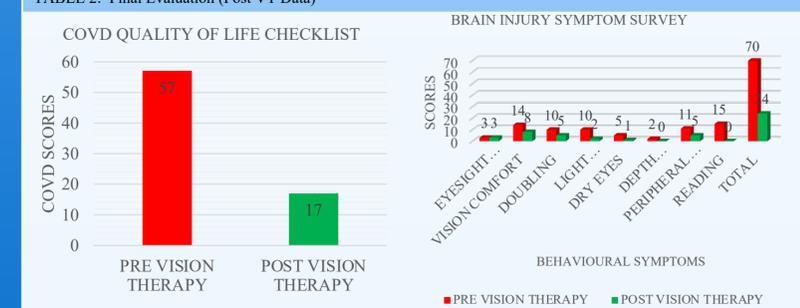
FIGURE 5: POST VT- NO Nystagmus Jerks noted during Pursuits Eye Movements (Fixation pattern : CSM)



VIDEO 3: FUSION PRESENT POST 60 SESSION OF VT (No Horizontal Disparity noted post VT)

TEST	POST- VT DATA	
	DISTANCE	NEAR
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SMOOTH VERGENCE RANGES	BO: 6/25/20 BI: X/18/10	BO:X/16/10 BI: X/8/2
EOM		FULL AND FREE

TABLE 2: Final Evaluation (Post VT Data)



GRAPH 1: COVD QOL SCORE PRE & POST VT

GRAPH 2: BIVSS SCORE PRE & POST VT

DISCUSSION

- Management and diagnosis of the concussion is very important for the rehabilitation and improvement for the quality of life of the patient. This is the first case study discussing LC and vision rehabilitation to the best of our knowledge.
- Labyrinthine concussion is very less explored area where along with the auditory symptoms, visual symptoms are also present and should be evaluated and treated properly.
- The patient in this case study started seeing changes and improved well post 60 in office vision therapy sessions, this corroborates with the fact that patients with LC have a faster recovery rate compared to other condition such as post-concussion syndrome or whiplash injury.(3)
- Gathering the baseline information on accommodation, vergence and eye movements which are affected due to the miscommunication or signal disruption from higher order centres of the brain (9) can help us as objective way for evaluating and treating concussion.
- In our case the patient had VOR disturbances secondary to inner ear problem and unstable binocularity which led him to have balance issues and dizziness as suggested in study by Cohen (6).
- Functional vision problem when not adequately managed can lead to disorientation and can impair patient ability to work or be present in an environment with extreme visual stimulation such as shopping mall.
- Management in Neuro-Optometric Rehabilitation includes spectacles correction of refractive error, prisms (yoked), to help with double vision and tinted filters to help with photosensitivity or visual discomfort and vision therapy protocol to improve the sensorimotor, visual motor, visual procession and VOR rehabilitation. (10)

CONCLUSION

Neuro-optometric evaluation and rehabilitation should be integrated as a multidisciplinary protocol to assess and help the patients with the TBI. The above findings of this case report demonstrate the essential role of neuro-optometric rehabilitation in the aftermath of a Labyrinthine concussion, demonstrating its pivotal contribution to enhancing the overall quality of life for affected patients. The above-mentioned approach holds the potential to address the visual challenges encountered in daily activities. This also shows the importance of a comprehensive approach to rehabilitation that includes targeted vision interventions for more effective outcomes in the post-concussion recovery process.

REFERENCES

