



A CHILD WITH AMBLYOPIA, NOT AN EYE! – DIGGING DEEP INTO DEVELOPMENTAL ASPECTS – A CASE REPORT

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INTRODUCTION

- Amblyopia is defined as “unilateral or bilateral decrease of best-corrected visual acuity (BCVA) caused by form deprivation, abnormal binocular interaction or both, for which no organic cause can be detected by physical examination of the eye and which in appropriate cases is reversible by therapeutic means at the appropriate time” by Von Noorden.(1)
- Amblyopia is the most common cause of preventable blindness. The prevalence of amblyopia worldwide is approximately 1%–5%. (2, 3)
- Amblyopia can be considered a disorder of development of the visual system or neurodevelopment abnormality (4) that can present with varying levels physiological alteration in visual pathways and impaired vision to one or both eye.(5)
- Clinically amblyopia is not just about the visual acuity but many other visual functions such as grating acuity, vernier acuity and contrast sensitivity and development aspects are involved.
- Amblyopic eyes can also have defective accommodation and can display oculo-motor deficits, including unsteady fixation and inaccurate tracking (6).
- Binocularly discordant input results in visual sensory and oculomotor dysfunction in amblyopia, which may contribute to reading difficulties(7)
- There are several researches which indicates amblyopia may be associated with developmental delay and can results in poor outcome required for proficiency of everyday tasks and can be related to reduced academic performances(9)
- There is a great deal of evidence showing that amblyopia results in a broad range of neural, perceptual, and clinical abnormalities that can occur when normal visual development is disrupted early in life. (4, 8)
- As clinicians it is important to know which life skills relevant to a child may be affected if amblyopia is left untreated and be aware of any functional difficulties that a child may experience following treatment.

CASE REPORT

CHIEF COMPLAINT: A 6-year-old girl presented to our clinic with a complaint of ‘lazy eye’ and associated learning challenges with her parents 1 year ago.

OCULAR HITORY: The child was diagnosed with amblyopia and was using patch for both the eyes alternately 2 hours per day.

GENERAL HEALTH: . The parents gave a history of delayed developmental milestones along with history of seizures for which she is under medication. There was also a history of suspected peri-ventricular leukomalacia (PVL). As per her parents the child gets frequent seizures which is a matter of concern for them and is under the care of neurologist.

CURRENT MEDICATION: levipil and epilex

The parents also complained about memory difficulties, a short attention span, challenges related to copying from the blackboard.

INITIAL ASSESSMENT (PHASE1)

Post initial Evaluation:

SUBJECTIVE REFRACTION: OD: +1.50 DS/ -5.00 DC x 20 ; BCVA 6/18P
OS: +1.50 DS/-3.50 DC X 180; BCVA 6/18P

WORTH FOUR DOT TEST: Fusion at distance and near

DIAGNOSIS: -Bilateral amblyopia (suspected organic amblyopia)
-Development delay

The noted refractive errors and the reduced visual acuity suggested a significant visual impairment that may be contributing to her learning challenges.

RECOMMENDATION:

The patient was advised to undergo vision therapy to improve her visual function and promote binocular vision. Patient was also advised for follow up review after 3 months of treatment along with Visual Perceptual evaluation and primitive Reflexes evaluation as a part of phase 2 treatment plan.

PROGRESS UPDATE (PHASE 1)

After 3 months of vision therapy, visual acuity improved to 6/9 for both right eye and left eye respectively.

VISUAL ACUITY: OD: 6/9
OS:6/9

WORTH FOUR DOT TEST: Fusion at distance and near

STEREOPSIS: 200 second of arc

The patient was further evaluated for her perceptual skill, visual motor skills and primitive reflexes.

SECONDARY ASSESSMENTS (PHASE 2)

Post evaluations, it was observed that the patients exhibited several areas of concern in her visual development such as

- Delayed eye movements (saccades and pursuits) with high incidence of fixation loss
- Fusional Vergence range both Base in and Base out were reduced
- Lag of Accommodation +1.00 DS determined by Monocular Estimation Method (MEM)
- The patient was further tested for her visual perceptual level using the TVPS-R (test for Visual Perceptual skills-Revised) revealed delayed and below age normative visual information processing skills in all the subtests.
- The visual motor integration skills, as assessed by Beery VMI (BEERY-Buktenica Developmental tests of Visual Motor integration), were delayed and below age normative particularly in copying and writing.
- The primitive reflex test indicated retained Tonic Labyrinthine Reflex (TLR) and Asymmetrical Tonic Neck reflex.

TABLE 1 : TVPS-R TEST PERFORMEDAT DIFFERENT TREATMENT STAGES

	PRE VISION-THERAPY	4 MONTHS POST VISION THERAPY	8 MONTHS POST VISION THERAPY
	TVPS-R (5 YEARS)	TVPS-R (5Y4M)	TVPS-R (5Y9 M)
VISUAL PERCEPTUAL QUOTIENT	62	72	78
OVERALL PERCENTILE RANK	1	3	7

TABLE 2 : BEERY VMI PRE AND POST VISION THERAPY

	VISUAL MOTOR INTEGRATION	
	PRE VISION-THERAPY	POST VISION THERAPY
STANDARD SCORE	101	106
PERCENTILE RANK	53	65

TREATMENT PLAN

PHASE 1

The initial treatment objective was to improve the visual acuity. The plan included 6 days per week of in-office sessions administered for one hour per day.

she was administered a combination of monocular oculomotor therapy which included the Sanet Vision Integrator (SVI) saccades module, SVI Rotator Module, Hart chart, SVI Saccadic Fixator, and Marsden Ball training and the Pegboard rotator.

PHASE 2

Based on the above comprehensive evaluation findings, the patient was advised to undergo comprehensive vision therapy program, to normalize her visual efficiency skills (issues with eye movements, vergence and accommodation).The patient was also recommended to engage in visual information processing therapies to improve her visual perceptual skills. Reflex integration program was also suggested to help her in maturing the retained primitive reflexes along with vision integration.

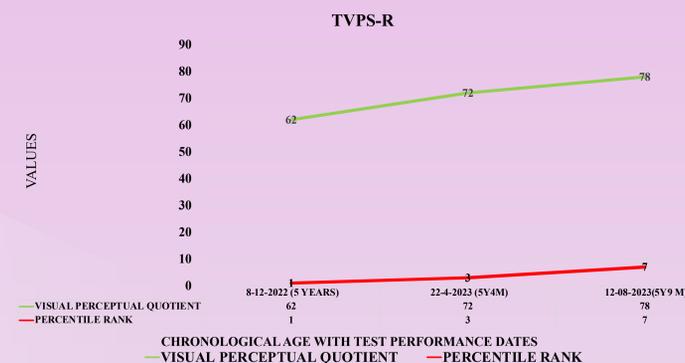
TABLE 3. METHODOLOGY

Activities	Purpose
Sanet vision integrator (eye hand, rotator, saccades)	Is a multi-sensory system incorporating eye hand coordination with cognitive processing and balance tracking to help improve these abilities and promote mental acuity. Enhances pursuits, saccades, fixation stability, eye-hand coordination, visual reaction time, speed and span of recognition, plus visual and auditory sequencing and visual memory.
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 skills
4-saccadic chart and rotational charts	The objectives of the chart for saccadic therapy are to increase the speed and accuracy of saccadic fixation and saccadic tracking
VTS-4	VTS4 computer orthoptic helps in training : fusional ranges (through RDS program and Manual Vergence) , stereopsis
Visual Perpetual Training	Visual form constancy, Visual closure, Visual sequential memory, Visual discrimination, Visual spatial relations Visual figure ground, Visual memory
Visual motor skills - geo board	A geo board is a wood board with 25 screws evenly spaced (about 1 inch apart). It's used to explore shapes and basic concepts of geometry. To use a geo board, the child replicates a pattern from a card (which we provide) on the board by stretching rubber bands across the screws.

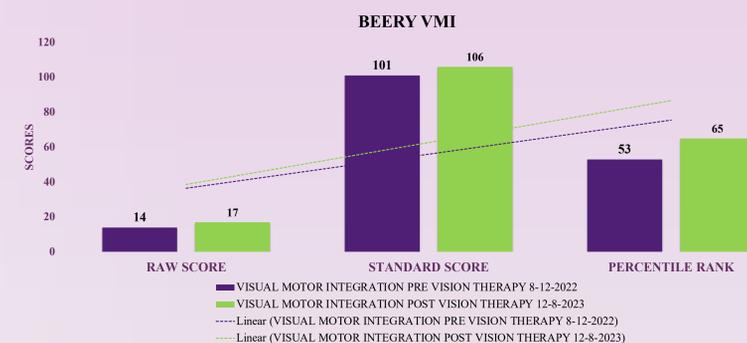
RESULTS

There was remarkable improvement noted in various aspect of the patient visual development. There was significant improvement noted in accuracy of her saccades and pursuits, her tests showed normalized accommodative function and normal fusional vergence ranges.

The patient’s performance in TVPS-R showed age normative results in four subcategories showing significant progress in visual information processing skills.



GRAPH 1 TVPS-R RESULTS PRE AND POST TREATMENT



GRAPH 2. BEERY VMI RESULTS

CONCLUSION

This above case demonstrate that Amblyopia may coexist and deeply connected with VIP delay and learning disabilities. VT is an effective way and evidently successful in treating the learning issues presents along with Amblyopia. Parents should be counselled of Vision therapy (VT) as an active form of treatment and compliance is key to successful treatment. We should also include developmental assessment parameter such as motor and non-motor perceptual skills along with comprehensive vision examination to rule out the depth of comorbidities associated with amblyopia.

DISCUSSION

- Amblyopia is neurodevelopmental disorder of the eye as whole that can result in physiological changes in the visual pathway. Many evidences suggest that there are both physiological and behavioral changes that can be traced back to the more complex visual processing at the level of brain(5).
- The initial development of visual system is systematically guided and is optimized by concordant binocular visual experience, but when there is discordant in that experience due to any physiological, neural change the normal visual development is misguided.(7)
- The pathophysiology can be considered as abnormal binocular visual experience which can impact the function of the visual pathway beginning at the level of primary visual cortex (V1) and beyond V1(11)
- In our case report the patient had delayed visual perceptual skills secondary to her amblyopia. As the patient’s vision improved post vision therapy, her visual information processing skills also started improving, which further became age normative post visual perceptual therapies, which also correlated with parents' complaints of difficulty in recognizing similar words in same page, short attention span, confusion and reversing of letters or words, difficulty with memory and so on which is what was publicized in study(8)
- Patient also exhibited mild oculomotor deficits, reduced, lag of accommodation, reduced fusional vergence ranges and delayed tracking, as seen in (6,10) which consequently led to her parents' complaint of issue with reading, writing which requires sequential and binocular eye movements. The patient also exhibited below age normative visual information processing & delayed visuo-motor integration skills.
- The patient also reported improvement of the visual motor skills which was poor before, correlating to the study conducted by Webber which elicited that the visual motor skills and skills required for performing everyday tasks demonstrated improvement post amblyopia treatment.

REFERENCES

