

## Evaluation and interpretation of VEP changes before and after treatment of amblyopia in children

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### Abstract

**Aim:** To assess prognosis of Amblyopia by evaluating and interpreting visual evoked potential changes before and after treatment.

**Objective:** To identify a relation between VEP changes in amblyopic patients before and after treatment. To identify the relation between VEP changes (latency and amplitude) and visual outcome.

**Materials and Methods:** This is a prospective interventional study conducted at the department of paediatric ophthalmology, Sarojini Devi Eye Hospital, Regional Institute of Ophthalmology, Hyderabad. The study was conducted from June 2009-Dec 2011.

30 amblyopic patients of age group 4-12 years with different etiologies presenting at Sarojini Devi Eye Hospital, Hyderabad were selected for the study. The etiology was 8 Strabismic amblyopia, 11 Anisometropic amblyopia, 11 Isometropic amblyopia. Sex ratio was 21 female to 9 male. The patients who were not treated earlier for refractive error, amblyopia or ocular disease were considered for study. Clear media and normal fundus on ophthalmoscopic examination was a prerequisite for selection. Children below 3 years of age, Non Co-operative and children with toxic amblyopia were excluded from study. All cases were thoroughly evaluated by an experienced Ophthalmologist by using, Torch and Loupe, Slit lamp, Direct and indirect Ophthalmoscope, Prism bars. Visual acuity was recorded by using Snellen's chart or Allen's Pictorial chart. Cycloplegic refraction was done in all cases. Post mydriatic test was done to prescribe glasses. All subjects were subjected to VEP test using Nicolet Viking Select Neuro diagnostic system Version 10. Occlusive amblyopia therapy was given for six month taking care about normal eye by avoiding occlusion for 2 days in a week. Post patch VEP was done and visual acuity recorded and conclusions were drawn.

**Results:** Mean age of the patients is  $7.46 \pm 1.98$  years. 44 amblyopic eye of 30 patients underwent occlusion amblyopia therapy for six months. All amblyopic patients had decreased visual acuity, increased VEP latency decreased VEP amplitude, and had improvement following patching indicates increased response of higher centres. All cases showed more than two Snellen's lines visual acuity improvement

**Conclusion:** Paired T-Test was done with sample collections comparing pre patch and post patch VEP P<sub>100</sub> values and found statistically very significant (RE and LE P values 0.003 and 0.031 respectively).

On curve fit analysis the pre and post patch VEP P<sub>100</sub> values of right eye showed F value 10.335 and P value 0.003 on curve fit analysis post and pre patch VEP P<sub>100</sub> values of left eye showed F value 5.692 and P value 0.024 both of which are highly significant.

**Keywords:** Amblyopia, Anisometropia, Strabismus, Visually evoked potential.

### Introduction

In amblyopia the child loses this sensitivity as there is a functional reduction in the visual acuity. In Greek "ambly" means dim or dull and "Opia" means vision. Amblyopia is also known as lazy eye.<sup>(1)</sup>

The prevalence or cumulative incidence of amblyopia is always underestimated because of no population based surveys with accurate sensitivity and specificity. The incidence of amblyopia is always estimated in a sector of people like students, army or aircraft employees etc.<sup>(2)</sup>

Amblyopia possesses an important socio economic problem. Hence diagnosis of amblyopia through large scale screening programmes and treatment of the children is important because risk of amblyopia patients becoming blind is significantly higher than the general population. Various studies conducted by Von Noorden 1995,<sup>(3)</sup> Tommila and Tarkkanen et al., 1958-78 have

shown that amblyopia is the leading cause of unocular blindness and causes more visual loss and "legal " blindness (20/200 acuity) under the age of 45, than all other causes combined.<sup>(4)</sup>

In India, amblyopia is the second common cause of decreased vision in children next only to refractive errors.<sup>(5)</sup> The goal of amblyopia treatment is achievement of maximum visual acuity of an individual child. One screening session, atleast at school entry could be of utmost help preferably by using age-appropriate Log MAR acuity tests. The children should be treated as early as possible to achieve optimum outcome.

Functional amblyopia is almost completely reversible condition with early diagnosis and treatment if initiated before visual maturation is complete.<sup>(6)</sup>

## Materials and Methods

This is a prospective interventional study conducted at the department of paediatric ophthalmology, Sarojini Devi Eye Hospital, Regional Institute of ophthalmology, Hyderabad. The study was conducted from June 2009-Dec 2011.

30 amblyopic patients of age group 4-12 years with different etiologies presenting at Sarojini Devi Eye Hospital, Hyderabad were selected for the study. The etiology was 8 Strabismic amblyopia, 11 Anisometropic amblyopia, 11 Isometropic amblyopia. Sex ratio was 21 female to 9 male. The patients who were not treated earlier for refractive error, amblyopia or ocular disease were considered for study. Clear media and normal fundus on ophthalmoscopic examination was a prerequisite for selection. Children below 3 years of age, Non Co-operative and children with toxic amblyopia were excluded from study. All cases were thoroughly evaluated by an experienced Ophthalmologist by using, Torch and Loupe, Slit lamp, Direct and indirect Ophthalmoscope, Prism bars. Detailed history regarding the onset of defective vision, squint, duration of symptoms, associated symptoms and previous treatment history was taken.

The base level visual acuity was tested with Snellen's visual acuity charts, Optotype charts, Allen's Pictorial charts for both distance and near, with and without spectacles monocularly and binocularly.

Ocular motility was tested in all cardinal positions of gaze binocularly. Monocular motility was tested by Ductions.

Cover test was done for distance and near with and without glasses. The angle of deviation was measured with PBCT.

Worth's four dot test was done to rule out suppression and to assess Binocular single vision.

Anterior segment was examined with slit lamp. The examination was done under diffuse and focal illumination.

In the both eyes pupils were examined for direct and consensual light reaction. The swinging flash light test was done to examine relatively afferent papillary reflex. Fixation pattern was assessed by the grid of Direct Ophthalmoscope.

The indirect ophthalmoscopic examination was conducted after full dilatation with to rule out fundus pathology.

Full cycloplegic retinoscopy was done to assess the refractive error.

Auto-refractometer readings were taken under cycloplegia.

Post mydriatic test was done to prescribe glasses.

All patients were subjected to VEP test using Nicolet Viking Select Neuro diagnostic system Version 10. The patient is instructed to shampoo hair before coming for test. VEP is recorded with normal size pupil without the effect of Miotic or mydriatic. Test done with patient wearing full refractive correction. The area

of the scalp where electrodes are to be placed is prepared by Nuprep skin gel. Electrodes are placed at Nasion (point between forehead and nose) and inion (lowest point of skull from back of the head indicated by prominence). Patient is made to sit 100cm from the TV monitor which display the checker board pattern. Light tight opaque patch is applied to unstimulated eye. Patient is asked to fix at the centre of board. Stimulus is pattern reversal on the board. The pattern black and white squares reverses simply without changing total light output. Patient should be comfortable well supported and without distraction especially from noise. Latencies and amplitude recorded at N<sub>75</sub>, P<sub>100</sub>, N<sub>145</sub>.<sup>(7)</sup>

Occlusive amblyopia therapy was given for six month taking care about normal eye by avoiding occlusion for 2 days in a week. Visual acuity recorded at the end of 1 month, 3 month and after 6 months. Post patch VEP was done and visual acuity recorded and conclusions were drawn.

## Results

Mean age of the patients is  $7.46 \pm 1.98$  years. 44 amblyopic eye of 30 patients underwent occlusion amblyopia therapy for six months. All amblyopic patients had decreased visual acuity, increased VEP latency decreased VEP amplitude before treatment (Pre patch). All patients had improvement following patching indicates increased response of higher centres. Out of 30 patients, 44 eyes with amblyopia were analysed for visual status and VEP changes before and after treatment. When we recorded post patch visual activity on Snellen's chart 34 out of 44 eyes had more than two lines improvement, 5 patients showed one line improvement and 5 patients showed 3 lines improvement from base line. The average improvement in visual activity of 44 treated eyes was 3 lines.

## Discussion

Early detection and treatment of amblyopia is very essential as there is a marked improvement in visual acuity if amblyopia is detected and treated early. This changes the social, psychological and economic status of an amblyopic individual.

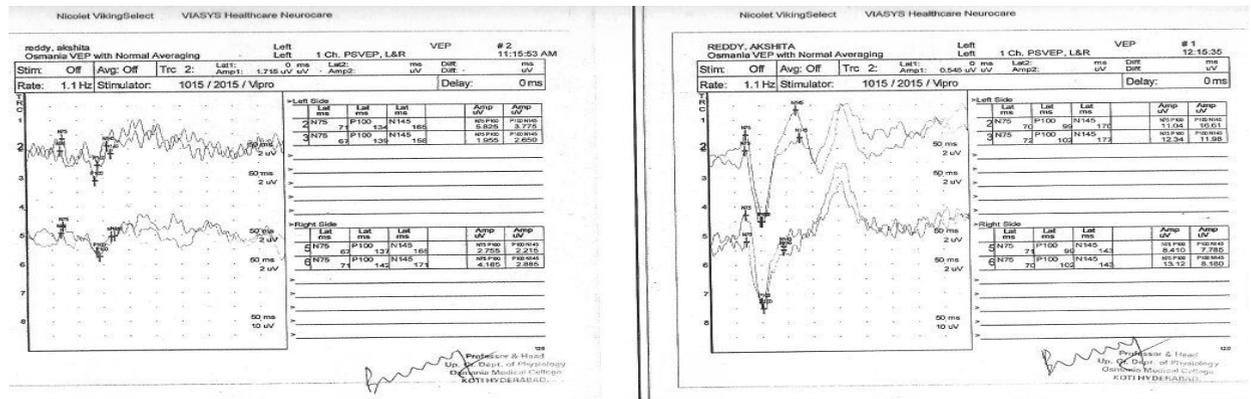
As per the studies conducted by the paediatric eye disease investigator group in 2003,<sup>(8)</sup> amblyopia is characterized by a decreased activity in primary visual cortex, which can be treated by patching as an effective initial treatment. In the present study we have opted patching of the sound eye as treatment option an observed good results.

The retinal involvement in the process of amblyopia is not very clear. A class of retinal ganglion cells (the sustained or X cells) in the central retina is thought to provide the physiological basis for high visual acuity.<sup>(9)</sup> Indeed, amblyopia is thought to be associated with functional loss of these cells due to inappropriate stimulation of the fovea blurred images

during the critical period of development in squinting eyes, which have lost the ability to fix.

Pattern VEP is the only objective technique available and widely used in assessing the visual function by ophthalmologists and clinicians. It has been shown to be a sensitive detector of amblyopia, particularly when small checks are used as stated by Sokol et al.<sup>(9)</sup> the latency of P-VEP is also abnormal in amblyopia. John et al<sup>(10)</sup> reported that there is a relation between the P-VEP waveform and the Snellen acuity in patients with amblyopia.

All the 34 eyes which showed more than two lines Snellens visual acuity improvement were analysed. The average improvement in visual activity was 3.735 lines on analysis positive correlation between P<sub>100</sub> latency, N<sub>75</sub>-P<sub>100</sub> amplitude and Snellen's visual acuity could be made out. This study demonstrates that there is decrease in P<sub>100</sub> latencies and increased in N<sub>75</sub>-P<sub>100</sub> amplitude in amblyopic eyes during the course of occlusion therapy. In addition decreased P-VEP latency and increased amplitude are correlating with the improvement in visual acuity in amblyopic eyes.



## Conclusion

Therefore, based on the above data, we can take Pattern-VEP as a useful method in monitoring the visual acuity in both preverbal and nonverbal and mentally retarded children with amblyopia under occlusion therapy. Hence we can consider that VEP as a useful objective technique in monitoring the effectiveness of occlusion therapy in amblyopic eyes.

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