

# CASE REPORT: SUCCESSFUL TREATMENT OF ADULT REFRACTIVE AMBLYOPIA

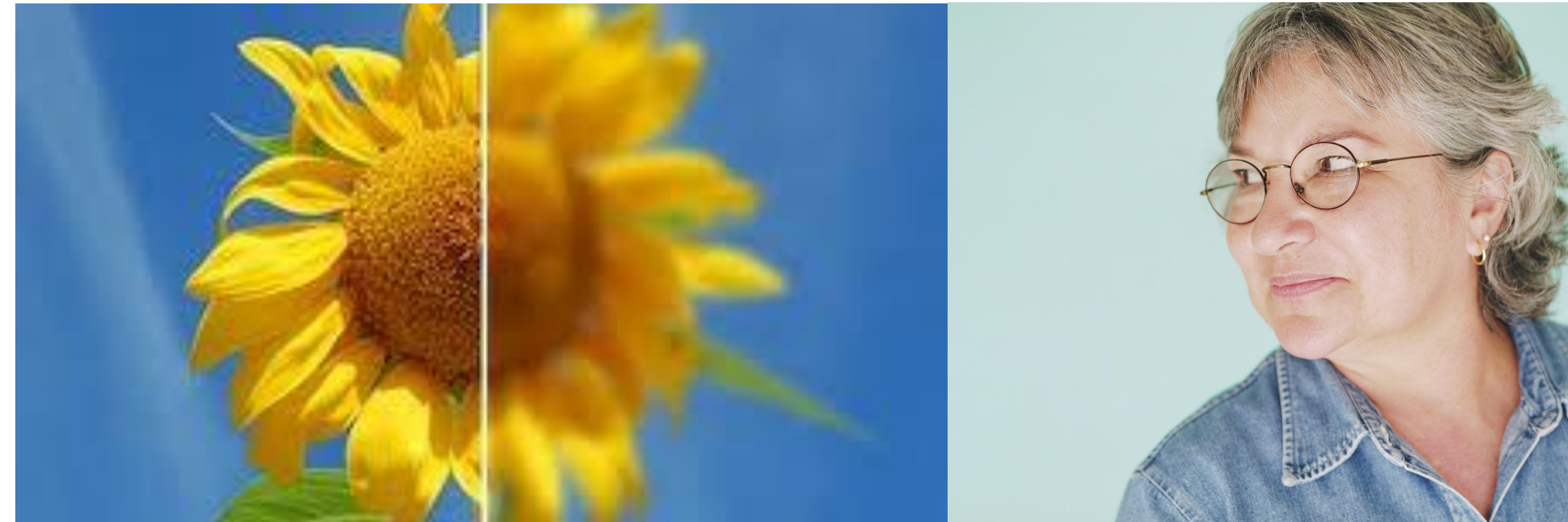
## Anisometric Refractive Amblyopia

**Background:** Anisometric refractive amblyopia occurs due to a blurred optical image from one eye affecting development of the visual system. Due to the normal eye appearance of this visual disorder, early diagnosis and treatment are not always possible. Despite the delay of treatment, this case demonstrates effective amblyopia treatment in adulthood.

For an accurate diagnosis, an amblyogenic refractive error must be present during development of the visual system in childhood (refer to Table 1). This defocus disrupts the normal neurophysiological development of the visual pathway and visual cortex. In this case, the patient had uncorrected anisometric hyperopia of over 1 diopter.

Table 1.

Potentially Amblyogenic Refractive Errors	
Isoametropia	Diopters
Astigmatism	>2.50 D
Hyperopia	>5.00 D
Myopia	>8.00 D
Anisometriopia	Diopters
Astigmatism	>1.50 D
Hyperopia	>1.00 D
Myopia	>3.00 D



Normal Vision is developed when both eyes send clear images to the brain that are blended into one perception. When one eye has poor vision, as in the case of anisometric hyperopia, the brain suppresses the blurred information causing amblyopia.

## Differential Diagnosis

All forms of pathology or disorders of development must be ruled out before making the diagnosis of amblyopia.

- Retinal Defects
- Central Nervous System Lesions
- Metabolic Disorders
- Toxin Exposure
- Congenital Defects
- Optic Nerve Insult
- Ocular Trauma
- Brain Trauma



## Clinical Findings

- Reduced Visual Acuity (typically ranges from 20/25 to less than 20/200)
- Poor Ocular Motility Accuracy
- Reduced Accommodation Skills
- Decreased Contrast Sensitivity
- Poor Spatial Judgment
- Crowding Phenomenon
- Unstable Binocular Alignment
- Poor Fusion Skills
- Reduced or Absent Stereopsis
- Suppression

## Introduction

### Case Summary

A 35-year-old Caucasian female presented with symptoms of blurred vision in the right eye, poor night vision, and inability to see 3D. She experienced frequent headaches, halos around lights, and skipping or repeating of lines when reading. She noted blurred vision around lights and projection screens. These vision difficulties were present her entire life. Medical history included a drug allergy to Sulfa medications and she was taking Juice Plus vitamin supplements. She had no history of eye injury or disease.

### Examination Findings See Table 2.

The patient was referred by her primary care optometrist for an evaluation on March 16, 2011. At this initial appointment, refraction was OD +3.50 DS and OS -0.25 DS with acuity of 20/70 at 20 feet and 20/200 at near OD and 20/20 at all distances OS. Depth perception was absent. All focusing skills were below typical performance. Eye alignment testing showed esophoria with convergence excess. Pursuit movements were full and smooth, but saccadic eye movements required additional head movement, re-fixation movements, and more time than expected. Significant suppression of the right eye was noted.

### Diagnoses

- Anisometric Hyperopia (367.31, 367.0)
- Asthenopia (368.13)
- Saccadic oculomotor dysfunction (379.57)
- Refractive Amblyopia (368.03)
- Suppression of Binocular Vision (368.31)

### Treatment

Treatment options of glasses, contact lens, patching, and active in-office vision therapy were discussed. A contact lens fitting for the right eye and vision therapy treatment were recommended with patient goals of gaining depth perception, better vision clarity, and improved reading skills.

The patient was fitted with a contact lens (Air Optix) in the right eye and began weekly office therapy April 7, 2011 with assigned home therapy reinforcement activities.

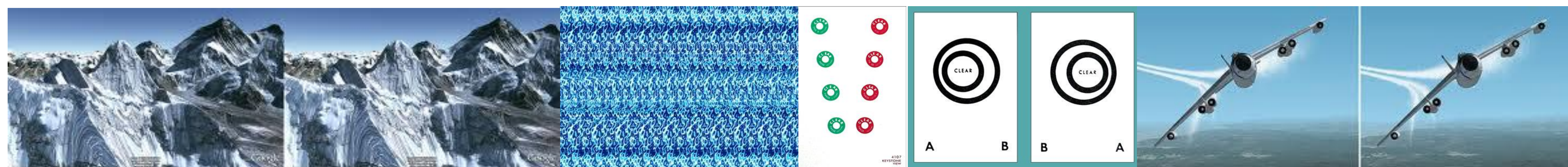
## Therapeutic Vision Therapy

### Plan:

1. Equalize Monocular Skills
2. Build Sensory Fusion
3. Improve Motor Fusion Accuracy and Fusional Vergence Ranges
4. Develop Accurate Stereopsis and Eye-Hand Coordination
5. Speed, Accuracy, and Maintenance of all Visual Skills

### Activities:

- Accommodation: Monocular, Bi-ocular, Binocular
- Oculomotor: Fixations, Pursuits, Saccades, Eye-Hand Coordination
- Sensory Fusion: Anti-suppression, Center/Peripheral, Monocular Fixation in a Binocular Field, Luster, Simultaneous Perception, Flat Fusion, Stereopsis
- Motor Fusion: Convergence, Divergence, Jump Ductions, BIM/BOP



Acknowledgments: Thank you to the following colleagues for their participation in the care of this patient: Ashlee Elmont, OD, Rachel Potter, OD, and Barbara Nelson, COVT  
 References: 1.) *Applied Concepts in Vision Therapy* by Leonard Press, OD, FCOVD 2.) *Fact Sheets on Conditions of the Visual System Treated with Vision Therapy* by the COVD Clinical Standards Committee 3.) *Care of the Patient with Amblyopia* by the American Optometric Association Clinical Practice Guidelines <http://www.aoa.org/optometrists/tools-and-resources/clinical-practice-guidelines>. 4. Bernell Corporation (Vision Therapy Equipment)

## Vision Testing

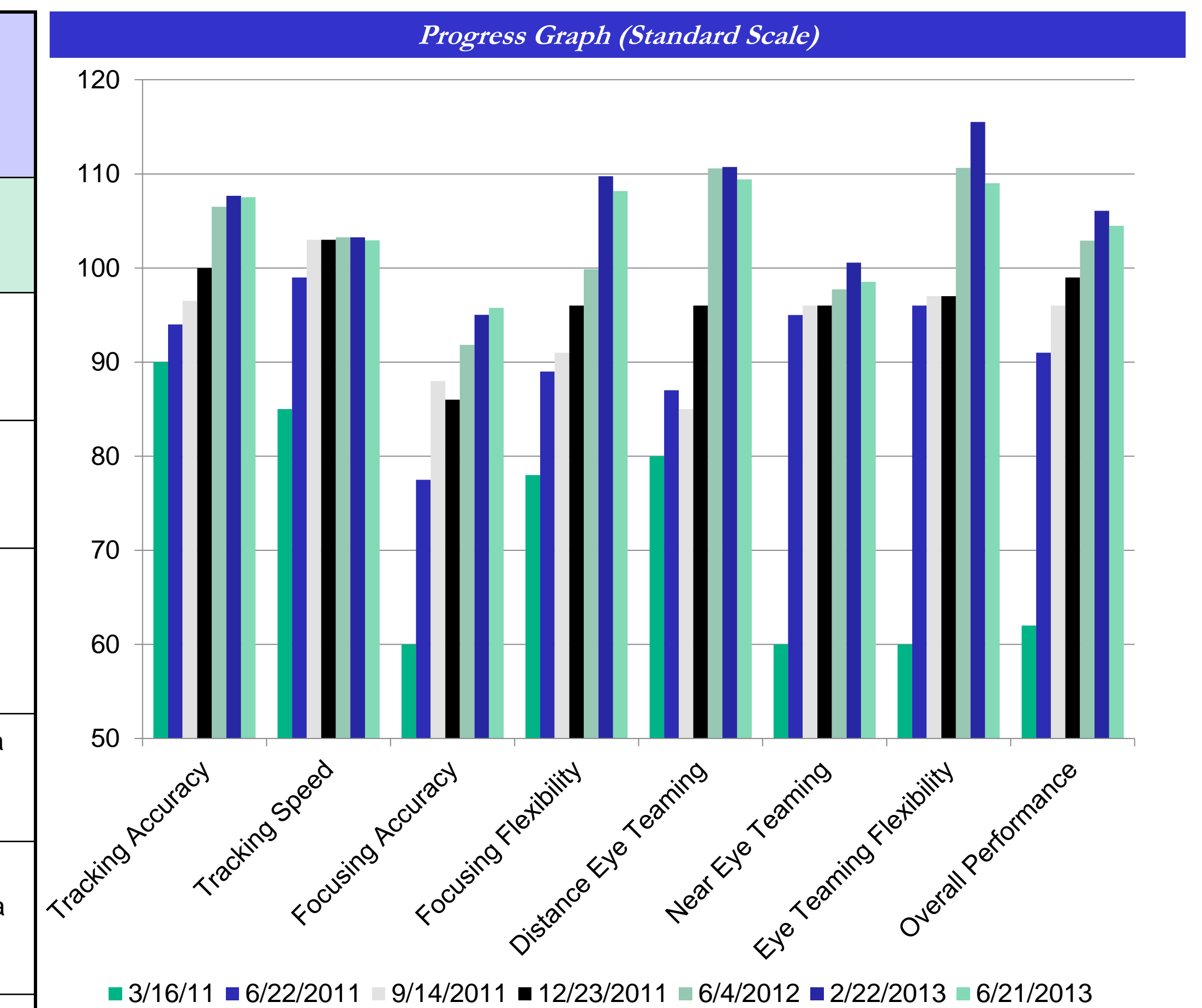
Table 2.

Diagnostic Test	Initial Examination 3/16/2011	Progress Examination 6/22/2011	Progress Examination 9/14/2011	Progress Examination 12/23/2011	Progress Examination 6/4/2012	Progress Examination 2/22/2013	Post-Therapy 6/21/2013
<b>Number of therapy sessions completed</b>	0	10	21	28	40	57	57
<b>Distance Visual Acuity (20 ft./6 M)</b>	sc: OD 20/200+ cc: OD +3.50 DS 20/70- sc: OS 20/20	cc: OD 20/50 <sup>+2</sup> sc: OS 20/20	cc: OD 20/40 <sup>-1</sup> sc: OS 20/20	cc: OD 20/40 <sup>-1</sup> sc: OS 20/20	cc: OD 20/30 <sup>+3</sup> sc: OS 20/20	cc: OD 20/25 (full chart) sc: OS 20/20	cc: OD 20/20- sc: OS 20/20
<b>Near Visual Acuity (16 inches/40 cm)</b>	cc: OD 20/200 sc: OS 20/20	cc: OD 20/50 <sup>+2</sup> sc: OS 20/20	cc: OD 20/40 sc: OS 20/25	cc: OD 20/40 sc: OS 20/25	cc: OD 20/40 sc: OS 20/20	cc: OD 20/32 sc: OS 20/20	cc: OD 20/32 sc: OS 20/20
<b>Accommodation</b>	NRA: +0.50 PRA: -1.50 BXC (FCC): +1.50 +/-2.00 Flipper: 4 cpm	NRA: +2.00 PRA: -2.00 (doubles) BXC (FCC): +1.50 +/-2.00 Flipper: 7 cpm	NRA: +2.25 PRA: -1.50 BXC (FCC): +1.50 +/-1.00 Flipper: 14 cpm	NRA: +1.75 PRA: -1.25 +/-1.00 Flipper: 14 cpm	NRA: +1.25 PRA: -2.25 BXC (FCC): +1.00	NRA: +2.00 PRA: -2.00 (doubles) BXC (FCC): +1.50 +/-1.00 Flipper: 18 cpm	NRA: +3.00 PRA: -1.50 BXC (FCC): +0.75
<b>Distance Eye Alignment</b>	Von Graefe: 4 eso Cover test: flick esophoria	Von Graefe: 4 eso Cover test: flick esophoria	Von Graefe: 2 exo Cover test: flick esophoria	Von Graefe: 2 exo Cover test: flick esophoria	Von Graefe: Orthophoria Cover test: Orthophoria	Von Graefe: Orthophoria Cover test: Orthophoria	Von Graefe: Orthophoria Cover test: Orthophoria
<b>Near Eye Alignment</b>	Von Graefe: 8 (variable) eso, intermittent suppression Cover test: flick esophoria	Von Graefe: 8 eso Cover test: 8 esophoria	Von Graefe: 8 eso Cover test: flick esophoria	Von Graefe: 8 eso Cover test: flick esophoria	Von Graefe: 3 exo Cover test: 4Δ esophoria	Von Graefe: 4Δ exo Cover test: 4Δ esophoria	Von Graefe: 3Δ exo Cover test: 4Δ esophoria
<b>Stereopsis</b>	Absent	400" arc seconds	100" arc seconds	100" arc seconds	100" arc seconds	70" arc seconds	70" arc seconds
<b>Near Point of Convergence</b>	2 cm/4 cm	2 cm/4 cm	To the nose	To the nose	To the nose	To the nose	To the nose
<b>Distance Fusional Ranges</b>	BO: 22/24/6 BI: x/8/2	BO: 16/32/10 BI: x/8/6	BO: 16/26/16 BI: x/10/6	BO: 12/24/20 BI: x/8/6	BO: 16/24/20 BI: x/8/6	BO: 26/32/22 BI: x/6/5	BO: 26/32/26 BI: x/7/5
<b>Near Fusional Ranges</b>	BO: 16/20/9 BI: 10/20/7 Fusion facility: unable	BO: x/18/11 BI: x/19/14	BO: 22/28/16 BI: x/22/18	BO: 12/23/18 BI: x/18/17 Fusion facility: 11 cpm	BO: 33/33/28 BI: 17/18/13 Fusion facility: 13 cpm	BO: 29/33/31 BI: x/18/14 Fusion facility: 14 cpm	BO: 29/33/30 BI: x/17/13
<b>Oculomotor Skills</b>	Colorado study group: Pursuits: 10/12 Saccades: 10/12 DEM • Vertical: 48 seconds <1 <sup>st</sup> %ile • Horizontal: 52 seconds <1 <sup>st</sup> %ile	Colorado study group: Pursuits: 11/12 Saccades: 11/12 DEM: • Vertical: 35 seconds 26 <sup>th</sup> %ile • Horizontal: 40 seconds 16 <sup>th</sup> %ile	Colorado study group: Pursuits: 11/12 Saccades: 11/12 DEM: • Vertical: 32 seconds 42 <sup>nd</sup> %ile • Horizontal: 34 seconds 44 <sup>th</sup> %ile	Colorado study group: Pursuits: 11/12 Saccades: 11/12 DEM: • Vertical: 31 seconds 48 <sup>th</sup> %ile • Horizontal: 37 seconds 27 <sup>th</sup> %ile	Colorado study group: Pursuits: 12/12 Saccades: 12/12 DEM: • Vertical: 32 seconds 42 <sup>nd</sup> %ile • Horizontal: 35 seconds 38 <sup>th</sup> %ile	Colorado study group: Pursuits: 12/12 Saccades: 12/12 DEM: • Vertical: 30 seconds 56 <sup>th</sup> %ile • Horizontal: 35 seconds 38 <sup>th</sup> %ile	Colorado study group: Pursuits: 12/12 Saccades: 12/12 DEM: • Vertical: 30 seconds 56 <sup>th</sup> %ile • Horizontal: 35 seconds 38 <sup>th</sup> %ile

### Abbreviations:

- sc = without corrective lenses
- cc = with corrective lenses
- OD = right eye, OS = left eye, OU = both eyes
- NRA = negative relative accommodation
- PRA = positive relative accommodation
- BXC = binocular cross cylinder
- FCC = fused cross cylinder
- cpm = cycles per minute
- eso = inward, exo = outward
- BO = base-out, BI = base-in, BIM = base-in prism with minus lens, BOP = base-out prism with plus lens
- DEM = Developmental Eye Movement Test
- SILO = small/in, large/out

## Vision Therapy Results



**Results:** The patient completed weekly in-office visits with home practice from April 2011 to February 2012. Vision Therapy was tapered through February 2013. Therapy included oculomotor, accommodative and binocularity training and vision perception (speed of information processing, perceptual span) Examination resulted in reduced fusional, accommodative and oculomotor efficiency findings. Due to clinical measurements of stable vision skills including acuity and stereopsis and the patient remaining symptom-free, in-office therapy was completed after the evaluation on February 22, 2013. A post-treatment evaluation was then completed on June 21, 2013

The outcome was increased vision clarity, reading speed, stereopsis, and visual comfort. Retesting resulted in 20/20- acuity at distance and 20/32 at near OD with stable refraction, 70" stereopsis, and elimination of symptoms.

**Discussion:** The patient achieved all therapy goals, including those beyond improved visual acuity through refractive correction and vision therapy as an adult. Treatment of amblyopia should be recommended for all patients regardless of age.

## Maintenance Therapy

❖ Maintenance vision therapy was prescribed for home practice, including computer and free space activities. See sample images.

- 1) Eccentric circles (convergence and divergence)
- 2) Free-space fusion images
- 3) Magic eye books and random dot stereo images

❖ The patient was referred to the co-managing optometrist for contact lens evaluations and annual comprehensive vision and ocular health examinations.