A Vivid Recovery of Stereopsis

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ABSTRACT

Strabismus can be a debilitating ophthalmic disorder. Often patients are referred for surgery; however, orthotropic eye posture does not necessarily mean a patient has regained quality binocular vision. Even in cases that do achieve stereopsis, recovery can take months to occur. (Lal) Our case highlights the use of common vision therapy activities, such as wide eye stretches and accommodative exercise, along with dichoptic antisuppression and stereoscopic activities using a virtual reality software. Combined, this therapeutic regimen helped our patient experience significant psychological motivation during the sessions and afforded our patient her first known appreciation of depth.

INTRODUCTION & CASE HISTORY

A 36-year-old white female presented for a vision therapy evaluation for esotropia due symptoms of worsening and now debilitating diplopia, asthenopia, and occasional dizziness. She additionally reported avoidance of outdoor activities with her family due to not feeling safe with her current state of vision. She previously underwent strabismus surgery for a left esotropia 15 years prior, which afforded her temporary cosmetic improvement, followed by eventual regression to >30 prism diopter predominantly left esotropia at distance and >25 prism diopter alternating esotropia at near. Amblyopia was not present. She presented without stereopsis and stated that she was unable to appreciate her entire life.

EXAM DATA

2001 - First Strabismus Surgery

- Orthophoric posture without stereopsis

2015 - Binocular Vision Evaluation

- Chief Complaint: patient reported symptoms and signs of strabismus and visited a vision therapy clinic for evaluation
- 30-40^ OS esotropia on distance cover test (DCT)
- 25-30^ alternating esotropia on near cover test (NCT)
- No measurable stereopsis at distance or near

2016 January - Start Vision Therapy treatment

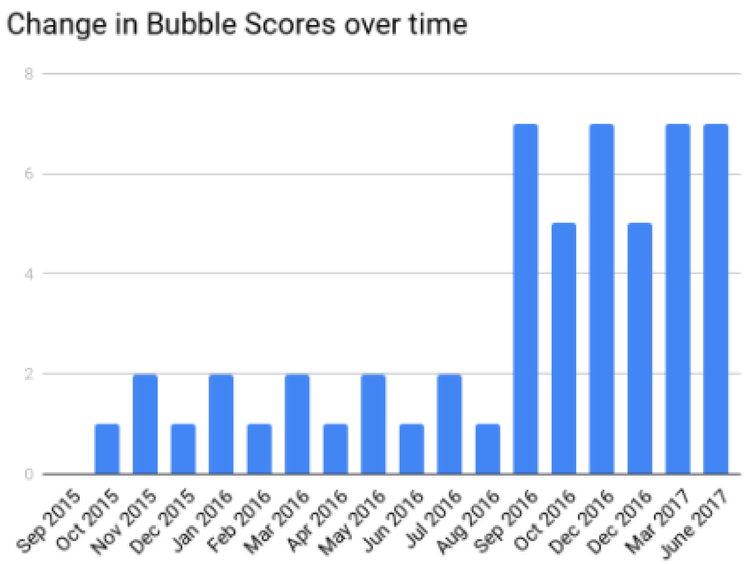
- Used Vivid Vision and standard orthoptic treatments
- Showed signs of having stereo vision in the Bubbles protocol within Vivid Vision in therapy

2016 November - Second Strabismus Surgery

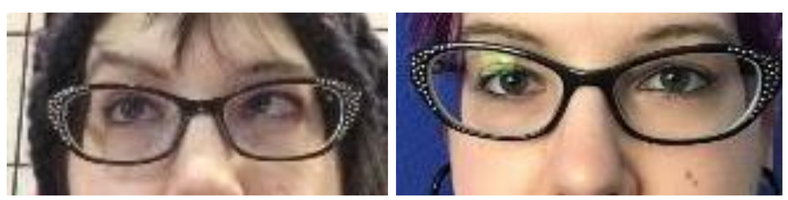
- Post sx presented with orthophoria at both on DCT and NCT
- 40 arc seconds of stereopsis at near post surgery
- Maintenance vision therapy until August of 2017

MEDIA

Breaker (left) works on anti-suppression by utilizing dichoptic presentation with virtual prisms and Bubbles (right) is used for stereopsis training



Bubbles score progression over time. Bubbles is a depth perception game that reduces disparity between targets with higher levels.



Before (left) and after (right) eye alignment pictures of patient

DISCUSSION

Visual rehabilitation has evolved significantly over the last 120 years. French ophthalmologist Émile Louis Javal was one of the first to describe techniques of rehabilitating a patient with strabismus using orthoptic exercises and a stereoscope. (Javal)

Virtual reality (VR) has recently emerged as exciting new platform for visual rehabilitation. Using a head mounted display and custom-designed, immersive, VR games the clinician is afforded full control of the patient's visual world. VR-based treatment of visual disorders, such as amblyopia, has been promising. (Ziak)

The VR software used in this case gave the clinician the ability to manipulate images and adjust factors such as image size, contrast, and clarity of images to reduce suppression and to promote use of both eyes simultaneously (i.e. simultaneous perception). Image location can be manipulated to mimic the effects of prismatic lenses to train both motor and sensory fusion (flat fusion). Stereopsis is the most highly developed level of binocularity. (Worth) Simultaneous perception, flat fusion, and stereoscopic cues are simultaneously present in all games. Games designed to train only stereoscopic vision removes all monocular cues and directly allow manipulation of target location, size, and disparity or the stereo target. Patients perform all tasks in an immersive virtual world. Utilizing concepts such as perceptual learning, peripheral awareness, and eye-hand coordination, our patient was able to directly train binocular, stereoscopic vision.

CONCLUSIONS

Even though our patient's deviation required surgical intervention, her pre- and post-surgical visual rehabilitation prepared her visual system to use both eyes simultaneously. Although this just one case study on the success of visual rehabilitation for a strabismic patient, a clinical trial is being conducted to evaluate on a larger scale the effectiveness of binocular rehabilitative treatment prior to strabismus surgery compared to no treatment prior to surgery. (NCT 01791946)

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