Article ▸ I Forgot People Could See This Way! A Case Study

Emily Aslakson, OD, Indiana University College of Optometry,
Class of 2015, Pediatric and Binocular Vision Resident,
Michigan College of Optometry, Ferris State University, Big Rapids, Michigan

ABSTRACT

Traumatic brain injury has, until recently, largely been ignored by the optometric community. However, those patients who have suffered from traumatic brain injury can often benefit from the care of an optometrist, as they frequently have symptoms that can be managed through lenses, prisms, colored filters, and vision therapy, or a combination thereof. This paper describes the case of Lisa, a 32-year-old Caucasian female who suffered from a traumatic brain injury and benefited greatly from the care of an optometrist. Fortunately, more and more optometrists are moving into the field of neuro-optometric rehabilitation as we learn more about the roles that they can have in this largely underserved patient population.

Keywords: Chromagen, neuro-optometric rehabilitation, traumatic brain injury

Introduction

Traumatic brain injury (TBI) can have a devastating impact on individuals and their families. Sources estimate that there are about 1.7 million cases of TBI each year. It is a leading cause of death in the United States.[1,2] Common causes of TBI in the United States are falls, motor vehicle accidents, and sports-related injuries.[1,2] Within the profession of optometry, there is a growing interest in how TBI affects not only vision but also perception and in the effect of TBI on activities of daily living. Common optometric complaints after TBI are blurry vision, diplopia, headaches, dizziness and disorientation, reading and concentration problems, and increased glare and light sensitivity. As evidenced by the numbers stated above, there is certainly a demand for growth in this area of optometry. This paper will discuss a patient who suffered a TBI and whose life was profoundly changed through optometry and the use of lenses, prisms, and vision therapy.

Case History

I met Lisa, a 32-year-old Caucasian female, after she had been referred to the office at which I was doing a clinical rotation; this referral took place one year after her TBI. She had fallen on a patch of ice in a parking lot and was diagnosed with a concussive head injury. Since the injury, she noticed that reading was very difficult, and she was having a hard time focusing. Her reading comprehension and memory had significantly deteriorated since her injury. She also complained of dizziness and a vague feeling of not being sure of where she was or where things were in relation to her. She said that moving her eyes gave her the "heebie jeebies" as the world seemed to "swim," and she would experience dizziness and feelings of confusion. Lisa had been working at a neuro rehabilitation clinic, where she received prism spectacles with 1^{Δ} BI OU, which improved her visual evoked potential (VEP) per the referring optometrist, and tint to help with light sensitivity. Her spectacle correction was changed by the optometrist at the neuro rehab clinic; her myopia had decreased by 0.50 D OU. She was referred to our office from the rehabilitation clinic so that we could work with her to improve oculomotor stability, ambient visual processing, and vestibular-ocular function.

Lisa presented to our clinic for a full examination. Her best corrected visual acuity was 20/20 OD, OS, and OU at distance and near. Pupillary responses were normal with no RAPD. Visual fields were full to careful finger count, and no simultagnosia was noted. Threshold visual fields as per the neuro rehab clinic were normal. Cover test was orthophoric in all nine directions of gaze at distance and near. The refraction was stable from the one found six months prior by the optometrist at the neuro rehab clinic (-10.00 DS OD and -8.00-1.00x180 OS). Saccadic testing revealed difficulty maintaining fixation, jerky movements to the left and the right, and loss of fixation with loading. Slit lamp examination was unremarkable, and dilated examination revealed lattice degeneration with no holes in both eyes. We recommended that she return in one week for a developmental vision examination, which is an extensive examination that tests visual information processing and perception, as well as ocular motility, accommodative, and binocular function.

At the developmental vision examination, Lisa filled out a COVD Quality of Life Questionnaire. She was obviously very anxious, so I sat with her. She filled out the questionnaire, and at the bottom wrote out more specific items with which she was having difficulty that were not on the questionnaire. These items included things like not being able to gauge the depth or width of stairs and not being able to understand where her feet were, especially when she was on a "busy" floor. She also confided to me that she was concerned about losing her job as a pharmacist because she was no longer able to read well enough to perform her duties. Her score on the quality of life questionnaire was 48 (any score above 20 indicates a potential vision problem and warrants further testing). She was particularly symptomatic in areas that concerned reading comfort and comprehension, memory and organization, and spatial awareness.

Through extensive testing, we found that Lisa had reduced accommodative facility (monocular testing revealed 3 cpm OD and 2 cpm OS using 20/40 letters and +/-1.50 flippers) and saccadic deficits (DEM testing revealed horizontal and vertical times which put her in the 0th percentile for her age). Testing also revealed that she had moderate deficits in visual closure and tachistoscopic tasks, testing in the 38th and 25th percentiles for her age, respectively, as well as severe deficits in visual span, testing only into the 1st percentile. Fusional ranges were normal. Lisa reported left eye suppression at 6 feet when tested with Pola-Mirror. The Test of Visual Perceptual Skills (TVPS) revealed deficits in all seven tested perceptual areas (visual discrimination, visual memory, visual-spatial relationships, form constancy, visual sequential-memory, visual closure, and visual figure-ground); all were either at or below the 37th percentile for her age. Primitive reflex testing was mostly normal, with the exceptions being a mild spinal galant reflex and a pervasive tonic labyrinthine prone response. Results of this examination are outlined in Table 1.

At the practice at which I was interning at the time of this examination, we tested all patients who received a developmental evaluation for Chromagen lenses. For those who are not familiar (I was not until I started my internship at this particular clinic), Chromagen lenses are based on the idea that the magnocellular pathways of the two eyes are ever so slightly "out of sync." Because of the inequality of transmission speeds between the two optic nerves, patients who are helped by these lenses often report symptoms of words floating up off the page, sinking down into the page, pulling apart, or scrunching together prior to treatment with Chromagen lenses.[3] As the name suggests, these lenses use very specific tints to equalize the transmission speeds between the two eyes. The Chromagen website provides numerous anecdotal examples of the lenses working for people who struggle with reading. There is minimal research concerning Chromagen lenses; however, there are several studies that

Table 1. Results of Developmental Eye Examination

Visual Closure	25th percentile (slightly below average)
Tachistoscope	52nd percentile (average)
Visual Span	38th percentile (slightly below average)
Saccades	100% correct, average time: 1.11 sec
Pursuits	98% correct, average time: 0.74 sec
Accommodative Rock	OD: 3 cpm OS: 2 cpm difficulty clearing plus lenses
Vergence Facility	13 cpm
BI Break/Recovery	21^/9^
BO Break/Recovery	74^/74^
Gardner Reversals	0 errors @ above 77%
Piaget	0 errors
Wold Sentence Copy	138 lpm
DEM	Vertical time: 51.5 sec @ 0% Horizontal time: 58.9 sec @ 0% Ratio: 1.14 @ 35%
DEM with Chromagen Lens	Vertical time: 47.9 sec @ 1% Horizontal time: 43.2 sec @ 25% Ratio: 0.91 @ 99%
Moro Head Drop Reflex	Absent
Moro Duck/Pigeon Walk	Mild Pigeon
TLR Standing	Pervasive
Spinal Galant	Mild
ATNR	Absent
STNR	Absent
HRR	Absent
Palmar	Absent

look at using colored filters for some patients diagnosed with learning disabilities based on the idea that there is some deficit in the magnocellular pathway in those individuals. The results of these studies are mixed, some reporting that colored filters may help these individuals, some reporting that there was no improvement for these individuals.[4-8] This topic shows great opportunity for further research.

Prior to testing, the patient filled out another symptom-based questionnaire of eleven questions that focused on near work and reading, asking whether the patient experienced each symptom never, sometimes, or always. Lisa's score was 17 (highest possible score is 22; Appendix 1). Lisa was asked to read a paragraph of nonsense text to determine her reading speed. She was then given another 8-question survey asking specifically about symptoms experienced during the testing. Lisa scored 5, with the highest possible score of 16 (Appendix 2). We then subjectively determined exactly to which lenses Lisa best responded for each eye.

In this procedure, the examiner holds two lenses and asks the patient to look at senseless text. The patient is told to give a "gut instinct" response as to which lens they prefer. There are 16 different colored filters, and the best lens is narrowed down by continually asking the patient which lens they prefer. This is done binocularly; however, the examiner starts with the non-dominant eye and then repeats the entire process for the dominant eye. The patient is then again asked to read a sample of nonsensical text with the chosen lenses and completes the same 8-question questionnaire. Lisa's symptom score was zero with the lenses. She reported that words no longer floated or "scrunched in" and that all of the words were the same in terms of brightness. Previously, she described that some words were bold while others where very faded, and they never stayed in focus. We then re-tested her DEM with the Chromagen lenses, and immediately she moved from the 0th percentile to the 25th percentile on her horizontal time and from the 35th to 99th percentile on her ratio.

After testing was completed, Lisa, her significant other, myself, and the doctor with whom I was currently working sat down with Lisa and went through her test results. We discussed the Chromagen lenses, and while she was very pleased with the result, she still was not convinced that they would help her. She again trialed reading various different media and reported that the lenses did help. We conspicuously had her switch the tints (place the tint intended for her right eye over her left eye and vice versa) to see if she noticed a difference; she reported almost immediately that she started to feel an oncoming headache.

We then brought Lisa outside. With the lenses in their proper places, we asked Lisa to look at the road at oncoming traffic. I will never forget

what happened when she did. Immediately, she took the hand of her significant other and said, "I can tell how far apart the cars are! I can tell that that's a curb across the street! I can tell which cars are parked and which ones are moving!" She then then started crying, gave the doctor a hug, and said, "I forgot that people can see this way!" She could sense depth again! The joy and excitement that Lisa was experiencing was intensely moving for me and completely reaffirmed my belief in the power of optometry and the unique position we have as optometrists to completely and profoundly help people. Further proof of success is seen by the post-Chromagen questionnaire of 0 (Appendix 3).

Conclusion

While I have always been passionate about vision therapy and vision rehabilitation (I was an elementary school teacher prior to starting optometry school, learned about the Brain Gym program for my classroom, and have never looked back since!), it is cases like Lisa's that constantly reignite my passion for this line of work. At the time of this writing, we had not even started vision therapy, and already Lisa had a renewed hope. She now understands that she has the capability to succeed and that everything she lost from her injury can be regained. Prior to our assessment, I got the sense that she had accepted that she was just going to have to continue to struggle through her job and that this was just "how things are" now. Ironically, the evening after I had this encounter with Lisa, I received an email announcing the Optometrists Change Lives writing competition. Cases like Lisa's embody how optometrists can change lives!

References

1. Cdc.gov. CDC Get the Facts: Traumatic Brain Injury. 2015. Available at: http://1.usa.gov/1UhuDj6. Last Accessed May 26, 2015.
2. Faul M, Xu L, Wald MN, Coronada VG. Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalization, and Deaths. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2010. http://bit.ly/TBIbluebook
3. Chromagen US. Chromagen Lenses of Chromagen Europe for Dyslexia and Colour Blindness, Producer and worldwide distributor of Chromagen Lenses, Colour Deficiency, ideas and designs worldwide. 2015. Available at: http://www.chromagen.us/. Last Accessed June 25, 2015.
4. Bradley A. Special review: Colored filters and vision care, Part 1. Indiana J Optom 2003;6(1):13-7. http://bit.ly/1NlDxGA
5. Bradley A. Special review: colored filters and vision care, Part 2. Indiana J Optom 2004;7(1):2-7. http://bit.ly/1Klyb9r
6. Evans B, Drasdo N. Tinted lenses and related therapies for learning disabilities – A review. Ophthal Physiol Opt 1991;11:206-17. http://bit.ly/1XSHdoh
7. Skottun B. The magnocellular deficit theory of dyslexia: The evidence from contrast sensitivity. Vis Res 2000:111-27. http://bit.ly/1i39doq
8. Stein J, Walsh V. To see but not to read: The magnocellular theory of dyslexia. Trends in Neurosci 1997;20(4):147-52. http://bit.ly/1OG51pl

Correspondence regarding this article should be emailed to Emily Aslakson, OD at easlakso@indiana.edu.

Aslakson E. I forgot people could see this way! A case study. Optom Vis Perf 2015;3(BSK):26-31.

Appendix 1: Symptom questionnaire prior to testing

ChromaGen® Survey – VISION ISSUES SECTION

The *Vision Issues* Section of the survey has been proven to be effective in identifying if a person is struggling with vision related issues that cause the symptoms outlined below while reading. These symptoms are sometimes referred to as the "Nagging Symptoms."

The following questions were answered by putting √'s in the corresponding column of the response.

	Never	Sometimes	Always
1) Do you get headaches when reading?		√	
2) Do you get nausea or stomach aches when reading?	√		
3) Do your eyes feel tired when reading or after you read?			√
4) Do your eyes get red, irritated, or watery when reading?	√		
5) Do you feel a "pulling" or "pressure" around your eyes when reading?			√
6) Are your eyes sensitive to bright light?			√
7) While working on the computer, do you get headaches, eyestrain or fatigue?			√
8) Do you lose concentration when reading?			√
9) Do you lose your place when reading?			√
10) Do you have to re-read the same line of words when reading?			√
11) Do you think your handwriting is sloppy or crooked or has uneven spacing or different size letters?			√
Score: 17	x0	x1	x2

Appendix 2: Symptom questionnaire during testing

ChromaGen® Survey – WORD MOVEMENT SECTION

The *Word Movement* Section of the survey has been proven to be effective in determining if a person sees words that appear to be moving on the page when reading or words that are not clear or are not in focus.

The following questions were answered by putting √'s in the corresponding column of the response.

	Never	Sometimes	Always
1) Do words or sentences become blurry or wiggly when reading?	√		
2) Do words or sentences come in and out of focus when reading?	√		
3) Do words ever move from side-to-side or up-and-down when reading?		√	
4) Do words "float up" or "pop out" when reading?		√	
5) Do words ever "scrunch together" or "pull apart" when reading?	√		
6) Do you have double vision or see two words or sentences when reading?		√	
7) Do words move, jump, swim, or appear to float on the page when reading?		√	
8) Are the white spaces in between the lines more noticeable when reading or do the spaces move when reading?		√	
Score: 5	x0	x1	x2

Appendix 3: Symptom questionnaire post treatment

ChromaGen® Survey – WORD MOVEMENT SECTION

This is the POST *Word Movement* Section that should be administered after the screening process and when the patient is wearing their chosen ChromaGen Lenses in the trial frame. The score on this POST Word Movement Section should be compared to the PRE Word Movement Section to determine symptom abatement with ChromaGen Lenses.

The following questions were answered by putting √'s in the corresponding column of the response.

	Never	Sometimes	Always
1) Do words or sentences become blurry or wiggly when reading?	√		
2) Do words or sentences come in and out of focus when reading?	√		
3) Do words ever move from side-to-side or up-and-down when reading?	√		
4) Do words "float up" or "pop out" when reading?	√		
5) Do words ever "scrunch together" or "pull apart" when reading?	√		
6) Do you have double vision or see two words or sentences when reading?	√		
7) Do words move, jump, swim, or appear to float on the page when reading?	√		
8) Are the white spaces in between the lines more noticeable when reading or do the spaces move when reading?	√		
Score: 0	x0	x1	x2

OPTOMETRISTS CHANGE LIVES™

OPTOMETRIC EXTENSION PROGRAM FOUNDATION

HOYA

Optometrists Change Lives™ Student Writing Competition

The Optometric Extension Program Foundation, HOYA Vision Care, Goodlite Company and Beta Sigma Kappa will present the annual award or an outstanding original paper submitted by an optometric student in the field of visual performance.

The award recipient will receive a "VT Starter Package" of goods and services, including products from Goodlite and books from the Optometric Extension Program Foundation, the sponsoring organizations, valued at $500. The winner and two runners-up will receive $250 towards travel to an OEPF Regional Congress, OEPF Clinical Seminar or the Conference on Clinical Vision Care (CCVC).

What are the requirements?

- The article can be on any topic related to visual performance
- Can be a Case Report, Review Article, or Article of Discovery (research)
- Must be original, unpublished work
- Minimum length is 1500 words
- The style must follow *Optometry* & *Visual Performance* guidelines.

Who is eligible?

- The applicant must be a full-time student in an optometric program

How does it work?

- Articles must be submitted to the Editor In Chief of *Optometry* & *Visual Performance*, Marc B. Taub, OD (mtaub@sco.edu) by April 1st.
- The winner will be selected by the *Optometry* & *Visual Performance* editorial board and announced May15th.