Article • Let the Students Speak: Essays on Pediatrics and Vision Therapy from Southern College of Optometry 4th Years

ABSTRACT

Almost 15 years ago, the Glen Steele and Al Fors Scholarship was created at Southern College of Optometry. It honors two Professors Emeriti who taught several generations of SCO students in the areas of pediatrics and vision therapy. The college prides itself on keeping student debt as low as possible, and one of the ways it does so is through scholarships. As part of this scholarship, the 4th year students are asked to write an essay on vision. We keep the instructions vague, as we want to see where the students take the essay. This year's crop of essays covered a variety of topics, and with the students' permission, we wanted to share their most excellent essays over the next two issues. Hopefully their visions give you pause and allow you to reflect on your model of vision.

Mallory Cook, OD

Vision therapy to me has been like a treasure chest. From the outside, people may not understand what the hype is all about, but after experiencing the effects of vision therapy for myself as a patient, therapist, and future provider of vision therapy, it seems wrong not to share that with others.

I was first introduced to effects of vision therapy after receiving diagnoses of convergence and accommodative insufficiency secondary to a traumatic brain injury that I was not aware of at the time of the injury. I learned that double vision, moderate motion sickness, and recurrent panic attacks in crowded places weren't things that are 'normal,' though they became common for me. After being at SCO and learning the lasting effects of mild and moderate TBI and the more subtle signs and symptoms, I quickly realized that I had sustained a concussion(s) while playing college softball that was brushed off and not properly cared for.

Luckily, I was introduced into the world of vision therapy and rehabilitation, and I was prescribed tinted lenses and microprism, both vertical and horizontal. I was put through vision therapy for convergence insufficiency, accommodative dysfunction, and motion sensitivity and was so relieved to have a doctor that seemed to understand what I was explaining was wrong. It was a relief and a joy to go through the vision therapy program at SCO and understand how to control my visual system and the information that I was taking in. My biggest moment in recognizing the validity of vision therapy was being able to read an entire book in the car on a 9-hour road trip towards the end of my therapy. This was an achievement that I didn't know was possible for me with the extent of the motion sickness I had previously suffered from. It was a moment which I look back on today and think that it is something that I want my future patients to be able to experience, so I must learn how to implement this into my future practice.

It came around as a full-circle moment when I elected to do one of my three externship rotations at Wow Vision Therapy in Grand Rapids, Michigan, and was now learning those exact skills on the doctor and therapist side of it all. I was fortunate to be the one now evaluating these patients and teaching them the skills that I had learned along my own journey as a patient and an extern. Seeing their progress in vision therapy, relief when introducing prism, joy after mastering a skill, and binocularity improving confirmed that this is something I must pursue in practice. After externing at Wow Vision Therapy I also plan to implement a more developmental approach to my lens prescribing, strabismus, and amblyopia therapies. I have seen, firsthand, the extremely beneficial effects of virtual reality, MFBF, and dichoptic training on patients with amblyopia with or without accompanying strabismus. After seeing vision therapy in the private practice setting, I became more grateful that we were introduced to these topics in our training at SCO and didn't understand that not everyone had exposure to that same methodology in other programs.

I am filled with joy to express that I have accepted a position at Neuro Visual Performance Institute, a vision therapy practice in Versailles, Kentucky. I am eager to have a similar impact on patients with a range of binocular vision disorders and provide vision therapy to central and eastern Kentucky. I am grateful for the pediatric and vision therapy doctors at SCO for introducing this path to me and hope to make as much of an impact on my patients as they have on me.

Amy Overland, OD

In, out, up, or down, strabismus comes in a vast array of differing clinic presentations. Such a diagnosis

comes with several important factors to rule out before therapeutic intervention can begin. These factors include varying etiologies, such as restrictive, hemorrhagic, neurological, or refractive, to name a few. Reasons for strabismus that can be solved with better control of systemic health issues or removal of a mass will typically allow for improvement without the need of therapy. Amblyopia, while sometimes presenting alongside strabismus, is defined as reduced vision in the absence of ocular pathology. Commonly associated with refractive error, amblyopia can also be caused by deprivation, or a blockage of the light coming through the eye due to a physical entity. Whatever the steps leading up to a diagnosis of amblyopia or strabismus, when a patient or parent is sitting in my chair asking what to do, it is important I remember my three R's: "Refract, Reconnect, Red/Green."

Prescribing corrective lenses is often an essential first step in strabismus and amblyopia treatment. This step is one that leaves optometrists contemplating the appropriate prescription to write. After all, many factors must be taken into consideration, meaning that the correct answer is often unclear. Best-corrected visual acuity, lens minification/magnification, improvement of ocular alignment, and the perception of space through such lenses are some of the influences on how one's visual experience can be affected.

During my time at both my externship rotations, it was expected that new patients arriving with TBI or for a binocular evaluation would recheck refraction and complete lensometry on any current spectacles. Assuming that the addition of prism or tinting was unnecessary, patients' spectacle prescriptions weren't updated unless there was an improvement associated with the change. At first, I didn't understand the necessity, especially for patients that had been referred by other optometrists for a vision therapy evaluation. Over time, however, I was able to correctly identify those who could benefit from a prescription change, even if it was a minor one. These cases gave me an understanding and appreciation on the impact an accurate refraction can have on the binocular system.

Once the patient has the appropriate glasses prescription, additional treatment options include full or partial occlusive patching and/or atropine penalization of the better-seeing eye. Though atropine is one of the oldest techniques used for the treatment of amblyopia, it is not used for patients with strabismus. Instead, patching is commonly the treatment of choice for strabismus. The theories behind blocking or degrading the signal of the non-strabismic or amblyopic eye is to force engagement of the eye showing a deficit. This forced reconnection of the strabismic or amblyopic eye can work to strengthen or jump start the neurological signals sent to the brain to allow for normal visual development. Up until this point in treatment, the brain has been allowed the opportunity to ignore the signals sent by the deficit eye and focus only on the signals sent by the clearer, comfortable-seeing eye. This phenomenon is known as suppression. However, if there is no suppression and the brain is receiving and attending to both eyes, it can cause diplopia and confusion for the patient. Either way, reconnecting and forcing the brain to attend to the eye exhibiting amblyopia and strabismus allows for equal opportunity and better success when the eyes are then asked to work together.

Following improvement with refraction and reconnecting the signals from the eye to the brain with monocular techniques, binocular and anti-suppression therapies, such as in the utilization of red/green glasses, are appropriate to teach the brain coordination and fusion. Anti-suppression activities are when the patient is tasked with watching or participating in an activity wearing red and green glasses. With opposing colored lenses over each eye, if the brain is not attending to both eyes, the activity cannot be completed. Binocular therapy exercises, in contrast, work to team the eyes together and encourage stereopsis. True stereopsis is seen through bi-foveation and the appropriate perception of space around them. Thus, it is important that the brain is able to equally process the information sent from both eyes without suppression in order to appreciate and understand true binocularity and stereopsis.

I had the opportunity to extern at two clinics who took differing methods when it came to working with younger patients presenting with strabismus and/or amblyopia. One of the offices took the approach of skipping monocular occlusion and atropine to focus solely on therapeutic techniques to build up stereopsis, anti-suppression, and binocular vision. Although not widely studied or used for strabismus, these doctors were also incorporating the use of technology, like CureSight and Luminopia, for at-home therapy in lieu of in-office therapy for many of their amblyopic patients. The second office relied heavily on the evidence-based medicine associated with monocular patching and/or atropine use until the age of 7 years old. While they did not dismiss anti-suppression or binocular therapy, their initial approach was to stick with patching and the use of atropine for their younger patients with strabismus and/or amblyopia.

While neither office offered an inappropriate initial treatment to their strabismic and amblyopic patients, it can be confusing for new graduates to choose a preferred method. While I see the benefits of both approaches, the dedication of time and resources to

effectively carry out "Refract, Reconnect, and Red/Green" are much more considerable than skipping the middleman and jumping straight from "Refract to Red/Green." At this early point in my career, I think I am most motivated to try out both techniques on patients and tailor my treatment protocols based directly upon my patient's experiences and outcomes.

Lastly, when it comes to strabismus treatment, most of the options discussed throughout this paper thus far have been geared towards teaching the patient about awareness of alignment and binocular vision. Many cases, however, warrant prismatic addition or surgical intervention. Prism is a great option for patients that are experiencing diplopia and cannot tolerate patching or those who are unwilling to partake in vision therapy. It is possible that prescribed prism can be reduced throughout the vision therapy course as vergence skills are improving. On the other hand, some patients look to prism to cosmetically straighten their ocular alignment during the course of vision therapy, demonstrating the two methods working in tandem.

I've had the pleasure of working with a handful of patients who were asking specifically for cosmetic alignment of their strabismus that was caused by pathology, including optic neuritis and optic atrophy. In these instances, prism was trialed in office for alignment of the eye from an outsider's perspective. Due to this cosmetic use of prism, it initially surprised me to see the opposite prism direction being used for alignment. It was also exciting to be a part of the careful balancing act being performed to find the neutral area between alignment and sparking any residual neural connection between the deficit eye and the brain.

Treatment of amblyopia and strabismus can be an uphill and ongoing fight for both optometrist and patient. The fragility of the binocular system can sometimes be overlooked until it is displaced by a high refractive error, eye misalignment, concussion, or illness. Nevertheless, I am both energized and motivated to take on challenging cases as I step into my new role working in vision therapy. I know my foundation is strong from hands-on experience and rigorous didactic coursework at Southern College of Optometry and my externship sites. My confidence and understanding continues to grow as I reflect, recognize, and rally as a budding clinician.

Kristen Trainer, OD

What is Vision Therapy?

Vision therapy trains the brain to accurately locate and focus on a target. This is the sentence written on every single vision therapy lab handout. While this is true, I believe vision therapy is so much more than that. It's a second chance for elderly stroke survivors, and it's a fresh start for children who are falling behind in school due to oculomotor dysfunction, convergence insufficiency, and strabismus. Vision therapy is something patients look forward to all week—playing games with their friend Dr. Taub or getting out of the house once a week to catch up with Dr. Maze.

Vision therapy is performing visual tasks to strengthen control of the eyes, improve awareness and flexibility, and to reduce symptoms. It is not an exact science, and there is not a rule book of activities to follow to resolve the patient's troubles. Some patients progress faster than others, even with the same diagnoses; this is why it is important for vision therapists to fully understand the exercises and the art of vision therapy.

Most vision therapy is conducted by performing one- to two-hour sessions per week in-office with a trained vision therapist, in addition to completing activities at home for thirty to sixty minutes per night. The success of vision therapy relies heavily on the individual patient's persistence and desire, which is why at-home activities are vital.

In general, tasks are performed based on order of complexity. Monocular skills, such as accommodation and oculomotility, come first to set the foundation. Then bi-ocular and anti-suppression tasks are practiced, which are followed by binocular therapy. The overarching goal of progressing through therapy is accuracy first, then speed.

My personal favorite vision therapy exercise is the Brock string. It is a binocular exercise that is performed to improve the accuracy of convergence and divergence, as well as the voluntary ability to do so. The materials needed for the activity include a string (roughly 10 feet long), different colored beads, and glasses if necessary for the patient to see clearly. One end of the string is tied to a stationary object, and the other end is held at the tip of the patient's nose. Several variations of the exercise can be performed, including bead jumping, where the eyes are focused quickly from one bead to another, and "bug on a string," which is performed by pretending there is a bug crawling towards or away from the patient slowly. To check the accuracy of convergence and divergence, the patient must be aware of where the strings cross while looking at a particular bead. If the strings are crossing behind the bead, the patient is not converging enough, and conversely, if the strings appear to cross in front of the bead, the patient is converging his or her eyes too much. If the patient reports the string crosses directly at the bead, the patient's convergence is accurate. Brock string can also increase peripheral awareness and appreciation of physiological diplopia;

when focusing on a particular bead, the bead farther from the patient should appear as two. Suppression can be checked with this exercise by making sure the patient sees two strings meeting at each bead; if the patient is suppressing an eye, he or she will report only one string at the bead. Endurance may also be improved, as this exercise is quite tiring after only a few minutes. The reason Brock string is my favorite vision therapy exercise is because it is easy to explain to the patient and it gives immediate feedback on whether the patient is using both eyes when focusing both near and far.

In the end, vision therapy is what you make of it. It's hard work for the patients (and the doctors), but it's also a time of fun and reward in most cases. Vision therapy provides a chance at improving your patient's quality of life, one Brock string at a time!

Madhurima Kota, OD

Amblyopia, often referred to as lazy eye, and strabismus, commonly known as crossed eyes, are two prevalent ocular disorders that have posed challenges in patients of all ages. These conditions typically manifest during childhood, potentially leading to lifelong visual impairment if not diagnosed and treated early. Traditional treatment options have included patching, corrective lenses, surgery, and vision therapy. However, with recent advancements in artificial intelligence (AI), there are new effective interventions revolutionizing how these conditions are diagnosed, treated, and managed.

Amblyopia occurs when vision in one eye does not develop properly, resulting in the brain favoring the other eye for functional vision. While amblyopia is considered a diagnosis of exclusion, some of the more common causes that can lead to it include strabismus, refractive errors, or visual deprivation. Current treatment methods of amblyopia include patching the stronger eye, vision therapy, atropine drops, and dichoptic visual training with virtual reality headsets. Although there are options, it is important to note that these approaches face limitations. Compliance with treatments like patching is poor, and outcomes are variable depending on the age of diagnosis and the severity of the condition. Strabismus, which can be congenital or acquired, is a condition where the eyes are misaligned, leading to double vision and/or poor depth perception. It can also lead to amblyopia if left untreated. While surgery is a common approach to correcting the alignment of the eyes, it doesn't address the neurological aspects of the disorder, such as the brain's ability to fuse the two images received from both eyes. In both cases, early intervention is critical for achieving the best possible outcome. Unfortunately, if diagnosis happens too late, the treatment may not yield optimal results for the patient.

Artificial intelligence has the potential to transform the treatment and management of amblyopia and strabismus through early detection, leading to a more accurate diagnosis. Optometrists can use AI to aid in and provide advanced metrics on eye movement tracking, an analysis of retinal scans and photographs, and videos to catch subtle signs of these conditions before diagnostic symptoms become noticeable through routine eye exams. For example, AI can assess ocular alignment and movement to detect early indications of strabismus, while independent eye-tracking devices can monitor visual performance to spot amblyopia. As there are already approved eye tracking devices on the market to evaluate for other binocular vision disorders, AI can utilize the results of these tests and analyze patients with their peers to assess for trends leading to amblyopia.

In the current treatment and management of these conditions, vision therapy has been a popular option among many practitioners. While traditional vision therapy programs are personalized to the patient and their diagnoses, they are limited in the possibilities of actives available to help reach the end goal. AI can assist in modifying the exercises to adapt to the patient's progress as they continue throughout their program. Without the limitation of physical materials, the possibilities of activities to train all binocular disorders are endless. AI has the potential to integrate virtual or augmented reality into vision therapy. These systems can create immersive environments where the patient engages in games and exercises designed to improve binocular vision, eye coordination, depth perception, and more. While there are already VR headsets designed to assist in certain binocular vision conditions through specific games, there is not a complete program that allows for continued monitoring and tracking based on all of the patient's diagnoses. AI algorithms can observe a patient's progress in these virtual environments and adjust the therapy to provide optimal visual training, ensuring that patients remain engaged and motivated throughout their treatment. This level of personalization will lead to a more efficient and effective treatment compared to traditional methods.

The treatment of amblyopia and strabismus is often not a one-time intervention, but rather an ongoing process that requires regular monitoring and follow-up visits. AI can play a critical role in long-term management by providing continuous accurate data of the patient's visual development. This advance in optometry has the potential to extend beyond the exam room. AI-powered applications can enable

patients to monitor their vision at home using tools that track their eye alignment and visual acuity for home therapy exercises. This eliminates any confusion and can alert both patients and clinicians to deviations that may suggest a regression or the need for further treatment, ensuring that interventions are timely and effective. Furthermore, AI can support post-treatment rehabilitation. After completing primary treatment, traditional vision therapy expects the patient to take part in ongoing exercises at home to maintain their visual improvements. AI-driven apps and devices can continue to provide adaptive vision therapy, ensuring that patients do not lose the progress they've made.

As with any technological advancement, it is important to address that the integration of AI into amblyopia and strabismus treatment brings along ethical considerations. Issues such as data privacy, the role of AI in clinical decision-making, and the accessibility of AI-driven treatments must be disclosed to ensure equitable and responsible use of these technologies. Additionally, while AI can significantly improve treatment outcomes, it should complement, not replace, the expertise and judgment of healthcare providers.

The future of amblyopia and strabismus treatment with artificial intelligence as a tool holds extensive promise. As AI continues to evolve in all aspects of human life, not just healthcare, its applications in early diagnosis, personalized treatment, and long-term management will likely lead to more effective, accessible, and cost-efficient care. AI will play a central role in shaping the future of eye care, and optometrists have the opportunity to integrate AI into clinical practices that will bring about a more accurate, efficient, and patient-centered approach to binocular vision disorders.