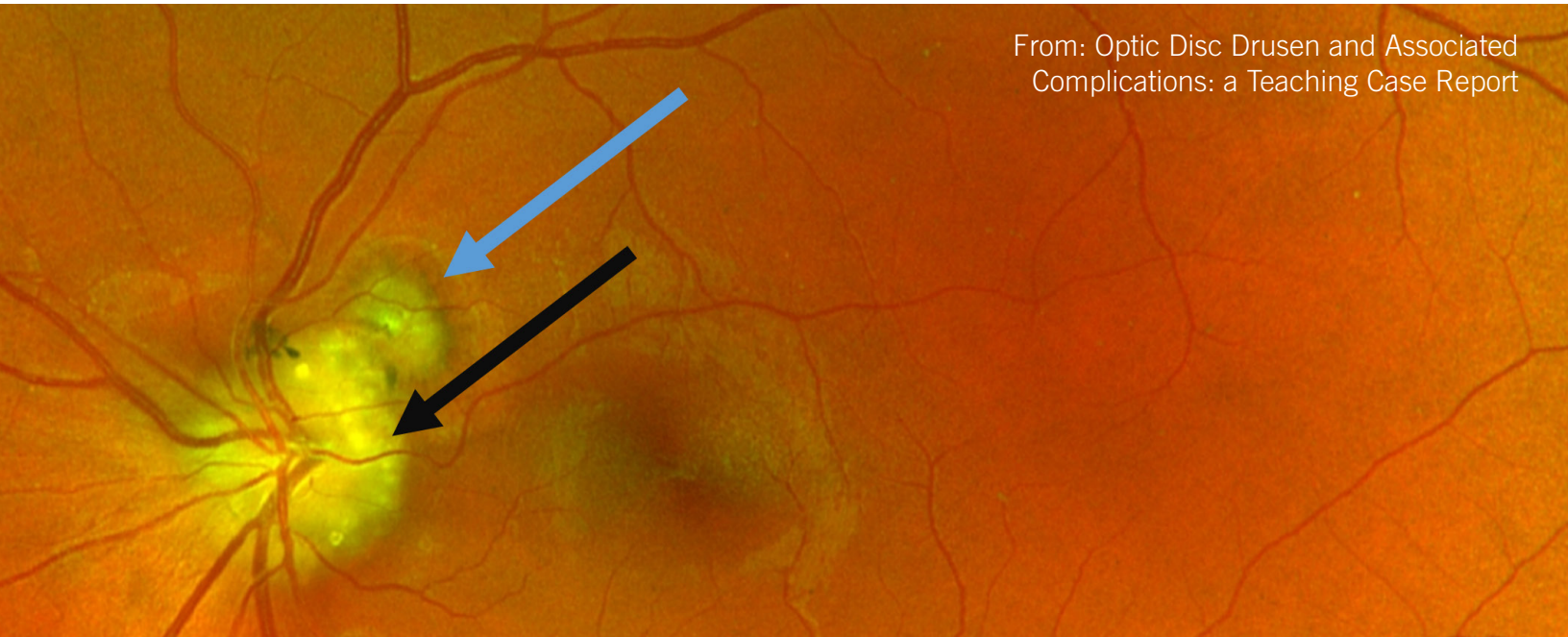


OPTOMETRIC EDUCATION

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From: Optic Disc Drusen and Associated
Complications: a Teaching Case Report



GRIT Survey Score in First-Year Optometry
Students: Pre-COVID vs. Mid-COVID

Binasal Hemianopia: an Observational Teaching
Case Report and Review of a Rare Visual Field
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VOSH/International and the Development of Optometry in the Latin American Region

Emiliano Teran, PhD | Optometric Education: Volume 48 Number 1 (Fall 2022)

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Emiliano Teran, PhD

Volunteer Optometric Services to Humanity (VOSH)/International is an organization devoted to providing vision care around the world through humanitarian clinics.¹ For its commitment to providing access to quality eye care in underserved communities, VOSH/International received the 2022 Jenny Pomeroy Award for Excellence in Vision and Public Health from Prevent Blindness.²

Volunteers, who include optometrists, ophthalmologists and lay people, organize and work in the clinics. Their efforts allow thousands of people, as many as 5,000 per week, to be evaluated and receive treatment for vision impairments. Optometry students who are members of Student Volunteer Optometric Services to Humanity (SVOSH) chapters at their optometry schools in the United States and many other countries are also among the clinic volunteers who help to provide care. (The process for opening a student chapter at your school is not difficult. [Email VOSH/International Executive Director Maria Arce Moreira for more information.](#)) In addition to their philanthropic aspect, the clinics are great opportunities for students to improve their clinical skills, gain exposure to diverse patient populations and observe vision conditions they may not see in their home settings.

Partner organizations may also be part of VOSH/International clinics. In my experience as an academic advisor to the SVOSH Autonomous University of Sinaloa (UAS) chapter in Mexico³ and a member of the VOSH/International Latin American Advisory Committee, strategic alliances with local optometry schools and other organizations increase the success of the clinics. For instance, in our most recent local humanitarian clinics we worked with the local Lions Club, who helped us to bring food bags to the participating families.⁴

Latin American communities have received strong support from VOSH/International through the humanitarian clinics. Here, I highlight other VOSH initiatives that have benefited this region as well as more the organization is developing. These include efforts to enhance the optometric profession's level of education and increase the number and quality of vision science research opportunities. Also, I suggest how optometry students in the United States could further help people around the world while improving their own skills.

Many Avenues of Support

Strategic alliances

VOSH/International continues to establish strategic alliances with organizations in Latin America to enhance its support. One of the most fruitful has been with the Latin American Association of Optometry and Optics (ALDOO in Spanish), where students and optometric faculty are committed to improving optometry in the region.

International student chapters

A VOSH/International pilot program aims to support international SVOSH chapters by providing scholarships of \$1,500 as a resource for enhancing their activities. Although this may not seem like a large amount, it is a huge help. For example, our UAS student chapter received this aid in 2019 and 2022. It helped us to publish the results of our research in 2020 and to move forward with our programs in 2022.^{5,6} I hope this pilot program can be replicated to help more chapters around the world.

Regionally focused committee

To address the specific needs of the region, VOSH/International created the Latin American Advisory Committee. I am an active member of the committee along with Beatriz Serna, OD, from Mexico, Jairo Mercado, OD, from Nicaragua, and Severo Sanchez, MSc, from Peru. We promote ideas for enhancing regional development in the profession of optometry and eye care

and are working hard to promote ideas for elevating optometry in Latin America. We believe expanding alliances with other organizations, such as ALDOO and the World Council of Optometry (WCO) would help us to achieve our goals.

Research

In 2019, VOSH/International obtained a grant from the One Sight Essilor Luxottica Foundation to study refractive error in children in Latin America. This assistance has had a positive effect on research by improving optometry students' skills and informing governments on the prevalence of refractive error. Moreover, it enabled children from vulnerable zones of the city to receive vision care.

To further promote optometric research in the Latin American region, VOSH/International created a scientific committee. Sandra Block, OD, MEd, MPH, FAAO, FCOVD, FNAP, President of the WCO, Bruce Moore, OD, Professor Emeritus from New England College of Optometry, and Hector Santiago, OD, PhD, Vice President of VOSH/International are the committee members. This committee is helping to develop research in the region. Currently they are helping to develop a project in hyperopia and learning performance. In addition, they helped to improve the implementation of the project that evaluated the prevalence of refractive errors in children in the Latin American region. Our UAS SVOSH chapter learns from them to develop our research projects. The goal of the scientific committee is to create more advisor groups to other faculties and students from Latin America.

The creation of this research-focused committee is a good opportunity for optometry faculty and students from the United States and researchers from Latin America to work together for mutual benefit. For instance, U.S. faculty and researchers in vision science can help researchers and optometry students in Latin America with study design, results analyses and manuscript writing, while the Latin American teams collect data.

Education

For many years VOSH/International has been supporting optometry in the Latin American region with lectures on optometry and vision care. VOSH has a short-term mentorship program called the Ambassador Program in which an optometrist from the United States visits schools in Latin America to teach. Another VOSH program, VOSH Corps, provides a longer-term teacher and mentor. One of the beneficiaries of VOSH Corps was the optometry program in Nicaragua, where they used help from VOSH to establish a successful optometry school in the National Autonomous University of Nicaragua. Also, VOSH/International Immediate Past President J. Dan Twelker, OD, PhD, FVI, visited Puerto Principe, Haiti, to provide lectures at the brand new optometry school.⁷ These are only two of the many lecture programs presented at schools and events in Latin America.

VOSH/International also shares the expertise of its members through talks to the student chapters. Recently, President Michael Ciszek, OD, diplomate ABO, FVI, presented a talk to the annual meeting of the Mexican Association of Faculty, Schools, Colleges and Councils of Optometry in Torreon, Coahuila, Mexico.⁸ In this meeting Dr. Ciszek outlined the benefits of being a member of VOSH/International and reported the achievements of its chapters and student chapters.

Many workshops to improve the skills of optometrists in the region have been carried out as well. For instance, in 2018 the UAS SVOSH chapter organized a workshop focused on research. In this workshop, Dr. Twelker shared his expertise in writing manuscripts. Likewise, he presented a workshop about improving refraction procedures for the students of the optometry program. Last year, VOSH/International and the UAS SVOSH chapter presented a workshop about writing scientific manuscripts in English, which was co-organized by Alcanza Language Consultants.⁹ This workshop was a great experience for the optometry students and graduated optometrists interested in research who attended from many countries in Latin America.

Strengthening Student Collaboration

I believe SVOSH members in the United States and Latin America have much they can share with each other, too. U.S. students could make a significant difference by sharing their knowledge and experience with their peers in Latin America. One opportunity might be for students from U.S. SVOSH chapters to give talks for international chapters via a video conferencing platform. It would be interesting to build more solid bridges between students from the United States and Latin America, where the purpose to provide primary vision health to people is the same, but the scenarios are very different.

Forging Ahead

As it has for many organizations, the COVID-19 pandemic reduced VOSH/International's resources. However, the group is well-organized, has a strong commitment to assisting others, and is developing smart strategies to maximize resources in Latin America. It has been a great start, and potential for the future is even greater.

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Hemi-Spatial Neglect as a Consequence of Acute Cerebrovascular Accident: a Teaching Case Report

Benjamin Young, OD, FAAO | Optometric Education: Volume 48 Number 1 (Fall 2022)

[PDF of Article](#)

Background

Hemi-spatial neglect is a failure of awareness on the side and space opposite the site of brain injury.¹ The most common etiology of hemi-spatial neglect is hemorrhagic or ischemic cerebrovascular accident (CVA), commonly referred to as a stroke.¹ Patients with hemi-spatial neglect fail to recognize or attend to objects on the left or right side of the visual field and are often unaware of these deficits.² Optometrists can perform paper- and pencil-testing such as clock drawing, scene copying and line bisection to support the diagnosis of hemi-spatial neglect in-office.³ The sudden onset of this finding warrants urgent imaging studies such as a computed tomography (CT) or magnetic resonance imaging (MRI) to elucidate the etiology of the deficit.⁴ Failure to diagnose acute CVA may occur if the CT scan is negative and the patient is unable to recognize the visual dysfunction.

Purpose

The following case report outlines the outcome of a consult that was placed from the emergency room to the on-call optometrist after a negative CT scan. The role of optometry in a hospital setting is explored, and the pathophysiology, clinical manifestations and treatment of hemi-spatial neglect is discussed. This case would benefit third- and fourth-year students to reinforce clinical competence in neuro-ophthalmic disease as well as optometry residents who take emergency call or work in a hospital setting.

Case Description

An 88-year-old male presented to the emergency department for severe ocular pain, which began 6 hours prior. The pain was described as sharp with 10/10 severity and began in his right eye before traveling to the back of his head. He also experienced mild confusion and disorientation at the onset of ocular symptoms according to his daughter, who was with the patient at the time his symptoms began. The patient denied any other neurologic symptoms, specifically: no paresthesia, unilateral weakness or slurred speech. The patient's medical history was positive for essential hypertension for which he took lisinopril. He did not take any other medication. Social history was negative for tobacco, alcohol or recreational drug abuse. He had no known drug or seasonal allergies. He was oriented to time, place and person and his mood was appropriate.

At the time of admission, the patient's blood pressure measured 105/72 mmHg and his oxygen saturation was normal on room air. The emergency room physician expressed concern for stroke because of the report of confusion and disorientation, and a CT scan was ordered. This scan was read as negative for intracranial hemorrhage and neoplasm 1 hour later. After the CT scan came back negative, the emergency room physician recommended that the patient undergo an eye examination and expressed concern that the patient may have been experiencing acute angle closure glaucoma due to his initial complaint of ocular pain. An emergent consult was placed to the on-call optometrist, who evaluated the patient half an hour later. Before case history could be obtained by the optometrist, the patient experienced a hypotensive crisis, became disoriented and experienced an episode of emesis. The patient's blood pressure measured 88/62 mmHg at this time. The emergency room physician reclined the patient and dispensed IV fluids, and the blood pressure stabilized to 112/75 mmHg. At this time, the optometrist decided to perform a bedside eye examination in the emergency room instead of transporting the patient upstairs to the eye clinic to mitigate the risk of inducing another hypotensive crisis.

Upon examination, the patient denied any visual complaints at distance without correction and had no visual complaints at near through his most recent pair of reading glasses. His last eye exam was more than 1 year ago, and he denied a diagnosis of any ocular condition other than cataracts, which were removed many years prior by a general ophthalmologist. Family ocular history was positive for age-related macular degeneration (mother).

Visual acuity testing was attempted with a Feinbloom chart held at the end of the bed slightly toward the left of the patient, but the patient was unable to see the largest letter with either eye. When the chart was brought closer and held to the right of the patient, he was able to read the lowest line from 5 feet away. Unaided distance visual acuity was recorded as 5/10 OD and 5/10

OS. Pupils were equal, round and reactive to light; no afferent pupillary defect was noted. Confrontation visual field test revealed a restriction of the entire nasal field OD and a restriction of the entire temporal field OS; both field defects respected the vertical midline. Extraocular motility (EOM) evaluation manifested a restriction of movement in left gaze with no voluntary movement to the left OU. The doll's head maneuver was performed, which increased the patient's range of motion to the left in both eyes while the patient attempted to maintain his gaze straight ahead toward the examiner. Cover test was orthophoric at distance and near. Perkins applanation tonometry measured 11 mmHg OD and 11 mmHg OS at 12:39 a.m. Slit lamp biomicroscopy revealed normal adnexae, lids, lashes, puncta and palpebral and bulbar conjunctivae in both eyes. The right and left cornea were clear. Both anterior chambers were quiescent without evidence of cells or flare; estimations of the temporal and nasal angle were >1:1 by Van Herick technique OU. Both irides were flat and blue. Pupils were dilated using one drop of 1% tropicamide and one drop of 2.5% phenylephrine OU. Evaluation of the posterior segment revealed posterior chamber intraocular lenses without posterior cortical opacification OU. Fundus assessment revealed optic nerve cup-to-disc ratios of 0.40/0.40 OD and 0.45/0.45 OS. Both cups were deep with robust rim tissue 360 degrees and no evidence of pallor or edema. Both maculae were flat and clear. The vitreous was optically clear OU. The right eye had a Hollenhorst plaque at the superior temporal arterial bifurcation OD; the vasculature was normal OS. The periphery was flat without breaks or tears 360 degrees OU.

The restriction of the nasal field in the right eye and restriction of the temporal field in the left eye upon confrontation fields in addition to the lack of voluntary eye movement to the left suggested a diagnosis of left hemi-spatial neglect secondary to an acute post-chiasmal CVA. Cognitive testing was not performed at this time as priority was given to expedited neurological imaging. An MRI of the brain and orbits with and without contrast was recommended to the emergency department as well as admittance to the inpatient neurology service. Carotid duplex imaging was also recommended to explore the etiology of the Hollenhorst plaque observed on fundus exam. The patient and his daughter were educated regarding the exam findings and the suspicion for stroke as well as the need to obtain an MRI to rule out other etiologies of his visual field loss. A follow-up was scheduled for the next day with the in-patient optometry service.

Follow-up visit #1

The exam was performed bedside at the in-patient ward because the patient continued to have mobility restrictions. He continued to report no visual complaints at distance without correction or near with his reading glasses and had no complaints of visual field loss in either eye. Visual acuity remained stable with uncorrected distance visual acuity recorded as 10/10 OD and OS with the Feinbloom chart held at the end of the bed while ensuring that the chart was held only toward the right of the patient's visual field. Entrance testing was unchanged from the previous examination with no improvement of the left visual field restriction with confrontation field testing OU. EOM continued to show no voluntary leftward eye movement. Hand-held slit lamp biomicroscopy revealed normal lids, lashes, conjunctivae, cornea, anterior chambers and irides. The patient was not dilated at this time, and the posterior health examination was performed with an ophthalmoscope. Fundus assessment revealed optic cup-to-disc ratios of 0.40/0.40 OD and 0.45/0.45 OS. Both cups were deep with robust rim tissue 360 degrees and no evidence of pallor or edema. Both maculae were flat and clear. The vitreous was optically clear in both eyes. The Hollenhorst plaque in the right eye was no longer present at the superior temporal bifurcation OD, and the vessels appeared normal in caliber without occlusion OU.

Following the ocular health examination, the patient was asked to describe the entire room around him and name objects that he could see. He pointed out several objects on the right side of the room including a clock, hospital bed, doctor and window. He did not voluntarily name or describe any objects on the left side of the room. He was then given a blank clock-drawing template and was asked to fill in all of the numbers around the clock and to draw the long and short hands. The patient completed the clock as shown in **Figure 1**.

He was then given a line bisection test to complete. The patient was asked to draw a vertical line through the middle of all of the horizontal lines on the paper in front of him. He completed the test as shown in **Figure 2**.

The patient was then given a scene copying test to perform. He was asked to redraw the pictures he saw below the original version. The scene was placed on a clipboard, and the patient completed the test as shown in **Figure 3**.

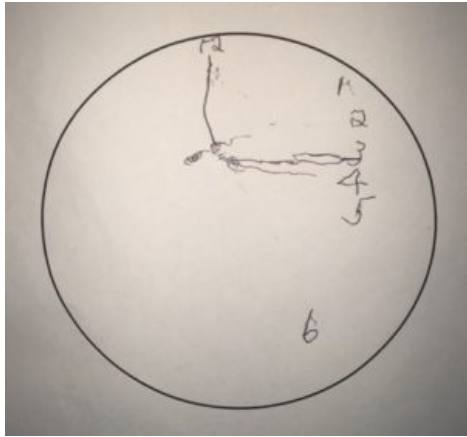


Figure 1. Clock drawing test. The patient filled in numbers 12 through 6 and then drew the long and short hands to represent 3 p.m. When asked to fill in the rest of the numbers, he responded, "I think that's all there is." [Click to enlarge](#)

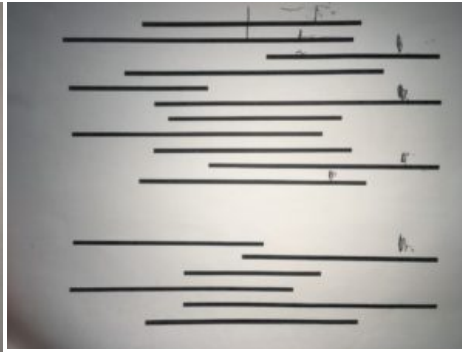


Figure 2. Line bisection test. The long thin vertical line in the middle of the top bar was completed as a reference for the patient to indicate how to complete the test. The remaining vertical lines represent the patient's attempt to bisect the bars with a vertical line. The vertical lines were drawn far to the right of the center of each horizontal bar, and most of the horizontal bars on the left side of the paper were ignored completely. [Click to enlarge](#)

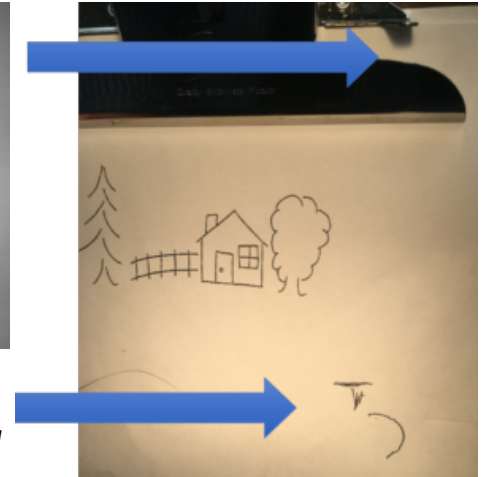


Figure 3. Scene copying test. The patient drew very little and said, "I think that is it." It was initially assumed that the patient had a poor understanding of the procedure, and the test was discontinued. Later, upon closer inspection, it was observed that the patient had in fact drawn the upper right aspect of the clipboard. The top arrow points to the upper right aspect of the board's metal clip, and the bottom arrow points to the patient's drawing of the metal clip. The entire scene of the trees, house and fence is likely on the left side of the patient's visual field within the area he cannot attend to as a result of hemi-spatial neglect. [Click to enlarge](#)

A diagnosis of left hemi-spatial neglect was made at this visit, supported by the following observations: the repeatability of left field restriction on confrontation fields, a lack of voluntary eye movement to the left side on EOM testing, failure to draw shapes or numbers on the left side of paper neglect testing, and the denial of any vision complaints. The patient was scheduled to return to the eye clinic in 1 week for Humphrey visual field testing if he was able to be transported safely from the inpatient ward.

Follow up visit #2

The patient was seen at the outpatient optometry clinic 1 week later for visual field testing. The radiology report of the MRI of the brain had been completed by this point and was read as a "gyriform T2 hyper intensity in the right occipital cortex and subcortical white matter with minimal extension into the parietal and temporal lobe." The patient was placed on intravenous unfractionated heparin by the in-patient neurology team to mitigate the risk of further ischemia. An axial section of the patient's MRI is shown in **Figure 4**.

After the MRI results were reviewed with the patient, he was asked to perform a Humphrey visual field 24-2 SITA-FAST test. The patient completed the test as show in **Figure 5**.

The loss of visual sensitivity of the left half of the visual field confirmed the repeatable results of previous confrontation field testing and also correlated to the cortical infarction observed on the right side of the occipital lobe on the MRI of the brain. The findings were explained to the patient and family, who were interested in the prognosis of visual recovery. The patient and family were informed of the guarded prognosis of any recovery in vision, but potential visual rehabilitation options to improve function were reviewed. The patient and family chose to consider visual rehabilitation options after the patient had stabilized medically, as he had experienced multiple hypotensive crises since he was admitted to the neurology ward. The prognosis for the patient's neurological and systemic condition mirrored the guarded prognosis of visual recovery, and management of the patient's CVA and systemic hypotension was deferred to the in-patient neurology team. A follow-up visit was scheduled for 1 month.

Follow up visit #3

The patient returned 1 month later for dilated fundus exam and repeat neglect testing. He reported no new visual symptoms but indicated an awareness of the visual field defects for the first time. He was given a blank clock drawing template and asked to fill out the numbers and to draw hands to indicate 3:45 p.m. The result is shown in **Figure 6**.

The anterior and posterior segment health was unchanged in both eyes upon examination. Consideration was made for visual rehabilitation strategies at this visit, but the patient continued to experience other systemic complications related to his CVA, which limited his ability to participate in rehabilitative therapy. Follow-up was scheduled for 1 month to explore visual rehabilitation options in the event that he was stabilized medically at that point. However, the patient passed away soon after this exam as a result of an infection from a catheter that was placed in the medical ward.

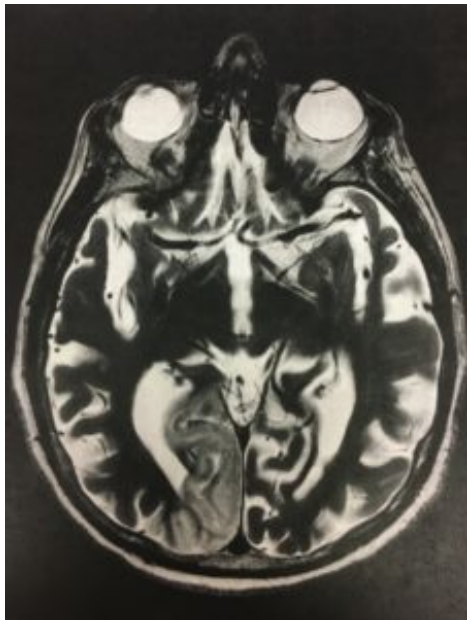


Figure 4. Axial section of the patient's MRI of the brain with contrast. An infarction of the right occipital cortex can be seen as hyperintensity of the gyri in that region.
[Click to enlarge](#)

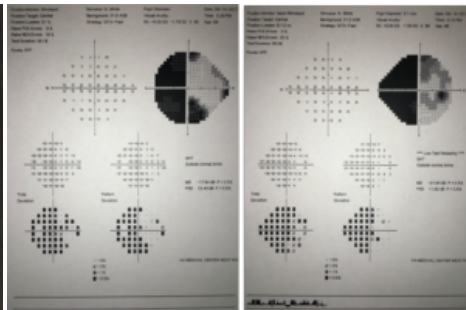


Figure 5. Humphrey visual field 24-2 SITA-Fast test results in the left eye (left) and right eye (right) revealing decreased sensitivity of the left visual field respecting the vertical midline OU. The high rate of false positives lowers the overall reliability of the results, which may explain some of the defects that appear to the right of the midline OU. [Click to enlarge](#)

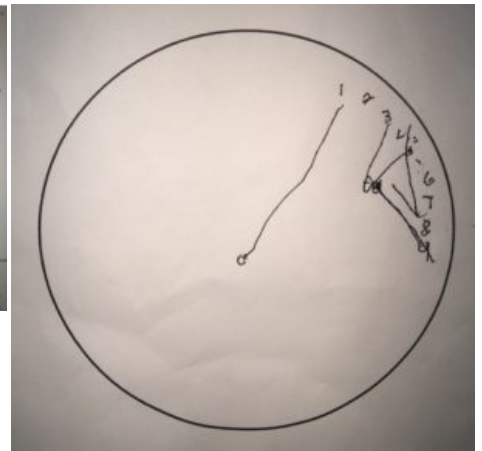


Figure 6. Repeat clock drawing test. The patient included more numbers than he did in his initial clock drawing test but confined the numbers to the right side of the clock face. Hands from the number 3 to 9 are drawn with other hands drawn in error. The patient reported, "this does not look right" regarding the placement of his numbers but did not want to repeat the test. [Click to enlarge](#)

Education Guidelines

Key concepts

1. In-depth understanding of the visual pathway is key to localizing potential intracranial lesions that result in visual field dysfunction
2. Optometrists should know the visual manifestations of acute stroke so the patient can be diagnosed and treated quickly
3. A full differential diagnosis for hemi-spatial neglect should be considered in patients with acute presentation
4. Visual neglect can be detected with careful analysis of ocular and cognitive testing
5. Follow-up with patients after diagnosis of hemi-spatial neglect is key to tracking any partial recovery that takes place

Learning objectives

At the conclusion of this case report, readers should be able to:

1. Identify the potential visual manifestations of acute stroke
2. List the differential diagnoses in patients with acute one-sided field loss
3. Differentiate homonymous hemianopia from hemi-spatial neglect
4. Describe expected results of paper- and pencil-testing in patients with hemi-spatial neglect
5. Explain the connection between the location of a lesion along the visual pathway and the location of the visual field defect
6. Understand the importance of CT scan and MRI in the diagnosis of acute CVA

Discussions questions

1. What are potential etiologies of hemi-spatial neglect?
2. How does the location of the lesion along the visual pathway impact the way in which the visual field can be affected?
3. What are neurological symptoms other than vision loss that are associated with intra-cranial lesions that develop posterior to the chiasm along the visual pathway?
4. How does the location of a lesion along the visual pathway impact the way in which vision loss manifests?

5. What regions of the brain are implicated in the pathophysiology of hemi-spatial neglect?
6. What theory explains the reason why left-sided neglect is more common than right-sided neglect?
7. How does the prognosis for recovery from hemi-spatial neglect differ in ischemic vs. hemorrhagic stroke?
8. Why is CT scan indicated before initiation of intravenous tissue plasminogen activator (tPA) after diagnosis of acute CVA?
9. What are potential visual rehabilitation options for patients with homonymous hemianopia and neglect?

Learning assessment

- Review images of normal intracranial MRI to orient students to the left and right side and identify important structures along the visual pathway
- Break students up into small groups and task them with researching the conditions that are considered as part of the differential diagnosis for acute hemi-spatial neglect; then have students compare and contrast the signs and symptoms of these conditions
- Assign a student as doctor and another as patient and have them practice patient education for acute stroke and visual field loss in a role-playing scenario
- Give students blank clock chart diagrams and have them draw out the results they are likely to see in patients with hemi-spatial neglect

Discussion

Hemi-spatial neglect is a failure of awareness on the side and space opposite the site of brain injury.¹ Typically, this defect is a result of right-sided brain injury.¹ The most common etiology of hemi-spatial neglect is acute CVA but it may also be caused by traumatic brain injury (TBI) or neoplasm.^{5,6,7} Other etiologies such as focal inflammation and infection can occur but are uncommon.

Hemi-spatial neglect should be differentiated from field loss such as homonymous hemianopia. While both of these dysfunctions represent loss of visual sensitivity of one half of the visual field,⁸ homonymous hemianopia alone does not manifest the loss of attention or awareness to the side of the field that patients can no longer visualize.⁸ In other words, patients with homonymous hemianopia who do not exhibit neglect are almost always aware that half of their visual field is missing in both eyes and can consciously draw their attention towards the side of their visual field that has diminished sensitivity.⁹

Neurologic visual field defects manifest differently depending on their location along the visual pathway. Loss of visual sensitivity in the right or left visual field in both eyes is indicative of a lesion along the visual pathway posterior to the optic chiasm.⁸ This field loss is described according to how similar the defect is between the two eyes, with more similar visual field defects being more congruous. The more posterior the lesion along the pathway, the more congruous the defect appears.¹⁰

There are often other neurologic symptoms that patients experience along with visual field loss, depending on the size and extent of the lesion. These symptoms include slurred speech, unilateral limb weakness and paresthesia but may include other processing deficits such as simultanagnosia, anosognosia and anosodiaphoria.^{11,12} The neurologic presentation of hemi-spatial neglect is likely due to the proximity of spatial awareness processing to the occipital lobe.^{13,14} Hemi-spatial neglect can manifest as the loss of visual attention to one half of the visual field, but patients may also experience verbal, motor or tactile neglect.¹⁵ These other manifestations of neglect were not observed in this patient. It is interesting that this patient experienced acute ocular pain before his diagnosis of CVA, as ocular pain is not a typical presenting symptom of stroke. However, acute headache has been reported in up to 35% of patients with acute ischemic CVA,¹⁶ which the patient may have erroneously localized to his eye.

The pathophysiology of hemi-spatial neglect is not fully established, but several theories have described potential mechanisms.¹⁷ One theory implicates the “peri-sylvian neural network,” which represents the cortical connections between the inferior parietal, superior/middle temporal, and ventral parietal lobes.¹⁸ The interconnections between these regions of the brain may be involved with determining the patient’s ego-centric space.^{17,18} Another unique feature of hemi-spatial neglect is that patients exhibit left hemi-spatial neglect much more often than right-sided neglect. Approximately 20% of patients with acute brain damage exhibit some form of hemi-spatial neglect, while approximately 50% of patients with right-sided brain damage exhibit signs of neglect.¹⁹ The theory behind this discrepancy is a postulated redundancy in cortical processing of the right visual field. According to this “coding theory,” the left visual field likely receives processing only from the right side of the brain, while the right visual field is likely processed by both the right and left brain.²⁰ Therefore, if the right visual field is processed by both sides of the brain, the right side of the brain may still be able to process the right visual field in the presence of left-sided brain injury. This disparity in processing accounts for the disproportionately high number of cases of left hemi-spatial neglect because in the presence of right-sided brain injury, the left side of the brain would not be able to properly process the left visual field.¹⁷

The anterior and posterior segment health evaluations are often unremarkable in cases of intracranial pathology such as stroke. However, it is important to conduct a complete ocular health examination to rule out ocular pathology that may result in visual field loss. Specifically, the optic nerve should be carefully examined to rule out conditions such as arteritic ischemic optic neuropathy, optic neuritis and glaucoma. Peripheral retinal examination should also be conducted to rule out peripheral pathology such as retinal detachment. The non-occluding Hollenhorst plaque that was observed in the patient's right eye upon initial examination was of no visual consequence but may have been part of the larger plaque that ultimately occluded the posterior cranial vasculature.

The differential diagnosis of hemi-spatial neglect should include any intracranial pathology that may result in compression or dysfunction of cortical matter along the post-chiasmal visual pathway. These etiologies include intracranial neoplasm, focal inflammation, infection and hemorrhage.^{6,7,21} The differential diagnoses considered in this patient after the initial exam included:

- **TBI.** TBI results from trauma and can cause visual field defects due to compression of the visual pathway by secondary hemorrhaging.⁵
- **Intracranial neoplasm.** Intracranial neoplasm can cause similar visual field defects to CVA or TBI due to mass effect along the post-chiasmal visual pathway.⁶
- **Migraine with aura.** Visual aura associated with a migraine may transiently obstruct vision, which may mimic visual field defects such as homonymous hemianopia.²²
- **Multiple sclerosis.** Multiple sclerosis is a demyelinating disease of the central nervous system characterized by inflammatory attacks, which can cause visual field defects if the inflammatory lesion develops along the visual pathway.²³

Most of these conditions can be differentiated with an MRI of the brain and orbits with and without contrast.^{4,6} For this reason, an MRI should be considered in all patients with new onset hemi-field dysfunction.

A myriad of cognitive testing methods have been developed to aid in the diagnosis of hemi-spatial neglect. Paper- and-pencil testing is a widely used tool for diagnosing hemi-spatial neglect and conceptualizing the extent of the dysfunction. Clock drawing, scene copying and line bisection tests are all examples of paper- and pencil-testing that were utilized in this case. Clock drawing requires placement of analog clock numbers within a pre-drawn circle,²⁴ scene copying entails having a patient redraw a series of pictures below the originals,²⁵ and the line bisection test has the patient draw a vertical line in the middle of a series of horizontal lines.^{3,26} Multiple tests should be performed to confirm diagnosis, as the sensitivity of paper- and pencil-testing is significantly higher when multiple tests, rather than one, are performed.³ In this case, paper- and pencil-testing was useful in confirming the diagnosis of hemi-spatial neglect and educating the patient's family members on the nature and severity of his condition.

Automated visual field testing is also important in order to document the location, depth and size of the sensitivity loss.²⁷ Many parameters may be employed when testing visual field loss with Humphrey visual fields. A larger testing parameter such as 30-2 may detect more peripheral defects but takes longer to perform.²⁸ In patients who fatigue easily or have a poor attention span as a result of stroke, a parameter such as a 24-2 SITA-FAST may be employed to decrease errors in reliability such as fixation loss, false positives and false negatives.²⁸ Visual field testing is also a useful way to educate the patient and family on what the patient is experiencing as well as monitor for any improvement, stability or decline in visual sensitivity.

Prognosis for visual recovery from visual field defects resulting from stroke is guarded. However, up to 50% of patients may experience spontaneous visual recovery within the first 3-6 months.²⁹ Visual field defects following hemorrhagic CVA may improve somewhat as the blood reabsorbs, but visual field defects as a result of ischemic infarction have a poorer prognosis because the tissue is no longer viable.³⁰

The initial management of neglect depends on the time of symptom onset as well as the etiology. Intravenous tPA is indicated in cases of ischemic stroke.^{31,32} The Food and Drug Administration currently only approves the use of tPA within 3 hours of symptom onset, though there is evidence to support its use up to 4.5 hours.^{31,33} However, a CT scan must be obtained first to ensure that the etiology is not hemorrhagic, as tPA may exacerbate intracranial infarction if bleeding is observed. This presents a unique challenge to acute medical providers, as approximately one-third of patients with acute stroke do not present with detectable signs on CT scan within 6 hours of symptom onset.³⁴ The emergency room attending physician in this case made the decision not to administer tPA based on the negative CT scan as well as the absence of any neurologic symptoms. By the time the eye examination had been initiated, the window for tPA administration had already expired.

After the etiology and extent of the CVA has been established, management focuses on mitigating the risk of subsequent strokes and treating any secondary neurological complications. Patients may be placed on anticoagulants such as aspirin or heparin to keep emboli from forming and traveling to the heart, lungs or brain.³⁵ Alternative methods such as lowering blood

pressure, hemostatic therapy, minimally invasive surgery, anti-inflammation therapy and neuroprotection are also being explored.³⁶

Visual rehabilitation may also be considered in patients who have stabilized medically after their initial stroke. The goal of therapy is typically compensatory in nature. While there is no standard of care regarding management of hemi-spatial neglect, many strategies have been proposed to help patients improve their function. The use of prism has been reported to help patients detect visual stimuli in the missing visual field,³⁷⁻³⁹ but more research is needed to determine the long-term efficacy of this method. Other techniques such as teaching the patient how to scan more extensively with exploratory eye movements have also been suggested, though the patient's restricted attention span is often a limiting factor.³⁹ Unfortunately, none of these strategies was implemented in this case, as the patient never entirely stabilized and passed away before visual rehabilitation options could be fully explored.

Conclusion

Acute CVA should be included in the differential diagnosis of patients presenting with acute hemi-spatial neglect. This case demonstrates the importance of careful entrance testing analysis, as the decision to obtain an MRI was based upon clinical evidence of stroke, even in the absence of pathology on CT scan. It is important for clinicians to be aware that acute stroke may not manifest on a CT scan, and an MRI is indicated if there is still suspicion for CVA. Although the prognosis for recovery in hemi-spatial neglect is generally guarded, spontaneous improvement may occur. Patients should be extensively educated and followed closely to monitor for improvement, stability or decline in their visual field and mental status.

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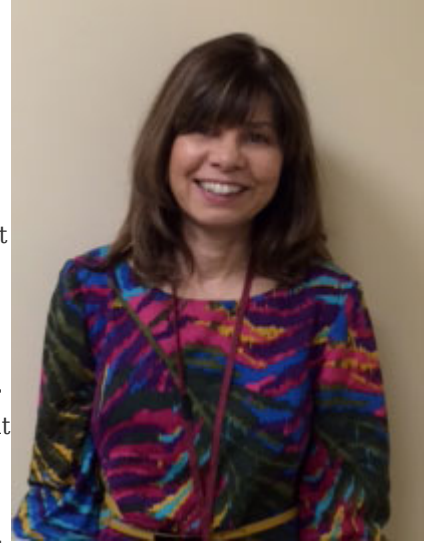
Student Academic Entitlement

Aurora Denial, OD, FAAO, DAAO (OE) | Optometric Education: Volume 48 Number 1 (Fall 2022)

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How often have we had a student ask that a grade close to a cutoff be bumped up, request the rescheduling of an exam or quiz for personal events (non-medical or non-emergency) or request that personal effort be taken into consideration when grading? Who has not experienced an attitude from some students that attending class, turning in homework and completing reading assignments should dictate at least a passing grade, independent of quality of the work?

When Greenberger et al. surveyed 466 undergraduate students in 2008, they found that 66% of them agreed “If I have explained to my professor that I am trying hard, I think he/she should give me some consideration with respect to my course grade”; 41% agreed “If I have completed most of the reading for a class, I deserve a B in that course”; 34% agreed “If I have attended most classes for a course, I deserve at least a grade of B”; 31% agreed “Teachers often give me lower grades than I deserve on paper assignments”; and 30% agreed “Professors who won’t let me take an exam at a different time because of my personal plans (e.g. a vacation or other trip that is important to me) are too strict.”¹



Student academic entitlement can be frustrating and emotionally draining for faculty. It takes time and energy away from teaching. Also, college and university administrators can play a significant role in supporting faculty or propagating student behavior. *Aurora Denial, OD, FAAO, DAAO (OE)*

A recent article published by The New York Times reported that a respected organic chemistry professor at New York University (NYU) was dismissed after 82 of his 350 students signed a petition against him.² The petition stated, “We are very concerned about our scores, and find that they are not an accurate reflection of the time and effort put into this class,” and “We urge you to realize that a class with such a high percentage of withdrawals and low grades has failed to make students’ learning and well-being a priority and reflects poorly on the chemistry department as well as the institution as a whole.”² The professor had previously taught organic chemistry at an Ivy League university for many years, written a text book on the subject and created new learning modalities that focused on problem-solving rather than memorization. Many students supported the professor and found him very likable. The university cited poor course evaluations for the professor and complaints about his tone as condescending and demanding as support for the firing. However, the professor taught at NYU for longer than a decade until the petition surfaced. What message does the NYU decision send to students and junior or adjunct faculty?

Student entitlement can be defined as a “tendency to possess an expectation of academic success without taking personal responsibility for achieving that success.”³ Researches have often viewed entitlement as a component of narcissism.⁴ Entitlement includes the concept of the world or society owing the individual something, meeting wants immediately and the bending or dismissal of rules.^{5,6} Entitlement has often been linked to customer-business or citizen-government models.⁷ These models lead to the student as a consumer and the grade or degree as a product that can be purchased rather than earned.⁷ End-of-course student evaluations often empower entitled students. These evaluations can often impact junior faculty, non-tenured faculty or adjunct faculty.

As a faculty member, I recognize that most of our students are hard workers who want to learn and master course material. They are conscientious and caring student clinicians who take responsibility for patient care very seriously. These students understand the concept of lifelong learning and the ethical responsibility of a healthcare provider to stay current with medical or optometric knowledge. However, it is hard to ignore the growing number of academically entitled students who seem to be oblivious to the harm that can come from this mindset and behavior. In my experience, over the years, student academic entitlement has grown. Students with entitlement characteristics have become more vocal and active. How can faculty respond?

The Syllabus⁸

Present clear expectations and guidelines in the syllabus and do not waiver from syllabus content. The syllabus is a powerful

tool that sets the goals and expectations for the course. It contains material that outlines the course goals, objectives, topical areas, schedules and, most importantly, the rules for success in the course. This may include rules on grading, curving scores, consequence of late assignments, borderline grades, the use of make-up or extra credit assignments and classroom etiquette (use of cell phones, tardiness, attendance, use of electronic devices in class). Developing a student entitlement-proof syllabus requires the exquisite anticipation of all prospective scenarios. I am still amazed at the number of students who approach me with "I know what it says in the syllabus, but can I have (fill in the blank)." Wavering from the syllabus opens a Pandora's box and there is no turning back. It can set a precedent and make it difficult for other faculty to strictly adhere to their course syllabus. Faculty who adhere to the syllabus may then be perceived as too strict and not flexible. Students who are following the syllabus may perceive the wavering as unfair. Extenuating circumstances may require flexibility, but this should be rare and on an individual basis. Not wavering from the syllabus is essential but challenging to execute.¹

Open Discussion³

Engaging students in an open discussion about entitlement may also be useful. Students who have grown up in a culture of entitlement may not realize the detrimental effects it can have on learning. There may be a disconnect between a student's past experiences and current expectations. Extra-credit assignments, curving exam scores, retaking exams and giving credit for effort not results can lead to grade inflation. The achieving of a higher grade than what is actually earned devalues the course grade, a degree and potentially compromises the integrity of a program.¹ Additionally, it's not fair to the students who actually learned the course material.

Administrative Support

Administrative support is essential. Department chairs, academic deans, presidents and provosts need to support faculty. The administration is often in a difficult position. Administration as well as faculty want students to have a positive experience and look back favorably on the institution. This can impact future applicants, who may rely on student blogs, reviews or social media as well as alumni support. However, propagating student entitlement is a disservice to the institution, students and the profession. As institutions, we have an ethical responsibility to graduate students who have mastered a required curriculum.

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Winning Essay: Student Award in Clinical Ethics

Andrea Meagher, OD | Optometric Education: Volume 48 Number 1 (Fall 2022)

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Andrea Meagher, OD, is the 2022 recipient of the Student Award in Clinical Ethics.

Her winning essay appears here.

Caring for Patients with Disabilities: Advocating for Those Who Cannot Advocate for Themselves

Andrea Meagher, OD

As optometrists, most of us have at one time provided care to a patient with a developmental disability. Individuals with disabilities often experience discrimination in health care.¹ There is also a lack of optometric education and research in the area of patients with developmental disabilities.² This case study involving a patient with Down syndrome and keratoconus helps bring to light the positive impact optometrists can have on this population through not only ethical treatment and management, but also advocating for their well-being.

Current clinical guidelines for management of keratoconus are based on whether patients are satisfied with their vision in glasses.³ This begs the question: What if a patient is unable to express that satisfaction, or lack thereof? How can a clinician decide whether patients are satisfied with their current vision if they cannot communicate such and have never had the opportunity to see the world clearly?

Patient Assessment

A 31-year-old female reported to the Cornea and Contact Lens department at Illinois Eye Institute for physician-directed follow-up for keratoconus. She had first been diagnosed with keratoconus in the Developmental Disabilities clinic at Illinois Eye Institute 2 weeks prior. She had undergone comprehensive eye exams at outside practices at least every 2 years since birth with normal results aside from refractive error. The patient's medical history was positive for Down syndrome and obesity. She was somewhat verbal, but spoke only Spanish. Her sister was present to translate during our exam. The patient had a positive family history of keratoconus. Her mother was the primary caretaker but her sister lived close by and was with her most days. Although the patient had been prescribed numerous pairs of glasses since age 5, she had never worn them successfully due to not liking the feeling of the frame on her face.

Her previous visual acuities were documented as "fixate and follow," but the patient was found to be very adept at Lea matching during her exam in the Cornea and Contact Lens department. She achieved a distance visual acuity of 20/200 in the right eye, 20/300 in the left eye, and 20/125 with both eyes through her glasses prescription. Her near acuity was measured as 20/40 in each eye, which indicated that she was likely not highly amblyopic. Pupil testing and extraocular motility testing were normal. Confrontation visual fields were unable to be tested due to patient understanding and poor fixation. Retinoscopy revealed a prescription similar to her previous glasses of -9.00 -2.00 x 028 in the right eye and -9.00 -4.50 x 160 in the left eye. A corneal tomography was obtained, although quality was slightly reduced due to poor fixation. It revealed keratometry readings of 58.40/60.60@099 in the right eye and 72.20/78.90@073 in the left eye with a minimum pachymetry thickness of 302 μ m in the right eye and 155 μ m in the left eye. The tomography also



Andrea Meagher, OD

showed apical stromal corneal thinning consistent with keratoconus in both eyes. Slit lamp examination revealed mild central corneal scarring in the right eye and significant central corneal scarring in the left eye with a significant Munson sign upon down gaze in both eyes. The bulbar conjunctiva was slightly diffusely injected in both eyes. Upon instillation of sodium fluorescein there was a band of 1+ punctate epithelial erosion in the left eye with a question of incomplete lid closure/lagophthalmos. All other slit lamp findings were normal. The patient had her pupils dilated at her exam 2 weeks prior, and the posterior pole examination was found to be within normal limits with cup-to-disc ratios of 0.30/0.30 in both eyes.

Current clinical guidelines indicate that first-line treatment for keratoconus should be corneal crosslinking for those who are eligible.³ Due to the patient's minimum corneal thickness of less than 400 μm and the central scarring present in both eyes, she was not an ideal candidate for corneal crosslinking.³ The next line of treatment is specialty contact lenses.³ Corneal transplant surgery is recommended only if contact lenses still cannot achieve adequate vision.³ Despite more than 25 years of eye care and known high ametropia, the patient had never been offered the correction option of contact lenses to improve her vision and comfort. Had she not been developmentally delayed, one can suspect she would have been given the option of contact lenses much sooner.

Patience Leads to Progress

The American Optometric Association (AOA) Standards of Professional Conduct support that we have an ethical obligation to provide this patient with the option of contact lenses with the following statement: "Optometrists have a duty to inform patients or their legal guardian about the patient's health care and health care options."⁴ This patient is not the only disabled patient who has been overlooked in this way. The prevalence of keratoconus in people with Down syndrome is higher than in the general population, but many patients go undiagnosed due to difficulty in providing care.⁵ Sadly, patients with developmental disabilities are not being provided the same level of health care as other patients.⁶ This is a violation of AOA's Code of Ethics tenet "to strive to ensure that all persons have access to eye, vision, and general health care" — not just those persons who are able to express their desire for functional vision.⁷

At this patient's first visit to the Cornea and Contact Lens department, we educated her accompanying guardians on her condition and management options. The guardians agreed to help the patient with application and removal of the lenses and to proceed with the contact lens fitting in hopes of achieving better vision and comfort than her habitual spectacles provided. We were able to apply a hybrid lens to her right eye (on the first attempt!) and the patient reported good overall comfort. We then attempted to apply a hybrid lens to the more severe left eye but encountered much greater difficulty. After repeated attempts, the patient became overwhelmed. We were unable to achieve an accurate visual acuity or fit evaluation of the lens, so it was removed and she was asked to return at the next available appointment to continue the fitting.

At her next fitting appointment 3 weeks later, the patient expressed her initial apprehension with the contact lens fitting process. With some time, reassurance and review of the process, she agreed to proceed with the fitting. Throughout this appointment she grew more and more comfortable with me and the lenses, and we were able to successfully apply and evaluate two hybrid lenses on the right eye and three hybrid lenses on the left eye. We adapted the fitting process to her specific needs: warming the preservative-free saline vials to reduce the blink reflex, providing a dental bib to catch any spills, and moving slowly with the utmost patience. The patient achieved best-corrected distance vision of 20/40 in the right eye and 20/30 in the left eye with over-refraction, a drastic improvement from 20/125 in her glasses! She expressed comfort with the lenses and amazement in her vision improvement that was truly heartwarming. Although we achieved an appropriate fit in the right eye, her left eye exhibited central touch with even the highest possible hybrid lens vault. For this reason, the patient was scheduled to return for an additional fitting appointment for scleral lenses. The hope is that she will be more cooperative with insertion of these larger gas permeable lenses after having had a positive experience with the hybrid lenses.

Fulfilling Our Responsibility as Optometrists

Down syndrome is not uncommon. It occurs in 1 of every 700 babies born in the United States.⁸ Furthermore, the number of patients with Down syndrome is increasing due to increasing maternal age along with medical advances in technology resulting in better survival rates for these children.⁹ It is our responsibility as optometrists to understand how to properly treat and manage the unique visual needs of this population. Although this patient was able to respond to Lea matching, most patients with Down syndrome respond best to Teller Acuity Cards.⁹ In addition to keratoconus, blepharitis, premature cataract and strabismus are common in Down syndrome patients.⁹

Patients with Down syndrome and other disabilities who present with high ametropia, including high amounts of cylinder and a

“scissor” reflex on retinoscopy, should be screened for keratoconus with corneal tomography. Careful slit lamp examination can also help identify signs of keratoconus including Munson sign, corneal scarring, Fleischer ring, Vogt striae and apical thinning. Early detection leads to better outcomes in these patients, especially if corneal crosslinking can slow the progression of the disease.³

Patients with disabilities deserve the same level of care as the rest of the population, and it is our ethical obligation as clinicians to provide such care. We should all be healthcare advocates for patients who cannot advocate for themselves.

Acknowledgement

Special thanks to Lindsay Sicks, OD, the attending doctor and mentor for this case.

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Optic Disc Drusen and Associated Complications: a Teaching Case Report

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Introduction

Optic disc drusen (ODD) are located in the optic nerve head of up to 2.4% of the population and are thought to be due to impaired axonal metabolism.^{1,2} In many cases, ODD are not visible due to being very small or poorly calcified or having a deeper location.³ They often give the appearance of optic disc elevation (pseudopapilledema), which can be confused with true papilledema caused by intracranial hypertension. Therefore, making a proper diagnosis is essential.^{1,4} Although most patients are asymptomatic, ODD can be associated with visual field defects in up to 87% of cases as well as visual acuity loss and infrequently choroidal neovascular membrane (CNVM) and non-arteritic ischemic optic neuropathy (NAION).² This case highlights the rare development of visual acuity and visual field loss in addition to a peripapillary CNVM in a young female patient with multi-modal imaging aiding in the diagnosis and management.

Case Presentation

A 26-year-old Caucasian female presented for evaluation of blurry vision OS > OD, which was equal at distance and near. She had no other associated symptoms. Her ocular history was unremarkable. Her medical and family health history was also unremarkable. On initial examination, entering uncorrected distance visual acuities were 20/25-2 OD and 20/30 OS. Pupils were round and reactive to light with a mild afferent pupillary defect (AFD) present OS. Extraocular motility and confrontation fields were full OU. Manifest refraction revealed compound hyperopic astigmatism OU with best-corrected distance visual acuities of 20/20 OD and 20/25 OS. Intraocular pressure (IOP) measured with Goldmann applanation tonometry was 16 mmHg OU. Slit lamp biomicroscopy was unremarkable OD and OS. Blood pressure was measured at 110/67 mmHg right arm, sitting. Dilated fundus examination revealed a scalloped and raised optic nerve giving the appearance of indistinct and irregular disc margins OD and OS. This was more evident superior-temporally in both eyes (**Figures 1 and 2**). A spontaneous venous pulse was not noted in either eye. The cup-to-disc ratio was estimated to be 0.1/0.1 OD and OS. The left eye was also remarkable for a fibrovascular lesion superior-temporal to the optic nerve with surrounding pigment (Figure 2). No hemorrhaging or fluid was noted around the lesion. The presence of pigment around the lesion along with fibrovascular tissue indicated likely chronicity of the unknown lesion.⁵⁻⁷ The macula OD and OS was unremarkable. Fundus autofluorescence (FAF), with clear imaging and no artifacts present, revealed focal areas of hyper-autofluorescence on both optic nerves, OS > OD (**Figures 3 and 4**). FAF also showed mixed hyper- and hypo-autofluorescence of the fibrovascular tissue (hypo-autofluorescence surrounded by hyper-autofluorescence) with surrounding hypo-autofluorescence of the corresponding retinal pigment in the area juxtapapillary and superior-temporal to the optic nerve OS (Fig 4). An incidental operculated retinal hole, located superior-temporally in the periphery of the left eye, was also found at this visit with no evidence of retinal detachment. The periphery of the right eye was unremarkable. A baseline 24-2 SITA FAST Humphrey visual field test was performed in both eyes. Testing OD was reliable based on low amounts of fixation loss, false positive errors and false negative errors. Testing OS was of questionable reliability due to the blind spot not being plotted. Testing OD revealed a shallow inferior arcuate defect (**Figure 5**). Testing OS revealed nasal defects > inferiorly indicative of an arcuate defect with extension into the inferior-temporal quadrant (**Figure 6**).

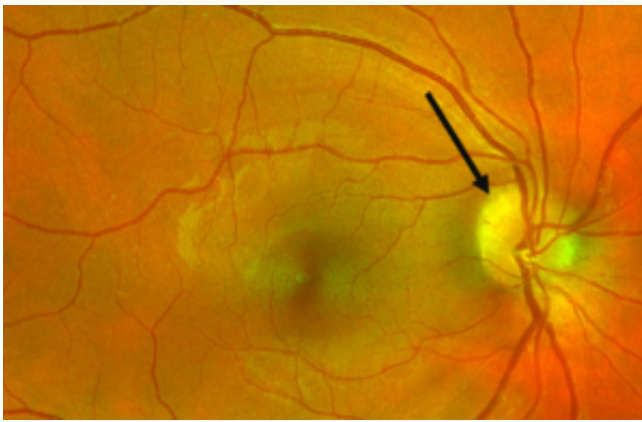


Figure 1. Ultra-widefield retinal imaging of the right eye showing a scalloped and raised presentation of the optic disc drusen giving the appearance of indistinct and irregular disc margins, more so superior-temporally (black arrow).
[Click to enlarge](#)

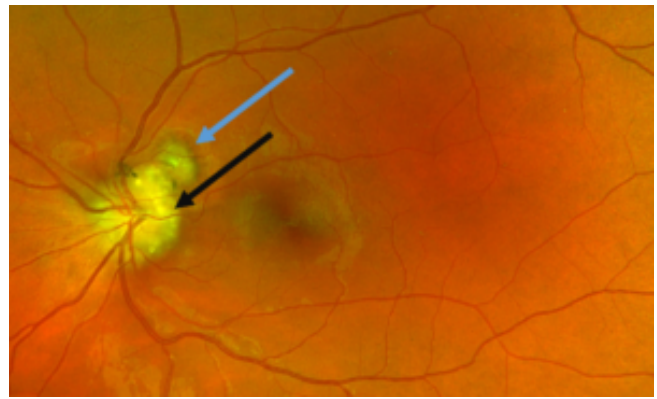


Figure 2. Ultra-widefield retinal imaging of the left eye showing a scalloped and raised presentation of the optic disc drusen giving the appearance of indistinct and irregular disc margins, more so superior-temporally (black arrow). A fibrovascular lesion with surrounding pigment, indicative of a choroidal neovascular membrane, is noted juxtapapillary to the optic disc (blue arrow).
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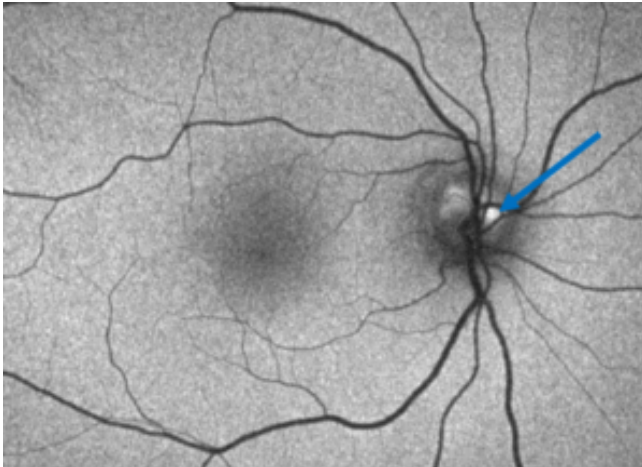


Figure 3. Fundus autofluorescence of the right eye showing hyper-autofluorescence of the optic disc, more so superior-temporally, indicating optic disc drusen (blue arrow).
[Click to enlarge](#)

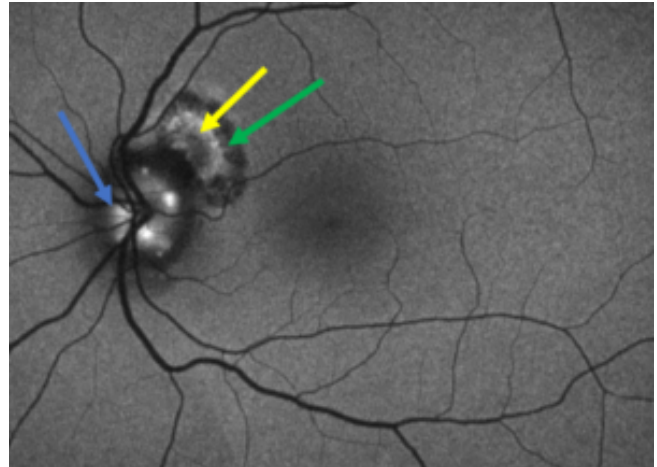


Figure 4. Fundus autofluorescence of the left eye showing hyper-autofluorescence of the optic disc indicating optic disc drusen (blue arrow). A mixed patch of hypo- and hyper-autofluorescence (hypo-autofluorescence surrounded by hyper-autofluorescence, yellow arrow) surrounded by hypo-autofluorescence (green arrow) is noted superior-temporal to the disc. This corresponds with the fibrovascular lesion with surrounding pigment disruption noted on fundus photos and is indicative of the inactive choroidal neovascular membrane.
[Click to enlarge](#)

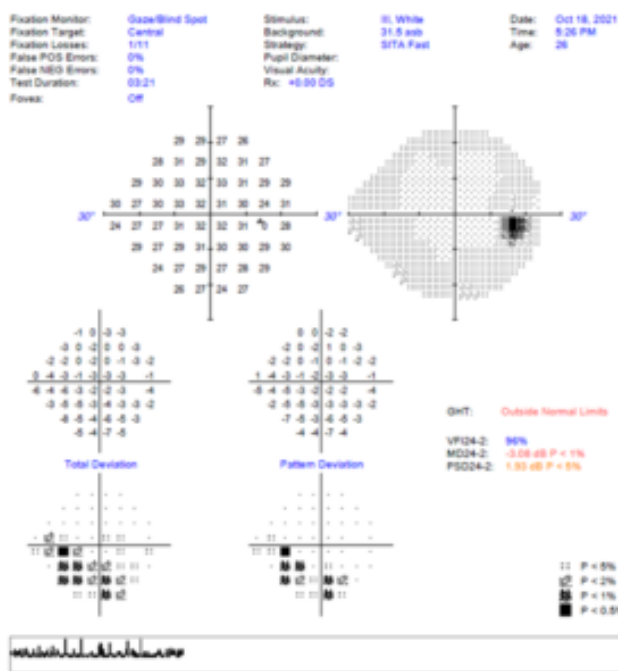


Figure 5. Baseline 24-2 SITA FAST Humphrey visual field test of the right eye. Testing was deemed reliable based on low amounts of fixation loss, false positive errors and false negative errors. Testing revealed an inferior arcuate defect that corresponded to the disc appearance on fundus photos (Figure 1) and with optical coherence tomography scans that revealed retinal nerve fiber layer thinning superior-temporally > inferior-temporally (Figure 7). [Click to enlarge](#)

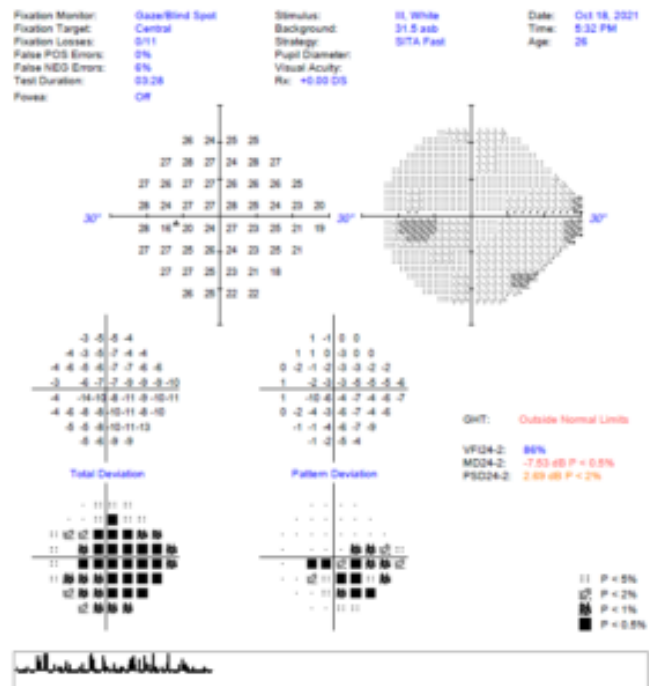


Figure 6. Baseline 24-2 SITA FAST Humphrey visual field test of the left eye. Testing was deemed questionable as the blind spot was not accurately plotted. Testing revealed an inferior arcuate defect that corresponded to the disc appearance on fundus photos (Figure 2), with optical coherence tomography scans that revealed retinal nerve fiber layer thinning superior-temporally > inferior-temporally and with large amounts of ganglion cell complex thinning noted superiorly on ganglion cell complex testing (Figure 8). [Click to enlarge](#)

Optical coherence tomography (OCT) of both optic nerves was also performed. The signal strength was adequate with no artifacts being noted indicating reliable test results. Small disc and rim areas were noted in both eyes along with very small to absent cup-to-disc ratios. The neuroretinal rim in both eyes was noted to be thicker than the normal range. Testing revealed significant retinal nerve fiber layer (RNFL) loss superior-temporally and inferior-temporally in both eyes (larger loss superior when compared to inferior), with larger amounts of thinning evident OS (**Figure 7**). These test results corresponded with the overall appearance seen on fundus photos. The OCT RNFL results also corresponded with the visual field defects (inferior arcuate defects OD/OS, deeper defect OS). The OCT scans, particularly the horizontal and vertical tomograms for each eye, revealed a lumpy bumpy internal contour of the optic nerves with no apparent or a very mild cup in addition to a normal retinal pigment epithelium (RPE)/Bruch's membrane contour (Figure 7). Ganglion cell complex (GCC) analysis was obtained with OCT as well. The scan was judged reliable based on a strong signal strength and absence of artifact. Testing OD showed dense temporal thinning, while testing OS showed significant amounts of overall thinning, with larger amounts of thinning noted in the superior quadrants (**Figure 8**). Comparison of the GCC scans showed significant asymmetry with larger amounts of thinning noted OS. An OCT raster scan, reliable with no artifacts present, was performed through the juxtapapillary lesion OS with testing showing raised and hyper-reflective fibrosis (**Figure 9**). There was no evidence of any fluid within or around the lesion.

Based on exam and multi-modal imaging findings (hyper-autofluorescence of both discs, neuroretinal rim thickening, RNFL loss and appearance on OCT scans and fundus imaging) the patient was diagnosed with ODD OD < OS. The juxtapapillary lesion OS was thought to represent an inactive and chronic CNVM secondary to the ODD. This was based on its location adjacent to the ODD, lack of fluid in and around the lesion, lack of hemorrhaging, and presence of retinal pigment. The mild reduced acuity and positive APD OS were attributed to the significant RNFL and GCC thinning that were more prominent OS. Lastly, the patient was diagnosed with an operculated hole OS with no evidence of retinal detachment.

The patient was referred, non-urgently, to a retinal specialist for further evaluation of the presumed inactive CNVM as well as possible prophylactic treatment for the retinal hole. The patient was seen 2 weeks later by the retinal specialist. He opted not to perform fluorescein angiography (FA) and chose OCT angiography (OCT-A) instead. OCT-A scanning was performed and was deemed reliable with no apparent artifacts. Testing showed a net of blood vessels in the avascular zone without flow indicating

an inactive CNVM. The retinal specialist also deemed it inactive based on a lack of adjacent fluid and hemorrhaging and due to the surrounding retinal pigment hyperplasia (**Figure 10**). Barricade laser was performed around the operculated retinal hole. The patient continues to be monitored every 6 months for possible progression of RNFL thinning and visual field defects. Her most recent visit revealed stable findings.

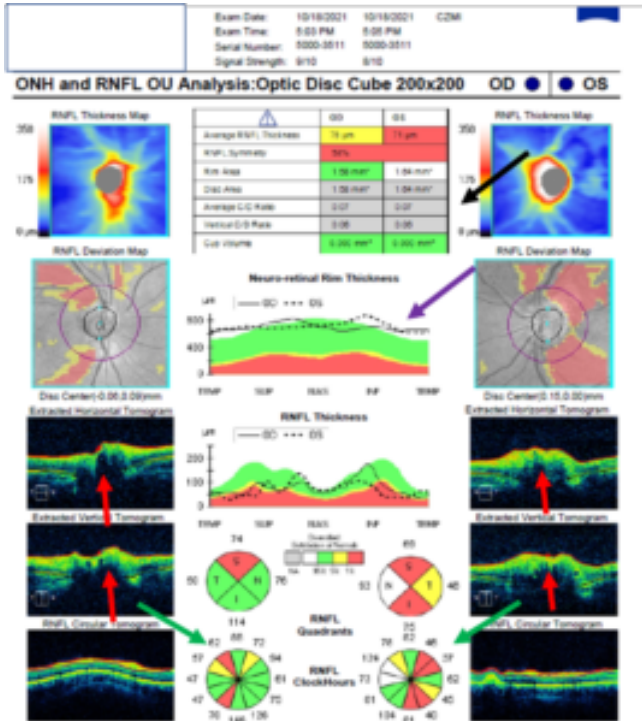


Figure 7. Optical coherence tomography (OCT) of both optic nerves. The signal strength was adequate with no artifacts being noted indicating reliable test results. Small disc and rim areas were noted in both eyes along with very small to absent cup-to-disc ratios (black arrow). The neuroretinal rim in both eyes was noted to be thicker than average (purple arrow). Testing revealed significant retinal nerve fiber layer (RNFL) loss superior-temporally > inferior-temporally in both eyes, with larger amounts of thinning evident OS (green arrows). These test results corresponded with the overall appearance of the discs seen on fundus photos. The OCT RNFL results also corresponded with the visual field defects (inferior arcuate defects OD/OS, deeper defect OS). The OCT scans, particularly the horizontal and vertical tomograms for each eye, revealed a lumpy bumpy internal contour of both optic nerves (red arrows) with no apparent or a very mild cup in addition to a normal retinal pigment epithelium/Bruch's membrane contour, which was indicative of optic disc drusen. [Click to enlarge](#)

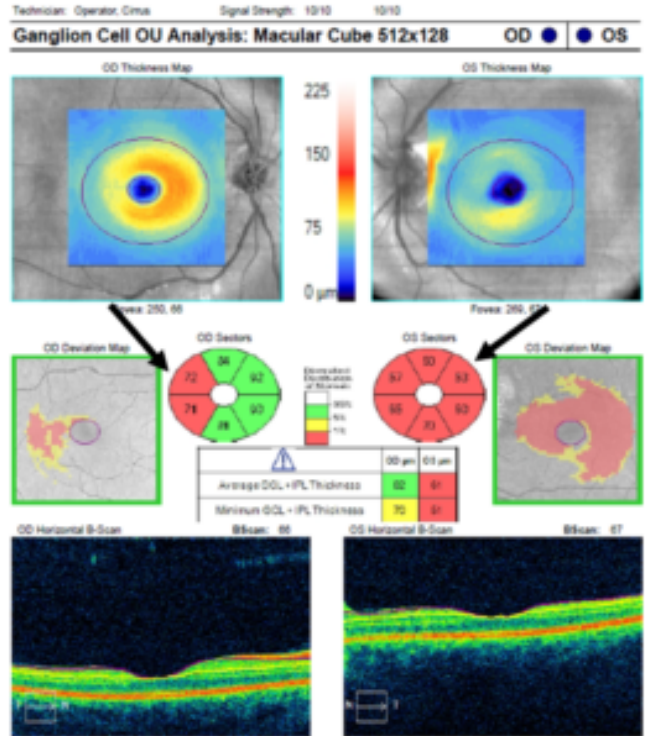


Figure 8. Ganglion cell complex analysis OD and OS. The scan was judged reliable based on a strong signal strength and absence of artifact. Testing OD showed dense temporal thinning, while testing OS showed significant amounts of overall thinning, with larger amounts of thinning noted in the superior quadrants (black arrows). The larger amounts of thinning OS correlated to the retinal nerve fiber layer thinning OS and to the reduced acuity and afferent pupillary defect noted OS. [Click to enlarge](#)

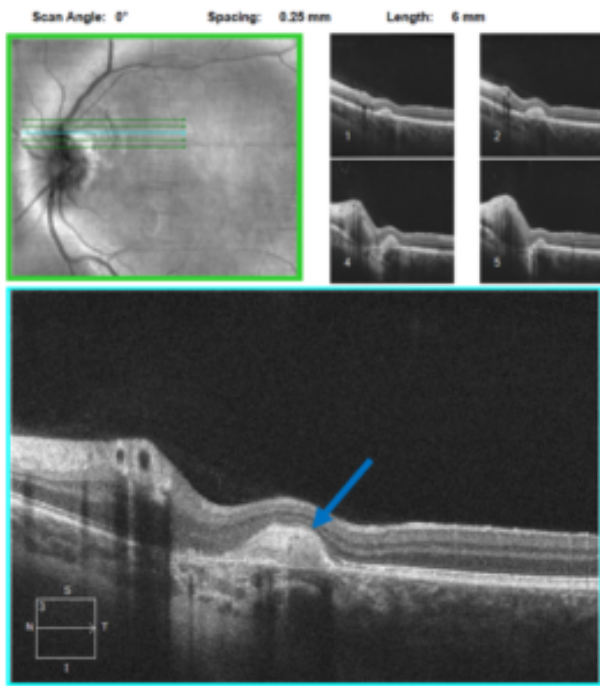


Figure 9. Spectral-domain optical coherence tomography raster scan of the inactive choroidal neovascular membrane OS. Fibrosis (blue arrow) is noted and no fluid is apparent. [Click to enlarge](#)

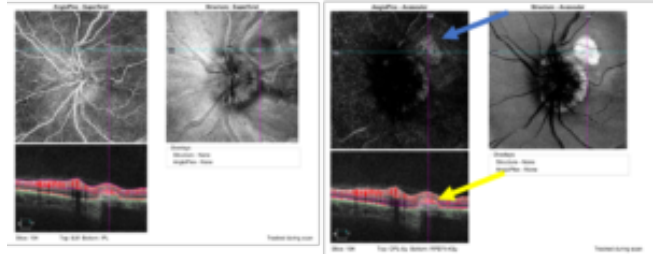


Figure 10. Optical coherence tomography angiography of the left optic nerve and retina, specifically the superficial enface (left) and the avascular enface (right). A hyper-reflective net representative of a choroidal neovascular membrane is present in the avascular layer (blue arrow). No blood flow is noted in the membrane indicating scarring and inactivity (yellow arrow). [Click to enlarge](#)

Education Guide

Key concepts

1. The basic anatomy, physiology and function of the optic nerve and its correlation to optic disc drusen
2. The pathophysiology of optic disc drusen and associated complications
3. Identifying and differentiating optic disc drusen from similar conditions
4. Appropriate treatment and management plans including possible referrals and referral timelines

Learning objectives

1. Recognize the clinical presentation of ODD including signs and symptoms
2. List the potential differential diagnoses of ODD
3. Create a management plan for a patient with and without complications from ODD
4. Increase understanding of the value of ancillary testing in diagnosing and managing ODD

Discussion questions

1. Knowledge, understanding and facts about the clinical case and condition presentation
 - a. What is the pathophysiology of ODD?
 - b. Describe the typical appearance and presentation of ODD
 - c. Discuss the complications that can occur secondary to ODD
2. Differential diagnosis
 - a. What other condition(s) should be considered as differential diagnoses for ODD?
 - b. How can ODD be differentiated from other similar conditions based on clinical appearance?
 - c. What additional testing should be considered to help differentiate ODD from similar conditions?
3. Patient management and role of the optometrist

- a. What is the prognosis of ODD without complications?
- b. How would you manage ODD if there were no complications?
- c. How does your treatment and management plan change based on potential complications?
- d. What patient education should be given to a patient with this condition?

4. Critical-thinking concepts

- a. When should you consider referring this patient to another eyecare professional?
- b. How quickly should the referral be made?
- c. How does patient education change if the patient was diagnosed as a child rather than as an adult?

Assessment of learning objectives

This teaching case report is suitable for use in multiple settings that can include formal classroom lecture, small-group learning/laboratory or online or distance-learning.

In a classroom setting, students can be given the case details and tasked with arriving at a formal diagnosis and management plan based on the presented findings and ancillary testing. Understanding and knowledge can be evaluated through open-ended questions to the class or through formal testing with multiple-choice questions utilizing platforms such as TurningPoint.

In a small-group setting such as laboratory or clinic, students can have an open discussion together once the case is presented. Groups can then request appropriate images and scans including fundus photos, OCT scans and visual fields that will be interpreted and formally entered into a lab assignment sheet or electronic medical record. This will enhance comprehension of the material and can help lead to appropriate differential diagnoses, a formal diagnosis and a treatment and management plan.

In an online format, the case can be presented along with appropriate ancillary testing and results. Comprehension and understanding can be gauged through multiple-choice questions that address key concepts such as pathophysiology, signs and symptoms, differentials, interpreting testing and treatment and management. Students can be presented multiple-choice questions that must be answered correctly before they can proceed to the next section. Immediate feedback can be provided as students can learn from their mistakes and build upon foundational concepts.

Discussion

ODD are aggregations of calcium phosphate and hyaline deposits that form and manifest early in life with a location anterior to the lamina cribrosa.⁸ They are clinically found bilaterally in most cases but can be seen in an asymmetric fashion.^{3,9} Males and females are equally affected with the prevalence being fairly rare at 1-2%.^{1,10} Caucasians tend to manifest the condition more so than other ethnicities.¹¹ The prevalence of ODD varies between ethnicities. A lower prevalence is noted in those with Chinese or African heritage while Caucasians tend to have an increased prevalence. This could be due to optic disc diameter, which is known to be smaller in Caucasians compared with other ethnicities.¹¹

Although they are usually a standalone finding, ODD can also be found with other ocular and systemic conditions including retinitis pigmentosa (RP), pseudoxanthoma elasticum (PXE) and rarer conditions such as Alagille syndrome.² Optic disc drusen in patients with RP are seen at an increased rate compared to standalone ODD (9%) with the ODD tending to be parapapillary rather than within the disc itself.^{2,10} The ODD are also seen more frequently with systemically associated forms of RP such as Usher syndrome type 1 (35%) according to one study.¹² Increased frequency of ODD is also seen with PXE as studies have estimated its prevalence to be anywhere from 8.5% to 24%, much higher than in the general ODD population.^{13,14} The increased prevalence is thought to be due to a hypo-calcification of Bruch's membrane, which may lead to increased calcification of ODD.¹⁰ Alagille syndrome is a rare genetic disorder that leads to damage of the heart and liver. These patients also present with higher frequencies of ODD with one study showing more than 90% of patients with Alagille syndrome having ODD.¹⁵ Another more recent study found the presence of ODD to be 52%.¹⁶

The exact cause of ODD is not known currently. Researchers postulate that formation is secondary to axonal disruption and swelling of mitochondria into the prelaminar extracellular space with dysregulation of calcium deposition.¹⁷ This theory has been supported by a recent histopathological study that reported the absence of macrophages in some specimens of ODD, suggesting chronic axonal transport obstruction.¹⁰ Research also suggests that ODD are secondary to an irregular dominant inheritance pattern.¹⁸ However, this pattern is shown to be incomplete and sporadic. A gene for ODD has yet to be identified.¹⁹ As reported by Mullie et al., it has also been hypothesized that ODD form more often in small, crowded optic nerve heads with smaller scleral canals.²⁰ Optic disc area has been shown to be significantly smaller in eyes with ODD.²¹

Signs or indications that a patient may have ODD include a small and elevated disc with irregular (scalloped) or blurred disc

margins. Clinicians should look for round yellow white refractile clusters in and around the disc.^{3,9,10} With age, drusen tend to go from buried to a more superficial state.¹ Other signs include abnormal vessel branching including tortuosity and trifurcations. The nasal aspect of the disc tends to be most affected.^{1,2,5,11,22-24}

Most patients with disc drusen tend to be asymptomatic; however, advanced drusen deposition has been known to lead to transient vision obscurations, vision loss and visual field defects.² Vision loss is usually mild, while field defects are very common and can progress as the drusen start to surface.^{2,3} Limited data exist on the rate of field loss at this time; however, studies have shown stability of field loss in adulthood.^{24,25} Our patient fits the general epidemiological profile based on her ethnicity, disc appearance and presentation with mild vision loss accompanied by field loss.

Clinical diagnosis can be straightforward if the ODD are visible; however, early on, the drusen may be buried preventing a proper funduscopic view.²⁵ Buried ODD can also appear clinically as an elevated or swollen nerve leading to an improper diagnosis of papilledema, the leading differential for ODD.² Although papilledema does look similar to ODD, clinicians can differentiate the conditions with a proper history, sound clinical examination and adjunct testing such as OCT, B-scan and FAF. As there is not true elevation in intracranial pressure with ODD patients, they should lack symptoms such as headaches and tinnitus.^{1,2,5,26} Close exam of the optic nerve may reveal elevation of the nerve. However, lack of retinal vessel obscuration and RNFL thickening in ODD patients can be used to differentiate from patients with true papilledema.⁹ Furthermore, differentiating the conditions has improved with the addition of multi-modal imaging. Specifically, with enhanced depth imaging OCT (EDI-OCT), clinicians can visualize ODD, even if they are buried, due to increased signal penetration.^{1,27} One study noted EDI-OCT to have a higher detection rate compared to the previous gold standard, a traditional B-scan.²⁸ EDI-OCT findings include the presence of ODD above the lamina cribrosa, a signal poor core, anterior hyper-reflective margins and hyper-reflective horizontal lines representing early ODD.² Careful examination of the EDI-OCT scans should be undertaken as peripapillary hyper-reflective ovoid mass-like structures (PHOMS) can also be seen. These were originally thought to be ODD, but research has shown them to represent a non-specific OCT indicator of axoplasmic stasis that is also seen in papilledema, central retinal vein occlusions and acute demyelinating optic neuritis.⁸ Clinicians should also examine the RPE/Bruch's complex as inward deflection or angulation is more indicative of papilledema. This finding is not seen with ODD and is due to elevated pressure in the subarachnoid space.²⁹ B-scan ultrasonography, the traditional standard in diagnosing ODD, is still a viable option. The ODD will present as hyper-echoic and intensely reflective structures with posterior acoustic shadowing.^{2,4,5,30} If the ODD are buried, however, especially at a very young age, B-scan may not detect them. This is likely due to the buried drusen being in an uncalcified state.^{31,32} The autofluorescence properties of ODD can also be utilized by FAF imaging. This is due to large amounts of porphyrins, which are fluorophores, present in disc drusen, making FAF a viable option for proper diagnosis.^{33,34} The ODD appear as hyper-autofluorescent deposits.³⁵ A weakness of this imaging modality is its inability to detect deeper or buried ODD.³⁵ FA can also be used; however, it represents an invasive way to image ODD.² Testing would show optic disc staining in the later stages of the FA.^{35,36} Lastly, ODD can be detected with computed tomography, but due to low sensitivity and lack of quick access, it is not recommended for diagnosis.¹

Papilledema is the primary differential for ODD, but other differentials can include congenital anomalies such as crowded or small discs and a malinserted disc, which can both give the appearance of pseudopapilledema.³⁰ Crowded discs resemble ODD due to their congested appearance and are secondary to a small posterior scleral foramen with a normal amount of retinal axons passing through it. However, they will lack hyper-autofluorescence on FAF and will not have hyper-echoic structures on OCT when compared to ODD.³⁰ They are almost always seen in patients with hyperopia.²⁷ Another differential is the malinserted disc. These are discs that show large amounts of nasal heaping or elevation secondary to a tilt on the vertical axis. At times this is seen as blurred or indistinct disc margins. However, these patients will also lack hyper-autofluorescence on FAF with OCT showing nasal heaping of the disc but no hyper-echoic structures.²⁷

As mentioned earlier, ODD are largely benign with most patients having a good visual prognosis. However, as they progress from a buried to superficial state with increased age, complications can arise. Superficial ODD can lead to axonal damage resulting in peripapillary RNFL thinning and secondary visual field loss.^{23,37} Buried drusen are thought to be less likely to affect the optic nerve head due to their deeper location, lesser calcification and smaller size compared with superficial ODD. Visual field defects can include an enlarged blind spot in patients with buried drusen, while patients with superficial drusen can manifest nasal steps and arcuate defects corresponding to respective RNFL thinning.²⁶

Macular thinning can also be seen, specifically in the ganglion cell/inner-plexiform layer (GCIPL). Casado et al. showed that as drusen severity increased, RNFL and GCIPL thinning were more likely.³⁸ This was evident in our patient, with the left eye being affected more superiorly than inferiorly. The superior GCIPL thinning correlated to the significant superior-temporal RNFL thinning in the left eye as well. Both of these findings then corresponded to the inferior visual field defect in the left eye. The visual acuity loss and a corresponding APD were a result of the significant GCIPL thinning, which was more evident in the left eye than in the right eye. Unfortunately, at this time there is no treatment for the progression of ODD and possible RNFL, GCIPL and visual field loss.

There is debate about whether treatment exists for standalone ODD. Studies have attempted to validate the use of IOP-lowering drops with or without an elevated IOP. Studies of patients with ODD with and without ocular hypertension have shown a greater prevalence of field loss in those with elevated IOP.³⁹⁻⁴¹ However, careful analysis shows these to be retrospective or case report studies. A more recent study of 34 patients with bilateral ODD concluded that a decrease in IOP, with topical brimonidine, resulted in delayed optic neuropathy progression. However, the authors themselves note limitations such as small sample size and short time of observation that could have affected the results.⁴² Controlled clinical research is still needed for validated results on IOP and its relationship with ODD. At this time, primary or standalone ODD can be followed without treatment as most patients have a favorable visual prognosis.

Complications secondary to ODD can also occur. They include peripapillary hemorrhaging secondary to the compressive effects of ODD on adjacent peripapillary vessels. These tend to be benign and resolve without treatment.⁴³ More serious complications can include CNVM, such as in our patient, or NAION. Peripapillary CNVM can be seen in younger or adult patients but younger patients tend to be more affected.⁹ CNVM tends to occur more nasally on the disc, likely due to the higher incidence of ODD on the nasal aspect of the disc. The etiology of peripapillary choroidal neovascularization is not known, but researchers postulate that enlarging drusen may compress and damage the vascular supply to the peripapillary retina resulting in an area of ischemia. This would lead to the release and upregulation of vascular endothelial growth factor (VEGF) and the development of a CNVM.^{5,44} This theory would correlate to younger patients presenting with CNVM.^{5,9} Although it is not used as frequently in the diagnosis of CNVM, when compared to FA, OCT and OCT-A, FAF may be a reasonable initial option as well. Subretinal fluid from active CNVM usually presents as hyper-autofluorescence, while disciform scarring or fibrosis presents as uneven autofluorescence of the lesion surrounded by hyper-autofluorescence (as in this case).⁴⁵ Hemorrhaging and exudation from active CNVM, if present, usually present as hypo-autofluorescence along with RPE atrophy and RPE hyperplasia (as in this case).⁴⁵ Anti-VEGF medications are standard treatment, and an urgent referral for treatment is indicated, especially when the CNVM threatens the macula. Most ODD patients require fewer injections for CNVM than do patients with age-related macular degeneration.⁵ If the CNVM is not near or threatening the macula, they can potentially be observed for self-resolution.^{2,5,9} The patient in this case report is therefore fortunate as the CNVM was located superior-temporal to the optic nerve and did not encroach near the fovea, which spared her central visual acuity.

Although extremely rare, another visually devastating complication that can occur secondary to ODD is NAION. Both NAION and ODD occur in eyes with an absent or small cup-to-disc ratio with a crowded appearance, namely a disc at risk. NAION in particular is known to be caused by a decrease in perfusion to the optic nerve leading to the resultant ischemic event.⁴⁶ In terms of NAION secondary to ODD, it is thought that patients with ODD can have a resultant NAION as the ODD crowd the disc even more, leading to a further decline in perfusion pressure.⁴⁶ Interestingly, cases of ODD-associated NAION tend to occur more so in younger patients with outcomes (vision and field loss) being more favorable when compared to traditional cases of NAION.²² Other signs and symptoms that can be seen with ODD-associated NAION include a sudden onset of vision loss along with disc pallor. None of these was noted by our patient or observed in her examination. Unfortunately, there are no treatments available for any type of NAION at this time. However, urgent referral to other eyecare professionals should be made if NAION is suspected.

Clinicians should follow ODD patients on a semi-annual to annual basis, with multi-modal imaging, to monitor for any progressive visual field and/or RNFL loss. Younger patients tend to progress more in terms of field loss and presenting with complications than older patients and should therefore be educated appropriately on this.^{5,22,28} Unfortunately, there are no treatments for ODD and treatment is reserved for possible complications arising from ODD.

This case highlights standard and rare complications that can be seen with ODD. Although most cases are benign with no visual sequelae, clinicians should be aware of the potential complications that can arise including vision and field loss. This can be due to normal ODD progression or be a consequence of conditions associated with ODD such as peripapillary CNVM or NAION. Patients, especially younger patients, should be educated on the natural progression of ODD and on identifying potential signs and symptoms associated with rarer complications. Clinicians should consider more frequent examinations in younger patients while also considering more frequent examinations in cases with ODD complications. Multi-modal imaging, such as OCT and FAF in addition to standard visual field testing, is strongly suggested in the management of patients with ODD and ODD-associated complications.

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GRIT Survey Score in First-Year Optometry Students: Pre-COVID vs. Mid-COVID

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Introduction

In her book “GRIT: The Power of Passion and Perseverance,” Angela Duckworth, PhD, describes her theory of how a willingness to persevere in pursuit of long-term goals is among the most important predictors of an individual’s success.¹ (“GRIT = “growth,” “resilience,” “intrinsic motivation” and “tenacity.”) To test her theory, Duckworth created a “GRIT” survey and administered the survey to several populations, including West Point cadets and University of Pennsylvania undergraduate students. Her results showed that their GRIT scores were just as powerful at predicting success in their programs as measures that are believed to reflect natural aptitude, such as the Scholastic Aptitude Test. Although her work has undergone much scrutiny,²⁻⁴ the concept that passion and perseverance play significant roles in success pervades.

Other researchers have used Duckworth’s survey and other perseverance assessment tools to explore the concept of GRIT in various student populations. Bowman et al. found that “perseverance of effort predicted greater academic adjustment, college grade point average, college satisfaction, sense of belonging, faculty-student interactions and intent to persist ...”⁵ With respect to academic achievement in graduate rehabilitation science programs (physical therapy, occupational therapy, speech-language pathology), a systematic review/meta-analysis revealed that GRIT has a moderate, positive, significant correlation with academic performance.⁶ Cisarik showed similar GRIT scores across two consecutive classes of first-year students in an optometry program, demonstrating consistency in the degree of self-reported persistence as measured with Duckworth’s survey early in the academic career for this profession.⁷ Cheung et al. found that lower GRIT scores were associated with adverse childhood events in a group of university students recruited for the study from 12 universities.⁸ Lee et al. demonstrated that GRIT is not a fixed personality characteristic, as the score can be enhanced with participation and advancement in taekwondo.⁹ Others have shown a positive association between teacher-student rapport and GRIT.¹⁰

According to Duckworth’s original publication, perseverance to accomplish long-term objectives requires endurance when circumstances are difficult.¹¹ The persistence of the global COVID-19 pandemic offers an opportunity to examine the effects on long-term stress and uncertainty on perseverance. Using Duckworth’s GRIT survey, we compared the self-reported measures of perseverance of first-year students in the optometric program in early 2022 (mid-COVID pandemic) with scores from two classes of pre-COVID-19 first-year optometry students.^{12,13}

Methods

The research protocol conformed to the tenets of the Declaration of Helsinki, and the Institutional Review Board (IRB) of Southern College of Optometry (SCO) determined that the survey methodology qualified this study for exemption from IRB review.

As part of an optional extra-credit activity (one point toward the final course grade that could not be used to pass the course as a whole) for the visual sensation and perception course at SCO, 137 students in the first year of the program in the spring semester of 2022 were invited to take the GRIT survey designed by Dr. Duckworth. The survey was administered electronically using the Google Forms platform. The instructions given in writing before the survey questions were as follows:

This survey was created by Angela Duckworth, author of “GRIT: The Power of Passion and Perseverance.” Read each sentence, then select the choice that best describes you relative to the sentence. Don’t overthink the questions. Just ask yourself how you compare to “most people” (not just how you compare to your family, friends or co-workers). All answers are required.

Students were told that the survey would take approximately 10-15 minutes to complete and were given 2 weeks to respond. Only one set of responses was accepted per student. If a student signed on more than one time to complete the survey, only the first completion (identified by a time stamp) was used in the analysis.

Statistical analysis was performed using SPSS (v.26.0) to compare the GRIT survey scores for the first-year students in 2022 with the scores of the first-year students in the optometry program at SCO in 2017 and 2018 that had been obtained for other studies.^{12,13}

Results

A total of 132 first-year students in the spring of 2022 responded to the survey. The proportions of respondents for 2017, 2018 and 2022, respectively, were 100% (all 132 students), 93.3% (126 of 135 students) and 96.4% (132 of 137 students). The respondents for 2022 had completed one semester of online-only lecture courses and in-person labs with reduced lab class size and other COVID safety protocols in place. The respondents for 2017 and 2018 had completed one semester with access to both in-person real-time lectures and recorded lectures as well as full-sized lab classes (28-30 students per lab section) during the semester prior to the collection of their GRIT survey responses.

Figure 1 shows the comparison of the mean GRIT scores (\pm 2 standard error, SE) across the three groups. The mean GRIT scores (standard deviation, SD) for 2017, 2018 and 2022, respectively, were 3.79 (0.47), 3.70 (0.47) and 3.55 (0.53). One-way ANOVA test indicated that the means of the GRIT scores for the three groups were significantly different ($F = 8.51$, 2-tailed $p < .001$). Post hoc analysis using Tukey's test indicated that mean GRIT score for 2022 was significantly different (lower) from that of 2017 ($p < .001$, 95% CI = [-.38, -.10]) and 2018 ($p = .03$, 95% CI = [-.30, -.01]), but the mean GRIT score for 2017 was not significantly different from the 2018 score ($p = .311$, 95% CI = [-.05, .23]).

Independent samples Kruskal-Wallis test was used to compare the distribution of responses to individual survey items across the years of survey administration, and the results for the items with significant differences between 2022 and the other two years are presented in **Figure 2**. Differences were found for item 1, "New ideas and projects sometimes distract me from previous ones" (**Figure 2a**, test statistic = 11.96, 2-tailed $p = .003$); item 8, "I am diligent. I never give up" (**Figure 2b**, test statistic = 14.68, 2-tailed $p < .001$); and item 9, "I have been obsessed with a certain idea or project for a short time, but later lost interest" (**Figure 2c**, test statistic = 17.86, 2-tailed $p < .001$).

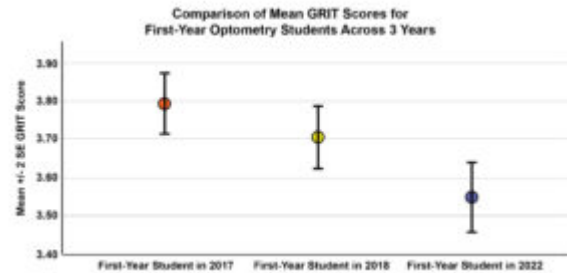


Figure 1. Error bars represent the standard error (SE) of the mean. See text for statistical analysis.

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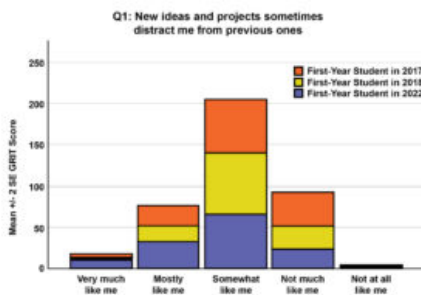


Figure 2a. The distribution of responses for item 1 (and items 8 and 9) on the GRIT survey was significantly different across classes. [Click to enlarge](#)

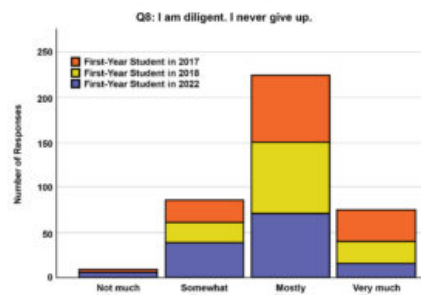


Figure 2b. The distribution of responses for item 8 (and items 1 and 9) on the GRIT survey was significantly different across classes. [Click to enlarge](#)

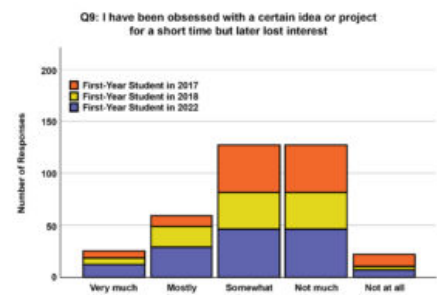


Figure 2c. The distribution of responses for item 9 (and items 1 and 8) on the GRIT survey was significantly different across classes. [Click to enlarge](#)

Discussion

The main finding of this study is that for first-year students at SCO, the mean GRIT score in 2022 was significantly different from the mean GRIT scores in 2017 and 2018; whereas, the mean GRIT scores for 2017 and 2018 did not significantly differ. This difference appears to be attributed to a difference in the distribution of responses across the years to survey items 1, 8 and 9.

The possibility exists that the lower mean GRIT score for the 2022 subjects is an expected statistical variation in the samples drawn from the population, but as evidenced by the minimal overlap of the standard error bars in Figure 1, that likelihood is very small. Given that the academic demographics on matriculation to SCO are similar for the 3 years of first-year students in this study,¹⁴ different education experiences or achievement do not explain the differences in mean GRIT scores. We did not query our subjects on factors reported to be associated with GRIT score, such as adverse childhood events,⁸ recent alcohol or

marijuana use¹⁵ or socio-economic status,¹⁶ but education accomplishment at the time of survey administration was similar across years.¹¹ With the sudden and recent economic decline experienced by many families due to the onset of the COVID-19 pandemic, we cannot rule out the influence that economic hardship may have had on the 2022 GRIT scores.

While many factors outside a specific academic arena are associated with academic success (prior academic achievement, emotional intelligence, motivation, self-regulated socio-cognitive skills, goals orientation),¹⁷ studies that have examined the academic environment's influence on GRIT have identified some areas that may have been adversely influenced by the pandemic. For example, Yuan reported that teacher-student rapport and teacher "stroke" (positive reinforcement of student performance) both were positively associated with learners' GRIT.¹⁰ Whether consciously or unconsciously, instructors at SCO may not be engaging with students mid-COVID to the same extent as pre-COVID, or the masks and other social-distancing measures may be impeding attempts at student engagement.

Several studies have examined the association between "burnout" or "emotional exhaustion" and measures of perseverance. A survey of emergency department residents in 2016 found that those meeting the criteria for burnout as assessed by the validated Maslach Burnout Inventory had significantly lower mean GRIT scores than those of residents not meeting the criteria for burnout.¹⁸ Note that this study was done prior to the COVID-19 pandemic. In 2020 Jumat et al. published a study demonstrating that higher GRIT scores measured at the beginning of the first year appear to protect first-year medical students from experiencing burnout symptoms later in the year.¹⁹ Thus, if a similar relationship between GRIT score and future burnout exists for first-year optometry students, our institution may experience the effects of their burnout in the near future, such as lower overall grade point average of graduates, lower national board scores, more students electing to drop from the program, fewer applicants for residency positions (or more applications for residencies if the acquisition of a residency is seen as a buffer against future economic hardship).

A respondent receives between 1 and 5 points for each item on the GRIT survey based on the response chosen for each item. The total number of points for the survey is divided by 10 to calculate the GRIT survey score for an individual respondent. The mean GRIT score of 3.55 (on a scale of 1-5, with 5 representing high GRIT) places the first-year students in 2022 in the 40th percentile by Duckworth's scale, which was developed based on a large sample of adults. The mean GRIT scores for 2017 and 2018 on this same scale place those groups in the 50th percentile. Both of these mean GRIT score values are lower than the mean value (4.01 ± 0.42) reported for medical students in 2014.²⁰ Whether the significantly different mean GRIT score for the first-year students in 2022 will have practical implications for them or for the institution is unknown. Also unknown is whether the scores for the first-year students in 2022 are actually higher or lower than they would have been if measured immediately upon matriculation. While research involving nursing students has shown improved GRIT score with accomplishment and age,¹⁶ no clear relationship between GRIT score and program level manifested (pre-COVID-19) in a cohort of pharmacy students.²¹

Training to improve one's resilience is offered by therapists,²² clinics²³ and the U.S. Army.²⁴ A meta-analysis of small randomized trials of the efficacy of such programs showed that most of the studies had moderate to high bias.²⁵ Nonetheless, generalized stress-directed programs showed a moderate effect on enhancing resilience.²⁵ In a study with a short-term follow-up, resilience training in healthcare workers in a hospital setting demonstrated that the implemented program was feasible and accepted and generated improved outcomes.²⁶ A separate meta-analysis of studies examining resilience training specifically in healthcare workers found the interventions to have moderate effects on resilience and stress, but the evidence had very low certainty.²⁷ Our previous work showed no relationship between GRIT score and grades in two individual classes.⁷ Whether a relationship exists between resilience and success in an optometric program as a whole, success on board examinations or success in a post-graduate residency program is unknown. Thus, further research, perhaps using other validated tools for assessing resilience, as well as studies of the effects of specific interventions, is needed before recommendations for resilience training in optometric education can be made.

Alternatively, the lower 2022 GRIT scores may reflect another aspect of the changing demographics of students entering optometry school. The DISC survey is a behavioral/personality self-assessment tool used widely by individuals and organizations to understand how personal behaviors impact communications.²⁸ The "S" component of this tool stands for "steadiness" and reflects the characteristics of patience, collaboration, calm approach and humility.²⁹ While some of these characteristics are desirable in caring for patients, a high score in this section of the survey indicates that the individual prefers to work in the background and to avoid conflict or change.²⁸ This communication style emphasizes cooperation with others within the existing circumstances, as opposed to challenging oneself and others.²⁸ According to Lisa Wade, OD, Director of the Hayes Center for Practice Excellence at SCO, the mean "S" score in the DISC assessment she uses for first-year optometry students at the college continues to trend upward and is well above the national average (personal communication).²⁹ A formal comparison of the DISC scores and the GRIT scores in the same group of optometry students could prove informational.

The current study has several limitations. GRIT scores for first-year optometry students at SCO are available for 2017 and

2018, but not for years earlier or later, except for 2022. Thus, we were unable to determine whether the difference observed in the data is likely to be pandemic-related or part of an already-existing trend. Nevertheless, the association between lower GRIT scores and less resilience or higher burnout,^{17,18} regardless of the influence of the pandemic, suggests that promoting resilience through instructor-student engagement and frequent positive feedback may help to mitigate burnout in optometry students.

Another limitation of this study is that the data were collected from only one optometric program. SCO, as one of the larger optometric programs in the United States, has had an entering class size of approximately 135 for the past two decades. Academic records of matriculating students may vary somewhat across optometric institutions. If the within-institution entering data is similar across years, then any difference in GRIT score trends from the trend reported from the SCO data may be related to class size and, perhaps, a difference in feelings of school connectedness.³⁰ Jorgenson et al. reported that dimensions of school connectedness vary based on student age, with students ages 21-25 experiencing a higher degree of connectedness based on interactions with faculty, rather than with other students.³¹ Establishing regular faculty-student interactions may be more easily accomplished in environments with fewer total students. Whether any interference in faculty-student interactions caused by adjustments in teaching to accommodate safety protocols related to COVID differed between larger and smaller optometric programs is unknown.

A third limitation of this study is the lack of data collection for assessment of student well-being, such as for depression or anxiety, for any of the study years. A meta-analysis of post-secondary student mental health during COVID-19 revealed pooled prevalence estimates of elevated depressive symptoms in 30.6% and elevated anxiety symptoms in 28.2% of students, unrelated to their level of training.³² With respect to student perceptions of the impact of COVID-19 on their medical education, Haskett et al. found that students with higher GRIT scores reported less anxiety, insomnia and tiredness.³³ An understanding of the relationship, if any, between GRIT scores and symptoms of anxiety or depression in optometry students would help determine whether institution-level changes are indicated, or whether interventions on an individual student basis would be more effective.

Conclusion

The assessment of resilience using Duckworth's GRIT survey in first-year optometry students across several years suggests that the students tested mid-COVID-19 pandemic rate themselves as less "gritty" than first-year optometry students from two different pre-COVID-19 years. Although the factors contributing to this change are uncertain, awareness of the change and of factors that can improve the sense of resilience may be helpful in mitigating undesired academic outcomes or career decisions for optometry students.

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Complex Case of Dry Eye Management Associated with Sjogren's Syndrome: a Teaching Case Report

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Background

The following case report is a guide for teaching optometry students and residents. It is relevant in all levels of training, especially for students during clinical training. Students may see few of these cases in their optometry training but are likely to see more during their careers. Sjogren's syndrome (SS) is a chronic, systemic, autoimmune disease that causes exocrine gland dysfunction. Damage of the lacrimal glands results in keratoconjunctivitis sicca. In chronic and severe cases, keratoconjunctivitis sicca can lead to filamentary keratitis (FK). While there are genetic associations with the pathogenesis of SS, environmental factors play a role as triggers in the development of the disease. This case illustrates the importance of accurate examination of FK and treatment of the condition along with underlying causes.

Case Description

Case history

- Patient demographics: 53-year-old African American female
- Chief complaint: Patient presented with dry eyes with symptoms of grittiness, soreness, irritation, occasional redness and white-yellowish discharge twice per week that she removes digitally.
- Ocular, medical history: In 2007, patient was diagnosed with keratoconjunctivitis sicca and SS, which she has been managing with preservative-free artificial tears (PFATs), ointment and silicone punctal plugs OU. She also has ocular hypertension secondary to long-term use of oral and ophthalmic steroids, and is currently using eye drops to lower intraocular pressure (IOP). The patient was diagnosed with stage 3 multiple myeloma in 2014, received bone marrow transplant in 2015, and is undergoing chemotherapy.
- Medications: Travoprost ophthalmic solution 0.004% (Travatan Z) every bedtime OU, prednisone 5 mg/day, dexamethasone 40 mg, pomalidomide 2 mg, daratumumab
- Other salient information: Patient worked near the World Trade Center for many years including before and after Sept. 11, 2001 (9/11). Patient reported that prior to 9/11 her medical history had been unremarkable. Patient developed dry eye disease in 2007 and initially managed with PFATs and ointment. However, given the patient's low aqueous tear production, punctal plugs were inserted in both eyes. Patient was using prednisolone acetate ophthalmic suspension 0.12% (Pred Mild) twice a day OU for bilateral FK that subsequently developed. She was on a higher dose of oral prednisone (20 mg/day) to minimize her inflammatory response to the graft bone marrow transplant. Patient developed a steroid response to oral and topical steroids that resulted in elevated IOP in both eyes, for which she was prescribed IOP-lowering drops, and subsequently discontinued Pred Mild and reduced prednisone dosage to 5 mg/day after consulting with her oncologist.

Pertinent findings

Clinical:

- Best-corrected visual acuity: 20/20 OD and OS
- Dry eye assessment: Schirmer I test without anesthetic yielded OD 1 mm and OS 5 mm, low tear meniscus (< 0.25 mm) OU, instant tear break-up time (TBUT) OU, tear osmolarity of 325/332 mOsm/L
- IOP 12/12 mmHg with Travatan Z every bedtime OU
- Initial IOP prior to initiating Pred Mild: 20/20 mmHg
- Tmax (highest measured IOP) 32/32 mmHg subsequent to use of Pred Mild twice a day OU
- Thin central corneal thickness: 504 µm OD, 497 µm OS

Physical:

- Ocular surface: OU: (-)lagophthalmos, (+)silicone punctal plugs right lower lid and left lower lid, 1+ papillae upper lid and lower lid, conjunctival injection, temporal and nasal bulbar staining with sodium fluorescein and Lissamine green staining; OD: loose mucus strand across cornea; OS: 3 filaments along inferior cornea

- Lens: trace nuclear sclerosis OU
- Funduscopy: OU: C/D ratio 0.30/0.30, (-)hemes; vitreous, macula, vasculatures, and periphery all unremarkable

Imaging studies:

- Retinal nerve fiber layer and macular optical coherence tomography: within normal limits OD and OS

Others:

- In-office filament removal with jewelers forceps OS (1 gtt proparacaine OU), and mucus strand removal from bulbar conjunctiva with forceps OD. Patient tolerated procedure well.

Differential diagnosis

- Primary/leading: FK with mucus fishing syndrome and SS with underlying aqueous-deficient and inflammatory dry eye disease

Treatment, management

- Patient's treatment for FK and keratoconjunctivitis sicca includes PFATs four times a day OU, preservative-free ophthalmic ointment, cold compresses 5 minutes prn, avoid fishing mucus out, and cyclosporine 0.05% ophthalmic emulsion (Restasis) twice a day OU. Patient was advised to lubricate with PFATs every hour for 1 day OS after in-office filament removal with forceps.

Education Guidelines

Key concepts

- Recognize the clinical findings of FK and SS
- Differential diagnosis of FK
- Treatment and management options of FK

Learning objectives

At the conclusion of the case, participants should be able to:

- Identify and describe the signs of FK
- Know the ocular manifestations of SS
- Understand the relationship of SS, keratoconjunctivitis sicca and FK
- Understand the association between exposure to environmental pollutants and autoimmune diseases
- Provide proper patient education on management of FK and keratoconjunctivitis sicca

Discussion questions/points

- Describe the signs and symptoms of FK
- What are the most effective treatment options for FK?
- How would you educate patients with SS about their ocular condition and prognosis?
- Which other healthcare providers would you communicate with and engage in interprofessional care?

Learning assessment

- Use slit lamp photos to identify and describe the abnormal findings in keratoconjunctivitis sicca and FK
- Literature review on environmental exposure, including World Trade Center exposure, and health consequences
- Engage students in report writing to different healthcare providers, including primary care physicians and rheumatologists

Discussion

There is a genetic risk factor for susceptibility to developing SS. The strongest associations are with the human leucocyte antigen (HLA) locus.¹ Genetic variants in the IRF5 and STAT4 loci of the interferon (IFN) signaling pathways are also associated with SS and its pathogenesis. However, these identified genetic risk variants only contribute to a modest increased risk of SS, indicating that environmental factors play a role in developing SS.² While infectious agents, such as Epstein Barr

virus, can play a role in SS pathogenesis,³ several environmental factors including stress, environmental pollution and silicone may contribute as triggers for predisposed genetic backgrounds.⁴ Several studies suggest a correlation between development of autoimmune diseases and aerosolized World Trade Center dust – a mixture of cement, glass fibers, silica, asbestos, lead, polycyclic aromatic hydrocarbons, polychlorinated biphenyls and polychlorinated furans and dioxins.⁵⁻⁷ Residents, workers and rescuers in the area were exposed to aerosolized World Trade Center dust, and the effect of chronic exposure increased by 13% for each month worked at the site. Those who worked at the site for 10 months compared with those who worked for 1 month had a 3.09-fold risk of developing systemic autoimmune disease.⁸

SS is an autoimmune disease associated with keratoconjunctivitis sicca.⁹⁻¹² SS is associated with dysfunction of exocrine glands, including the lacrimal glands and salivary glands. Common symptoms are dry eyes (keratoconjunctivitis sicca) or dry mouth (xerostomia), but symptoms can also extend to the nose, throat and skin. Most individuals with SS are women.¹ Ophthalmic procedures for confirming signs of keratoconjunctivitis sicca include Schirmer test, TBUT, phenol red thread test and dye staining. Serology is also recommended to confirm the diagnosis of SS. Positive results in antinuclear antibody (ANA), rheumatoid factor (RF) or SS-specific antibodies (anti-Rho [SS-A] or anti-La [SS-B]) can help confirm the diagnosis.¹³

FK is characterized by strands of degenerated epithelial cells and mucus that adhere to the corneal surface. It is a chronic and recurrent corneal disorder that is associated with various ocular surface diseases including dry eye.¹⁴ Other causes include ocular surgery, corneal exposure (e.g., seventh nerve palsy), blepharoptosis, graft vs. host disease (GVHD) and extended use of anticholinergic medications. Alterations and abnormalities in the tear film and corneal surface can lead to the development of FK. Often, a decrease in aqueous tear production or an increase in tear-film mucus production is responsible. The decrease in aqueous- to tear-film mucus ratio leads to the formation of mucoid strands, or filaments.

Patients with FK complain of foreign body sensation and ocular surface irritation, which worsen with blinking. They may also experience redness, epiphora, blepharospasm and photophobia. Filaments adhered to the corneal surface are best viewed under slit lamp examination, as are additional signs including decreased aqueous tears and tear production, increased mucin in the tear film, subepithelial opacities at the base of the filaments, or epithelial defects at the sites where filaments have been detached.

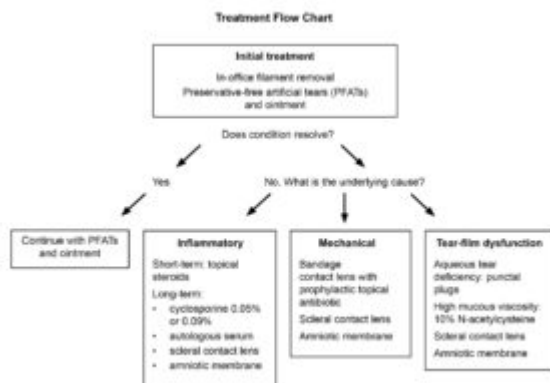


Figure 1. Treatment for filamentary keratitis includes providing symptomatic relief via in-office filament removal and managing the underlying condition.

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Treating FK includes providing symptomatic relief via in-office filament removal and managing the underlying condition, which in this case is keratoconjunctivitis sicca (**Figure 1**). Constant topical lubrication with PFATs and ophthalmic ointment should be the first line of treatment.¹⁴ Over-the-counter PFATs contain cellulose derivatives, which are ophthalmic demulcent agents that help protect and lubricate mucous membranes on the ocular surface.²³ Lubricating ointments that contain ophthalmic emollient agents can protect and soften tissue to prevent drying and cracking of the ocular surface and increase tear stability and TBUT.²³ Restasis or cyclosporine ophthalmic solution 0.09% (Cequa) addresses the underlying cause by reducing inflammation when corticosteroid is not an option.¹⁰⁻¹² Topical autologous serum is another option.¹⁰⁻¹² Patient education is important in minimizing issues such as mucus fishing syndrome. In these cases, cold compresses and lubricants are recommended.¹⁵ For cases where lubrication alone is not sufficient, low water-content bandage contact lenses may be used in combination with prophylactic topical antibiotic. A topical mucolytic agent, 10% N-acetylcysteine, can be used to decrease the viscosity of the mucinous layer of the tear film. Punctal plugs are also helpful in cases where aqueous tear deficiency is present. In moderate to severe dry eye disease, scleral contact lenses and amniotic membrane can be considered to manage patients whose chronic dry eye affects vision and comfort.^{16,17} Prognosis is generally good, but patience is required given the chronic state of this condition as well as long-term management of the underlying systemic condition contributing to the chronicity of the disease.

Patients with a history of steroid response need to be monitored carefully even after discontinuation of topical steroids to ensure no rebound effect, especially when these patients remain on oral steroids.^{18,19} While topical steroids can be used to manage FK, patients should be monitored carefully for elevated IOP and potential long-term side effects. When topical steroids need to be prescribed, it is important to consider less potent steroids that have safer side effect profiles, such as loteprednol

etabonate and fluorometholone.²⁴

Studies have demonstrated that multiple myeloma and prostate and thyroid cancer are associated with post-9/11 environmental exposure.²⁰ A case series study found that firefighters had a 1.8-fold higher risk of developing multiple myeloma.²¹ Likewise, workers in manufacturing occupations and industries, particularly textile, apparel and furnishing machine operators and tenders, were significantly at greater risk of developing multiple myeloma.²² 9/11 particulate exposure has been linked to development of autoimmune diseases.

Individuals with history of bone marrow transplant are susceptible to developing GVHD.²⁵ Chronic GVHD can involve multiple systems, including the musculoskeletal and hematologic systems, as well as organs including the skin, gut and eyes.²⁵ GVHD is thought to involve type 1 T-helper cells, interleukin (IL)-2, IFN- γ and IL-1.²⁶ In ocular GVHD, this T-cell-mediated process occurs along the conjunctival and lacrimal gland tissues.²⁵

As demonstrated in this case, it is important to manage patients with systemic autoimmune diseases with other healthcare providers, including the primary care physician and rheumatologist. Likewise, the case highlights the importance of interprofessional communication when managing systemic medications for autoimmune diseases, especially when ocular side effects develop. Careful monitoring is indicated for patients on oral steroids, who may develop ophthalmic side effects including elevated IOP. For patients with increased IOP or development of steroid-induced glaucoma, it is important to manage the ophthalmic condition and communicate the findings with patients' physicians. In this case, the patient's oncologist was also informed of the findings, which prompted the oncologist to reduce the dosage to a level that reduced the patient's IOP while maintaining good control of her systemic symptoms.

Differential diagnosis

Corneal filaments are pathognomonic for FK. However, the condition may have several underlying causes. Other causes include tear-film abnormalities and dysfunction and mechanical causes including lid ptosis, previous ocular surgery and toxic keratopathies. Keratoconjunctivitis sicca is often the underlying cause of FK.

The location of the filaments can be helpful in differentiating between the potential underlying causes. Filaments caused by keratoconjunctivitis sicca and tear-film abnormalities typically are observed along the interpalpebral space. Filaments that form superiorly are due to lid ptosis, and those due to surgery will be seen at the site of the wound.

In this case, tear-film dysfunction, specifically aqueous-deficient dry eye disease secondary to SS, was the leading contributor for the condition given that Schirmer testing, tear meniscus and TBUT were all reduced. Ocular surface hyperemia and elevated tear osmolarity indicate an inflammatory component is also associated with the development of FK. The patient's normal lid anatomy and location of the filaments made mechanical causes unlikely underlying factors in the development of her FK. The patient's medical history suggests that she developed GVHD, and consequently SS, following her bone marrow transplant in 2015.

The patient presented with an initial treatment regimen that included PFATs, lubricating ointment, cold compresses 5 minutes prn and punctal plugs OU, all of which she was advised to continue. She was also advised to avoid fishing mucus out and educated on how this action delays resolution of the condition. Restasis was additionally prescribed to address the underlying inflammatory component. During acute episodes of severe dry eyes and presence of filaments, a less potent loteprednol etabonate 0.5% ophthalmic suspension was prescribed for twice a day OU, and the patient was monitored closely given her history of steroid response and ocular hypertension. The patient continued to use Travatan Z at bedtime OU for her ocular hypertension, and her IOP remained stable. Scleral lenses and amniotic membrane were discussed as potential future treatments if the condition fails to resolve. Long-term management includes monitoring for recurrence of filaments and measuring IOP. If IOP remains normotensive, Travatan Z may be removed and the patient will continue to be followed carefully to ensure IOP remains normotensive. The removal of topical medications when possible can potentially provide a beneficial treatment in patients with dry eye disease.

Teaching instructions and assessment methodology

This teaching case report is most appropriate for third- and fourth-year optometry students and optometry residents who have learned about FK and ophthalmic manifestations of SS in a didactic setting and can apply their knowledge clinically. Review of this case should provide these students and residents a better understanding of the pathogenesis of SS and how it can lead to conditions such as FK. Also, students should gain insight on causes of SS and FK, as well as the optometrist's role in the management of these conditions in an eye exam and in an interdisciplinary healthcare setting.

This teaching case report can be delivered to optometry students and residents in a grand rounds format or a journal club

reading assignment for discussion in primary care, ocular disease or anterior segment clinic or residency. Students and residents should share their thought process, develop differential diagnoses and discuss the case regarding how to treat and manage patients with SS and/or FK. Discussion can also include glaucoma management, the use of oral steroids and interdisciplinary communication with other healthcare providers.

Assessment of students' and residents' understanding of the case can include a group discussion of similar cases they have encountered in the past and their approach to managing the care of those patients, with a focus on how or if this case report changed their decision-making in the prior cases. Another option is to present anterior segment photos of patients with various dry eye conditions of varying severity, including FK, and have students ask and discuss symptoms, pertinent history, underlying causes and ultimately determine a treatment plan for each case.

Conclusion

This case highlights the need for increased clinician awareness of the possibility of autoimmune disorders in areas of chronic environmental exposures, including the World Trade Center. Keratoconjunctivitis sicca and FK are conditions that can be associated with autoimmune conditions, such as SS. A detailed medical history and careful ocular examination can assist in arriving at the correct diagnosis, appropriate treatment and management and co-management of associated systemic diseases with interprofessional providers. This case covers multiple treatment options and strategies to consider for this condition that are dependent on symptomatology, chronicity and responsiveness to prior treatment. Furthermore, this case emphasizes the importance of understanding the impact of systemic conditions on the eyes.

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Management of A-Pattern Exotropia: a Teaching Case Report

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Background

Strabismus is a common disorder that can be challenging for practitioners. It is especially important that it is identified early in life if it is amblyogenic. Population-based studies estimate the prevalence of strabismus in the general population to be 2.5-4.6%.¹ It is further estimated that 12-50% of cases of horizontal strabismus will demonstrate a pattern or vertical incomitance.^{2,3} Although pathology must always be considered in non-comitant deviations, pattern strabismus is common and can be non-pathologic in origin. The two most common non-pathological conditions with pattern strabismus are infantile esotropia and intermittent exotropia, which are associated with inferior oblique overactions. Although less common, superior oblique overaction (SOOA) may also manifest as pattern strabismus. Careful case history and full sensory and motor evaluation with a dilated comprehensive eye exam are imperative for ruling out disease and recommending the best management. This teaching case report is significant in that it examines two cases of A-pattern exotropia, one presenting with an abnormal head posture (AHP). It is intended for third- and fourth-year optometry students and all clinical eyecare providers.

Case 1 Description

A 2-year-9-month-old female presented with her grandmother for her first complete eye exam with concerns regarding squinting up close and far away. The grandmother also noted she occasionally noticed an intermittent eye turn out in the child, OS > OD, daily. She was unsure of the timing of onset, but noted that it only occurred for short periods of time, then went away. Upon further questioning, the grandmother reported that the child sometimes had a chin-down posture but no eye closure. The patient's birth history was unremarkable, but she had a history of febrile seizures as an infant, which required hospitalization twice. She was taking diazepam (Diastat) prescribed by her neurologist and Claritin. There were no known drug allergies. She had a history of speech delay, but her grandmother noted it had rapidly improved and nearly resolved since starting day care a few months prior. Also according to the grandmother, the patient's mother had a history of exotropia and glasses wear.

Observation of the child from the waiting room to the exam room revealed a chin-down posture, but no overt strabismus. Distance visual acuity with LEA matching was 20/50 OU. Unfortunately, the patient couldn't be engaged to test monocularly due to objection to occlusion OS > OD. Near visual acuity was central, steady, maintained with a toy OD/OS. Confrontation fields were grossly normal to distraction OD/OS, and pupils were equal, round and reactive to light with no afferent pupillary defect. Ocular motilities were significant for 2+ SOOA OD/OS in an A-pattern. No restrictions or underactions were noted in ductions. Distance cover test showed ~14-16^Δ X(T) with a slight OS fixation preference, Mayo scale 1.⁴ Near cover test showed ~18-20^Δ X(T) with no fixation preference, Mayo scale 1. Covering an eye for longer than 3 seconds resolved the patient's AHP. The patient was not able to be engaged in a cover test conducted in multiple positions of gaze. Near point of convergence (NPC) was 7/10 cm, OS out, with apparent effort. Color vision and stereopsis tests were not possible due to patient understanding. Non-cycloplegic ("dry") retinoscopy was OD: +0.50-1.25×010, OS: +0.25-1.25×180.

Slit lamp examination was unremarkable, revealing only racial melanosis OU. Digital pressures were soft and equal to palpation, and the patient was dilated with 2 gtts of 1% cyclopentolate OU. Cycloplegic retinoscopy was OD: +0.75-1.25×010, OS: +0.50-1.25×180. The patient's dilated posterior ocular health exam was unremarkable. The grandmother was educated on the findings and asked to keep a journal at home to monitor the frequency, laterality and duration of the eye turn. A follow-up appointment was scheduled for 6 weeks to monitor control and re-attempt multiple positions of gaze cover test and monocular optotype acuity. A copy of LEA symbols was sent home for practice.

The patient was lost to follow-up for a few months but returned to the clinic at age 3. Her grandmother and preschool teacher noted consistent squinting at distance and near with an intermittent eye turn outward that occurred almost equally between the two eyes, though slightly more frequently OS. The chin-down posture was still noted at times and there was no eye closure. The grandmother noted a stable OD fixation preference at home but, interestingly, the first exam had demonstrated an OS fixation preference. No changes since the previous eye exam were reported for medical history, medications or family history.

TABLE 1
Case 1 Near Cover Test

	18 ^Δ X(T)	
20 ^Δ X(T)	20-25 ^Δ X(T)	20 ^Δ X(T)
	30 ^Δ X(T)	

Table 1. Case 1: near cover test in multiple positions of gaze demonstrating an A-pattern exotropia.

[Click to enlarge](#)

Observation of the child from the waiting room to the exam room still revealed a chin-down posture, but no overt strabismus. Distance visual acuity with LEA matching was 20/63 OD/OS/OU, and near visual acuity with LEA matching was 20/50 OD/OS/OU. No objection to occlusion was noted. Confrontation fields and pupils were still unremarkable. Color vision testing was completed at this visit with normal findings, and global stereopsis was 400 arcsec with Randot 3. Ocular motilities were stable with 2+ SOOA OD/OS revealing an A-pattern. No restrictions or underactions were noted in ductions. Distance cover test showed 5^Δ XP, Mayo scale 0. Near cover test revealed ~20-25^Δ X(T), Mayo scale 4. Covering an eye for greater than 3 seconds again resolved the AHP. Multiple positions of gaze cover test confirmed the A-pattern, as shown in **Table 1**.

Near cover test was repeated with 2 DS overminus (calculated from previous cycloplegic retinoscopy) OU and 2^Δ base-down yoked prism. The patient's head immediately straightened with the trial frame, and near cover test showed 12^Δ X(T), Mayo scale 2. A glasses prescription was provided with OD: -1.50-1.25×010, 2^Δ BD and OS: -1.75-1.25×180, 2^Δ BD. The patient was asked to return in 8 weeks for follow-up.

At the second follow-up visit 8 weeks later, the grandmother noted that the patient wore the glasses full-time, and AHP and squinting fully resolved. She reported a rare eye turn outward, only when the patient was angry or crying. The grandmother also noted that the glasses sometimes slip down the child's nose. There was no change since last eye exam reported for medical history, medications or family history.

Observation of the child from the waiting room to the exam room revealed no AHP or overt strabismus. Distance visual acuity with LEA matching was 20/40 OD/OS/OU, and near visual acuity with LEA matching was 20/40 OU. No objection to occlusion was noted. Confrontation fields and pupils were still unremarkable. Ocular motilities were stable with 2+ SOOA OD/OS revealing an A-pattern. No restrictions or underactions were noted in ductions. Distance cover test showed 4^Δ XP, Mayo scale 0, and near cover test showed 10^Δ XP, Mayo scale 0. Stereopsis with Randot 3 was 100 arcsec. It was recommended that the patient continue full-time glasses wear, and rubber temple hooks were recommended for the glasses to prevent slippage. The patient was asked to return for follow-up in 8-12 weeks, or sooner if symptoms or frequency of the eye turn changed.

Case 2 Description

An 11-year-old African American male presented with his father for a complete eye exam. He reported blurred vision at near while reading, which began a couple of years prior. He was unsure of the exact timing of the symptom onset after beginning reading, but noted that it happens "pretty quick." Associated symptoms included sharp frontal headaches, asthenopia and binocular horizontal diplopia. The patient had no history of glasses wear. He noted that the only way to improve symptoms was to discontinue reading. Sometimes his symptoms interfered with his hobby of playing video games, after he is on the computer for long periods of time. The patient and his father denied ever noticing an eye turn, AHP or frequent eye closure. The father reported that the patient does well in school, but it is difficult to get him to read for school or fun. He was in the sixth grade and denied having an individualized education plan or other extra help/services. His most recent eye exam had been 3 years ago, and the father noted that everything was "normal" at that time. After the previous exam note was reviewed, the assessments were mild hyperopia OU (functional emmetropia) and a convergence insufficiency type intermittent exotropia with "good control."

The patient's medical history was positive for asthma for which he used Flovent and ProAir inhalers. He had no history of surgeries, hospitalizations or known drug allergies. Family history was positive for hypertension, diabetes and asthma.

Uncorrected distance visual acuity was 20/20 OD, 20/20⁻¹ OS, and 20/20 OU. Uncorrected near visual acuity was 20/20 OD/OS/OU. Ocular motilities were significant for 1+ SOOA OD and 2+ SOOA OS. No underactions or restrictions were noted on ductions. Distance cover test was 8^Δ XP and near was 12-14^Δ XP. **Table 2** shows cover test findings in multiple positions of gaze. NPC was 8/10 cm, left eye out with suppression. Stereopsis was nil, but Worth 4 Dot (W4D) testing showed fusion at both distance and near. After an A-pattern deviation was noted in cover testing, stereopsis and W4D tests were repeated. Stereopsis was 12.5 arcsec with Randot 3 in primary gaze,

TABLE 2
Case 2 Distance Cover Test

	4 ^Δ XP	
8 ^Δ XP	8 ^Δ XP	8 ^Δ XP
	15 ^Δ X(T)	

Table 2. Case 2: distance cover test in multiple positions of gaze demonstrating an A-pattern exotropia. [Click to enlarge](#)

and W4D showed crossed diplopia in down gaze. Confrontation fields, pupils and anterior segment biomicroscopy were within normal limits. Dry retinoscopy was +0.75 DS OU.

After prism adaptation testing, the patient was stable and comfortable with 8^Δ base-in total (4^Δ base-in OD and 4^Δ base-in OS). Modified Thorington in down gaze showed a 4^Δ exotropia deviation, NPC was to the nose, and W4D demonstrated fusion in down gaze at near. The patient was given a children's sports magazine to read for 30 minutes. At the conclusion of this trial, the patient reported continued comfort and reported he had never been able to read for that long in one sitting. Clear and single vision was reported for 100% of the trial period.

Digital pressures were soft and equal to palpation. The patient was dilated with 2 gtts of 1% tropicamide OU and retinoscopy was +1.50 DS OD and +1.25 DS OS. The dilated posterior ocular health exam was unremarkable.

Treatment options were discussed. These included ergonomic changes/behavioral modifications such as using a slant board to prop up reading material more in primary gaze rather than down gaze. The option of prism glasses was discussed including insurance's replacement policy if glasses were lost or broken. A vision therapy program was also discussed. The patient and father chose a combination of prism glasses and use of a slant board. A plano glasses prescription was provided with split base-in prism (4^Δ base-in OD and 4^Δ base-in OS). No hyperopic correction was included due to good uncorrected visual acuity and lack of blur symptoms during prism testing.

A follow-up call was conducted 3 months later. The patient and father reported resolution of symptoms with the glasses, which the patient wears for all near work. An annual comprehensive eye exam was recommended at that time.

Education Guidelines

Key concepts

1. Primary, secondary and tertiary actions of cyclovertical extraocular muscles
2. Adaptations when binocular vision is compromised
3. Ancillary testing in sensorimotor evaluations

Learning objectives

After this case discussion, participants should be able to:

1. Recognize the different signs/symptoms in patients with primary gaze deviations vs. those with non-comitant deviations
2. Develop an ocular motility protocol to evaluate a pattern strabismus
3. Know the difference between objective and subjective testing of strabismus
4. Understand the pathophysiology of A-pattern exotropia
5. Understand potential issues related to quality of life and barriers to care

Discussion questions

1. Knowledge and concepts
 - a. How is strabismus classified?
 - b. What different types of pattern strabismus are there?
 - c. What type of testing can be done to evaluate strabismus?
2. Differential diagnosis
 - a. What are the differential diagnoses to be considered?
 - b. Is it a pathological or non-pathological deviation?
 - c. Are there associated amblyopia or amblyogenic risk factors?
3. Management
 - a. Does the patient require optical intervention?
 - b. What kind of prism could be used?
 - c. How can prism adaptation be assessed?
 - d. Could vision therapy play a role?

- e. Is the patient eligible for surgical intervention?
- f. What is the most appropriate follow-up schedule?

4. Patient education and barriers to care

- a. What is the most effective way to educate a patient or parent regarding this condition?
- b. How does this affect the patient's quality of life?
- c. What options are provided for young children who have trouble with the fit of glasses or frequently break them?

Assessment of learning objectives

1. Students can be tested on the classification of strabismus
2. Students can be presented with a case of reported or presumed strabismus and be required to conduct the components of patient history and ask the pertinent questions
3. Students should be evaluated on their ability to come up with a list of differential diagnoses and how to rule out each
4. Critical-thinking skills can be evaluated by asking students which adjunct testing can be used to assess strabismus and evaluate the effect of the chosen treatment

Discussion

Beyond direction of the deviation, strabismus has further classifications: horizontal vs. vertical, unilateral vs. alternating, constant vs. intermittent, comitant vs. non-comitant. Each aspect is important in understanding the cause and impact of the strabismus. For younger patients, it is especially important to treat amblyogenic strabismus. To assist in quantifying the patient's control, intermittent exotropia control scales such as Newcastle or Mayo can be used. The Mayo scale has been well-studied and is therefore used in this case discussion. It is a 5-point scale ranging from phoria (0) to constant exotropia (5) that describes whether or not the intermittent exotropia manifests spontaneously or only under dissociated conditions.⁴

It is important to note that non-comitant deviations can be phorias or tropias; therefore, patients may not always present with diplopia complaints, but potentially asthenopic complaints and/or avoidance behaviors. Vertical incomitancy describes a horizontal misalignment that differs in up and down gazes.^{2,5} By convention, these findings are not considered clinically significant unless different by ≥ 10 prism diopters for A-patterns⁵ and ≥ 15 prism diopters for V-patterns.^{2,3,6} The practitioner should obtain measurements that are ~ 25 -35 degrees above and below the midline to ensure that the patient is looking far enough in the desired direction.^{2,3,5,6}

Pattern deviations describe relative convergence and divergence, and the letters are assigned based on the shape the eyes mimic. V and A patterns are most common, and X, Y and λ (lambda) are less common. The most common non-pathological non-comitant pattern deviation is V-pattern exotropia. These patients typically present with inferior oblique overaction and fewer symptoms than in A-pattern exotropia because up gaze is not as frequently used in day-to-day activities. Down gaze tends to be the most important functionally after primary gaze. The prevalence of A-patterns among all strabismus ranges from 4.5-36% in various epidemiology studies, with A-pattern esotropia deviations being $\sim 2x$ as common as A-pattern exotropia deviations.⁵ There are no known racial, age or sex predilections. Adults may become more symptomatic for A-pattern exotropia deviations at the start of presbyopia as they look down through bifocal or progressive-addition lenses as opposed to unconsciously moving material upward toward primary gaze in single-vision lenses. All non-comitant deviations require careful testing to rule out other neurological conditions.

The differentials include, but are not limited to, uncorrected refractive error, non-strabismic binocular vision disorder, pathological strabismus and pseudostrabismus. The first step is always to correct any significant refractive error as this may cause pseudo pattern deviations (such as in accommodative esotropia) and better vision tends to promote better binocularity. In the absence of strabismus, patients may have symptoms that are similar if there are accommodative, vergence or oculomotor dysfunctions. Pathological strabismus can be caused by ocular disease, paralytic or restrictive etiologies, which can be assessed with ductions (including forced duction testing) and a thorough anterior and dilated posterior ocular health exam. Imaging should always be considered if any neurological findings are present or when the cause of the pattern cannot be confidently identified.

Ductions should be conducted for patients with pattern strabismus or those with any apparent underaction during version testing. Although patterns are often detected through version testing, multiple positions of gaze cover test is important for determining comitancy and isolating which muscles are most likely affected. Interestingly, ocular torsion can be seen on fundus exam when comparing the positions of the fovea and optic nerve head.^{3,6} Stereopsis, W4D and diplopia field testing are all useful sensory evaluations. Modified Thorington can be additive in understanding the subjective angle vs. the objective angle measured by cover test. Double Maddox rod is of further use when assessing torsion.

The stereopsis and W4D tests are of interest in case 2, as practitioners need to consider in which gaze the testing is conducted. The stereopsis books are often held upright in down gaze, not always straight ahead. Due to the A-pattern exotropia in this patient, his stereopsis was significantly different when tested in the two positions. Similarly, W4D testing is often conducted in primary gaze, but practitioners should also consider the complaint or findings when conducting this test. If only obtained in primary gaze, this patient's findings appeared normal, but testing in down gaze reaffirmed his complaint of diplopia when reading. Sensory findings may vary depending on whether the patient is phoric in any position of gaze or if the strabismus is intermittent. If the patient is strabismic in all or the majority of positions, suppression and anomalous retinal correspondence (ARC) may be noted. Interestingly, in regard to ARC, the angle of the anomaly varies with the angle of deviation.³ In cases where ARC is found, prisms are not an appropriate management option.⁷

Patients may present with chin-down posture, which keeps eyes in the preferred position (up gaze), or they may present with avoidance behaviors as described above. In cases of AHP, the nose tends to point where the eyes cannot go (i.e., the most affected gaze). If AHP is not restrictive or paralytic in nature, covering an eye will often induce automatic head straightening as the patient is only symptomatic binocularly. Yoked prisms can be helpful in these cases. The minimum amount of prism needed to resolve the AHP is best for weight considerations in the glasses. Practitioners use a variety of techniques to determine the amount of horizontal prism needed, but most often use a relieving prism. Prior to prescribing prism, it is imperative to evaluate the ability for sensory fusion. If prism can improve sensory fusion status, prism is used to relieve or eliminate the motor demand. If there is no potential for sensory fusion, then prism should not be used as a mode of treatment.⁷ Sheard's criteria⁸ or Caloroso's Residual Vergence Demand (RVD) can be applied in such cases. RVD is best used in patients who have vergence ranges that have been maximally trained through vision therapy, but still need prism to maintain comfortable binocular vision in free space.⁹ There can be a difference in the objective and subjective angle. Some practitioners use techniques such as Modified Thorington to guide their prism prescribing in order to relieve the subjective angle and thereby relieve diplopia. Surgery is indicated in patients who have significant AHP or strabismus that cannot be easily managed with prism or vision therapy.

Due to the young age of the patient in case 1, vision therapy was deferred. The patient was prescribed overminus treatment to assist in the control of the intermittent exotropia by increasing her accommodative convergence. Although not thoroughly discussed here, the plan is to slowly wean her out of the overminus over time as she increases her convergence ability. When she is older, active vision therapy can be initiated if her control is fairly good, or surgical treatment can be considered if she has not gained better control.

Although there is no known genetic predisposition to this pattern strabismus, it is interesting to note that the father in case 2 also reported similar symptoms beginning in childhood and persisting into adulthood. A quick assessment of versions was conducted on the father and showed an A-pattern exotropia deviation. The pathophysiology of A-pattern exotropia deviations most commonly arises from oblique muscle dysfunctions — in this case, primary SOOA. This results in a tertiary abduction effect that torques the eyes outward in down gaze, increasing relative divergence.^{3,6} In the case of primary SOOA, there is no identifiable etiology. Secondary SOOA may include inferior oblique paresis (rare) leading to an overaction of the ipsilateral superior oblique muscle (Hering's Law).^{2,5,10}

Horizontal rectus dysfunction may be the proposed cause in the absence of SOOA. This theory attributes the dysfunction to underaction of the medial rectus in down gaze and lateral rectus underaction in up gaze; however, there is some controversy regarding this theory.^{2,3,5} Vertical rectus dysfunction is another proposed theory in the absence of SOOA, though this is generally less accepted. Muscle pulley anomalies or mislocations have been supported by MRI studies, showing even small displacement can cause vertical incomitance. For example, a superior displacement of the lateral rectus pulley can induce an A-pattern.^{2,5}

Orbital anomalies such as those seen in craniofacial disorders may also show pattern deviations and can be difficult to treat. Neither of the patients presented in this case report had one of these conditions.

Pattern deviations not acquired due to pathology do not resolve, but associated control of the horizontal deviation (i.e., intermittent exotropia) may change over time. Younger children should be followed more closely due to the risk of amblyopia and potential for more frequent refractive error changes. Patient and guardian education about AHP and quality of life is important. Quality of life issues can include musculoskeletal health and comfort, diplopia, risk of amblyopia if strabismus is amblyogenic, and positional awareness in places such as classrooms or movie theaters. For example, patients with A-pattern exotropia will have to develop a significant AHP in stadium seating if they are looking down from the top, or may have more difficulty managing stairs if they look down. In the classroom or at home, slant boards are useful for propping up material to lessen the need for down gaze. Young children are very active; therefore, the fit of glasses is extremely important not only for comfort but also to prevent them from falling down the nose or off the face. Cable temples and ear hooks/temple tips are useful.¹¹

Conclusion

Optometrists have many tools for evaluating and treating pattern strabismus. Both motor and sensory evaluations are important in the differential diagnosis and management of strabismus. Multiple treatment options are available to optometrists, and careful history evaluation will help guide the decision of which treatment to use.

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After-Hours Practice Time and Optometric Theory and Methods Laboratory Success in Remote Online Learning

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[PDF of Article](#)

Introduction

At the onset of the COVID-19 pandemic in March 2020, the majority of education institutions suspended face-to-face in-person teaching, closed their campuses and moved their course curricula to remote online learning.^{1,2,3,4} This transition posed a problem for clinical laboratories in optometric curricula. Clinical laboratories involve hands-on learning of procedural skills with in-person preceptor instruction. This hands-on nature proved challenging for faculty transitioning to virtual platforms and for student learning.²

Online learning has been around for some time; however, its use in practice-based learning has been limited until the recent pandemic. While online learning and blended teaching has been effective in many courses at different institutions,^{5,6} practice-based learning, or hands-on learning, in clinical laboratories has been the traditional method of delivering education in various fields of medicine. As with any learning strategy, some students excel while others struggle, and the transition to online learning during the COVID-19 pandemic was no different. Several studies have looked at how blended learning, simulated learning environments, clinical simulators and other strategies influence student education.^{1,5,6}

Many institutions have implemented forms of virtual learning within lab-related courses. A study published in 2016 assessed the effect of short-term exposure to a simulated learning environment on student clinical subjective refraction performance. Fourth- and fifth-year optometry students enrolled in the 5-year dual Bachelor of Vision Science and Master of Optometry degree program at the University of Auckland were assessed. Results demonstrated a positive influence for the less-experienced students.⁷ In another study, the University of Auckland conducted a survey to evaluate whether their students, using a blended teaching approach of either a static or an interactive website for Ocular Anatomy and Physiology, obtained better examination scores than students in the previous year who only had access to a static website. They also assessed the students' perceptions and impressions of the interactive vs. static website. They concluded that although access to the interactive website did not significantly improve the students' grades, their responses to the interactive website were positive. However, there were critical comments regarding the absence of educator assistance when using the online tools. This led the researchers to further conclude that for their Ocular Anatomy and Physiology program, a blended style that includes the educator as the main administrator of student learning is necessary.⁸

Pacific University College of Optometry also assessed blended learning, specifically in the optometric procedural courses in the second year of the program.⁵ The study compared blended strategies with strictly in-class instruction from previous years and found no significant difference in exam scores between in-class and online teaching.⁵ A study at New England College of Optometry involving third-year students compared the effectiveness of an interactive multimedia learning module vs. traditional learning in preparation for in-person B-scan procedural training. Use of the interactive multimedia module resulted in a 20% improvement in test scores and significantly positive feedback on surveys.⁶

Transitioning to a purely online learning environment poses many challenges to both students and faculty. Students are unable to complete practical assessments and receive appropriate grades for courses requiring hands-on procedural skills.¹ Remote online learning also involves a steep learning curve as students and faculty must quickly familiarize themselves with the technology and delivery methods of the curriculum,^{1,2} which can include video conferencing platforms, collaboration and communication apps, remote proctoring solutions and others.^{3,4} An added limitation to these strategies is the inability to practice the skills on a variety of eyes. This reduces students' competency in the subject matter as they are exposed to less variable scenarios.

Due to the nature of the optometric skills taught in laboratory settings, in-person guidance and instruction has always been the primary method of training across all optometric education institutions. There had not been cause or reason to analyze the teaching and learning of these skills remotely. The pandemic provided a unique opportunity to assess whether online instruction of optometric techniques could be a viable alternative to in-person delivery with equivalent levels of success. The aim of this study was to demonstrate how the number of in-person practice hours correlated with pass rates in different

optometry skills after a semester of virtually learning each of these techniques.

Methods

The study was approved by the Nova Southeastern University Institutional Review Board. Each participant provided signed informed consent after discussion about the nature and purpose of the study and guaranteed anonymity of responses. First-year optometry students at Nova Southeastern University completed their first semester of optometry school from home in fall 2020 due to protocols set because of the COVID-19 pandemic. They were taught the Optometric Theory and Methods (OTM) lecture course and laboratory virtually via Zoom with instructional lab videos and live demonstrations. Weekly 2-hour labs were held via Zoom for each lab section with topics taught concurrently with the lecture component.

Virtual lectures were delivered over the period of 1 hour for color vision, 1-2 hours for stereoacuity and 2 hours for extraocular muscle (EOM) testing and saccades. Students were provided handheld laboratory equipment for performing the skills at home on roommates or family members. In the virtual lab sessions, 1 hour was dedicated to color vision, 1 hour to stereoacuity and 2 hours to EOM testing. Lab manuals with videos were provided to the students for each skill. Three preceptors were assigned to Zoom breakout groups to address any questions and to see if students had a grasp of the theory. Students paired up and went through the motions of administering the skills, and they were required to complete a worksheet of the activity. Students completed assignments where they recorded themselves performing preliminary skills (color vision, stereoacuity and EOM movements) at home and then critiqued one another's performances along with instructor feedback.

Keratometry instruction was delivered via Zoom for approximately 3 hours and further discussed in a virtual lab session for 2 hours in the small breakout groups. Diagrams of the instrument labeling all knobs and dials were provided. Worksheet activities and video demonstrations were provided to guide the students, although they could not practice this skill hands-on because they did not have access to this instrument at home.

Retinoscopy content was taught over the course of 3 hours with 6 hours of virtual lab time. Lab manuals and video demonstrations were provided. Students were guided through retinoscopy using schematic eyes, taught how to simulate various spherical and spherocylindrical refractive errors and educated on how to check their work in neutralizing the reflex. They also had to complete a worksheet that guided them through the skill. Preceptors were available virtually to direct them through the activity.

Subjective refraction instruction was provided for 3 hours via Zoom prior to 4 hours of lab sessions. The lecture component included demonstrations of the technique and, again, worksheets were provided during the lab sessions for students to complete in order to understand the steps of refraction. Instructors assisted in breakout rooms to walk through these techniques and provide feedback.

The students returned to campus in January 2021 and were able to perform these techniques in the laboratory with guidance from three lab instructors. The skills included keratometry, color vision, stereoacuity, EOM movements and saccades, retinoscopy and subjective refraction. Due to strict COVID-19 protocols during this time, students were split into eight lab sections. Each section was assigned weekly evening practice times during which students could sign up for optional 1.5-hour practice sessions. One instructor was present during these after-hours practice sessions to oversee lab activities and ensure safety and social distancing. Due to the inability to properly assess their competence in these skills virtually, testing the students via practical examination format was pushed into the spring semester of 2021. Students were given 1 month of in-person practice time before they were examined on the preliminary and keratometry techniques. Retinoscopy and subjective refraction were tested later in the semester after approximately 3.5 months to allow students more time to practice and utilize actual lab equipment during the semester.

After the spring semester of 2021, students were given a 5-minute survey (**Figure 1**) inquiring how many hours on average they signed up to practice during the semester and how many hours they practiced the week of their practical exams. They were also asked to voluntarily report which skills they passed or failed on the first attempt.

Data analysis

Survey about Checkouts and After Hours Attendance

- Are you a:
 - OD/EE student?
 - OD/EE student?
- Do you pass the following skills on the FIRST try (please checkmark)?

Skill	Yes	No	Not Applicable
Keratometry			
Color vision			
Stereoacuity			
EOM/Saccade			
Retinoscopy			
Subjective Refraction			
- How many hours, on average did you practice skills in the OTM lab after hours PER WEEK during your first year winter semester for OTM2?
 - 0 hours
 - About 1 hour
 - About 2 hours
 - About 3 hours
 - About 4 hours
 - About 5 hours
- How many hours, on average, did you practice skills in the OTM lab the week before your checkouts during your first year winter semester for OTM2?
 - 0 hours
 - About 1 hour
 - About 2 hours
 - About 3 hours
 - About 4 hours
 - About 5 hours

Figure 1. Survey provided to first-year optometric students at Nova Southeastern University inquiring whether they passed each skill on the first attempt and the number of hours they spent practicing throughout

The pass rate in each OTM skill was calculated and the differences in pass rates *the semester and during the week prior to the exam.* were assessed with Chi-square test. Linear regression was applied to explore [Click to enlarge](#) the association between pass rate and the number of hours spent on each OTM skill. A p-value less than 0.05 indicates statistical significance.

Results

The overall pass rate in keratometry (0.51) was significantly lower than the pass rate in other OTM skills (0.77 in color vision, $p < 0.01$; 0.81 in stereopsis, $p < 0.01$; 0.79 in EOM, $p < 0.01$; 0.76 in retinoscopy, $p < 0.01$; and 0.77 in subjective refraction, $p < 0.01$; Chi-square test). Of the 104 students testing, 53.7% failed keratometry in part due to incorrect documentation, whereas 46.3% failed solely due to inaccurate technique or running out of time.

The average number of after-hours practice throughout the semester was analyzed for preliminary examination skills (**Figure 2**). Linear regression was applied to reveal the relationship between pass rate and the number of hours spent. Sample sizes less than 9 were not included in the analysis. There was no significant relationship between hours spent and pass rate for color vision (Figure 2B), stereopsis (Figure 2C) or EOM (Figure 2D). However, there was a significant linear relationship between the pass rate and hours spent on practice for retinoscopy (Figure 2E) and subjective refraction (Figure 2F). Pass rate increased as more hours were spent on practice.

We also analyzed the relationship between pass rate and hours of practice during the week before the test (**Figure 3**). It should be noted that the pass rate for subjects who spent only 1 hour was low in all OTM skills. There was a dramatic elevation in pass rate for subjects who spent 2 or more hours (Figures 3A to 3F). Due to the small sample sizes of subjects who only spent 1 hour, the dramatic increment did not reach significance. Linear regression was applied to analyze the relationship between pass rate and the number of hours spent. Sample sizes less than 9 were not included in the analysis. There was no significant linear relationship between the pass rate and hours spent on practice for color vision (Figure 3B), retinoscopy (Figure 3E) or subjective refraction (Figure 3F). However, there was a significant relationship between hours spent and pass rate for stereopsis (Figure 3C) and EOM (Figure 3D). Pass rate decreased as more hours were spent on practice the week before the test. In addition, a significant correlation ($r = 0.7338$, $p < 0.001$) was found between after-hours spent during the semester compared to the week of the checkout.

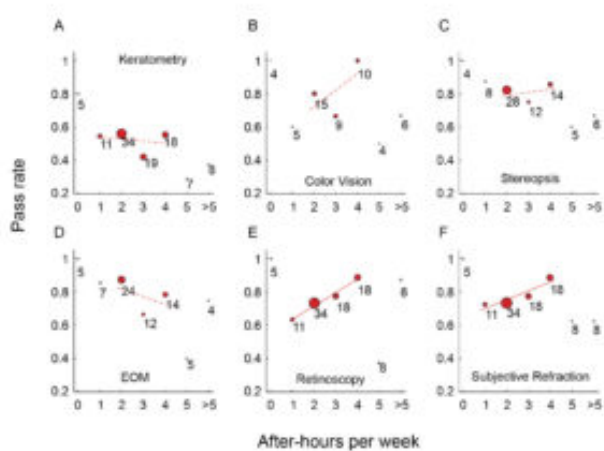


Figure 2. Average number of hours spent practicing in the Optometric Theory and Methods lab during the semester. A solid line indicates a significant regression trend ($p < 0.05$). Symbol size is proportional to the sample size. Samples with a size smaller than 9 were not included in the analysis. [Click to enlarge](#)

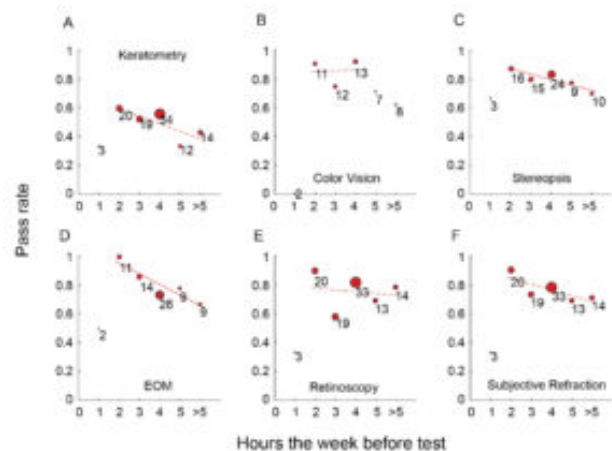


Figure 3. Hours spent practicing in the Optometric Theory and Methods lab the week before the test. A solid line indicates a significant regression trend ($p < 0.05$). Symbol size is proportional to the sample size. Samples with a size smaller than 9 were not included in the analysis. [Click to enlarge](#)

Discussion

Based on the COVID-19 safety protocols during this academic year, students were limited in the number of hours they were able to practice in the OTM lab during spring 2021. Students were separated into eight lab sections to reduce the number of individuals in the lab and ensure appropriate social distancing. Prior to COVID-19, the lab was open during evenings and weekends for students to practice at any time with any other student in their class. With slightly more than 100 individuals per

class year, students had a large variety of eyes to practice on throughout the semester. The COVID-19 precautions limited students to one or two 1.5-hour practice sessions per week, and they were only allowed to practice with students in their own lab group, which consisted of 14-16 students each. For the entire semester, students were permitted to practice only on a maximum of 16 pairs of eyes, which greatly reduced their exposure to different ocular health conditions and refractive errors. However, students were supervised by an optometry faculty member or resident during each of these practice sessions to offer more support and ensure compliance with safety guidelines.

To our knowledge, no previous studies have evaluated the relationship between student practice time and pass rates. Prior to the pandemic, monitoring which students took advantage of after-hours practice, how long they spent practicing, and who they practiced with was not possible. Pandemic guidelines mandated the monitoring of all these parameters for contact-tracing purposes. During after-hours practice time, students were provided instructor supervision while in the lab, which was not the case prior to COVID-19. This allowed students an additional resource for structured feedback while performing optometric skills so that questions could be answered and errors identified and corrected instantaneously. Before the pandemic, students were practicing on their own after normally scheduled lab time for as long as they desired without observation or suggestions for improvement from a licensed practitioner.

These optometric skills can be separated into three main categories with preliminary tests (color vision, stereoacuity and extraocular muscle movements) as one category, keratometry as another category, and retinoscopy and subjective refraction as the third category. There are differences in the results across each of these categories. Results revealed high pass rates for preliminary exam skills across the board, which could be due to a lack of need for this skill to be performed in the lab setting with faculty supervision. Equipment required for this testing is mainly portable, and the techniques can be performed at home. Partners can easily modify their responses in order to provide more practice opportunities and troubleshoot how to assess abnormal results. However, keratometry, retinoscopy and subjective refraction all require instrumentation, including a keratometer, phoropter and acuity chart, as well as human eyes, that are available only on campus.

Despite the increased hours of practicing, keratometry still had a higher fail rate compared with the other skills, which could be due to multiple factors. Keratometry was one of the first skills tested after only 1 month of practicing on campus along with the preliminary skills. Despite the high pass rates for the preliminary techniques, keratometry posed a different challenge for students. Because this skill cannot be performed from home and requires use of a keratometer in the lab, students had a limited 1-month timeframe to practice this skill prior to being evaluated. In addition, failure was based on both accuracy of technique as well as proper documentation. The percentage of students failing due to documentation errors was higher compared to the rate of students failing due to inaccuracy of the skill or not completing the skill within the allotted timeframe. This could be due to students using after-hours practice sessions to focus mainly on performance and efficiency and less on documentation because the latter can be reviewed and learned from home. Instructor guidance during these sessions emphasized precision in measurement rather than in recording findings correctly. Because student practice time was restricted, the best use of this lab time was believed to be in performance rather than documentation.

During the week of both practical exams, results demonstrated that 1 hour spent practicing was not sufficient for passing the practical examination. Utilizing the lab for 2 hours during the week of the practicals had the highest pass rates. However, practicing more than 2 hours the week of the practicals did not appear to improve pass rates. These trends were consistent among all skills tested. This indicates that there is an ideal amount of time for students to practice during this stressful week. Spending 3 or more hours practicing during the week of the practical exam may result in burnout for students where they are not improving in technique performance. This may also be due to students fatigue from longer days, less sleep and more stress resulting in lower pass rates.

Performance in optometric skills requires strict dedication to practicing in the lab diligently and consistently. Based on survey responses, students who practiced frequently throughout the semester also likely practiced the most during the week of their practical examination. This study demonstrated that certain skills require more practice and instructor guidance than others. The results demonstrated that preliminary skills can be conducted at home with minimal supervision and equipment. Keratometry, retinoscopy and subjective refraction require more hands-on learning with the use of a laboratory setting. Students benefit from supervision, guidance and instant feedback on skill performance from a licensed practitioner during this time. This study also revealed that more emphasis should be placed on documentation and ensuring that students also practice reading measurements appropriately and recording accurately.

One of the limitations of this study was that the survey simply inquired about the number of hours spent practicing but did not assess the breakdown of time spent on each of the skills. A few students in the class have parents or relatives in the optometric field and may have had the advantage of access to office equipment during the remote sessions in fall 2020. However, based on informal student feedback, the majority of students moved to residences near campus to attend the virtual semester in order to better focus on coursework away from home. General trends from instructor feedback indicated that students tended to

practice the skill of the week during their after-hours session early in the semester. They then practiced all skills together closer to their practical exam weeks as they became more proficient. However, there was no formal assessment of the exact number of hours spent on each technique after-hours. A future study may be conducted to specify how many hours were spent practicing each of the skills individually.

An additional limitation to the study was the lack of comparing this data to a class year prior to the pandemic when students had full access to the lab and all hands-on learning. Although previous class years had unlimited access to the lab and could practice on any classmate, they lacked the added advantage of having an instructor present during all after-hours sessions to provide guidance and immediate feedback. A future study may collect this data for comparison purposes.

Another limitation of this study was that students were asked to self-report the information. Data can be skewed if students did not report truthfully or accurately. Inquiring about how many hours they practiced in the lab is considered an estimation with room for error. A future study may review the sign-in sheets and accurately calculate each student's exact number of hours in the lab throughout the semester. Students also self-reported whether they passed or failed each skill, which may lead to participants falsifying their responses to avoid shame or disappointment. However, when the number of students who failed due to documentation errors on keratometry was reviewed, it correctly matched the number of students reporting passing or failing of this skill. Student pass or fail responses were compared via grading reports for each skill and confirmed consistency between the self-reported grades and actuality. This provides investigators with greater confidence in the accuracy of self-reporting.

Conclusion

This study indicated that students can achieve high success rates in performing preliminary optometric skills despite the skills being taught virtually and with minimal instructor feedback. However, keratometry, retinoscopy and subjective refraction are skills that required lab instrumentation and consistent after-hours practicing in order for students to successfully pass.

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Results and Action Plans from an Optometric Education Global Summit

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[PDF of Article](#)

Summary

In October 2019, the Association of Schools and Colleges of Optometry, the American Academy of Optometry and the World Council of Optometry designed and hosted a Global Optometric Education Summit. The summit included optometrists from around the world and achieved its goal: to promote understanding and open lines of communication between optometric education programs around the world to develop opportunities for advancing optometric education globally. The substance of discussions and action plans that emerged are reported here and revealed that many of the issues and opportunities facing optometric education are shared by institutions around the world.

Thank you to all of the dedicated optometric educators who contributed to the planning and execution of the Global Optometric Education Summit: Barbara Caffery, Elizabeth Hoppe, Scott Mundle, Glen Steele, Hector Santiago, Luigi Bilotto, Ariela Gordon-Shaag, Daniel Taylor, John Nishimoto, Peter Hendicott, Pete Haydon, Suit May Ho, and Nick Rumney.

Background

The optometric profession is practiced differently across the world. While the shared goal is to provide patients with excellent vision and eye health, the level of training and scope of practice vary from country to country. Over time, numerous articles have been written to convey the conditions in different regions, aspirations for the future and hurdles to overcome.¹⁻¹³ Conversations aimed at strengthening cooperation between and among countries and programs have occurred for nearly 40 years.¹ During that time, several conferences have been conducted involving different organizations addressing various topics in optometric education.

The most recent was held on Oct. 27, 2019, when three organizations, the Association of Schools and Colleges of Optometry (ASCO), the American Academy of Optometry (AAO) and the World Council of Optometry (WCO) designed and hosted a Global Optometric Education Summit during the joint AAO/WCO meeting. This summit brought together optometrists with three goals: to assemble representatives from optometric academic institutions around the world and identify issues facing optometric education globally; to share current best practices in optometric education; and to share ideas on future developments in optometric education. The three goals were linked to key objectives that were defined for the participants: share



Figure 1. At the Global Optometric Education Summit, participants were seated so that each table included at least one participant from each of the World Council of Optometry representative regions. After a panel of optometric leaders from around the globe provided content relative to each of the goals, the participants discussed each topic within their groups. Each of the 12 groups identified challenges and opportunities that emerged from their respective discussions. The groups reported out to the larger group and submitted a written summary of their conclusions. At the conclusion of the summit, the comments from each group were collected. [Click to enlarge](#)

geographically specific challenges facing optometric education; identify synergies in addressing the challenges facing optometric education; share outcome measures for program effectiveness; explore solutions for deficiencies in and/or threats to resources; communicate techniques and strategies for faculty recruitment, development and retention; identify and share effective tools to assess student learning; and explore future trends in the optometric profession and how institutions will prepare for important changes.

The participants were seated so that each table included at least one participant from each of the WCO representative regions. Following a panel of optometric leaders from around the globe providing content relative to each of the goals, the participants discussed each topic within their groups. Each of the 12 groups identified challenges and opportunities that emerged from their respective discussions. The groups reported out to the larger group and submitted a written summary of their conclusions (**Figure 1**). At the conclusion of the summit, the comments from each group were collected.

During the process of synthesizing the collected data, several common themes, concerns and potential solutions arose. The challenges and opportunities for each goal are summarized below.

Goal 1: Assemble representatives from optometric academic institutions around the world and identify issues facing optometric education globally

Objectives

- Share area-specific challenges facing optometric education
- Identify synergies in addressing the challenges facing optometric education

Goal 1 challenges

Curriculum, faculty and leadership

The following curricular, faculty and leadership challenges for Goal 1 were identified by each table in varying capacities:

- academic leadership development
- access to master's level training
- faculty and staff development
- need for curriculum benchmarking
- resistance to change/innovation

The need for academic leadership development was shared by all geographical regions as the profession does not have a widely recognized and/or standardized approach to identifying and cultivating future thought leaders. A unified approach to this could assist in effectively achieving many of the goals discussed during the summit. Similarly, the concept of mutually beneficial mentorship relationships was explored. Also germane to this discussion was access to master's degree training. For institutions outside of the United States, this type of training signifies advanced clinical and/or research skills and is also a pathway into faculty positions and academic leadership. Interconnected to leadership development, faculty and staff development was described as a challenge due to varying skill sets among both faculty and staff in addition to varying levels of motivation. Furthermore, teaching and assessment models are constantly evolving. Finally, the emergence of new content areas, such as telehealth, were considered. These areas will present a gap in faculty skillsets that will need to be addressed. While a systematic approach to offer leadership, faculty and staff growth and mobility was championed, resources to fully support these types of initiatives are needed.

The topic of curriculum benchmarking linked to discussion on scope of practice, and ultimately patient outcomes was explored. If we are to further solidify the identity of our profession, we need to have a widely accepted mechanism by which to measure the impact our curricula have on patient-important outcomes. The WCO has done extensive work in this area and continues to serve as a valuable resource.¹⁴ In addition to the high-level perspectives captured in this model, perhaps working groups aimed at sharing curricular highlights among partner institutions could lead to strengthened programs for all. Similarly, the pros of exploring curriculum gaps and emerging program needs with a unified approach was explored.

Resistance to change is human nature. There was significant dialogue regarding the need to innovate in terms of our chosen content topics, use of technology, pedagogical delivery model, etc., and the resistance that might arise from faculty, accreditation bodies and legislative entities. Effective professional development initiatives could serve as a pathway to mitigating some of that resistance and/or establishing mechanisms to move forward creatively within existing guardrails.

The topic of the need to support continued innovation broadened to encompass practitioners already in the field. Are they practicing to the fullest scope of the profession? If not, why? The following factors were brought forward as possible reasons:

- socio-political barriers, including resistance from ophthalmology (further need to align education with legislation)
- need to adopt and or integrate into an interprofessional practice delivery model
- do we have an appropriate level of flexibility as a profession? (continuing education needed to facilitate early adopters of effective technology)

The likelihood that developing countries may be more poised to be the early adaptors for some types of technological advancements was examined and agreed upon on for certain levels. For example, institutions that reside in regions where accrediting bodies don't have as much impact on program approaches have additional flexibility that can be utilized in this regard.

Students

The following student-related challenges for Goal 1 were revealed by each table:

- student recruitment
- public awareness of profession
- growing class sizes outpacing resources
- developing students to become faculty
- student apathy

Student recruitment was expressed as a current challenge for all. Creating an enduring pipeline for applicants that have a strong understanding of the profession was a topic of particular emphasis as it speaks to sustainability of the profession and, as a result, patient access to care. It was determined that we could work harder at reaching out to students in high school (or even younger) to educate them on the profession and the typical pathways taken to pursue a career in optometry. In some regions, such as North America, there were concerns as to the growing number of optometry schools while others noted a small and/or shrinking applicant pool.

A common conversation thread existed through all geographical regions on the need for increased awareness by the public in general as to what specific role an optometrist plays in health care. Regardless of geographical area, the representatives from each table concluded that many members of the general population simply don't have a solid concept of that role. The recent campaign by North American-based ASCO — "Optometry Gives Me Life" — targets prospective school applicants, but doesn't draw a direct connection to what is entailed in the services provided by an optometrist. More needs to be done about expanding the working knowledge of the unique value optometrists bring to a patient's healthcare team to fully address issues surrounding the profession's identify. Successful efforts to this end could serve to both shore up a well-informed applicant pipeline and appropriately elevate the status of the profession.

Of equal importance is the need to extrapolate this normalization of the knowledge of optometry's professional identify to

TABLE 1
Summary of Goal 1 Challenges and Opportunities

Curriculum, Faculty and Leadership	Students	Optometric Profession
Challenges <ul style="list-style-type: none"> • Academic leadership development • Access to master's level training • Faculty and staff development • Need for curriculum benchmarking • Resistance to change/innovation 	Challenges <ul style="list-style-type: none"> • Student recruitment • Public awareness of profession • Growing class sizes outpacing resources • Developing students to become faculty • Student apathy 	Challenges <ul style="list-style-type: none"> • Social-political barriers/regional conflicts • Language barriers • Cultural competency • Scope of practice • School recognition
Opportunities <ul style="list-style-type: none"> • Faculty training • Technology implementation in education 	Opportunities <ul style="list-style-type: none"> • More emphasis on soft skills in student recruitment and training • Increased focus on critical-thinking skills 	Opportunities <ul style="list-style-type: none"> • Support from World Council of Optometry, Association of Schools and Colleges of Optometry and administration at optometric institutions • Shared advocacy for the profession and education • Tiered levels of practice

Table 1. Click to enlarge

creating a shared vision of where the profession is headed. Many at the summit agreed that we need to embrace evidence-based practice, interprofessional education and technological advancements to remain relevant and sustainable.

Another topic considered was the rising pressure to increase class size to maintain financial viability for programs. As class sizes grow, additional resources are required to meet diverse and expanding student needs, and securing quality candidates becomes more challenging. Due to a decreased tolerance for rising tuition costs, could partnering with industry help mitigate some of these pressures? Could online program offerings provide an opportunity for the reallocation of resources?

Faculty members are typically recruited through residency programs. There was deliberation on whether this approach should be expanded to recruit a more diverse group of faculty members. Should we be reaching into the community and engaging more adjunct faculty members to enrich the students' experience as well to combat decreases in resources? Perhaps grooming students who demonstrate potential as educators and/or leaders while they are still students could facilitate the development of a strong faculty and/or administrative pipeline?

Finally, growing student apathy was identified as a shared challenge among the various geographical regions. While the need to create lifelong learners was widely accepted, rich discussion centered on how to engage students at a higher level during their academic programs.

Optometric profession

The following profession-specific challenges for Goal 1 were illuminated by the representatives at each table:

- social-political barriers/regional conflicts
- language barriers
- cultural competency
- scope of practice
- school recognition

In addition to the shared challenges discussed above, some regions face ongoing disruption, and sometimes even violence, in their communities that present an additional layer of burden. Faculty and student recruitment, cultural competency (including language barriers) and professional advocacy all become more difficult yet essential in the impacted regions.

Discussions on school recognition were tied to broader deliberations on professional identity and student and faculty recruitment. The reality that some institutions and/or faculty members may be reticent to share granular details with partner institutions to maintain a competitive edge was addressed, but certainly not resolved.

Goal 1 opportunities

Along with the challenges considered for Goal 1, groups were also able to underscore opportunities that could be pursued.

Curriculum, faculty and leadership

The following faculty and administrative opportunities for Goal 1 were brought forth by each table:

- faculty training
- technology implementation in education

It was agreed that establishing and strengthening collaborations between institutions would be beneficial for many programs. Newer programs could learn from established programs, and established programs would be exposed to other ways of doing things that would reinforce what they have already incorporated at their home institution. This could also allow opportunities for interdisciplinary collaboration between optometry schools and other healthcare programs.

Other opportunities centered around training faculty and upgrading the training for optometrists who are already in practice. Often, faculty are recent graduates of the institution in which they now teach. Additional courses to train them beyond the level of that program would give them a greater depth of knowledge to impart to their students. This was something participants felt was very desirable. It was suggested that recently retired faculty from other institutions could be an asset for educators at newer institutions. The seasoned educators could serve as role models and mentors. Part of the concern in recruiting quality faculty was being able to provide a salary that would be competitive with that of a private practitioner. It was mentioned that some small specialty areas, for which a faculty member would be unaffordable, could perhaps be addressed through distance learning programs using experts from afar. This would allow a small topical area that could not sustain an entire faculty to be

covered in the curriculum as part of another course without the expense of bringing in a guest lecturer. Concerns that were discussed relative to this had to do with copyright issues and accrediting body approval. While much was discussed about embracing technology and teaching and the use of apps to augment lessons, there is probably greater acceptance of this now as everyone has been teaching remotely for the past 2 years due to the pandemic.

Students

Corresponding to Goal 1, opportunities to recruit students better poised for the evolving demands of the profession were identified as:

- more emphasis on soft skills in student recruitment and training
- increased focus on critical-thinking skills

Most groups hoped that embracing technology and the use of apps in teaching the science would allow for emphasizing critical-thinking and soft skills in the classroom setting. It was also felt that the technological advancements could lead to enhanced collaborations with other schools and other healthcare disciplines.

Optometric profession

The following profession-wide opportunities were highlighted by each table in connection to Goal 1:

- support from WCO, ASCO and administration at optometric institutions
- shared advocacy for the profession and education
- tiered levels of practice

It was felt that some of the advocacy conducted on behalf of the profession should be directed to supporting optometric education as students will become the profession of the future and advocate for the profession down the road. Part of that advocacy could be accompanied by WCO membership after an appropriate level of training has been attained. With a higher level of training, an active optometric association could be formed in the country to help advocacy efforts internally.

Thought was given to considering different levels of optometry to better meet the needs of patients. All optometrists would not need to be trained to the highest level of practice, if those practicing at a different level were in greater demand and less expensive to train. However, there were concerns that creating another level of practitioner would be confusing to the public and other healthcare providers. There was also discussion about cooperation between ophthalmology and optometry related to providing patient care and educating future optometrists to optimize the education and have a better appreciation of how they complement each other. Tiering the profession of optometry might make the distinction between optometry and ophthalmology even more confusing.

Goal 2: Share current best practices in optometric education

Objectives

- share outcome measures for program effectiveness
- explore solutions for deficiencies in and/or threats to resources
- communicate techniques and strategies for faculty recruitment, development and retention
- identify and share effective tools to assess student learning

Goal 2 challenges

Curriculum, faculty and leadership

The following curricular, faculty and leadership challenges related to Goal 2 were elucidated by each table:

- interaction levels and quality control in virtual learning
- match assessment techniques to course content/level
- alignment of competencies assessed on national board examinations and in optometry program curricula
- remove inconsistencies based on geographical area

The need to address this challenge was accelerated when the COVID-19 global pandemic thrust everyone into a virtual learning environment. Many of those who identified themselves as learning/teaching/meeting more effectively face-to-face had to embrace virtual platforms to survive. Ongoing retrospective and prospective studies are collecting data to provide

information on best practices. Faculty and administrators are continuing to reflect upon lessons learned and innovative approaches that are here to stay.

TABLE 2
Summary of Goal 2 Challenges and Opportunities

Curriculum, Faculty and Leadership	Students	Optometric Profession
<p>Challenges</p> <ul style="list-style-type: none"> • Interaction levels and quality control in virtual learning • Are assessment techniques well matched for course content/level? • Alignment of competencies assessed on national board examinations and in optometry program curricula • Faculty compensation: Are there inconsistencies based on geographic area? 	<p>Challenges</p> <ul style="list-style-type: none"> • Changing student expectations • Technology: Is it distracting from patient interaction? • More diverse cultural differences 	<p>Challenges</p> <ul style="list-style-type: none"> • Program regulation • Benchmarking of curricular and student outcomes • Need for national board examinations in certain regions • Professional fees for optometrists: Are they in line with other healthcare provider fees?
<p>Opportunities</p> <ul style="list-style-type: none"> • Flipped classrooms and evidence-based practice • Specialized training programs to promote practicing at the highest level • Global training opportunities • Innovation in teaching, practice and patient care • Leveraging technology for offering more choices in teaching, student assessment and program assessment 	<p>Opportunities</p> <ul style="list-style-type: none"> • Enhancing skills that promote lifelong learning • Maximizing use of feedback to boost student learning • Better alignment of student competencies and patient expectations 	<p>Opportunities</p> <ul style="list-style-type: none"> • Increased partnerships with all stakeholders

Table 2. [Click to enlarge](#)

Student assessment is an important topic that speaks to practitioner competency and preparedness for lifelong learning. While the focus was formerly on curricular elements, greater emphasis is being placed on how we are ensuring that students are learning the content we are choosing to include in their degree programs. There are different assessment techniques designed to best measure student learning that takes place in various environments. For example, are there methods for which we can more objectively assess clinical competency?

Of equal importance is evaluating the alignment of the competencies assessed on licensing examinations with those emphasized in the relevant degree programs. Of note is that several regions throughout the world do not have a standardized examination linked to license acquisition.

Finally, the subject of faculty compensation arose. In the changing higher education landscape, are colleges and schools of optometry poised to offer competitive faculty salaries? Some ideas for value added for faculty recruitment were unique faculty development opportunities, clearly defined pathways for growth and creative ideas for mentorship that lead to more career fulfillment.

Additionally, some regions across the globe are severely understaffed. Can virtual platforms provide much needed support for the faculty that are working in such environments?

Students

The following student-related challenges commensurate to Goal 2 were illuminated by each table:

- evolving student expectations
- technology: is it distracting from patient interaction?
- more diverse cultural differences

Students are expecting more for their tuition dollars in addition to desiring more control over their learning environments. To stay competitive, programs need to continuously engage students on their preferences while also measuring this against student performance.

The technology boom has brought “bright new shiny objects” to the classroom, the laboratory and the clinical setting. Ensuing that students are taught that the focus should still be placed on the patient is critical.

Student bodies are becoming more and more diverse. This diversity enriches the experiences of all, but also comes with unique concerns that need to be properly addressed.

Optometric profession

The following profession-specific challenges corresponding to Goal 2 were discussed by the representatives at each table:

- program regulation
- benchmarking of curricular and student outcomes
- need for national board examinations in certain regions
- professional fees for optometrists that are in line with other healthcare provider fees

Optometry program regulation with standardized approaches to accreditation vary greatly around the world. The advantages of regulation are that prospective candidates, graduates and the public have the assurance of a certain level of consistency and quality for accredited programs. A disadvantage may be that the accreditation bodies have the power to hinder innovation if they do not adjust expectations and regulations in alignment with advancements in delivery models, etc.

As mentioned previously, discussions relative to the need to confirm that curricular outcomes are evaluated in the context of all relevant student outcomes is important.

Another important topic addressed was professional fees for optometrists. Is the profession keeping in step with adjustments made in other healthcare professions? If not, what are the advocacy actions needed? Can shared resources assist in standardizing approaches across geographical and geopolitical settings?

Goal 2 opportunities

Along with challenges associated with Goal 2, groups were able to spotlight opportunities that could be pursued.

Curriculum, faculty and leadership

In alignment with Goal 2, the following opportunities were dissected:

- flipped classrooms and evidence-based practice
- specialized training programs to promote practicing at the highest level
- global training opportunities
- innovation in teaching, practice and patient care
- leveraging technology for offering more choices in teaching, student assessment and program assessment

With the student of today being different than the student of 20 years ago, ongoing innovation in teaching and practice is a must. Like advances in all other aspects of life, teaching must move forward to use new technologies and keep students engaged. As students becoming professionals are expected to become lifelong learners to stay current with best practices, educators must additionally stay current on teaching approaches. This requires them to keep abreast of advances in teaching as well as in the profession. Incorporating technology into programs for student assessment, patient simulations and monitoring outcome measures was discussed to expand teaching opportunities and reduce costs. The conversation also revealed that technology often has an upfront cost that can make it difficult to implement. Partnering with other groups may reduce the financial impact by creating cost-sharing opportunities.

The development of global training opportunities was one avenue discussed as a possible way to provide education in some areas to foster advancement of the profession. This could allow for more specialized training in areas that require unique skillsets, such as low vision, geriatrics, pediatrics and contact lenses, and would also reduce the financial impact of the training as the specialty topics would not require the addition of another full-time faculty member. It would allow for the training to be conducted by a content expert and not someone with limited expertise in the subject, while laying the foundation to ensure the profession is practiced at the highest level. Additionally, partnerships between institutions could offer opportunities for faculty to pursue advanced degrees that would strengthen teaching programs for the longer term.

Using the approach of flipped classrooms was advocated to increase student engagement. Evidence-based approaches would be part of the discussions to reinforce for students the concept that the science behind patient care continues to evolve. Along with this approach there was a desire to provide more formative feedback in student learning and have more training in cultural respect. The hope was to better align student competencies with patient expectations.

Students

The following student-related challenges commensurate to Goal 2 were highlighted:

- enhancing skills that promote lifelong learning
- maximizing use of feedback to boost student learning
- better alignment of student competencies and patient expectations

The opportunities mentioned centered around creating practitioners who are truly caring doctors and not technicians. The emphasis was on human interaction and recognizing the value of the patient in the room as a person. The desire was to create an education program that not only taught students the necessary materials, but presented the materials in such a way that students understood the need for, and internalized the desire for, lifelong learning. The desire was expressed to construct feedback for students in such a way that it motivated them to pursue additional knowledge independent of faculty guidance.

Optometric profession

The following profession-wide opportunity relative to Goal 2 was identified by each table:

- increased partnerships with all stakeholders

Increased partnerships with all stakeholders were mentioned consistently among all summit participants. The partnerships began with the recognition of what the optometry profession contributes to improving the quality of life for everyone. With that recognition there needs to be an understanding of all that is involved in optometric education and support for that training. It is a mutual support process with optometric education continuing to improve people's health and quality of life. Optometric education needs to be a partner with practitioners, industry, other healthcare providers and government to be involved in decisions that improve population health.

Goal 3: Share ideas on future developments in optometric education

Objective

- explore future trends in the optometric profession and how institutions will prepare for important changes

Goal 3 challenges

Curriculum, faculty and leadership

The attendees focused on the following challenges specific to curriculum, faculty and leadership:

- current inconsistencies in the workforce (inclusive of faculty and leadership)
- what are the minimum areas of competency and defined levels to earn the title "optometrist"?

As mentioned previously, some institutions are facing critical scarcity in number of faculty members and/or breadth and depth of knowledge and skills. As the scope of practice has evolved, it is imperative that optometrists retain ownership of the fundamental skills that have defined our profession since its inception. Additionally, the need for more specialized training in areas such as the visual sciences, myopia control and traumatic brain injury was identified as an effective pathway to best student, and ultimately, patient outcomes.

An ongoing point of discussion for the profession from a global perspective is which competencies are needed for a healthcare provider to be defined as an optometrist. The WCO has spent significant energy and resources to this end.¹³ Does this model need additional adjustment?

The following challenge was discussed as it relates to Goal 3:

Students

- student recruitment as it relates to public knowledge of the services provided by an optometrist and their value from a public health perspective

To continue to have a talented applicant pool who possess the appropriate skills to be successful in optometry degree programs and in optometric careers, the need to educate the public on the value of the profession is paramount.

Optometric profession

In alignment with Goal 3, the following challenge was identified relative to optometry as a profession:

- increased need for advocacy on behalf of the profession relative to expanded scope of practice

Advocacy efforts in the profession of optometry look different depending upon geographic location. Some regions benefit from highly organized efforts that are mobilized by a strong foundational matrix comprised of appropriate education levels, national board examination requirements for licensure and strong accreditation standards. Others, on the other hand, face large opposition without the supporting associations and partnership efforts.

Goal 3 opportunities

Curriculum, faculty and leadership

The following faculty and administrative opportunities corresponding to Goal 3 were brought forth by each table:

- global harmonization of curricula

- defining the path forward for the profession
- transitioning from data collection to data analysis

Transitioning optometric education from data collection to data analysis was considered a laudable goal and discussed at length. It was also mentioned that students need to understand all that is involved in data collection to truly understand good data vs. bad data. While higher-order thinking should be the emphasis, students must also be educated, as in the basic sciences, about how data is collected and what can go wrong in the process. By harmonizing curricula globally, there is a greater opportunity for cultural sensitivity and more alignment in what it means to be an optometrist around the world. Global harmonization also offers the opportunity to create the caring practitioner presented as an opportunity in Goal 2. With optometrists around the world working together, discussions that clarify the future path for the profession can take place.

TABLE 3
Summary of Goal 3 Challenges and Opportunities

Curriculum, Faculty and Leadership	Students	Optometric Profession
Challenges <ul style="list-style-type: none"> • Current inconsistencies in the workforce (inclusive of faculty and leadership) • What are the minimum areas of competency and defined levels to earn the title "optometrist"? 	Challenges <ul style="list-style-type: none"> • Student recruitment as it relates to public knowledge of the services provided by an optometrist and their associated value from a public health perspective 	Challenges <ul style="list-style-type: none"> • Increased need for advocacy on behalf of the profession relative to expanded scope of practice
Opportunities <ul style="list-style-type: none"> • Global harmonization of curriculum • Defining the path forward for the profession • Transitioning from data collection to data analysis 	Opportunities <ul style="list-style-type: none"> • Attracting students with strong communication skills • Students who exhibit critical-thinking skills 	Opportunities <ul style="list-style-type: none"> • Interprofessional education • Strengthened partnerships with stakeholders

Table 3. Click to enlarge

Students

Opportunities connected to Goal 3 in recruiting the best students were identified as:

- Attracting students with strong communication skills
- Students who exhibit critical-thinking skills

An opportunity exists to recruit students with strong communication and critical-thinking skills to better participate in patient care. The goal is to recruit a student population that could analyze data and effectively inform patients, thus providing more humane care. Along with the strong communication skills there would be an emphasis on cultural competency to be respectful of the individual patient. This discussion ties into the opportunity for faculty and leadership in Goal 3, as well as the opportunity for students presented in Goal 2. The desire is to create a caring practitioner who doesn't see only a pair of eyes, but realizes the patient is a person and is part of a family and a larger community.

Optometric profession

The following profession-wide opportunities associated with Goal 3 were identified by each table:

- interprofessional education
- strengthened partnerships with stakeholders

Integrating optometry more fully into the healthcare systems in each country was every group's goal. This would offer opportunities for team-based integrated patient care and open the door for interprofessional education for students. This can be assisted by strengthening partnerships with education, industry, other healthcare providers and governmental and professional organizations. As education produces the next generation of optometrists, it needs to be linked to all stakeholders to better address the future.

Discussion

In summary, action plans generated during the summit fell broadly into four areas: linking education to the scope of practice; keeping education on pace with evolving technology and information; recruiting students who will succeed and thrive in the profession; and forging strong partnerships and interactions with all parts of the eyecare community.

There was an interest in an ongoing evaluation and adjustment of the definition of optometry linked to the scope of practice and the competencies required and demonstrated. Summit participants felt that a competency-based curricula offering a skill-based, tiered approach to training would complement broader goals. Student assessment techniques would be further aligned with course levels, the learning activities and intended learning outcomes. A global body could establish benchmarks comparing optometric practice around the world and other healthcare professions. Such a body could also consider the role of online education and a possible route to accrediting that format.

There was a desire to increase the use of technology to strengthen professional/continuing education offerings and refresh and/or retrain practitioners in the field. There was an interest in applying technology to create quality patient care simulations that could replace or supplement some of the direct patient care requirements. This would require some innovation but could

enhance student engagement and facilitate the transition from data collection in education to data analysis in patient care. This could possibly reduce some of the cost associated with procuring equipment for educational institutions and students as well. A strong interest was expressed in engaging retired faculty and practitioners as mentors and advisors to institutions with specific needs.

Looking to the future, it was acknowledged that the students of today are the profession of tomorrow. It is important to recruit students with skills sets that match the evolving needs of the profession. Students need to be educated and inspired to be lifelong learners and stay current with evolving evidence-based practices. They need to respect other cultures and be culturally competent as students to become culturally humble faculty, administrators and academic leaders.

Educators wanted to strengthen and broaden partnerships with optometric organizations, such as ASCO and the WCO, but also hoped to further engage industry to support shared initiatives involving faculty and leadership development. It was felt that this would help solidify optometry's role in interprofessional collaborative care and healthcare systems while also further engaging the public and affording them a better appreciation of the profession and the healthcare services it provides. This would also advance efforts to align legislation and education, which would advance the scope of practice and population health.

Conclusion

Many of the issues facing optometric education are shared by institutions around the world and are not unique to one region. Using shared efforts and resources, innovative models can confront challenges the summit discussions identified. Increased collaborative efforts to address those challenges will allow for effective implementation of the synergistic solutions that were identified. This will facilitate a unified approach to the advancement of the profession of optometry with the ultimate goal of improved patient outcomes.

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Binasal Hemianopia: an Observational Teaching Case Report and Review of a Rare Visual Field Defect

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PDF of Article

Introduction

True binasal hemianopia is a rare visual field defect.¹⁻¹⁴ The existence of true binasal hemianopic visual field defects has been met with doubt in the past.^{5,15,16} Historically it has been suggested that many binasal hemianopic visual field defects appear hemianopic but are more likely intraocular nerve fiber bundle defects from bilateral optic nerve disease (e.g., glaucoma, optic disc drusen, papilledema).^{6,11,16} However, extraocular binasal hemianopic visual field defects really can occur and have been reported with numerous causes, which include: intracranial vascular compression, optic chiasm disease and/or pituitary gland disorders, brain tumors and/or increased intracranial pressure, post-stroke, post-infection, post-surgery, sinus disease, bilateral lateral geniculate nuclei disease, bilateral optic nerve pathology, bilateral retinal disease, bilateral keratoconus, functional/nonorganic vision loss, idiopathic, and presumed congenital anomalies.^{1-5,7-15,17-34} To expand on this list of known associations and causes, a report of an artifactual binasal hemianopia from improper visual field testing instructions by a technician follows.

Case Description

A 59-year-old African-American female presented for annual eye examination with no vision complaints. Her medical history included hypertension, diabetes mellitus, hypercholesterolemia, vitamin-D deficiency and asthma. Visual acuities were 20/20 right eye (OD) and 20/20 left eye (OS). Pupil testing was within normal limits, without afferent pupillary defect. Confrontation visual fields were also normal in both eyes (OU). Extraocular motilities showed full range of motion OU. Her exam was otherwise unremarkable until retinal examination. Bilateral optic nerve appearances were suspicious for glaucoma. Optical coherence tomography (OCT) imaging and automated visual field testing were ordered. Baseline visual field testing revealed binasal hemianopia OU that respected the vertical midline (**Figure 1**). Repeat visual field testing 1 week later showed identical binasal hemianopias. Given the visual field test repeatability, the severity of the defects that did not correlate with the glaucoma suspect status of the optic nerves, and the lack of retinal nerve fiber layer thinning on OCT (**Figure 2**), an extraocular neurological cause of the visual field defects was suspected. The patient was referred urgently for neurological consultation. Neurological exam and magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) of her brain were entirely within normal limits. The patient was then lost to follow-up.

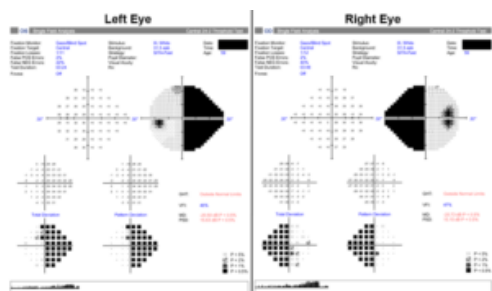


Figure 1. Baseline automated Humphrey visual field testing (24-2 protocol) showed binasal hemianopic visual field defects. [Click to enlarge](#)

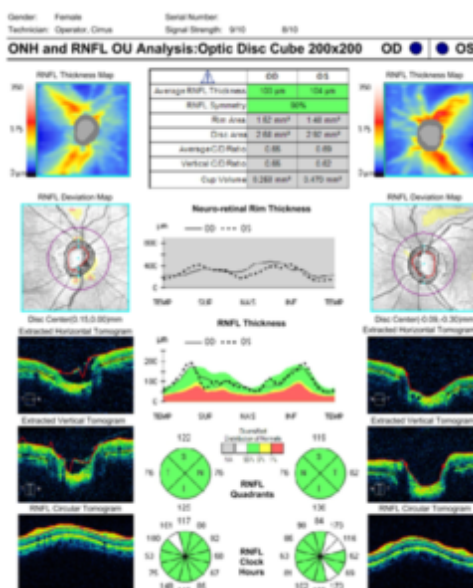


Figure 2. Baseline optical coherence tomography (Cirrus) scans showed normal, age-expected retinal nerve fiber layer thickness in both eyes. [Click to enlarge](#)

Three years later the author assumed the patient's care as she was referred by her primary care physician for a dilated diabetic eye exam. The patient reported no changes to her vision or medical history since her visit 3 years prior. Visual acuities were stable at 20/20 OD and 20/20 OS. The remainder of her exam was stable from her visit 3 years prior. At this visit, the patient was asked what visual field test instructions she had been given at her initial appointment 3 years earlier. Interestingly, she vividly remembered being very confused by the directions at both the baseline and 1-week follow-up tests 3 years earlier. She reported that the technician phrased the visual field test directions in this manner:

"Mrs. XXX, we are going to perform a test to check your side vision. Please look straight ahead at the fixation target and click the button in your hand when a second light shows up in your side vision. Please cover your left eye with this eye patch as we are going to test your right side first."

The patient admitted she was confused as to why the technician said right side instead of right eye but was embarrassed to ask for clarification. Therefore, she performed the test as requested; she only clicked the button when the target light was in the temporal side of her vision (i.e., her right side). Because the patient completely ignored the nasal half of the visual field based on the instructions she was given, the result of her visual field test was a complete nasal hemianopia OD. The patient recalled that at the end of the right-eye visual field test, the technician continued in this manner:

"You have completed your side vision test for your first eye. Good job! Please cover your right eye with this eye patch as we are going to now check your left side."

The patient admitted she had been again too embarrassed to ask for clarification, and because the technician said "good job" she assumed she performed the test correctly with her right eye. Therefore, for the left eye test, she only clicked the button when she saw the target light on her left side. Thus, she produced false binasal hemianopic visual field defects. The patient said she was able to see the target in both nasal hemifields during testing but was doing her best to comply with the technician's directions. Astonishingly, she was able to completely re-create the entirely artifactual visual field defects at her follow-up test 1 week later, where, she reported, the technician gave her the same directions as the previous week (using the term "side" rather than "eye").

After this was made known by the patient, proper test instructions were reviewed with her before testing was repeated. The new tests showed normal visual fields OU (**Figure 3**). Additionally, repeat OCT was stable OU compared to baseline testing 3 years earlier (**Figure 4**).

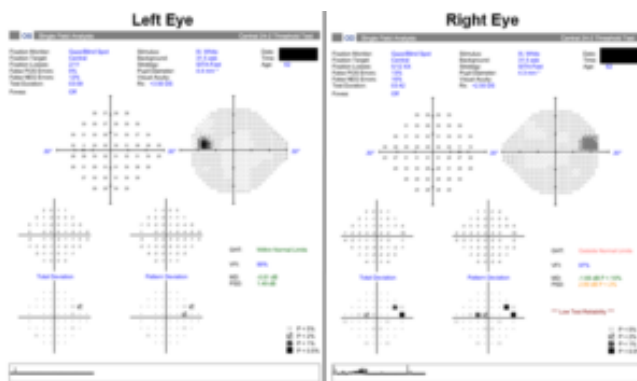


Figure 3. 3 years after baseline, and after correct test instructions were reviewed with the patient, the results of repeat automated Humphrey visual field testing were normal in both eyes. [Click to enlarge](#)

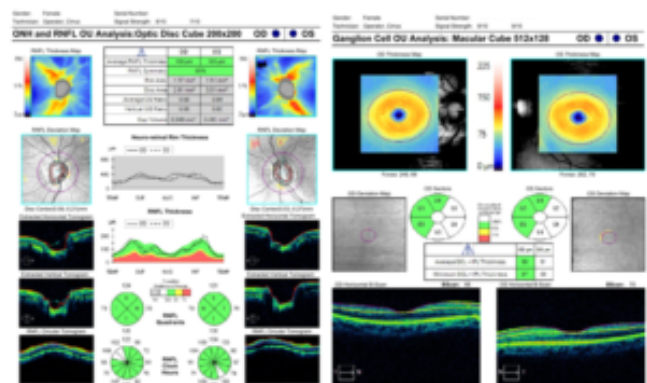


Figure 4. Left, repeat optical coherence tomography (OCT) scans (Cirrus) showed stable retinal nerve fiber layer thickness in both eyes 3 years after baseline. Right, OCT (Cirrus) ganglion cell analysis showed normal macula ganglion cell layer thickness in both eyes. [Click to enlarge](#)

Education Guidelines

Key concepts

1. The pathway of the visual fibers from the retina to the occipital lobe and corresponding visual field defects
2. Communicating with patients and the role of clear instructions
3. Patients' perception and understanding of tests and instructions

Learning objectives

1. Describe the classic presentation of binasal hemianopia with/without symptoms
2. Recognize the signs and symptoms of true vs. artifactual binasal hemianopia
3. Discuss differential diagnosis of binasal hemianopia
4. Identify causes of binasal hemianopia
5. Understand the visual pathway to predict lesion location based on visual field test findings
6. Identify additional testing to help diagnose true vs. artifactual binasal hemianopia
7. Develop a management plan for encountering possible binasal hemianopia

Discussion questions

1. Knowledge, understanding and facts about the clinical case and condition presentation
 - a. what is the pathophysiology of true binasal hemianopia?
 - b. describe the symptoms that would be expected in binasal hemianopia
 - c. what case history questions/risk factors can be asked/identified to help identify true vs. artifactual binasal hemianopia?
 - d. what is the most common cause of binasal visual field defects?
2. Differential diagnosis
 - a. what conditions have been shown to cause true binasal hemianopia?
 - b. how can certain etiologies be ruled out/in with a comprehensive eye exam?
 - c. what additional diagnostic testing can be performed to aid proper diagnosis in patients suspected to have binasal hemianopia?
 - d. what specific question(s) can be asked to help identify false binasal hemianopia?
3. Patient management and role of the optometrist
 - a. when is neuroimaging (e.g., computed tomography [CT] or MRI) warranted in suspected cases of binasal hemianopia?
 - b. how can you help prevent unnecessary neuroimaging in patients presenting with binasal hemianopia?
 - c. when is neurological and/or neurosurgical consult warranted in suspected cases of binasal hemianopia?
 - d. what patient education discussion points/tools can be used to explain findings to the patient efficiently and effectively?

Assessment of learning objectives

This case may be used in the clinical setting:

- the case can be presented and discussed in small groups
- visual field testing parameters and interpretation such as test selection, reliability indices, results and anatomical correlation to identified defects can be discussed (One activity could involve showing binasal hemianopic visual field defects and then predicting where the lesion(s) would need to be to cause such a defect)
- the neuroanatomy of the visual pathway (specifically the optic chiasm) can be reviewed to reinforce concepts learned in foundational optometric education classes

Discussion

Visual field defects

Visual field defects are numerous and may be unilateral or bilateral, complete or incomplete, central or peripheral, sectoral, arcuate, altitudinal, constricted, quadrantanopic, hemianopic or other patterns.¹⁰ Visual field defects can be homonymous (corresponding left or right side of visual field missing bilaterally) or heteronymous (bitemporal or binasal).^{2,3,6,9,10,12,15,16} Homonymous hemianopias are more common than heteronymous, and bitemporal heteronymous hemianopias are more common than binasal heteronymous hemianopias.^{2,6,29,35}

General binasal visual field defects are most commonly caused by glaucoma.^{1,2,11,14,20,36} Additionally, binasal visual field defects have been reported in 8 out of 100 (8%) visual field defects, with binasal hemianopias accounting for only 2 of 8 of those cases (2%).² Binasal visual field defects have been reported to be intraocular in 75% cases and intracranial in 25% cases.² Neurologic binasal hemianopias are reported to be most commonly related to optic chiasm pathology (e.g., pituitary adenoma, ischemia, aneurysm).^{3,4,9,13,15} As optic chiasm can be pre-fixed, centrally fixed or post-fixed over the pituitary gland, there appears to be considerable microvariability in the length, position, height, etc., of individuals' optic nerves, optic chiasm and optic tracts, which might result in varying patterns of visual field defects.^{3,13,33,35,37}

Neurologic binasal hemianopic visual field defects are rare.¹⁻¹⁴ An early study of 300 cases of intracranial tumors found 5-6% cases had unilateral or bilateral nasal hemianopia.^{2,38} Another study of intracranial tumors reported three incidents of binasal hemianopia in 3,033 cases (0.1% of cases), also underscoring the rarity of binasal hemianopic visual field defects.^{14,39} In three other studies of patients with pituitary tumors, binasal hemianopia was reported in 1 of 21 patients (4.8%), < 1% patients, and 0% of patients, respectively.^{13,33,35} In an additional study of 479 post-stroke patients with visual field loss, binasal hemianopia was reported in 1 patient (0.2%).²⁹

Binasal hemianopia appears to occur equally in men and woman at an average age of approximately 44 years.² However, the patient age range seems to vary widely from 10-83 years.^{1,2,4,7,9,11,15,17,21,25-27,34} This large age range likely reflects the many potential underlying causes and overall rare occurrence of binasal hemianopia in general.

Visual acuity, pupil response and color vision in binasal hemianopia may be normal or reduced depending on the underlying pathology.^{1,2,9,11,15,17,21,26,27} Pre-fixation blindness can occur with binasal hemianopia in a similar fashion as post-fixation blindness occurs in bitemporal hemianopia.⁴⁰ If present, pre-fixation blindness suggests that the binasal hemianopic visual defect is likely real.

Possible causes of binasal hemianopia

Ocular cases of binasal hemianopia described in the literature include glaucoma, ischemic optic neuropathy, optic disc drusen, chronic papilledema, keratoconus, optic nerve pits, retinitis pigmentosa and other bilateral retinal diseases (e.g., toxicity, occlusive disease).^{9,11,18,19} It is recommended that these ocular causes be ruled out first, especially glaucoma as it is the most common cause of binasal visual field defect, before neuroimaging and/or lab tests are ordered.^{1,9,11,20,36} Fortunately, these ocular causes can be relatively easy to rule out with an astute comprehensive dilated eye examination.

Additionally, complete and incomplete binasal hemianopia has been reported in association with neurological visual pathway vascular compression (e.g., internal carotid artery aneurysm or atherosclerosis, internal carotid artery or anterior cerebral artery dolichoectasia and/or fusiform enlargement), increased intracranial pressure (e.g., hydrocephalus, distended third ventricle), sphenoid sinus disease, empty sella syndrome, post-infectious arachnoiditis, post-resection of pineocytoma, lateral geniculate nuclei myelinolysis, epilepsy, brain tumors (e.g., pituitary adenoma/apoplexy, cerebellar, intraventricular, meningioma), post-stroke, bilateral retinal disease (e.g., retinitis pigmentosa sine pigmento, retinal ischemia/occlusive disease), bilateral retinal toxicity (e.g., vigabatrin), bilateral temporally located keratoconus, neurosyphilis, functional/nonorganic vision loss and idiopathic and presumed congenital anomalies.^{1-5,7-15,17-34}

Unilateral nasal hemianopia has been reported in the literature as being caused by aneurysm compressing the lateral uncrossed temporal retinal ganglion fibers of the optic chiasm.^{12,28} In cases of aneurysmal compression of the lateral optic chiasm, 35-60% cases result in ipsilateral nasal visual field defects.²⁸

It is also possible to have binasal quadrantanopsia (secondary to pituitary adenomas, optic disc drusen, optic disc pits).^{2,30,31} Binasal quadrantanopsia was reported recently in one case of bilateral posterior cerebral artery occlusion causing ischemic stroke.⁴¹ Because glaucoma is the most common cause of binasal visual field defects, it is prudent to keep in mind the possibility of a binasal quadrantanopsia mimicking a glaucomatous visual field defect in some clinical situations.^{1,2,11,14,20,36}

Pathophysiology of binasal hemianopia

The temporal retinal fibers of each eye serve the nasal visual fields, and each eye's temporal retinal fibers pass closest to one another at the optic chiasm.^{13,42} The ratio of nasal to temporal fibers in the optic chiasm is believed to be 53:47, with the nasal fibers crossing in the chiasm, while the temporal fibers remain lateral and uncrossed as they travel via the ipsilateral optic tracts to the ipsilateral lateral geniculate nuclei.^{3,13,37,42-44} Because the temporal retinal fibers serve the nasal visual fields, it has been suggested that bilateral and symmetrical optic nerve lesions were necessary to cause a binasal hemianopia.^{3,4,11} However, lesions involving the optic chiasm might also impinge upon the temporal retinal fibers bilaterally as these fibers course temporally through the optic chiasm on their way to synapse at the lateral geniculate nuclei. Therefore, optic chiasm lesions also could result in binasal hemianopias.^{3,4,11} Single lesions (e.g., tumors) near the optic chiasm have also been shown to cause binasal hemianopia.^{4,13,30,31,33} This is similar to bitemporal hemianopia, which is most commonly caused by single lesions, such as pituitary adenomas, that cause compression of the nasal crossing fibers of the optic chiasm.^{3,35}

Many theories about the pathophysiology of extraocular nasal or binasal visual field defects have emerged.^{13,14,17,33,42} One theory is mechanical compression of the optic nerve in the optic canal where the superior and inferior temporal fibers pass.³³ Another theory holds that lateral optic chiasm compression could cause binasal hemianopia by compressing the temporal retinal ganglion cell axons as they pass through the lateral aspect of the optic chiasm.^{13,14} A third theory put forth suggests that in some cases binasal hemianopia might be a congenital anomaly on the order of a "congenital temporal retinal axon missorting

syndrome,” similar to some cases of albinism in which there is abnormal decussation of the temporal retinal ganglion axons outside the normal 53:47 crossed-to-uncrossed ratio.^{17,42} A fourth theory is that some of the idiopathic cases of binasal hemianopia described in the literature might be due to poor visual field test performance by patients or poor test instructions, as in our patient’s case.

Kinetic vs. automated visual field testing in neurologic binasal visual field defects

To the author’s knowledge, no studies have specifically compared kinetic (i.e., Goldmann perimetry) vs. automated (i.e., Humphrey Visual Field Analyzer 30-2/24-2 protocols) visual field testing in neurologic binasal hemianopic visual field defects. However, several studies have found very good correlation in general between kinetic and/or automated visual field testing in neurological visual field defects.^{45,46} This suggests both modes of visual field testing are also acceptable in binasal hemianopia.

Fabricated and/or artifactual visual field defects

Is it possible for patients to willingly fabricate visual field defects? Fabricated and/or unreliable visual field defects are well-documented in a variety of disorders with either organic or nonorganic causes, and they can occur under the watchful guidance of experienced clinicians.^{27,34,47-52} Several studies have indicated how easily neurological visual field defects can be fabricated by normal individuals.⁴⁷⁻⁴⁹ In one study, a binasal hemianopia was completely fabricated by a normal individual.⁴⁷ The ability to fabricate visual field tests is reported to be similar between kinetic and automated perimetry.⁴⁹ The clinician must remain diligent in interpreting visual field test results and repeating suspect tests with correct instructions (as in this case), as well as correlating results to clinical findings as it is possible to easily fabricate a range of false neurological visual field defects.⁴⁷⁻⁴⁹ When encountering a questionable heteronymous visual field defect such as binasal hemianopia on perimetry, the clinician should confirm it with monocular and/or binocular confrontation visual field testing.^{47,51,52} If the defects are present on automated perimetry but absent from confrontation visual field testing, the defects are likely fake. An additional clue could be the presence or absence of post-fixation blindness in bitemporal hemianopia, or pre-fixation blindness in binasal hemianopia.^{40,50}

Suggested workup in binasal hemianopic cases

When encountering binasal hemianopic visual field defects in a clinical setting, clinicians should perform an astute dilated comprehensive exam to rule out ocular causes (approximately 75% cases).² Confirmation of the persistence of the binasal visual field defects with confrontation visual field testing and documenting the presence or absence of pre-fixation blindness is recommended. Previously suggested workup for binasal hemianopia from the late 1970s includes comprehensive eye examination including applanation tonometry, dilated optic nerve and retinal examination, electroretinogram, syphilis serology/tests, neurologic examination, erythrocyte sedimentation rate test and neuroimaging.² It now seems reasonable to add fundus photography, OCT, keratometry and/or corneal topography and electrophysiology to this diagnostic approach when clinically appropriate.^{1,7,27,34,42}

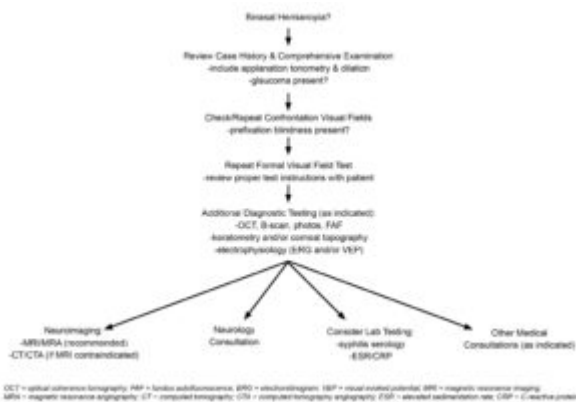


Figure 5. Overview of suggested protocol when encountering binasal hemianopia in a clinical setting. [Click to enlarge](#)

Common intraocular causes of nasal visual field defects (e.g., glaucoma, ischemic optic neuropathy, optic nerve drusen, retinal disease) should be ruled out before considering an intracranial lesion. This especially applies to glaucoma because it is the most common cause of binasal visual field defects.^{1,11,20,28} In the absence of the common causes of nasal visual field defects, aneurysms and other intracranial lesions should be ruled out by MRI, MRA, CT or computed tomography angiography.^{7,20,28} Prior to moving forward with neuroimaging, a good clinical rule of thumb may be to add the additional step of reviewing what visual field test instructions were provided to the patient by the technician. This would help ensure that miscommunication of the instructions is not responsible for the appearance of a binasal visual field defect, as in this case. **Figure 5** provides an updated suggested protocol for evaluating potential binasal hemianopia.

Treatment and prognosis

Eye care providers should appropriately identify, treat and refer for further consultation cases of binasal hemianopia. Treatment should be directed at the underlying cause. Therefore, appropriate referrals might include ophthalmology subspecialists (glaucoma or neuro-

ophthalmology), neurologists, neurosurgeons, primary care physicians or other medical specialists. Vision should be maximized with appropriate refractive error correction, and low vision rehabilitation should be strongly considered when quality of life and/or activities of daily living are impaired by decreased vision.

Prognosis is guarded and is likely variable based on time to diagnosis, extent of visual field damage, involvement of central vision, response to treatment (if available), degree of visual pathway atrophy or appropriate referral. One paper has shown that some cases of binasal hemianopia may be reversible if treated appropriately and before permanent visual pathway damage occurs.²⁵

Conclusion

True binasal hemianopia is rarely encountered clinically but can present a diagnostic challenge.¹⁻¹⁴ Eyecare providers should perform astute clinical examinations with appropriate technology to rule out ocular causes of binasal hemianopia before proceeding to considering intracranial causes.² Improper or unclear test instructions may lead to erroneous diagnosis of visual field defects, as in this case. Proper automated visual field test instructions should be explained to patients based on the manufacturer's recommendations (**Figure 6**).^{53,54} It is reasonable to verify the visual field test instructions given to patients with binasal hemianopia and repeat the test before proceeding to more expensive and time-consuming tests such as neuroimaging. This case report helps to expand the list of known causes of binasal hemianopic visual field defects to include improper visual field test instructions given by technicians supervising the test.

Patient Instructions for Automated Visual Field Testing

1. This test will measure the central and side vision of each eye individually. During the test, always look straight ahead at the steady yellow light.
2. Other lights will flash one at a time off to the side. Press the button whenever you see one of these lights flashing anywhere in the bowl.
3. The test is designed so that it will dim the light flashes until you no longer see them. Thus, you are not expected to see all the lights, and in fact you will probably see fewer than half of them. This also means that many of the lights you do see will be barely visible.
4. If you want to pause the test, hold down on the button. The test will resume when you release the button.
5. Testing time varies, but typically takes 2-6 minutes for each eye. You can blink normally. When your test is over, you will hear two beeps. You may then sit back and relax.

Figure 6. Correct patient test instructions for automated visual field testing with the Humphrey Visual Analyzer (Carl Zeiss Meditec, Dublin, CA).^{53,54}
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Queering Optometric Education

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Introduction

Providing competent eye and vision care for all is an ideal espoused in optometric accreditation standards, cultural competence guidelines, and codes of ethics.¹⁻⁴ Yet, neither these sources nor the optometric literature explicitly address the care implications for patients who identify as sexual or gender minorities. This absence is important because sexual and gender minorities experience preventable health disparities through fewer opportunities to achieve optimal health and a greater burden of disease, injury, and violence.⁵ Some health professional schools have introduced curricula that consider the impact of gender and sexual identity on patient care priorities and needs.⁶⁻¹⁰ However, the optometric education literature has remained silent on this aspect of training, suggesting a potential problematic gap in the training of future optometrists.

The lack of explicit attention to this area of care begins with the Accreditation Council on Optometric Education (ACOE) standards that require graduates of the professional optometric degree to attend to “diverse populations” (2.9.5), “diversity, equity, and inclusion principles” (2.9.6), and “culturally competent communications” (2.9.8).¹ Similarly, graduates of ACOE optometric residencies must provide patient education, communication, and shared decision-making that is “culturally competent” (2.4.1).¹ Nowhere, however, is “cultural competence” defined. In contrast, American medical schools can map their curricula to the Association of American Medical Colleges (AAMC) general competencies that include an explicit recognition of multiple relevant identities: “Demonstrate sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation” (5.5).¹¹

Despite this AAMC competency, problems persist. In Canada and the United States, medical education about sexual and gender minorities’ health has been described as limited, inconsistent, and devoid of agreed-upon specific core competences.¹² Studies in the past 10 years have found that formal education on this topic is limited to a median of 5 hours¹³ and most students judge their training as “fair” or worse.¹⁴ Transgender training is typically identified as the most limited sector of sexual and gender minorities health education.¹⁵⁻¹⁷ Limited trans health education has been found to be a barrier to competent care by medical students and residents.^{13,18-23} In a qualitative study of Canadian physicians, Snelgrove et al.²⁴ compellingly characterized medical care of transgender patients as “completely out-at-sea” in part because of the normative practice of “two-gender medicine.”

Reviews and studies of medical student and resident training do not reveal pedagogical and curricular consensus; however, there is support for adopting multi-modal, scaffolded approaches that are founded in cultivating values, exploring self-awareness of privilege and bias, and enhancing communication skills.²⁵⁻²⁸

The AAMC publication “Implementing Curricular and Institutional Climate Changes to Improve Health Care for Individuals who are LGBT, Gender Nonconforming, or Born with DSD: A Resource for Medical Educators”²⁹ discusses competencies, strategies for integrating and assessing these competencies, as well as clinical scenarios and discussion points. Thirty competencies have been set across eight domains: knowledge for practice, patient care, practice-based learning and improvement, interpersonal and communication skills, professionalism, systems-based practice, interprofessional collaboration, and personal and professional development.

To date, there are few indications that the profession of optometry recognizes the need for care and training that attends to sexual and gender minorities. Denial et al.³⁰ and the Association of Schools and Colleges of Optometry (ASCO) “Guidelines for Culturally Competent Eye and Vision Care”⁴ acknowledge that culturally competent optometric care includes a consideration of gender and sexual orientation, although no specific guidance is provided. The ASCO guidelines⁴ — currently under review — may ultimately deepen consideration of sexual and gender minority care because ASCO recently released a set of case studies³¹ that includes one case about respecting a patient’s pronouns and preferred name. Two of us (PSM & LK) have provided American Academy of Optometry lectures on “Optometric Care of Transgender Patients.”^{32,33}

In this paper we aim to start redressing this apparent educational gap by laying out a justification for updating optometric education and providing curricular and pedagogical guidance. We take the AAMC competencies²⁹ and adapt them for optometry in an attempt to stimulate a conversation among optometric educators about how we train optometry students to

provide competent care to diverse and often mistreated communities.

Justifying a 2SLGBTQ+ Inclusive Optometry Curriculum

The justification for inclusive optometry curricula lies in the regularity that members of sexual and gender minority communities present for eye care, the health disparities they routinely experience, and the prevalent health impacts they encounter. A brief review of this literature anchors this justification.

Defining the communities

LGBT (lesbian, gay, bisexual, and transgender) is widely used, yet it mixes populations whose identities are based on sexual orientation (i.e., lesbian, gay, bisexual) and gender identity (i.e., transgender), it falsely implies mutually exclusive categories, it incorrectly presumes homogeneity regarding needs and priorities, and it presupposes binary masculine/feminine and hetero/cisgender norms. Cover³⁴ discusses the continually evolving “taxonomy” that proliferates in an attempt to include disenfranchised voices from traditional LGBT and binary-norming discourses. The recognition that LGBT fails to fully describe all sexual and gender minorities has led to various longer acronyms. In this paper, we use 2SLGBTQ+ to acknowledge that “two-spirit” (2S) Indigenous people were the first sexual and gender minorities living on Turtle Island (North America), gender queer individuals (Q) have non-binary gender identities, and additional sexual and gender minorities exist (+).³⁵

The AAMC “Resource for Medical Educators”²⁹ maintains the LGBT “shorthand,” separating the differing care needs within that grouping, and considers two additional diverse populations to address the LGBT-identity shortfall: people who are “gender nonconforming” and people “born with differences in sex development” (DSD). Gender non-conforming people purposefully express their gender differently from gendered societal norms, while people born with DSD have atypical features of their gonads, genitalia, or sex chromosomes (e.g., congenital adrenal hyperplasia, androgen insensitivity syndrome, Klinefelter Syndrome, Turner Syndrome). This AAMC resource importantly notes that identities are declared by the person; the process of establishing one’s identity naturally evolves over time, particularly among youth; and gender identities do not predict sexual histories, practices, and feelings.

Estimates of the 2SLGBTQ+ population in North America depend on self-reporting and survey wording.³⁶ Statistics Canada and the United States Census Bureau have historically collected binary female/male data; however, this strategy fails to recognize sex-gender differences or capture non-binary identities. This can be remedied with a survey that employs a two-step question about the person’s assigned sex at birth and their current gender identity, with the latter including transgender and non-binary options. Statistics Canada has collected sexual orientation data since 2003 and adopted the two-step question in its 2021 census,³⁶⁻³⁸ while the United States Census Bureau has yet to collect either.³⁹ American estimates can be gleaned from the annual Behavioral Risk Factor Surveillance System (BRFSS),⁴⁰ which includes questions about sexual orientation and gender identity without employing the two-step question.

Adult 2SLGBTQ+ community estimates are 3.6% in Canada⁴¹ and 4.5% in the United States⁴²; however, age impacts these estimates. North American surveys of younger adults (under 35 years of age) report estimates two to three times higher than surveys of all ages.⁴¹⁻⁴⁴ Blackless et al.⁴⁵ estimate that one in 100 people are born with DSD, noting that DSD itself does not determine sexual or gender identity. Depending on practice demographics, optometrists will regularly or frequently provide care to 2SLGBTQ+ patients.

Drivers of health disparities

Sexual and gender identities are social determinants of health; this is particularly true of gender identity. Hatzenbuehler and Link⁴⁶ identify the underpinnings of health disparities among gender minorities as structural (e.g., government policy, institutional practices), interpersonal (e.g., abuse, rejection, discrimination), and individual (e.g., concealing identity, internalized stigma). Gender identity is a social stratifier that can exclude people from society and services.²⁵ Sexual and gender minorities experience greater health disparities if they identify with additional socially constructed marginalized identities.^{47,48} For example, in addition to facing heterosexist, homophobic, and transphobic oppression, two-spirit Indigenous individuals encounter racist and colonial oppression by government and mainstream society and marginalization within a Western LGBT community.⁴⁹ These traumas combine to significantly increase rates of substance abuse, addiction, suicide, morbidity, and mortality relative to non-Indigenous peers.⁴⁹ Ng⁵⁰ posits that health practitioners need to proactively practice through a lens of intersectionality by acknowledging that membership in multiple minority groups affects patient health in terms of risks, care experiences, decision-making, and outcomes.

Sexual and gender minorities are marginalized by societal heteronormativity and cisnormativity. The former assumes people are and should be heterosexual; the latter presumes gender aligns with assigned sex at birth.²⁵ These normative assumptions fuel phobias that can be hostile, particularly in the case of transphobia.²⁵ Social norms regarding sexual and gender identities

can inform laws about what constitutes legal consensual sexual behavior and hate crimes, leaving some people — particularly those who are older or have lived in certain countries — not expecting safe health care.^{29,51,52} Stigmatized social status creates a “minority stress” that risks mental health and heightens vigilance regarding further negative experiences.^{53,54} While minority stress can build resilience in the form of “group-level coping” among members of minority groups,⁵⁴ repeated and significant trauma more likely creates vulnerability in the form of negative health outcomes or risky behaviors.²⁹

People who are transgender or gender non-conforming routinely encounter negative healthcare experiences, including discrimination, microaggressions, hostility, abuse, and knowledge gaps.⁵⁵⁻⁶⁰ Gender minorities delay or avoid health care because of concerns about practitioner behavior, affordability due to socioeconomic status or insurance coverage, and potential negative outcomes of hormonal therapy.⁶¹⁻⁶³ They are reluctant to disclose their gender identity, and health facilities are ill-equipped to accurately collect their identity data.⁶³

Sexual and gender societal norms can problematically impact health education and health research.²⁵ Societal homophobia and transphobia are not unlearned through healthcare education when it is taught through biomedical or biopsychosocial positivist approaches that silence or limit consideration of the social constructs of gender and sexuality.^{25,64} Das Gupta et al.⁶⁵ argue that health education must be informed by a social justice lens to avoid commonly occurring harmful practices such as service providers deciding whether patients will obtain access to gender-affirming care.⁶⁶⁻⁶⁸

Health research can further obfuscate the mindset of healthcare providers. For example, there is limited research about two-spirit Indigenous health, and the destruction and distortion of records by priests, missionaries, and researchers have skewed some research findings.⁴⁹ The research-based classification systems of the American Psychiatric Association’s “Diagnostic and Statistical Manual of Mental Disorders” (DSM) and the World Health Organization’s (WHO) “International Classification of Disease” (ICD) may also impact health provider attitudes.²⁵ Homosexuality was classified as a mental illness by the DSM until 1973,⁶⁹ and gender diversity did not appear in the ICD until 1975.⁷⁰ Currently, gender diversity is classified as “gender dysphoria” by DSM-5 and “gender identity disorder” by ICD-10. In 2022, ICD-11 will adopt the term “gender incongruence” and move it from the “Mental and Behavioural Disorders” chapter to “Conditions Related to Sexual Health.”²⁵ Proponents of current DSM and ICD classifications argue that they minimize stigma, acknowledge psychological stress, and support access to care, including gender-affirming modalities, whereas detractors maintain that gender diversity in and of itself is not a pathology requiring classification.²⁵

Transgender individuals experience harm via government-issued documents, lab work orders, patient records, and coding and billing systems that are founded in hetero- and cis-normative assumptions.⁷¹ Identity documentation should first determine the patient’s gender identity, name, and pronouns — which are most important to the patient — and then determine assigned sex and name at birth — which may impact assessment decisions.⁷¹ Clinic staff should accept government-issued documentation as presented and not make assumptions when the documentation differs from the patient’s stated identity.⁷¹

The increased use and implementation of electronic medical records (EMRs) can constrain or enable gender-affirming care. The World Professional Association for Transgender Health EMR Working Group provides several recommendations.⁷¹ There should be an optional field for recording preferred name, gender identity, and pronouns that is separate from the field containing assigned sex and name, needed for billing. Gender identity and pronoun options should be flexible to accommodate changing patient preferences and evolving gender minority taxonomies. The system must be able to flag differences between assigned and preferred identity at the right time for each EMR end-user. Additionally, EMRs must support an updatable anatomy inventory and gender-affirming medical care record (e.g., surgery, hormones) that can auto-populate appropriate workup templates. This information must be decoupled from gender and sex identity fields. Tuite et al.⁷² also note that the pedigree nomenclature used in some patient records needs updating to represent patients who are gender non-conforming or born with DSD.

Health impacts

Discrimination, stigmatization, rejection, and internalized homophobia and transphobia trigger physiologic responses (e.g., activating the hypothalamic-pituitary-adrenal axis) that contribute to a higher prevalence of internalizing disorders like depression and anxiety as well as externalizing disorders such as substance abuse, self harm, and suicidal ideation and behavior.^{38,53,73,74} Encouragingly, competent care can reduce the occurrence of mental illness. For example, similar depression rates among cisgender children and gender minority children experiencing gender transition social supports suggest these supports can offset typically higher depression rates among gender minorities.⁷⁵

Compared with heterosexual peers, LGB adults have higher risks of asthma and cardiovascular disease, bisexual individuals have double the smoking rate, and gay men experience disproportionately higher rates of human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs).⁷⁶

Transgender people, particularly trans women, face disproportionately higher rates of systemic disease compared with cisgender peers.⁶³ Trans women experience significantly higher rates of HIV and other STIs. If they have pursued gender-affirming hormonal therapy (i.e., estrogens and anti-androgens), they also have higher rates of vascular disease (e.g., venous thrombosis, myocardial infarction, type 2 diabetes, cerebrovascular disease), osteoporosis, and autoimmune disease (e.g., systemic lupus erythematosus and autoimmune hepatitis).⁶³ The latter may be tied to elevated C-reactive protein.⁷⁷ Thus, a key gender-affirming step of many transgender people — hormonal therapy — may support their mental well-being yet work against some aspects of their physical well-being.

Long-term gender-affirming hormone therapy in trans women may be linked to a higher risk of neuro-ophthalmic disease according to case reports of bilateral non-arteritic anterior ischemic neuropathy and post-surgical cerebral venous sinus thrombosis.^{78,79} Hollar et al.⁶³ argue that transgender people may be more likely to experience progressive glaucomatous optic neuropathy, diabetic neuropathy, and reduced retinal ganglion cell survival after traumatic optic neuropathy. They suggest that brain-derived neurotrophic factor may play a role and that trans women may more likely be missing this neuroprotective factor.

The increased prevalence of osteoporosis among transgender women taking gender-affirming hormones may elevate their risk of inflammatory conditions of the eye and ocular adnexa (e.g., uveitis, episcleritis/scleritis, optic neuropathy, orbital inflammation).⁶³ Gender-affirming hormone therapy for transgender men may cause idiopathic intracranial hypertension, leading to papilledema and ocular motor dysfunction.

A significantly higher prevalence of HIV infection and increased risk of type 2 diabetes and thromboembolic events among trans women means that eyecare practitioners should consider the greater likelihood of HIV retinopathy, CMV retinitis, other opportunistic retinal infections, diabetic retinopathy, and retinal occlusive disease.⁶³ Higher smoking rates among this community may exacerbate the risk of these retinopathies.⁸⁰

Gender-affirming hormone therapy may improve (testosterone) or worsen (estrogen) ocular surface disease.⁸¹ Optometrists need to also understand that gender-affirming surgery for some individuals includes facial surgical procedures such as eyebrow lifting and hairline lowering that may impact ocular functions.⁶³

These health impacts complicated by notable health disparities necessitate developing a set of competencies for optometrists that considers the diversity of the 2SLGBTQ+ communities.

Competencies for a 2SLGBTQ+ Inclusive Optometry Curriculum

The AAMC “Resource for Medical Educators”²⁹ has created the only comprehensive set of competencies that addresses the care needs of 2SLGBTQ+ communities. Included with each of the 30 AAMC competency objectives are examples of demonstrating the competency and educational modalities that may help students meet the competency. We adapted the AAMC competencies²⁹ for optometric practice using a consensus building approach, which started with a version created by one of us (MMS). Modifications were made through an iterative discussion among the three of us. A similar approach was taken to providing non-exhaustive examples of demonstrating competencies and education modalities. For the latter, we created unique examples that focused on one of four types of learning activities: case, discuss, skill, project.

We determined that all eight AAMC competency domains applied to optometrists. At the specific competency objective level, differences in practice scope triggered some changes. Of the six “patient care” domain competencies, two were altered and one was eliminated. In addition, one of the six “system-based practice” domain competencies was eliminated.

Tables 1 to 8 show the adapted AAMC competencies and related examples across 8 competency objectives: knowledge for practice (**Table 1**), patient care (**Table 2**), practice-based learning and improvement (**Table 3**), interpersonal and communication skills (**Table 4**), professionalism (**Table 5**), systems-based practice (**Table 6**), interprofessional collaboration (**Table 7**), and personal and professional development (**Table 8**). For brevity, we did not explicitly identify the patient cohort in each cell unless it pertained to a subset of the 2SLGBTQ+ communities. In doing this work, we recognized the inter-relatedness of aspects of the eight competencies. For example, certain knowledge for practice (Table 1) is required to provide competent patient care (Table 2), which might include specific interpersonal and communication skills (Table 4). The eight competencies and related examples may help optometric educators consider ways to adapt their curricula as needed.

and challenging system level, historical institutional inequities, role-modeling openness and a willingness to listen, and demonstrating empathy and cultural humility.⁸⁸ Recognizing that some students may espouse values that could hinder the quality of 2SLGBTQ+ care, educators still need to set clinical competencies to manage diverse student populations.⁸

In creating 2SLGBTQ+ health curricula, recommended practices call for curricular co-creation that involves 2SLGBTQ+ faculty, staff, students, and patients, scaffolded design, interprofessional opportunities where possible, and competency-based learning objectives.^{8,29} A curricular mapping process can help identify 2SLGBTQ+ health gaps in current curricula.⁸ In addition to improving basic knowledge and facilitating clinical preparedness, curricular design needs to enable attitudinal awareness through cultivating values, exploring self-awareness of privilege and bias, and enhancing communication skills.²⁹ Thus, pedagogical approaches that support deep learning, self-awareness, and critical-thinking will be most effective. Towards this end, recommended health profession 2SLGBTQ+ learning activities include self-reflections, group discussions, role plays, standardized patients, and interactions with people who identify as 2SLGBTQ+.^{5,89} Noonan et al.⁵ report that standardized patients who identify with the gender they portray are more effective because their lived experiences allow them to authentically play the role and provide constructive feedback to the learner in a safe learning environment. Team-based learning or flipped classrooms that support facilitated class discussions and objective structured clinical examinations that provide a safe environment for demonstrating clinical skills are also advocated pedagogical strategies.^{5,8} As with all learning environments, learning objectives should be articulated and aligned with learning activities and assessments.⁹⁰

Conclusion

We have identified a potential gap in optometric education, provided a justification for why it should be addressed, and proposed a set of competencies to help optometric educators review their curricula for any problematic or absent content. A broader discussion and potential modification of these competencies may be warranted for the benefit of training optometry students to provide culturally safe care that considers the unique needs and priorities of patients who identify with the 2SLGBTQ+ communities.

Thus far, the literature about teaching 2SLGBTQ+ patient care has occurred in health settings outside optometry. While this emerging knowledge may translate reasonably well, we encourage research situated in optometry settings to unpack unique elements of optometry's professional and educational environments. Some clinicians will have limited formal training in the unique and varied care needs of these diverse communities and many more clinicians will lack formal training in teaching specific associated communication skills. Thus, optometry schools and colleges can help students provide culturally safe care to members of 2SLGBTQ+ communities if they offer faculty/clinician training that addresses healthcare needs, critical consciousness, and teaching strategies.

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