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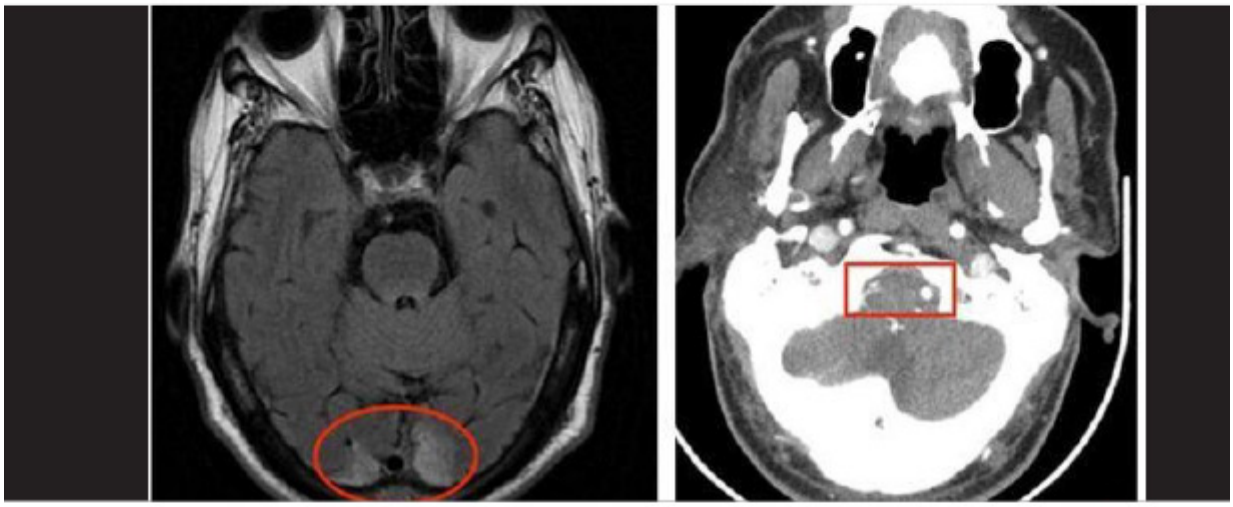

Teaching Pupil Dilation: Faculty Perceptions Regarding Elevated Blood Pressure and Dilating Agents

Bilateral Parieto-Occipital Cortex Infarcts and their Effects on the Visual Field: a Teaching Case Report

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Teaching Pupil Dilation: Faculty Perceptions Regarding Elevated Blood Pressure and Dilating Agents

Katie Foreman, OD, FAAO, and Anne Rozwat, OD, FAAO | Optometric Education: Volume 44 Number 1 (Fall 2018)

Abstract

Background: *To assess whether a common blood pressure threshold exists, above which faculty members at an optometry school would instruct students to abstain from dilating a patient's pupils.* ***Methods:*** *Seventy-three faculty members completed a survey about their practice habits regarding dilating the pupils of individuals who have elevated blood pressure.* ***Results:*** *The majority of optometrists surveyed (94.5%) were not concerned about using 1% tropicamide, but more than half (64.4%) were concerned about using 2.5% phenylephrine. The highest percentage of survey respondents typically refrain from dilating a patient with systolic blood pressure higher than 200 (45.2%) and diastolic blood pressure higher than 105 (34.3%).* ***Conclusion:*** *The majority of optometrists in an academic setting have reservations about using 2.5% phenylephrine in patients with elevated blood pressure. A need for this apprehension about dilation is not proven in the literature but seems to be a medical-legal concern. This clinical decision-making rationale is imparted on students, potentially shaping their practice habits.*

Key Words: *blood pressure, dilation, tropicamide, phenylephrine*

Introduction

To be considered comprehensive, an eye examination should include visualization of the fundus through a dilated pupil. To achieve maximal mydriasis for optimal visibility, a combination of 1% tropicamide (a muscarinic receptor antagonist) and 2.5% phenylephrine (an alpha-receptor agonist) is typically used.[1] While adequate pupil dilation may be achieved with 1% tropicamide alone, some situations (e.g., dark irides, diabetes, aging) require a combination of the two drops to achieve greater dilation in a shorter time.[2-5]

Optometric educators guide optometry students as to when it is necessary to dilate a patient's pupils. Evidence-based clinical guidelines have been established to aid in this decision.[6-7] While the indications for dilating the pupils are clear, the contraindications and precautions are more difficult to navigate for clinicians and students.[8]

No consensus exists on a systolic or diastolic blood pressure threshold at or above which a practitioner should abstain from dilating due to the potential risks of the dilating drops. When given systemically, phenylephrine is known to cause cardiovascular adverse effects including increases in systolic blood pressure, diastolic blood pressure and heart rate.[9-11] A mounting body of evidence suggests that short-

and long-term increases in blood pressure, as well as short- and long-term variability in blood pressure, are associated with the development, progression and severity of cardiovascular events.[12] Adverse systemic side effects associated with topical phenylephrine have also been reported to the National Registry of Drug-Induced Ocular Side Effects.[13] These side effects include marked increase in blood pressure, syncope, ventricular arrhythmias, pulmonary edema, myocardial infarction and subarachnoid hemorrhage.[14] However, the majority of these side effects occurred with the use of 10% phenylephrine, a concentration that is not typically used in a clinical setting to dilate a patient's pupils.

Conversely, numerous studies have shown no statistically significant increase in blood pressure or other systemic side effects after the instillation of 2.5% or 10% phenylephrine and/or 1% tropicamide.[9, 14-20] The largest clinical trial, involving 150 subjects, compared 10% phenylephrine against 1% tropicamide and found no increase in blood pressure or heart rate up to 30 minutes after either drop was administered.[7] A meta-analysis of studies evaluating cardiovascular adverse effects of topical phenylephrine, which included eight randomized clinical trials and data on the 2.5% and 10% concentrations, found 2.5% phenylephrine did not cause an increase in blood pressure at either 20-30 minutes or 60 minutes or longer after application. Ultimately the investigators concluded that the sum of the data provided no evidence of an effect of 2.5% phenylephrine on blood pressure or heart rate and only a short-lived effect of 10% phenylephrine.[21]

The conflicting reports make it challenging for a practitioner to make an evidence-based medical decision about using 2.5% phenylephrine and/or 1% tropicamide to dilate pupils when blood pressure is elevated.[15] Students at the Illinois College of Optometry (ICO) are educated about the side effects of mydriatic pharmaceutical agents in their pharmacy courses; however, guidance on when to dilate is not taught in the classroom.

The aim of this study was to poll optometrists who are involved in patient care at Illinois Eye Institute and determine what they teach their students about elevated blood pressure and pupil dilation. In addition, their dilation routine was evaluated to see whether it correlated with their gender, years in practice or practice specialty.

Methods

Table 1. Click to enlarge

This study was approved by the ICO Institutional Review Board. A survey was distributed to all 79 optometric clinical faculty at ICO. All faculty members surveyed taught at Illinois Eye Institute, the on-site clinic for ICO. No faculty who taught at satellite clinics were included in the study. The faculty represented attending doctors in primary care, pediatrics, contact lens, low vision and advanced care clinics. The survey was anonymous and inquired about gender and years in practice. The seven questions for the survey were developed by the authors based on their clinical experiences and observations. A literature review did not reveal any similar survey or research on this subject. The participants were asked questions regarding their practice habits related to dilating asymptomatic adult patients with elevated blood pressure. They were also asked questions pertaining to their opinions about specific dilating eye drops and their effect on blood pressure and any medical-legal concerns they might have regarding dilating a patient with elevated blood pressure **(Table 1)**. All data were analyzed using Statistical Package for Social Sciences (IBM SPSS version 21.0, Chicago, IL). The chi-squared test of independence was used to interpret the survey results. A p value of <0.05 was considered statistically significant.

Results

Seventy-three of the 79 clinical faculty members (92.4%) participated in the study. The majority of optometrists (94.5%) were not concerned about 1% tropicamide increasing blood pressure in patients who presented with elevated blood pressure. However, more than half of the optometrists (64.4%) were concerned that 2.5% phenylephrine may increase blood pressure in individuals with elevated blood pressure. The majority of optometrists (71.2%) were concerned for medical-legal reasons about dilating a patient with elevated blood pressure.

Figure 1. Survey respondents' cutoff for dilation based on systolic blood pressure. Click to enlarge

Figure 2. Survey respondents' cutoff for dilation based on diastolic blood pressure. Click to enlarge

When asked at what blood pressure level they would typically not dilate an asymptomatic adult patient with 2.5% phenylephrine and 1% tropicamide, the highest percentage of faculty reported they would not dilate individuals with systolic blood pressure higher than 200 mmHg (45.2%) **(Figure 1)** and diastolic blood pressure higher than 105 mmHg (34.3%) **(Figure 2)**. Neither gender nor years in practice had any significant association with dilation decision-making for tropicamide ($?^2_{1df}$ = 0.77, p=0.38) and ($?^2_{1df}$ = 0.60, p=0.44) respectively or phenylephrine ($?^2_{1df}$ = 0.75, p=0.39) and ($?^2_{1df}$ = 0.00, p=0.99) respectively. However, a significant difference was found between subspecialty optometrists and primary care optometrists with regard to practice habits and concern about the use of 1% tropicamide ($?^2_{1df}$ = 7.05, p=0.03). Conversely, no statistically significant difference was found between the various subspecialties regarding concern about 2.5% phenylephrine increasing blood pressure in hypertensive patients ($?^2_{1df}$ = 0.60, p=0.29).

Discussion

Optometrists in this teaching setting tend to act conservatively when considering whether to use 2.5% phenylephrine in patients with elevated blood pressure. This approach may be guided by the small number of studies that indicate an increase in blood pressure and heart rate following administration of 10% phenylephrine.[9-11] Overwhelmingly, the concern seems to be driven by the medical-legal implications of using these drops in these particular individuals.

This approach with hypertensive patients and discussions while managing the cases may make students much more aware of the status of each patient's systemic health beyond the diagnosis. Students are taught to take an accurate blood pressure reading and to ask about the specifics of the patient's hypertension, including current medications and compliance and recent visits to primary care physicians. It is also important to take any physical symptoms a patient is having into account when making the decision to dilate. The students are taught to ask how a patient is feeling when they measure elevated blood pressure. Specific symptoms that would impact the decision to not dilate include dizziness, headache, nausea and vomiting. In these instances, students are taught that they should contact the primary care physician, or, in extreme cases, call for an ambulance or send the patient directly to the emergency room.

Studies that have investigated a relationship between phenylephrine and blood pressure and heart rate are limited in number, have small sample sizes or heterogeneous samples, and often include the

application of tropicamide concurrently.[9,12] There is also a lack of data available on cardiovascular adverse effects of topical phenylephrine specifically in persons with cardiovascular risk factors or a history of cardiovascular events. These unknowns may lead faculty to act more conservatively when deciding whether to use 2.5% phenylephrine in patients with elevated blood pressure.

While no blood pressure cutoff for pupil dilation is formally taught at ICO, like many aspects of clinical care, students may mirror their teachers and develop their practice habits based on those of their clinical faculty. As this study demonstrates, approaches to this particular issue vary as the long-term practice habits of students likely will.

A limitation of this study includes its small sample size, specifically of optometrists practicing in subspecialties. The small sample size prevents the data from accurately being extrapolated. Going forward, the authors would be interested in surveying other optometric educators. Assessing student perceptions about what they are learning in clinic about dilation would also inform understanding of this topic.

Medical decision-making is a complex process that is shaped by patient expectations and by doctors' efforts to maximize benefits while reducing risks. Typically, the aim is to make decisions based primarily on the highest levels of clinical evidence.[22-23] However, the reality is that management decisions are often shaped by a range of other influences, including individual intuition, professional experience and concern about malpractice litigation.[24-26] This is especially true in scenarios where strong evidence or clinical trial results are lacking, which ultimately leads to disparity in practices among clinicians. Clinical decision-making processes are imparted to students, potentially shaping their own practice habits and perpetuating such disparities. Optometry students should be taught about the decision-making process surrounding pupil dilation in patients with elevated blood pressure and be well aware of the positive and negative clinical and nonclinical influences on the decision. When they are aware of these aspects of the issue, they will be better equipped to make their own patient care decisions.

Conclusion

This study demonstrates that optometrists in an academic setting have reservations about using certain dilating eye drops in patients with elevated blood pressure, specifically 2.5% phenylephrine. The highest percentage of faculty typically instruct students to refrain from dilating a patient with systolic blood pressure higher than 200 and diastolic blood pressure higher than 105. A reason for concern about dilation in this scenario has not been proven in the literature but seems to be more of a medical-legal consideration.

A challenge in educating optometry students is teaching evidence-based medicine while also stressing the importance of nonclinical influences on patient management and treatment decisions. If educators understand the trends and driving forces behind specific clinical decisions, such as dilating patients with elevated blood pressure, they can create a more consistent approach to teaching and also to overall patient care.

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Electronic Health Records, Clinical Experiences and Interprofessional Student Perceptions

Diane Russo, OD, Beth Harper, OD, Tony Guarino, PhD, and Erik Weissberg, OD | *Optometric Education: Volume 44 Number 1 (Fall 2018)*

Abstract

This study evaluates changes in interprofessional attitudes and perceptions for students exposed to shared electronic health records (EHR) and students not exposed to shared EHR. A longitudinal study was conducted with 70 New England College of Optometry students. The Interprofessional Education Perception Scale survey was administered three times during the second and third year of training. Optometry student perceptions of how other health professionals perceive optometry were significantly more negative for the group who experienced early shared EHR than for the group without that experience. Optometric educators should be aware of the possible clinical impact on perceptions when assessing interprofessional educational programs and consider these findings when designing a clinical curriculum.

Key Words: *interprofessional education, clinical education, electronic health record*

Background

Interprofessional education (IPE) is defined as “when students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes.”[1] The pedagogical implementation of IPE has steadily gained traction within the academic community in the past decade, markedly so since the Interprofessional Education Collaborative released its Core Competencies for Interprofessional Collaborative Practice in 2011.[2] As such, graduate health professional schools have begun to incorporate interprofessional education objectives as part of their accreditation standards.[2,3] The endorsement of IPE by the Institute of Medicine has been a driving force behind IPE initiatives, with the intended goals of safer and higher quality care, delivered with increased efficiency and cost effectiveness.[2,3,4]

Many institutions of higher education have integrated specific didactic activities to train students in IPE. Among graduate professional programs with clinical training, students may also be required to complete clinical assignments with interprofessional components. These assignments may require interprofessional activities such as referral coordination, communication with other providers, and other actions necessary for patient care. These various modes of communication are even more likely given the introduction of technology and electronic health records (EHR). There is evolving acknowledgement that health information technology plays an important role in providing team-based care, which should be integrated into IPE programs.[5,6,7] Recently proposed models include a blending of EHR use and team-based activities, with the aim of delivering “technology enhanced collaborative care.”[7]

The effectiveness of didactic and clinical IPE training programs is typically assessed through changes in perception as measured by surveys.[8-11] While traditional clinical experience and EHR use are pervasive in the training of healthcare professionals, there is a paucity of literature regarding whether these activities can also change perceptions in the absence of a formal didactic training component. Rather, the published literature typically includes structured IPE interventions and/or clinical experiences in

which interprofessional interactions are deliberate and purposefully planned.[8,12-17] Additionally, the use and impact of EHR alone, when shared among several different healthcare professionals does not appear among the IPE literature.

The impact that clinical assignments have on IPE perceptions is not known. A better understanding of how clinical experiences and use of EHR impact student interprofessional perceptions may allow us to improve the design of IPE programs and influence clinical training for healthcare professionals.

The purpose of this study was to determine whether the clinical experience, without a planned IPE component, impacts student professional perceptions and whether the use of interprofessionally shared EHR plays a role. For the purposes of this study, an interprofessionally shared EHR setting was defined as a system that allows providers of different disciplines, i.e., primary care providers, pediatricians, behavioral health providers, etc., to review a mutual patient's comprehensive health record and communicate in real time.

Methods

A longitudinal study was conducted over a 22-month period, from 2015-2017, with second-year students (n=70) at New England College of Optometry (NECO). All study protocols conformed to the Declaration of Helsinki and were approved by the Internal Review Board at NECO. Approximately half the class was randomized into two groups at the beginning of second year **(Figure 1)**. The control group (n=35) was given a clinic assignment without interprofessionally shared EHR. These assignments were based at NECO owned and operated optometry clinics and private solo and group practices. The treatment group (n=35) was given a clinical assignment with interprofessionally shared EHR. These assignments were based in community health centers where multidiscipline care was occurring. Students were assigned for the entire second year (approximately 35 weeks), during which time the focus was on building technical and communication skills. During clinical assignments, students are required to perform any combination of the following: automated pre-testing, case history, entrance testing, retinoscopy, refraction, slit lamp biomicroscopy, Goldmann tonometry and dilated fundus exams.

Students were not recruited for this study and there was no additional benefit or incentive to participation. All students received the Interdisciplinary Education Perception Scale (IEPS) survey. Only students with clinical assignments at sites meeting the eligibility criteria (year-long assignments during second year in a shared or non-shared EHR site) were included for analysis.

Figure 1. Study design with baseline, outcome 1, and outcome 2 of surveys.
Click to enlarge

At the conclusion of the second year, the control and treatment groups were mixed before commencing third-year assignments. Throughout third year (approximately 40 weeks), all students rotated through 1-2 semesters in a community health center, 1-2 semesters in a NECO owned and operated clinic, and a small percentage of students were assigned to Veterans Affairs or hospital-based settings. This clinical year focused on primary care with increasing responsibility for patient diagnosis and management. Competencies assessed represented a more comprehensive skill set at this time, including the ability to analyze exam data and develop differential diagnoses and treatment and management plans.

The IEPS survey, an 18-item psychometrically validated instrument that has been widely used in the published literature,[18,19] was administered via Qualtrics before the start of second year (baseline, B), at the end of second year (outcome 1, O1), and at the end of third year (outcome 2, O2). Qualtrics is an online subscription software used for the detailed control of survey development, distribution and

analysis. The IEPS assesses “competency and autonomy, perceived need for cooperation, and perception of actual cooperation.”[20] Each item utilizes a 7-point scale with three subcategories, as developed by this study’s investigators. The three subcategories are as follows: OD student perceptions of the optometric profession (OD-OD), OD student perceptions of other health professions (OD-Ot), and other health profession perceptions of optometry (Ot-OD). **Table 1** shows the IEPS with the subcategories.

Table 1. Click to enlarge **Table 2.**Click to enlarge

A 2-sample t-test was used to compare demographic and academic variables between treatment and control groups. A 2×3 mixed ANOVA analysis was conducted with groups (control and treatment) used as the between-subjects variable and three subcategories (OD-OD, OD-Ot, and Ot-OD) used as the within-subjects variable. Follow-up univariate tests were conducted. A p-value of <0.05 was used as the threshold for statistical significance.

Results

The survey was completed by 70 participants at baseline and O1 and 69 participants at O2. One student dropped out of the study due to a leave of absence from NECO. **Table 2** shows the demographic and academic variables for all study participants. No statistically significant differences were found between treatment and control groups for age (p=0.44), sex (p=0.61), race/ethnicity (p=0.06), or GPA (p=0.81).

Figure 2. Total survey scores for all participants and by group at baseline, outcome 1, and outcome 2.
Click to enlarge

Figure 3. Click to enlarge

Figure 4. Click to enlarge

Figure 5. Click to enlarge

Total survey scores for all participants and total survey scores by group did not yield statistically significant differences from baseline to O1, or O1 to O2 **(Figure 2)**. All p-values were >0.05 for this analysis.

For a 2×3 mixed ANOVA, the treatment and control groups served as the between-subjects variable, and the three subcategories (OD-OD, OD-Ot, Ot-OD) served as the within-subjects variable. Results indicated a statistically significant group x subcategory interaction effect, F (2, 66)=3.36, p=.04, ?2=.09 (a moderate effect). Follow-up univariate tests detected a significant change, F (1, 67)=4.68, p=.03, ?2=.065 (a moderate effect), between baseline and O2 on “other health profession perceptions of optometry.”

There were no significant change differences between the groups concerning “OD student perceptions of the optometric profession” or “OD student perceptions of other health professionals.” **Figures 3 and 4** show the mean percentage change by subcategory from baseline to O1, and O1 to O2. **Figure 5** shows the mean percentage change for subcategory Ot-OD from baseline to O1, O1 to O2, and baseline to O2. While the treatment group scores attenuated by .06 (-6%), the control group scores increased by .15 (+15%).

Discussion

This study investigated the evolution of optometry student professional perceptions throughout the second and third year of optometry school at New England College of Optometry. Overall, student professional perceptions changed very little during this time period. Furthermore, it was found that during the second year of the OD program, perceptions of those assigned to a shared EHR setting did not significantly change compared to those assigned to a clinic without shared EHR. However, at the completion of the third year, when all students had assignments with shared EHR, students whose exposure to shared EHR was delayed until the third year maintained consistently more positive perceptions of how others view optometry. Conversely, those who were exposed to shared EHR earlier thought that other professions viewed optometry more negatively than those who did not have early exposure to a shared EHR setting.

This calls into question whether there is something inherent in the clinical experience that impacts the way students perceive other professions' view of optometry. Perhaps students with early exposure to more integrated clinical environments experience negative or mixed first impressions with other health professionals, resulting in negatively shifting perceptions. Furthermore, students in siloed clinical environments may be more likely to be protected from positive and negative interactions with other health professionals, allowing a steadily positive perception to persist. In other words, students in an isolated clinical environment may be more positive about the profession because they do not have the opportunity to experience the contrary.

A study among nurses and physicians by Foronda et al. noted that "Egos, lack of confidence, lack of organization and structural hierarchies hindered relationships and communications."[21] We posit that similar mechanisms may affecting second- and third-year optometry student professional perceptions, particularly when they are exposed early to interprofessionally shared EHR settings. Additionally, the year in which students are exposed to the type of clinical environment could be an additional factor shaping their perceptions. Perhaps the nature and amount of clinical responsibility placed on a student in the second year vs. the third year cultivates more or less confidence when working with other professionals.

Importantly, the results of this study raise questions about the role of formal didactic IPE instruction in optometric education. Specifically, would professional perceptions shift if students were better prepared to handle the interprofessional components of a clinical assignment? Although this study was not designed to answer this question, this has been identified as an area of future research.

Among the strengths of this study is the use of natural observation of the clinical educational process. The participants in this study were not specifically educated or primed with respect to IPE prior to survey administration. Additionally, the IEPS survey was chosen specifically because it did not use the term "interprofessional" or ask about shared learning or team work. This allowed for an unbiased assessment of interprofessional perceptions. Second, there was no intentionally designed didactic component in this study, as is the case with the majority of the IPE literature. A common approach in the IPE literature involves a didactic intervention with students of several disciplines learning about IPE and taking surveys before and after intervention. Because our study did not include this exercise, it allowed for a more focused evaluation of the clinical experience and how it impacts perceptions during the second and third year of optometric training.

There were several limitations to this study. It reflects only two years of data collection, which does not include the fourth year of optometry school. The investigators plan to collect a third year of survey data to determine whether these short-term shifts in perception persist through the final year of the program. It is possible that perceptions are more easily impacted with students earlier in their optometric tenure but equalize by graduation. Additionally, student clinical grades were not factored into the analysis of this study. It is, therefore, unknown how student clinical performance and grades impact the evolution of interprofessional perceptions. Furthermore, the findings of this study do not address how student

perceptions impact performance or patient outcomes/perceptions. It would be beneficial to know whether the positive or negative shift in perceptions affect student performance and, ultimately, patient care, but data was not gathered to address this important question.

Conclusion

While the overwhelming majority of IPE literature includes a specifically structured interprofessional intervention, this study offers some evidence of the shift in student perceptions during more traditional clinical exposure. Overall, student perceptions changed very little during clinical assignments. However, students whose exposure to interprofessionally shared EHR was delayed tended to have more positive perceptions of how other professionals view optometry, while those exposed earlier in their education tended to have more negative perceptions of how other professionals view optometry. The long-term impact and whether it affects clinical performance requires further investigation.

Acknowledgments

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PEER REVIEWED

The Use of OCT in Differential Diagnosis of Elevated Optic Discs

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Abstract

Optical coherence tomography (OCT) can aid in the differential diagnosis of optic nerve head (ONH) elevation. Specific OCT hallmarks, such as "V contour" and a "lumpy-bumpy" appearance, associated with optic disc edema and optic nerve head drusen, respectively, were investigated in isolation from line scans added to photographs of various elevated ONHs in a web-based survey distributed among Australian and New Zealand optometrists. Despite randomization of participants into a control (n=91) and intervention group (n=106), who were offered a short education on the investigated OCT feature, diagnostic accuracy was solely correlated with self-reported experience with OCT scans. As such, the provision of educational material did not result in anticipated improvement of clinical acumen for differentiation of elevated pathological optic discs from elevated non-pathological optic discs.

Key Words: *optic nerve head, papilledema, elevated optic disc, differential diagnosis, optical coherence tomography*

Background

One of the challenges facing the ophthalmic care provider in clinical practice is the presentation of an elevated optic nerve head (ONH). The most critical initial assessment aims to differentiate true papilledema from pseudopapilledema due to the fundamentally different implication regarding appropriate care.[1] Papilledema, one of the most common reasons for optic disc edema (ODE), is triggered by raised intracranial pressure and requires urgent management to circumvent a potentially fatal outcome. Pseudopapilledema, on the other hand, comprises a variety of conditions that can be managed through routine reviews, most commonly buried optic nerve head drusen (ONHD), obliquely inserted optic discs or crowded optic discs.[2,3]

The increasing use of optical coherence tomography (OCT) in primary ophthalmic practice has allowed the in-vivo visualization of the retinal layers, thereby improving patient management in optic nerve and retinal disorders. Given the time and cost involved in obtaining OCT scans, it is vital for practitioners to gauge the overall significance of it as a diagnostic tool and evaluate OCT features that are better suited to add to diagnostic accuracy. It is commonly acknowledged that education can improve the application of individual techniques. Therefore, the interpretation of OCT may well depend on the familiarity of the practitioner with the method.[3-7]

Recent studies have suggested that OCT can improve differential diagnosis between true swelling and pseudopapilledema.[2, 8-10] The retinal nerve fiber layer (RNFL) has been extensively studied as an important contributor to ONH disease, [2, 11-17] and thinning or thickening can be present in both ODE or ONHD depending on the stage of the disease.[16,18] A recent study by Johnson et al[8] describes specific features on OCT that can provide guidance to practitioners for differentiation of ODE and ONHD. The

study also suggests that RNFL thickness values may assist in the differentiation between ODE and ONHD, but the authors identify unique image features that are associated with these two ONH changes. ODE is characterized by the formation of a “lazy V contour” created by a subretinal hyporeflective space adjacent to the ONH. ONHD presents with a “lumpy-bumpy” internal contour of the optic nerve.[8] The “lazy V contour” and the “lumpy-bumpy” appearance proposed to be diagnostic for ODE and ONHD, respectively, may be difficult to distinguish from each other and from tilted or crowded optic discs.[1] Consequently, it was of interest to evaluate these particular features as diagnostic markers and consider integration into future recommendations regarding OCT image interpretation. Aside from the differentiation of pathological optic discs from non-pathological optic discs, we were also interested in differentiating obliquely inserted and crowded optic discs from each other.[19-23] Unlike papilledema and ONHD, crowded optic discs and tilted, obliquely inserted optic discs generally do not require treatment. This differentiation is clinically important to avoid both potential false positive and false negative diagnoses.

To our knowledge, there have been no studies assessing the diagnostic accuracy of OCT hallmarks in the differentiation of pathological optic discs from non-pathological optic discs or examining the impact of educational material on clinical acumen. The current study, therefore, investigated en-face OCT scans using a previously established, individual OCT observation, and aimed to establish its value as a diagnostic parameter in isolation. A web-based clinical study was designed to test the hypothesis that this particular feature enhances differential diagnosis of ONH pathologies if highlighted in the form of respective educational material. Isolated 2D imaging and line scan presentation of individual eyes were chosen to ensure standardized conditions for all study participants and enable evaluation of the investigated feature in the absence of other diagnostic markers, such as RNFL thickness. Although this presentation does not reflect clinical settings, it allows assessment of specific OCT hallmarks to optimize this tool for differential diagnosis of ONH elevation and examines the impact of isolated information on the clinical diagnosis process.

Methods

Case compilation

We developed a case series of elevated optic discs from 40 patients seen at the Centre for Eye Health (CFEH). CFEH is a specialized referral-only imaging and diagnostic center staffed by highly trained optometrists and consulting ophthalmologists. All clinical data were retrospectively collected from patients previously seen at CFEH who had undergone routine ONH examination. Patients were only included in the study if they were unambiguously diagnosed by two optometrists and a consulting ophthalmologist. Diagnoses of ONHD were based on B-scan ultrasonography and fundus autofluorescence and included cases that were classified as buried ONHD on the basis that diagnosis could not be made from ONH photography. If papilledema was suspected, patients were immediately referred to hospital care for further investigation. Only patients with a diagnosis of idiopathic intracranial hypertension confirmed by the consultant hospital ophthalmologist were included as ODE cases in this study. One pathological disc of incipient vein occlusion was included in the case series. In the classification of non-pathological discs, the discs were categorized as congenitally crowded or obliquely inserted. Crowded discs are a congenital variation: a small optic disc with ill-defined margins and no obvious cupping, likely a consequence of the standard number of ganglion cell and optic nerve axons entering at a small optic disc.[20,21] Obliquely inserted optic discs are a congenital condition thought to lie within the ocular colobomata spectrum. In these cases the optic nerve penetrates the eye at an oblique angle causing height differences most commonly between the nasal and temporal rim, with the relative elevation causing the appearance of blurring of the disc margins and suspicion of a swollen optic disc.[22] For the purpose of this study, disc elevation leading to indistinct margins was mapped per quadrant for each disc, and disc size was recorded. Discs were classified as crowded if at least two quadrants were elevated with indistinct margins in the context of a small disc measured on the retinal photography

software (<2.4mm^2).[20.21] Obliquely inserted discs were defined if the degree of torsion of the longest disc diameter was beyond 15 degrees.[19-23]

Written consent was obtained from patients following the tenets of the Declaration of Helsinki and ethics protocols approved by the Human Research Ethics Advisory panel of the University of New South Wales (UNSW) Sydney, Australia.

Cases were chosen to reflect the quantity and quality of patients seen in optometry-driven primary eye care, although cases of ODE were limited to papilledema only. As such, the study comprised five papilledematous discs, 18 “normal” discs (8 obliquely inserted, 10 crowded), 16 discs with ONHD and one other pathological disc (incipient vein occlusion). For each patient, a color 2D photo was taken with a Kowa Nonmyd WX-3D at 34º field angle (20º horizontal and 27º vertical, 12 megapixel digital resulting in 72 dpi resolution of the final image). An OCT line scan through the center of the ONH was isolated for each patient from a 15×10º or 15×20º OCT volume scan consisting of 97 B-scans spaced 33 µm at ART 23 using the Spectralis OCT (digital resolution of 3.9 µm axially by 6 µm laterally). This single line scan for each patient was chosen independently by two optometrists to best represent the condition, and decided by a third optometrist if equivocal, to ensure standardized conditions for case reviews. The OCT line scans were chosen based on images identified in the literature as specific to the optic disc condition.[8-10, 20-22] Image sizes were adjusted to provide views of the ONH. Examples of clinical information, including all five papilledema cases are provided in **Appendix A**.

Figure 1. All participants (n=197) were initially asked to assess optic disc photos alone. Participants were then randomized into intervention (n=106) and control (n=91) groups. The intervention group was shown short educational material on OCT characteristics. Both groups then assessed the optic disc with OCT information. Click to enlarge

Survey development

Although the survey was completely anonymous, basic demographic and background information about participants’ therapeutic endorsement (TE), geographic distribution, age, gender, number of OCT scans performed per week, and confidence in interpreting OCT was collected for basic statistical information and to gauge the expertise of participants with OCT. The body of the survey aimed to assess the use of specific parameters of OCT to assist with diagnosis. To isolate these parameters, presentation of patient data was standardized as 2D images and OCT line scans, and variables likely to independently influence diagnosis, such as bilateral data or RNFL thickness, were purposefully eliminated. Based on these criteria, participants were asked to classify ONH images of all 40 patients into one of four categories: papilledema, ONHD, other pathological disc, or normal disc. For normal discs, the subcategories of crowded or oblique optic disc were available **(Appendix B)**. At the end of the initial assessment of all 40 images, participants were randomly allocated into a control or intervention group **(Figure 1)**. The control group immediately proceeded to a second assessment round, while the intervention group was provided with a short education summarizing the main OCT characteristics of true swelling, ONHD, obliquely inserted optic discs and crowded optic discs **(Appendix C)**. The same patients were then assessed again in randomized order, but OCT line scans were provided alongside the original ONH images. Once a diagnosis was submitted, optometrists were not able to access the case again. The completed survey was piloted on 12 optometrists from the CFEH and the School of Optometry and Vision Science UNSW Sydney, Australia, prior to distribution. Minor amendments were made based on feedback regarding comprehension before the case series was deployed online via Survey Monkey (https://www.surveymonkey.com).

Participants and collection of data

Practicing optometrists registered with Optometry Australia (4,073, comprising 94% of Australia's practitioners) and the New Zealand Association of Optometrists (570, comprising 84% of New Zealand's practitioners) were invited to participate in the study via an e-mail through the respective associations. The invitation letter provided access to the online case series and contained details regarding confidentiality of information, research purpose and informed consent in accordance with the UNSW Sydney Human Research Ethics Advisory Panel. Anonymous participation was limited to a single entry for each participant as identified by their IP address. The number of participating optometrists needed for this study was calculated to detect statistical significance of 5% improvement with 95% power at a p-value=0.01. Assuming 72.5 mean accuracy and equal standard deviation of 5.74 based on the pilot study, this amounted to at least 91 subjects in either group. The online study only remained open until the required number of responses was obtained.

Statistical analysis

After excluding entries with more than 5% of answers missing, a total of 197 entries were analyzed with 106 and 91 optometrists in the intervention and control groups, respectively. Data analysis was performed using IBM SPSS Statistics (Version 21; SPSS Inc., Chicago, IL, USA). The primary outcomes were the number of correct diagnoses (score out of 40) and diagnostic accuracy. Both variables were normally distributed in either cohort (D'Agostino & Pearson omnibus normality test) and were reported as mean and standard deviation (SD). Comparisons between and within groups were tested with chi-squared goodness of fit and paired t-test, respectively. A generalized estimating equations (GEE) model was applied to assess the effect of the intervention on the change in correctly diagnosed patients with the addition of OCT imaging to account for repeat diagnoses. An independent working correlation matrix structure was chosen for a model defined by a normal distribution and identity link function testing for categorical variable intervention in addition to age category, gender, TE, average number of OCTs performed per week and confidence with OCT interpretation.

Results

Diagnoses of potential ONH swelling from ONH photography without and with the addition of OCT line scans for 40 patients were completed by 197 Australian and New Zealand optometrists. Basic demographic details (age and gender) and parameters potentially influencing outcomes, including status of TE, number of OCT scans performed per week, and self-reported confidence in using OCT were equally distributed between the two cohorts **(Table 1)**. The number of cases correctly diagnosed was normally distributed in both the control and intervention groups based on ONH photography before (p=0.22 and 0.44, respectively) and after the addition of OCT line scans (p=0.22 and 0.53, respectively), but differed significantly between the two diagnostic modes for the control group only (paired samples T-test) **(Table 2)**. This was reflected by a decrease in diagnostic accuracy from 66%±8.9 (26.3 average number of

Table 1. Click to enlarge

Table 2. Click to enlarge

diagnoses) to 63%±10.6 (25.3) in the control group, and change from 66%±9.4 (26.4) to 67%±7.9 (26.9) in the intervention group amounting to a significant difference between the two groups for the OCT line scan (independent samples T-test) (Table 2).

GEE analysis confirmed the significant change from baseline between the control and intervention group after correcting for age, gender, TE, number of OCTs performed per week or confidence in OCT analysis (1.5; 95% CI 0.4-2.7; p-value=0.006). None of these variables was associated with differences between

the two groups or overall diagnostic accuracy based on ONH photography, while overall diagnostic accuracy from line scans was correlated with the participant group (control or intervention) as well as the average number of OCT scans performed per week ($p<0.01$). The difference in change was caused by curbing a subgroup of optometrists who diagnosed fewer patients correctly after the addition of OCT line scans in the control group compared to no significant change between ONH and ONH & OCT assessments in the intervention group **(Figure 2)**.

The impact of investigated OCT parameters on diagnostic accuracy was of particular interest with regard to individual pathology. For the purpose of analysis, the discs were classified into five papilledema cases, 17 other pathological optic discs, and 18 non-pathological optic discs. While non-pathological optic discs included eight obliquely inserted and 10 crowded discs, other pathologies were in essence limited to ONHD and a single case of incipient vein occlusion. Most strikingly, diagnostic accuracy across all 197 participants decreased 13% with the inclusion of OCT line scans for papilledema (from 69% to 56%), while other pathologies showed a 3% decrease (from 64% to 61%) and non-pathological discs were diagnosed 3% more accurately on average (from 68% to 71%). A closer look at the control and intervention groups exposed that the loss of diagnostic accuracy for papilledema cases was mainly caused by a relatively greater loss in the intervention group, while the control group showed almost identical gain and loss of diagnostic accuracy for this particular group **(Figure 3)**.

Figure 2. The number of correct answers for individual optometrists ranged between 15 and 34 (A), with a similar distribution for the control and intervention group if diagnosis was made from ONH photography only (y-axis), but the control group performed worse if OCT was included (x-axis) (B, C). The change is illustrated by box-and-whisker plots, whereby the box presents the 25th to 75th percentile with the median marked by the engulfed line and the whiskers outlining the range of the obtained answers. Individual changes depicted in between highlight the higher variability in results for the control group (B) after adding OCT line scans as a diagnostic test.
Click to enlarge

Figure 3. The percentage loss or gain of accurate diagnoses after reviewing OCT line scans compared to the original results from ONH photography alone was recorded overall (top) and for individual disease statuses in relation to those diagnoses that remained unchanged (light grey), regardless of whether these diagnoses were initially correct or incorrect. Of note, while changes were relatively consistent within the control group, a large number of practitioners misclassified papilledema after the addition of OCT scans in the intervention group, who showed otherwise similar gain in diagnostic accuracy to the control group.
Click to enlarge

Table 3.
Click to enlarge

More specifically, of all misdiagnosed papilledema cases, 7.4% were classified as ONHD, 51% as “other pathology,” and 41.6% as normal (of these, 80% crowded and 20% obliquely inserted) based on photo presentation only. Following the introduction of the OCT scans, the unidentified papilledema cases were diagnosed as ONHD in 35.3% of cases, as “other pathology” in 22.7% of cases, and interpreted as normal in 42% of cases (54% crowded and 46% obliquely inserted). In the intervention group, percentages were 35.3% and 40.4% for ONHD, 45.6% and 10.3% for “other pathology” and 44.4% (81% crowded and 19% obliquely inserted) and 49.3% (61% crowded and 39% obliquely inserted) for normal with presentation of photo alone and after addition of the OCT line scan, respectively.

Both the control and intervention groups had only marginally more loss than gain with other pathologies cases. This was also true for non-pathological discs in the control group, while the intervention group had a large gain of diagnostic accuracy with these patients **(Table 3)**.

Discussion

Some OCT parameters, such as RNFL thickness, can yield a sensitivity of 98% distinguishing between

diseased and healthy ONH, yet specificity lags behind at 77%.[8-10, 18,24] Measuring the peripapillary total retinal thickness may be even more sensitive in detecting mild papilledema than the measurement of RNFL thickness alone.[25,26] While there was a statistically significant increase in overall diagnostic accuracy in the intervention group vs. the control group, there was a relative loss in the diagnostic accuracy in critical cases. Our study suggests that the assessment of an isolated structural feature from OCT line scans previously described by Johnson et al and Flores-Rodriguez does not aid differential diagnosis in the absence of a full spectrum of clinical information of optic disc elevation.[8,24] It may, in fact, decrease diagnostic accuracy, possibly due to over-interpretation of isolated information or, alternatively, due to the limited experience of participating optometrists with performing OCT scans at all during their practice.

A similar observation was made in a previous study by Kulkarni et al,[27] who investigated the effect of extensive tutorials in the differentiation between mild papilledema and buried ONHD on the basis of OCT images and RNFL measurements. It should be highlighted that the conclusions of this study were based on results from five participating clinicians only and all presented eyes were pathological with the exception of two ONHD cases, which had one unaffected fellow eye each. In contrast, the current study aimed to reflect representative skills of a broad range of optometrists and mimic the prevalence of types of elevated optic discs typically seen in clinical practice in the presence of a reasonably large number of non-pathological discs. Despite significant differences in the design, both studies highlight the limited effect of provided educational material in conjunction with isolated diagnostic parameters, despite OCT imaging being increasingly used in general practice.

Australian and New Zealand optometrists in the control and intervention groups of the current study had similar age distribution and experience levels. A web-based survey was utilized to enable convenient access for the participants, and we assumed that practicing optometrists in Australia and New Zealand possess core skills relating to the interpretation of OCT. Questions we posed to study participants included whether they felt self-confident in the interpretation of OCT scans, number of OCT scans performed per week, and if they were therapeutically endorsed. While diagnostic accuracy was correlated with self-reported experience with OCT scans, none of the parameters was found to have an impact on the comparison between the control and intervention groups, perhaps reflecting an overall lack of knowledge base regarding imaging techniques. This result is contrary to previous studies in which TE impacted results.[28,29] This is likely a consequence of the current study assessing a clinical skill as opposed to theoretical skills, further supported by the number of OCT scans performed by participating optometrists being associated with the number of correct diagnoses obtained from OCT line scans. Thus, short-term didactic training may be more effective when the teaching is combined with standard clinical training techniques and a sound understanding of the constraints of imaging technology.[5,30,31]

While some combinations of clinical tests and education can improve sensitivity and maintain or improve specificity,[4,32,33] the 4% significant difference between our control and intervention groups was caused by preventing a decrease in incorrect diagnoses with the addition of OCT line scans possibly counteracting some of the inexperience with interpretation of this technique. The concurrent 30% loss in correct papilledema diagnoses could be a consequence of the relatively small number of pathological discs within the case series, which aimed to provide a more realistic representation of the number of papilledema cases seen in clinical practice, a subset of patients with idiopathic intracranial hypertension.[34] Alternatively, it could reflect over-confidence by the participants or lack of feedback during the case series, leading to a less conservative decision after integrating the provided education material on a specific image feature.[35-37]

Interestingly, while diagnostic accuracy of pathological optic discs decreased, diagnostic accuracy in the identification of non-pathological optic discs improved in the intervention compared to the control group. This suggests that adjunct techniques and educational information have the potential to positively impact the false positive rate. This improvement, however, may be at the expense of the incorrect diagnosis of

pathologies, an undesirable outcome in critical cases.[5] Even though the educational material was reduced to information on a single image feature described by Johnson et al,[8] it did reduce the variability in accuracy within the intervention cohort, a result also achieved by long-term programs targeting unification of originally diverse cohorts.[38] Overall, however, the outcomes highlight the difficulties in providing guidance on isolated diagnostic parameters in the education on OCT interpretation in lieu of comprehensive clinical training. Clinical assessment for potential ODE or ONHD should include B-Scan ultrasonography, the current gold standard for ONHD diagnosis, or short-wave fundus autofluorescence (SW-FAF), which is considered the least invasive way to detect ONHD owing to its ability to cause the drusen to appear hyper-autofluorescent.[39,40] SW-FAF indeed has had the highest sensitivity and specificity in differentiating ONHD from papilledema on red and green filters.[41] Most importantly, technological advances need to be assimilated into an existing knowledge base rather than taught as an isolated diagnostic skill.[4,42,43] It may be that short-term training is inadequate and that more extensive, continued training is required to improve the diagnostic accuracy of clinicians.[44-46] Integration of potentially more successful teaching strategies, such as extensive long-term training on OCT interpretation, increased exposure to new technology, and performance feedback prior to final assessments might need to be considered in the future. Former use of technology, group learning activities and instructor feedback in particular have been identified as key to successful online education.[47-48]

Limitations of the study

This study was limited to the investigation of an isolated clinical test parameter, which cannot reflect actual diagnostic accuracy achieved in a clinical setting. Furthermore, as the OCT line scans were chosen by optometrists who were aware of the diagnosis, a potential selection bias could have been present. OCT scans were reduced to a single line scan to provide optimal and standardized visualization for all participants and enable direct comparison to previous published images.[8] Because the case series was deployed online, we could not control for the screen resolution or environment used to view the images. In addition, time allowed by participants in the intervention group to study differential diagnosis using the provided details on OCT interpretation may have varied.

The concept of the usefulness of OCT for diagnosis of pathological optic discs was comparatively short to avoid unreasonable time constraints, and participating optometrists were not provided with sample questions on which to practice their skills or interactive feedback prior to being assessed. The educational material provided was limited to the description of a single, isolated imaging feature. Future studies will focus on expanded provision of educational materials through integration of related diagnostic markers, such as RNFL thickness measurements and optimized educational intervention to increase consistency of knowledge acquisition.

As with any anonymous online study, we also cannot control potential self-selection bias. Basic characteristics of participants reflecting their clinical experience, such as TE, the number of OCT scans performed per week, and self-reported confidence with OCT did not differ between the control and intervention groups. However, the information provided by participating optometrists did indicate a lack of familiarity with the assessed technique, which could significantly hamper its use to support clinical diagnosis.

Conclusion

This study highlights the potential pitfalls in applying simplified diagnostic principles, such as isolated image features, which can have no or negative impact on sensitivity. While OCT is becoming an integral tool in daily clinical optometric practice, interpretation of results should only be undertaken by appropriately trained practitioners in conjunction with comprehensive clinical data. As a consequence, professionals should be encouraged to continuously expand their care knowledge base through

comprehensive, contemporary education to ensure integration of fast advancing technology for optimal diagnostic outcomes.

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Appendix A. Click to enlarge

Appendix B. Click to enlarge

Appendix C. Click to enlarge

Elizabeth Wong is a Senior Staff Optometrist at the Centre for Eye Health in Sydney, Australia, where she has a special interest in glaucoma. She teaches undergraduate optometry students and delivers continuing professional development to the optometric profession in the form of webinars and workshops. Elizabeth was recently admitted as a Fellow of the American Academy of Optometry.

Jaclyn Chiang is a Senior Staff Optometrist at the Centre for Eye Health in Sydney, Australia, and is involved in the development of continuing education material and clinical research in optic disc pathology.

Dr. Hennessy is a Senior Staff Specialist Ophthalmologist at Prince of Wales Hospital in Randwick, NSW, Australia, and Centre for Eye Health in Sydney, Australia, and a Senior Lecturer at University of New South Wales Sydney. He has long-standing expertise in optic nerve head physiology and pathology and has developed a significant track record teaching and publishing in this area.

Dr. Kalloniatis, a leader in the field of retinal neurochemistry and a pioneer of the amino acid characterization of the retina, is Director of the Centre for Eye Health in Sydney, Australia. He has worked closely with Prince of Wales Hospital Ophthalmology to develop new models of healthcare delivery, education, dissemination of health-related information and scientific research. Dr. Kalloniatis

has to his credit more than 100 publications in peer-reviewed journals and distinguished awards, most recently the “Excellence in Senior Leadership 2015” award presented by University of New South Wales Sydney and the 2017 distinguished alumnus award from the University of Houston College of Optometry.

Dr. Zangerl [bzangerl@cfeh.com.au], who completed a well-rounded education in the field of medicine and genetics, has dedicated more than 18 years to the research of blinding disorders, maintaining a strong focus around differential diagnosis and prevention and treatment of various degenerative eye diseases through application of advanced technologies. Dr. Zangerl’s current affiliation with the Centre for Eye Health and the School for Optometry and Vision Science at the University of New South Wales Sydney, Australia, allows her to integrate current research outcomes into a contemporary curriculum for medical professionals and evaluate its effectiveness in clinical practice.

Features

Announcement

Optometric Education Journal Seeking Associate Editor

Desiree Ifft | Optometric Education: Volume 44 Number 1 (Fall 2018)

The Association of Schools and Colleges of Optometry invites applications for the position of Associate Editor of its peer-reviewed journal *Optometric Education*.

Responsibilities

The Associate Editor is responsible for collaborating with the Editor on the content of the journal, including sharing the writing of three editorials per year. The Associate Editor consults with the Editor on appointments to the Journal Review Board and works with the Editor and Managing Editor to facilitate a smooth peer-review process. The Associate Editor assists with the development of issue features and solicits manuscript contributions to the journal.

Skills and Qualifications

Strong writing and editing skills, educational publication experience and a demonstrated interest and involvement in optometric educational issues are required. The successful candidate will possess the Doctor of Optometry degree and have a minimum of 3 years of experience in optometric education. The Associate Editor position is a volunteer role.

Application Requirements

Interested candidates should submit:

- A cover letter describing experience in professional writing and editing
- A curriculum vitae
- Two writing samples

Information and Application Submission

Contact: Aurora Denial, OD, FAAO

Industry News

Announcement

Recipients of the 2018 ASCO Educational Starter Grants

Desiree Ifft | *Optometric Education: Volume 44 Number 1 (Fall 2018)*

The Association of Schools and Colleges of Optometry (ASCO), along with The Vision Care Institute, LLC, an affiliate of Johnson & Johnson Vision Care Inc., awarded two Educational Starter Grants this year. The recipients and their research projects are:

- Shankaran Ramaswamy, PhD, MCPHS University — “Relationship Between Grit and Academic Performance in Optometry Students”
- Joshua Cameron, PhD, Western University of Health Sciences — “Advantages of 3D Printed Physical Models Over Computer Generated Models and Textbooks”

ASCO applauds all of the faculty who submitted grant applications this year and appreciates their commitment to improving teaching and learning and moving the profession forward.

Industry News

Announcement

Call for Submissions: 3rd World Congress of Optometry

Desiree Ifft | *Optometric Education: Volume 44 Number 1 (Fall 2018)*

Click to enlarge

The World Council of Optometry (WCO) invites educators, optometrists, researchers, public health experts and students to participate in the 3rd World Congress of Optometry by submitting abstracts for continuing education lectures, workshops and the scientific program. The Congress will be held in partnership with the American Academy of Optometry, Oct. 23-27, 2019, in Orlando, Fla.

- The submission window for lectures and workshops is open Jan. 1-31, 2019
- The submission window for the scientific program and posters is open May 1-31, 2019

Industry News

Editorial

Statistical Literacy Isn't Just for Researchers

Desiree Ifft | Optometric Education: Volume 44 Number 1 (Fall 2018)

Aurora Denial, OD, FAAO

Statistical literacy is the ability to interpret data and use it to understand the world, make comparisons and, ultimately, make decisions. It is becoming a necessity for people to possess at least some level of statistical literacy because they are inundated with statistics in everyday life — on the news, in political polling and in advertising, to name just a few examples. In health care, statistical information, from health studies in particular, is often presented to patients in relation to disease risk and incidence, appropriateness of screening tests, survival rates, mortality rates, treatments, and so on. Unfortunately, as explained by German psychologist Gerd Gigerenzer, there exists a phenomenon of "collective statistical illiteracy" whereby "the majority of people do not understand what health statistics mean, or even consistently draw wrong conclusions without noticing."[1] For instance, Gigerenzer has pointed out, "few are aware that higher survival rates with cancer screening do not imply longer life, or that the statement that mammography screening reduces the risk of dying from breast cancer by 20% in fact means that one less woman out of 1,000 will die of breast cancer."[1]

Healthcare providers are also inundated with information that requires statistical literacy, specifically data to support evidence-based patient care decisions. It is essential that providers understand the benefit of diagnostic and treatment options, as well as interpretation of positive and negative test results and false-positive rates.[2] Few studies have investigated healthcare providers' statistical literacy. One study found low statistical literacy among obstetrics-gynecology residents.[3] From their work training gynecologists in risk communication, Gigerenzer et al. reported that only 21% of 160 gynecologists could correctly name the positive predictive value of screening mammography.[4] Wegwarth et al. concluded that "Most primary care physicians mistakenly interpreted improved survival and increased detection with screening as evidence that screening saves lives. Few correctly recognized that only reduced mortality in a randomized trial constitutes evidence of the benefit of screening."[5] A literature search of Google Scholar, PubMed and ERIC found no studies related to statistical literacy in optometry.

The Association of Schools and Colleges of Optometry reports that 20 out of 23 U.S. optometric institutions require a course in statistics for admission into the program.[6] The remaining three institutions strongly recommend a course.[6] However, a basic undergraduate course in statistics does not necessarily give future optometrists the skills needed to be statistically literate. The American Optometric Association designates as an ethical duty of the optometrist "to involve the patient in care and treatment decisions in a meaningful way, with due consideration of the patient's needs, desires, abilities and understanding, while safeguarding the patient's privacy."[7] If patients are to participate in their own care, they need a basic understanding of statistics.

Statistical literacy needs to be a priority for all healthcare providers, optometrists included. As providers, it is our ethical duty to provide patients with the appropriate information for making decisions about their care. As educators, it is our responsibility to provide and reinforce through role-modeling the statistical concepts our students need to interpret and use data as they care for patients.

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Dr. Denial [deniala@neco.edu], Editor of *Optometric Education*, is a Professor and Chair of the Department of Primary Care at the New England College of Optometry and a Clinical Instructor at a community health center in Boston.

Industry News

Industry News

Desiree Ifft | Optometric Education: Volume 44 Number 1 (Fall 2018)

Industry News

Students Can Apply to Be Part of Clinic Trip

Optometry students who wish to participate in the 2019 Student OneSight clinic trip can apply until Dec. 15, 2018 at www.luxotticaeyecare.luxottica.com. The trip will take place May 11-18, 2019, and students selected for the trip will be notified of the clinic location in January 2019. On the OneSight clinic trip, optometry students work under the supervision of Luxottica Retail-affiliated doctors performing comprehensive eye exams for a community in need. They help support a core team of Luxottica volunteers in the frame fitting, manufacturing and dispensing of new eyewear. Expenses associated with the clinic, including air fare, accommodations and meals are covered.

The 2019 trip is a partnership between OneSight, Luxottica and the National Optometric Student Association. In May 2018, two groups of students traveled to Oaxaca, Mexico and helped to provide eye care to more than 7,000 people in nine clinic days.

Also: Luxottica brands Pearle Vision, LensCrafters, LensCrafters at Macy's, Target Optical and Sears Optical offer optometry residents and recent optometry school graduates the opportunity to earn extra money while gaining clinical experience with flexible, part-time opportunities in the lane. E-mail Luxotticaeyecare@luxottica.com for more information.

Student Grant Program Focuses on Public Health

National Vision Holdings Inc. is now accepting entries for its annual grant program. The 2018-2019 program focuses on optometrists' role in public health. The company is challenging students to explain how they will make an impact by combatting a national or regional public health issue as a future Doctor of Optometry. A flyer with additional information and entry requirement details is available in the Students section of the Optometry Careers page at the company's website. Completed applications can be e-mailed to Carly Schenck or mailed to National Vision, Inc., Attn: Carly Schenck, Communications Manager, Professional Services, 2435 Commerce Ave., Building #2200, Duluth, GA 30096.

Also: National Vision supports mission trips through the chapters of Student Volunteer Optometric Services to Humanity (SVOSH) by providing $1,000 per optometry school each year to defray trip costs. Other assistance is available as well. For more information or to take advantage of these programs, e-mail Kristen Reynolds or call her at (470) 448-2139.

Public-Private Strategic Partnership Takes Aim at Myopia

Johnson & Johnson Vision has entered into a $26.35 million research collaboration with the Singapore National Eye Centre and the Singapore Eye Research Institute to help combat myopia, a serious threat to eye health around the world. According to Paul Stoffels, MD, Vice Chairman of the Executive Committee and Chief Scientific Officer, Johnson & Johnson, "The incidence of myopia is increasing at an alarming rate around the world and if left unchecked, the human and financial toll could skyrocket in the coming decades, especially in Asia."

The public-private strategic partnership aims to create a deeper understanding of how myopia develops, how it progresses and how it may be intercepted. It will focus on developing tools for identifying those at risk for developing high myopia, conduct research on the underlying mechanisms of the condition, progress novel therapies, and discover and validate methods of preventing onset and progression.

Also: TIME magazine named ACUVUE OASYS with Transitions Light Intelligent Technology as one of the "Best Inventions of 2018" in its annual round-up spotlighting groundbreaking innovations worldwide. The two-week contact lenses not only correct vision but also help reduce exposure to bright light indoors and outdoors, including filtering blue light and blocking UV rays that can affect eye comfort and vision.

Next-Generation of Back-Side Lens Technology

HOYA Vision Care launched the Array 2 lens, building on the flexible backside platform of Array 1 to include Binocular Harmonization Technology (BHT). As explained by the company, the benefits of BHT are most pronounced for the more than 70% of patients who have a difference in vision-correction prescription from their left to right eye. The Array 2 lens design with BHT ensures that both eyes receive the appropriate accommodative support for achieving optimal binocularity in order to minimize non-adaptation and maximize comfort.

Array 2 lenses are available in a broad range of materials, treatments and coatings and are available in many of the most popular vision plans. Contact your HOYA territory sales manager or visit the HOYA Vision Care website for details.

New Artificial Tear Incorporates Osmoprotection

Allergan introduced REFRESH REPAIR, the first and only artificial tear in the United States with CMC, HA (inactive ingredient) and Osmoprotectants. REFRESH REPAIR helps to promote healing of the cornea and conjunctival epithelia as well as visual performance and comfort in patients who have dry eyes. Osmoprotection is designed to safeguard epithelial cells against hyperosmotic stress by displacing salts with restorative, organic osmolytes.

Among the findings of clinical evaluations, REFRESH REPAIR was shown to extend tear breakup time, and 70% of patients reported that the thickness of the drop is just right. Visit refreshbrand.com/doc for more information.

Contact Lens Recycling Program Diverts 31,000 Pounds

BAUSCH + LOMB
See better. Live better.

Bausch + Lomb announced that its ONE by ONE Recycling Program has recycled a combined total of more than five million units of used contact lenses, blister packs and top foils (31,000 pounds) since the program's inception in November 2016. The program is made possible through a collaboration with TerraCycle, a world leader in the collection and repurposing of hard-to-recycle post-consumer waste. The Bausch + Lomb ONE by ONE Recycling Program is available to optometrists and their patients in the United States. To register or learn more, click here.

Also: The LUMIFY (brimonidine tartrate ophthalmic solution 0.025%) redness reliever eye drop was named a Product Showcase winner in the healthcare and over-the-counter category at the National Association of Chain Drug Stores' 2018 Total Store Expo.

Platform Integrates Multimodal Diagnostic Imaging

ZEISS

The Integrated Diagnostic Imaging (IDI) platform from ZEISS digitally integrates data from diagnostic devices, combining modalities into individualized assessments to help doctors make optimal treatment decisions quickly and efficiently. IDI works with ZEISS gold-standard instruments such as CIRRUS OCT, Humphrey Field Analyzer HFA3, the CLARUS 500 ultra-widefield retinal camera, and the new VISULAS green therapeutic laser.

According to vitreoretinal specialist Peter A. Karth, MD, MBA, integration is crucial. "One of the biggest challenges in retina practices today is viewing and integrating multimodal imaging to efficiently and fully assess macular disease in busy clinics," says Dr. Karth. "I consider the ZEISS Integrated Diagnostic Imaging platform to be a key part of patient management, giving me the data integration that I need to make the best decisions for my patients."

Click here for more information about the ZEISS Integrated Diagnostic Imaging platform.

Free App Aids Contact Lens Fitting and Education

CooperVision™

CooperVison's OptiExpert app, a digital reference used by tens of thousands of eyecare professionals worldwide, has come to the United States and Canada for the first time. The U.S. and Canadian versions of OptiExpert contain three primary features:

A Multifocal Calculator for making the fitting process for presbyopic patients simpler and more efficient

A Toric Calculator that provides a timesaving model for calculating and evaluating the recommended diagnostic toric contact lens

Oxygen Profiles that provide credible clinical support to aid upgrade discussions with patients, including a clear visual demonstration of oxygen transmissibility levels of CooperVision silicone hydrogel contact lens compared to other products.

The app is available for free from the Apple App Store and Google Play. Also visit the OptiExpert webpage for more information.

Annual Scholarship Competition is Now Open

Walmart and Sam's Club Health & Wellness announced the opening of its 2019 Project Foresight national scholarship competition. First-year, second-year and third-year students enrolled in one of the 23 ASCO member optometry schools in the United States and Puerto Rico are eligible to participate in this annual competition.

To participate, students should submit an essay (written or video) on their own unique practice idea, i.e., something that would impact one practice, multiple practices or the entire profession. The idea should reflect the vision of Walmart & Sam's Club Health and Wellness, which is to provide quality, affordable and accessible healthcare for everyone. This year, one winner from every school that participates will receive a $2,000 award to be split as a scholarship and travel grant for attending the 2019 Optometry's Meeting in St. Louis. One student will be selected as the grand prize winner and receive a $5,000 scholarship and traveling trophy.

For more information, students can reach out to the Regional Talent Specialist who supports their school. The deadline for submitting an entry form and essay is Feb. 1, 2019. Submissions should be e-mailed to Dr. Ramon Yalldo.

Early Detection of Diabetic Eye Disease

Seeing tomorrow, today.

New from Diopsys is the Chromatic Flash Vision Screener, an in-office screening test designed to detect early changes in retinal function in patients with diabetes. Using red-on-blue flash electroretinography in an undilated eye, the test protocol provides quantitative measurements of retinal function. Using a handheld mini-Ganzfeld, a red flash of light is presented on a blue background, and the electrical potential of the retina is recorded using patented skin sensors placed just below the lower eyelashes. Results are analyzed against healthy reference range data to help doctors understand the probability of

the patient developing retinopathy. The testing protocol is part of the Diopsys Full Field Electroretinography module and is compatible with all new Diopsys platforms. Find more information about the new test here.

FDA Clears Multi-modal Imaging Device with Swept Source OCT

Topcon Medical Systems announced that its DRI OCT Triton Series has received 510(k) clearance from the FDA. The DRI OCT Triton features easy image capture and a 1-micron, 1050-nm light source with a scanning speed of 100,000 A-scans/second. The multi-modal instrument incorporates a built-in retinal camera, eye tracking during capture of selected scans, and combines the company's years of expertise in OCT imaging, color, red-free, fluorescein angiography and fundus autofluorescence imaging with the diagnostic power of swept source OCT.

For more information, visit www.topconmedical.com.

Device Manufacturer, Optometry School Enter into Partnership

Haag-Streit USA and the University of California, Berkeley, School of Optometry have initiated a new partnership. The partnership, which includes a donation of equipment to the school, demonstrates the school and company's shared commitment to providing students with exemplary clinical training and pursuing advances in eye care and research. "Haag-Streit's gift will transform the pre-clinic at Berkeley Optometry," says Dean and Professor John Flanagan, PhD, DSc(hon), FCOptom, FAAO. "Our partnership with Haag-Streit USA creates the opportunity for our students, who are introduced to the teaching laboratory as early as their first semester, to be trained on the best medical and diagnostic equipment from the start."

New Technology Links EHR and Product Ordering

Rev360, provider of RevolutionEHR and a suite of practice advancement solutions, announced the availability of RevAlliance. RevAlliance utilizes a proprietary order processing technology infrastructure to connect RevolutionEHR users directly with their vision-correcting product suppliers, all from within RevolutionEHR. Rev360 CEO Dr. Scott Jens calls RevAlliance "the fastest, most accurate end-to-end product ordering and delivery experience in the market."

Currently participating RevAlliance product partners include CooperVision, HOYA, New Era, OOGP and WVA, and additional partners will be announced soon. There is no cost for RevolutionEHR users to join RevAlliance and take advantage of its ordering efficiency and accuracy, transparent product pricing, and discounts and rebates.

Click here for more information about RevAlliance.

New Slit Lamp Series Debuts

Marco has introduced a new line of slit lamps, the Ultra M Series, which it says features elegant and intelligent design, progressive engineering and functional flexibility. Attributes of the Ultra M Series include multiple color correction filters, single element LED, patented integrated background illuminator, extended slit aperture and wider field of view, fully incorporated transformer and cabling, and intelligent operator and patient interfaces. Marco describes the slit lamp series as an “inspiring orchestration of the Ultra Optics pedigree.”

For more information on Ultra M Series design enhancements, visit www.MARCO.com.