Association of Schools and Colleges of Optometry

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## FEATURES AND DEPARTMENTS

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry News</td>
<td>43</td>
</tr>
<tr>
<td>Editorial: Innovations in Teaching—Added Value to Education</td>
<td>45</td>
</tr>
<tr>
<td>Elizabeth Hoppe, OD, MPH, DrPH</td>
<td></td>
</tr>
<tr>
<td>Guest Editorial: Introducing Teaching Case Reports</td>
<td>46</td>
</tr>
<tr>
<td>Barry S. Kran, OD, FAAO</td>
<td></td>
</tr>
<tr>
<td>Think Tank: How Has Teaching Changed Over the Past 20 Years, and What Do You Predict for the Next 20 Years?</td>
<td>47</td>
</tr>
<tr>
<td>My Best Day in Optometric Education</td>
<td>51</td>
</tr>
<tr>
<td>Gregory J. Nixon, OD, FAAO</td>
<td></td>
</tr>
<tr>
<td>ASCOTech: Make Way, Old Dog</td>
<td>52</td>
</tr>
<tr>
<td>Geoffrey W. Goodfellow, OD, FAAO</td>
<td></td>
</tr>
<tr>
<td>Dominick M. Maino, OD, MEd, FAAO, FCOVD-A</td>
<td></td>
</tr>
</tbody>
</table>

## ARTICLES

### Management of Anisometropic Amblyopia and Head Posture in a Patient With Oculocutaneous Albinism: A Teaching Case Report

Barry S. Kran, OD, FAAO

This case of an individual with albinism covers numerous aspects of care, ranging from prescribing for anisometropia to spectacle management of the null point. Background information on aspects of the genetics, pathophysiology, and care relative to psychosocial, educational, and low vision needs of individuals with albinism is presented.

(Continued on page 42)
Initial Experiences With an Audience Response System in the Optometric Classroom
Caroline B. Pate, OD, FAAO
Elizabeth A. Steele, OD, FAAO
This study assessed the advantages and disadvantages of an audience response system (ARS) in the optometric classroom and its effectiveness as a teaching aid. The results of this survey study showed that when effectively integrated into a lecture, the ARS can provide an incentive for student attendance, increase class participation, promote active thinking, and make lecture time more enjoyable.

Supplementing Traditional Lecture-Based Pedagogy With Online Discussion Boards and Assessment Tools
Raymond H. Chu, OD, MS
Eric Borsting, OD, MS
Promoting active engagement in a lecture setting often can be challenging; however, course management systems offer a discussion forum tool to foster social learning through instructor-to-student as well as peer-to-peer collaboration. This is a descriptive study of using online discussion boards and online assessment tools to supplement the traditional classroom for a pediatric optometry course.

Cover: courtesy of Kerri McTigue, Graphic Designer
The following companies support ASCO’s national programs and activities benefiting the schools and colleges of optometry in the U.S. and Puerto Rico.

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FDA Approves Alcon’s AcrySof® IQ ReSTOR® + 3.0 D Intraocular Lens

New lens corrects for cataracts with presbyopia

Alcon, Inc., has announced that the U.S. Food and Drug Administration (FDA) approved its +3.0 diopter add power AcrySof® IQ ReSTOR® IOL. This new lens, which was introduced in many major markets outside the United States earlier this year, is now approved in the United States for cataract surgery in patients with presbyopia. The U.S. clinical trials included a three-month follow-up exam of near, intermediate, and distance visual acuities. The percentage of patients who achieved 20/20 or better at all three distances with the AcrySof® IQ ReSTOR® +3.0 D was nearly fourfold the rate of patients who received the control lens, AcrySof® IQ ReSTOR® +4.0 D. The clinical studies also showed a high rate of patient satisfaction, with over 95% of patients stating that they would have this lens implanted again.

ASCO is establishing a Contact Lenses Faculty Lecturer Bureau!

Are you interested or do you know any contact lens faculty members who are qualified to provide a lecture at other schools and colleges of optometry? If so, please forward the following information to LaShawn Sidbury (lsidbury@opted.org):

- Faculty member name
- Faculty member institution
- Faculty member email address
- Faculty member expertise
- Faculty member years of teaching experience (if known)

This information will be used to aid schools and colleges who are interested in participating in the program but who may not know of any lecturers who meet the criteria.
HOYA Vision Care Grant and Scholarship Program

HOYA Vision Care is offering 3rd- and 4th-year students a $1,000 grant program and an opportunity to qualify for a $6,000 scholarship. To be considered, students will submit a patient case study involving HOYA products. There will be one winner at each school and each winner will receive $1,000. The winning case studies will then be reviewed by HOYA’s ECP Advisory Panel and an overall winner chosen. This student will receive an additional $6,000 scholarship.

Judging will be based on originality, application of technology involved, product knowledge, and overall analysis and composition. The written case study report must be submitted to the faculty judge, designated at each school, by May 1, 2009. The Grant winners from each school will be notified by June 1, 2009. The 19 winners will be invited to the AOA meeting in Washington, DC, June 24-28, 2009. HOYA will cover airfare and hotel room expenses for the meeting. The scholarship winner will be announced at the HOYA Awards Luncheon on Friday June 26, 2009. The grant and scholarship winners will receive their awards at the luncheon.

HOYA Vision Care North America is sponsoring the program for the Optometry Schools in the United States and Puerto Rico. HOYA Vision Care Canada is sponsoring the program for the two Optometry Schools in Canada.
Innovations in Teaching—Added Value to Education

Elizabeth Hoppe, OD, MPH, DrPH

“A poor surgeon hurts one person at a time. A poor teacher hurts 130.”
—Ernest Boyer, President, Carnegie Foundation for Advancement of Teaching

This issue of the journal explores a theme of innovation in teaching. The authors provide us with a variety of perspectives, describing the ways in which they continue to strive for teaching excellence. As readers, we may ponder the value added by teaching innovations. How can we seek to evaluate the impact of new teaching methodologies?

We might begin by creating a framework to describe the potential benefits of improved teaching. In an optimal situation, better teaching might result in students’ improved retention of knowledge, better critical thinking skills on behalf of the learners, and, ultimately, improved patient care outcomes. Innovations in teaching may also enhance the satisfaction of the learners and the teachers, making the educational process more enjoyable. We also know that the dynamic changes occurring in health care technology will require today’s learners to develop lifelong learning skills to remain current throughout practice careers that may exceed 40 years. Effective teaching is also important to encourage effective self-teaching.

One might argue that the content of teaching is most significantly impacted by external forces, such as state scope of optometric practice acts, and the content of licensure examinations like the National Board of Examiners in Optometry (NBEO). The Accreditation Council on Optometric Education (ACOE) also influences curricular content to some extent. The ACOE Professional Optometric Degree Standards that became effective on January 1, 2009 include eight standards describing competencies that graduates must demonstrate.²

When the curricular content is circumscribed, the means in which the content is packaged and delivered may take on greater importance. When you think back on the optometric educators, who made the biggest differences in your own education—was the impact from what they taught or from how they taught? Daloz eloquently expressed this sentiment by writing:

For good teaching rests neither in accumulating a shelf full of knowledge nor in developing a repertoire of skills. In the end, good teaching lies in a willingness to attend and care for what happens in our students, ourselves, and the space between us. Good teaching is a certain kind of stance, I think. It is a stance of receptivity, of attunement, of listening.³

In the 1990s, Boyer introduced the concept of the “scholarship of teaching” to help facilitate the dialogue for placing appropriate emphasis on the role that teaching plays in higher education.⁴ Across the country, there has been a movement to more fully recognize the value of innovative teaching and the importance of the scholarship of teaching. McKinney advised that “scholarly teaching” incorporates an approach much like that taken in other forms of scholarship, including research and clinical practice. She advised that scholarly teachers engage in activities such as reflection on their teaching, use of classroom assessment techniques, discussion of teaching issues with colleagues, trying new things, and reading and applying the literature on teaching and learning to their own discipline.⁵

The authors in this edition of the journal provide us with examples of the scholarship of teaching at its best. Drs. Pate and Steele share their experiences using a new type of classroom assessment technique and describe innovations designed to improve student interactions during lectures. Drs. Chu and Borsting provide information about the value added by technology enhancements used to supplement lecture courses. As described in the issue’s Guest Editorial, the journal is also introducing a new article format, the teaching case report. Dr. Kran provides us with an application of teaching scholarship by reviewing a complex case, and Drs. Murphy, Frick, and Hitchmoth advance our understanding of scholarly teaching by analyzing a potentially life-threatening scenario. In My Best Day, Dr. Nixon reminds us that joy of staying attuned to students is truly one of the best parts of being an educator. Contributors to Think Tank provide insight into how teaching has changed over the past 20 years and what we can expect for the future. Whatever the future holds, we must continue to embrace the elements of the scholarship of teaching for the benefit of our students and the benefit of our profession.

References
2. Accreditation Council on Optometric Education. Professional Optometric Degree Standards, Effective January 1, 2009 [adopted by the ACOE at its Fall meeting], October 12-14, 2007; standards 2.9.1-2.9.8.

Dr. Hoppe is founding dean of Western University of Health Sciences College of Optometry. E-mail: ehoppe@western.edu
Introducing Teaching Case Reports

Barry S. Kran, OD, FAAO

As faculty members and clinical preceptors, we are continually trying to improve our teaching effectiveness by finding new ways to reach our students. A couple of years ago, Dr. Elizabeth Hoppe and I were discussing how to improve on the use of case studies throughout the curriculum—both in the classroom and in the clinic. What if a collection of cases existed for faculty to pick from that could be used in the classroom to provide a practical application to a theoretical discussion? On a slow clinic day, wouldn’t it be great to have cases on hand to share with students? Wouldn’t it be helpful to have access to patient cases that have been fully researched and, with minimal effort, can be turned into useful teaching moments for students with various levels of training?

Charles Bonwell, PhD, and colleagues at the Idea Center in Kansas often speak and write about an active learning environment. Adding cases with time for discussion and mutual self-discovery is a valuable adjunct to classic lecturing. Furthermore, cases that augment didactic experiences can provide the opportunity to explore aspects of a case that one may not have time for in a face-to-face encounter. Completing exercises in a case-based learning format should increase the student’s ability to care for the next patient with similar or related issues. Case-based learning also helps to develop both critical thinking and clinical thinking skills.

This issue of Optometric Education contains the first two case reports organized in a novel fashion to facilitate use in the classroom or clinical setting. Unfortunately, the journal cannot currently support the ability to use links to electronic presentations, videos, and other pertinent information. Instead, we have presented cases in a format that we hope will maximize student participation and, at the same time, provide educators with sufficient background material to use “as is” or to utilize portions of the case as needed.

Specifically, there are two sections, one for students and the other for educators. The student section contains the case, learning objectives, key concepts, and discussion questions. The educator section provides the case disposition, a brief literature review, and embellishment regarding theoretical clinical standards of care and other aspects of the case.

The case regarding an individual with albinism is illustrative of the diversity of application across the curriculum. The patient’s anisometropia is appropriate for utilization in the first year of the curriculum, as it pertains to the art of prescribing or relative to refractive development. Issues surrounding nystagmus are appropriate for courses that cover this topic didactically (eg, an eye movement course, a pediatrics course, the optometry sequence as it relates to monocular assessment of acuity) or clinically during the third-or fourth-year rotations. As an inherited condition, this case can also be cited in a genetics course. How and when to consider low vision devices can also be discussed using this case. In addition, how optometrists interface with vision educators is a critical discussion point of this case.

Furthermore, there are at least two psychosocial–patient management issues in this case that can give rise to prolonged and meaningful discussion. One relates to patient management given the timeframe between eye exams and lack of follow up with the same practitioner. The second is the fact that the patient is an individual with differences. This may impact her in many ways; not all of which are positive. From a myopic perspective, this is just one reason why glasses or even “simple” low vision devices may not be accepted. This feeling typically has other sequelae in other aspects of an individual with albinism’s life. As such, we have the opportunity and responsibility to address these issues and offer resources to the family.

The second case regarding an individual with ocular ischemic syndrome by Murphy et al. clearly has applications in the general medical courses early in optometric training as well as in the ocular pathology sequence. Furthermore, this is an excellent case to use in the students’ clinical rotations. Students need to be reminded that there is a body attached to their patients’ eyes, and just as we can make great impact with a patient when addressing psychosocial issues, as with the first case, we also have the opportunity to save or improve the quality of one’s life by our appropriate diagnosis and management of conditions such as this.

We hope that you like and come to look forward to this feature. After reviewing and using several of these cases, please share your ideas on how to further improve this method of presentation.

Reference

Dr. Kran is chief of the Individuals with Disabilities Service, at the New England College of Optometry, and optometric director at the New England Eye Perkins Low Vision Clinic, Boston, MA. E-mail:Kranb@neco.edu
“How has teaching changed over the past 20 years, and what do you predict for the next 20 years?”

I envision team-based learning (TBL) becoming an important primary component of optometric professional education. TBL is rapidly gaining support from collaborative groups of educators, and, as a result of successful incorporation into health professions education, the benefits of this methodology are now being seen.

TBL is based on a series of procedures for developing high-performance learning teams that enhance the quality of student learning by building problem-solving skills, reducing or eliminating lecture time, ensuring students are prepared and in class on time, creating an energetic learning environment, and promoting teamwork. The benefits of the TBL methodology are many: It enables a single instructor to facilitate multiple, small groups simultaneously in one classroom while allowing the instructor to retain control of course material and act as both facilitator and content expert; it allows learners to actively participate in and out of class through preparation and group discussion; it focuses class time away from presenting and learning facts onto the application and integration of information; and it allows for individual and team performance assessment for grading and evaluation.

In addition, TBL also provides a functional framework for the incorporation of evolving technology into the classroom. In the future, the use of audience response systems, integrated clinical experiences, live Web-collaboration, and e-learning will be routine. Online resources, including e-texts, virtual patients, and clinical case reviews, will be standard components of the “classroom experience,” limited only by the imagination of the instructor and the resources of the institution.

Although still remaining, the traditional “sage on the stage” lecture-style is no longer the preferred medium for teaching students. Technology has brought more educational resources to students before and after lecture. In-class videos, demonstrations, and audience response systems are engaging students in a better way. I believe that the future holds a more customized teaching paradigm where students may choose from a palette of learning opportunities that best suit their needs. More independent learning may allow students to progress through the curriculum in new and different ways. Clinical decision making will be heavily emphasized while patient-centered health care will drive students into the clinic earlier and earlier.

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The Johns Hopkins University School of Medicine Wilmer Eye Institute Lions Vision Research and Rehabilitation Center

Geoffrey W. Goodfellow, OD, FAAO
Associate Professor of Optometry
Illinois College of Optometry
Several years ago, a popular book titled Future Shock dealt not with the fact that we would be shocked by future events but how shockingly and exponentially the future was arriving, particularly in technology. Certainly that has come true as educators face the challenges of teaching in the third millennium.

Gone are the days of 35-mm slides, slide trays, jammed slides, overhead transparencies, and chalkboards that were integral parts of our everyday lecturing. We have now converted these presentations to PowerPoints. How wonderful it is to have this particular technology to enhance our everyday teaching! It affords us the ability to easily update lectures just hours and in some cases even minutes before our lectures. Our students can get the most up-to-date information every lecture. Many professors have added a number of clinical cases and videos to these presentations. But have things really changed that much in our methodical approach to optometric education? I, and I assume many of my colleagues, continue to lecture to students in a fashion that really involves very little student interaction. We all encourage questions from the students and occasionally even ask questions of our students, but for the most part we are “preaching” to them. I have for years wondered if there is much actual learning occurring. How long can we keep their attention? Many of us have thought that there has to be some better method. We have the lectures placed on teaching servers and encourage the students to review them, but this rarely happens. Our technology allows us now to do so much with electronic transmission of lecture material. The students have immediate information gathering with the Internet. Looking into that “crystal ball” of what the future may hold is difficult to predict. Will there even be the need for having traditional classrooms, or will there be just virtual classrooms where students will be “sitting at home” gathering most of their information?

Communication with the professors will be online. I actually feel that 20 years is too far off for me, or anyone else, to envision what electronic capabilities will occur. Yes, information gathering will be at their fingertips. However, as much as the learning can and will occur electronically, I feel there will always be the necessity for personal eye contact education to occur for some part of the learning process. I predict in the very near future that optometric education will occur in smaller group sessions with emphasis on engaging interaction and student participation with the professor. I envision that students will have reviewed the classic lectures with electronic transmission of lecture material. The students have this rarely happens. Our technology allows us now to do so much teaching servers and encourage the students to review them, but has to be some better method. We have the lectures placed on can we keep their attention? Many of us have thought that there is much actual learning occurring. How long are we “preaching” to them. I have for years wondered if there is much actual learning occurring. How long can we keep their attention? Many of us have thought that there has to be some better method. We have the lectures placed on teaching servers and encourage the students to review them, but this rarely happens. Our technology allows us now to do so much with electronic transmission of lecture material. The students have immediate information gathering with the Internet. Looking into that “crystal ball” of what the future may hold is difficult to predict. Will there even be the need for having traditional classrooms, or will there be just virtual classrooms where students will be “sitting at home” gathering most of their information?

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Victor E. Malinovsky, OD, FAAO
Clinical Professor
Indiana University School of Optometry
Teaching has changed immensely in the past 20 years, with the arrival of improved technology. No longer are students taking copious notes in the classroom while the instructor stands in the front of a white/chalkboard drawing out an occasional diagram. The entire concept and structure of being a student have changed with technology. Students no longer have to get up in the morning to get to their class on time, and they may not even need to leave their homes. The fact that many college students can take some or all of their courses online has improved the access for higher education to many who previously may not have been able to receive it due to financial hardships or family commitments. Students can now work full-time jobs and/or raise families during the day, and finish their coursework at night or on the weekends. This allows more second-career students and more socioeconomically diverse students to go into fields such as optometry, because they can attain their prerequisite courses more easily.

Improved access to instructor handouts and lectures has also made student learning more self-directed. Internet access has made research easier and faster than ever; however, it also has allowed students to more easily plagiarize their work, or become lazy in their learning. Students today are less likely to attend to a topic that they have minimal interest in because there is always something potentially more interesting on the next Web page. Students are looking more for entertainment in their learning than substance, and this can lead to less actual teaching time during the classroom as instructors struggle to keep attention and attendance. Today’s students are often “plugged in” every minute of the day with laptop computers in the classrooms or communication devices. This can be a distraction for the student, their colleagues, and the instructors. Never before has there been so much information at such easy access. Today’s students are used to working and living at a different pace than the rest of the world, and this may cause a difficult transition to a structured work setting, such as they would have in the field of optometry.

The next 20 years will bring an almost paperless environment to education. Whereas many of us have grown up enjoying the feel of holding a book in our hands or quickly taking a book off the shelf to look something up, the next generation of students will be so proficient at using computer-based technology that they will be very comfortable without paper. Technology-based education will become the norm, and all lectures and lab introductions will be accessible to students at any time of the day/night. This will allow students to review information easily and as often as they would like. The need to get students together in hands-on laboratories will be the most direct link to conversation and socialization among students and instructors. The accessibility to more information will also allow students to prepare to work in clinical situations earlier and will allow students to progress at their own pace. We may see students in optometry school graduating at different paces, with some finishing the program in 3 years and others taking 5 years. Teaching will become a different full-time career as students will expect contact via e-mail at any hour of the day. However, this will also allow more overall flexibility, which can have the added benefit of providing more time for research or other clinical endeavors.

Education has been one of the most changing fields due to technology in the past 20 years, and it is going to be at the forefront of change for the next 20 years. Education is the driving force for any culture to achieve. Maintaining high standards of education in these incredibly fast-moving times will be the challenge for any institution of higher learning.

Christine L. Allison, OD, FAAO, FCOVD
Associate Professor of Optometry
Illinois College of Optometry
Content has been the predominant change in the past 20 years and continues to change as the scope of optometric practice expands. From state to state and province to province, there are varying levels of scope of practice. If we look back to 20 years ago, there were some states that only had diagnostic privileges and other states that had significant therapeutic privileges. Today, all states have some level of therapeutic ability and more and more of the Canadian provinces are expanding in their therapeutic rights. We are now seeing states expanding their privileges to include lasers, injections, and minor surgery. The National Board of Examiners in Optometry has already conducted and continues to run pilot tests for injections (intravenous and intramuscular) and looks to future implementation within the Patient Care portion (part III) of the examination.

The educational institutions have a responsibility to provide an optometric education to each of its graduates that allows them to practice wherever they choose. Many states are increasing the flexibility of an optometrist to have portability of their optometric license by allowing licensure by credential. Following a negotiated bill for scope expansion in California, it was amazing how much of it boiled down to consistency of education and curriculum to ensure that all graduates have the same degree of training on graduation. As academic institutions, it may be challenging to determine how the curriculum must change to meet the expanding scope of optometric practice. If we truly direct the future of the profession, then it is the responsibility of each and every optometric academic center to regularly review its courses and their content to ensure that we are teaching to the highest level of optometric care.

In addition, as educators, we need to recognize the change in the learning style of our students. With so much of the socialization and analytical tasks being digital or virtual, I am astonished to see that referencing to something at a clock position is often followed by a questionable look, or written and verbal communication often appears as unprofessional or impersonal. I have also observed that mechanical acumen or ability to fix or repair equipment and problem solve appears to more of a challenge for today’s student. As educators, we must construct a learning environment that provides experiences that allows the optometric student the ability to learn in a method that optimizes their knowledge. The traditional lecture may be better replaced with Podcasts, or blackboard courses and more emphasis placed on practical application of hands-on laboratories or clinics. Recognition should go to institutions and academicians who have already stepped away from the lecture podium for alternative forms of delivery.

As optometric educators, the curriculum that was taught 20 years ago should have been in preparation for what we can practice today. Conversely, what we teach today should be in preparation for the scope of optometric practice 20 years from now.

Harue J. Marsden, OD, MS, FAAO
Associate Dean of Clinical Education
Southern California College of Optometry
It typically goes without saying that most optometric faculty have a deep-seated interest in the education of our students. Most of us have dedicated our professional lives to passing along the knowledge and ideals of our profession to the next generation. Yet, what drives us and what benefit do we get from it? The answer may be a little different for each of us. However, I imagine that many have answers similar to mine.

For me, being an optometric educator combines my own interest in lifelong learning with a dedication to serve others. My initial interest in pursuing optometry was to use whatever talents I had to help patients maximize their vision. Throughout my own optometric education, I had the great fortune to be influenced by many outstanding optometric faculty members. Without knowing it, these faculty served as mentors to broaden the perspective of my optometric career path. They taught me that, with the proper amount of dedication, insight, and ingenuity, a passionate educator could inspire students to thirst for knowledge and ignite a call to service to use that knowledge in the care of their patients.

With that, I embarked on my own career as an optometric educator. Since that time, I have operated by a fairly simple premise: that students will either rise or fall to the level of expectations. If I set the bar too low, students will gladly slumber over it with whatever minimal effort is required to do so. However, if I set a high expectation of achievement, excellence, personal responsibility, and professionalism, students will strive to reach this goal. In addition, when they witness my efforts to support them with the appropriate resources and direction, they will often not only accomplish the task but exceed the expected level of performance.

So, how do I judge my best day in optometric education? Regardless of the time put into writing lectures, preparing clinical case presentations, or creating improvements to the curriculum, this means nothing unless the effort makes an impact on a student. There are many examples of when this impact is evident. I never tire of witnessing students having an “aha” moment when some concept finally develops meaning for them. Being recognized by thank-you notes and positive comments about my teaching effectiveness also validates that I am contributing something of value for the students. In addition, I always have a level of pride whenever I encounter the countless times that students go the extra mile to benefit the outcome of their patients.

Yet, if I had to choose one day as my best day, it would be graduation day. Each year, I continue to experience excitement and emotion as each class celebrates the crowning achievement of their optometric education. Commencement exercises also mark a new beginning. Learning of students’ ambitions to open their own practice, volunteer time in a free clinic, or continue their training through a residency program or graduate school always enlightens me to the generous levels of service our graduates choose to perform with their optometric degrees. This is just one final example of them exceeding expectations. So, it is on graduation day, that I am reminded of how fortunate I am to be a part of the optometric program that trained and mentored our newest colleagues of the profession.

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Make Way, Old Dog

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The EDUCAUSE Center for Applied Research (ECAR) releases their study of undergraduate students and their use of technology each year. In its 5th year, the ECAR Study of Undergraduate Students and Information Technology provides information about the technology behaviors, preferences, and attitudes of higher education's undergraduates.¹

As educators, we see these students enter our schools and colleges of optometry with a very different technology background than the students of a decade or two ago. The survey of 27,317 freshmen and seniors at nearly 100 colleges and universities in the United States reveals some interesting findings.

• More than 80% of students own laptops, 53.8% own desktops, and 33% own both.
• 66.1% of students owned an Internet-capable cell phone.
• 85.2% are daily engaged in social networking Web sites such as Facebook, MySpace, Bebo, LinkedIn, and so forth. (In fact, 49.7% of students reported using these social networking sites to communicate with classmates about course-related topics.)
• 83.6% use text messaging daily.
• 73.8% instant message several times per week.

The above forms of technology are being used at an incredibly high rate by our students. Of lesser use but still significant are the following:

• 46.6% contribute monthly content to photo or video Web sites.
• Over 30% contribute monthly content to wikis and blogs.
• 30% use video-creation and audio-creation software.
• Another 30% use podcasts and Webcasts.

Clearly our students are plugged in and connected, and many of us communicate with students about coursework out of the classroom setting via e-mail or Web postings. These technologies have been around for a long while now. However, education’s role in social networking Web sites is relatively new and ill defined.

Stephen Hoare of The Guardian wrote that some “e-learning gurus want to exploit their students’ passion for the new generation of interactive online communication tools—collectively known as Web 2.0—to deliver academic content. Not content with podcasting minilectures to students’ mobile phones and i-Pods, they are hijacking the internet telephone system, Skype, and invading FaceBook.”² It is likely that the schools and colleges of optometry are slower to adapt these
newer technologies. What educational benefit do these tools have anyway?

Robin Mason, professor of educational technology at the UK’s Open University, has done some thinking about the educational purposes of the above technology tools. She has described how blogs have become an acceptable educational tool and how wikis also fit well into collaborative projects and are common in higher education today. Social bookmarking is also becoming an important tool; after their research, students share bookmarks of good sites. Last, she has described how communication tools like Skype enable students to communicate for free and share their results.

Do you use some of the above tools in your teaching? We would love to hear about it. We also invite you to visit Dr. Maino’s blog at http://www.mainosmemos.blogspot.com.

References
Management of Anisometropic Amblyopia and Head Posture in a Patient With Oculocutaneous Albinism: A Teaching Case Report

Barry S. Kran, OD, FAAO

Abstract
This case of an individual with albinism covers numerous aspects of care, ranging from prescribing for anisometropia to spectacle management of the null point. Background information on aspects of the genetics, pathophysiology, and care relative to psychosocial, educational, and low vision needs of individuals with albinism is presented.

Background
This case is to be used as a learning tool to illustrate numerous concepts to optometry students of all levels and to support critical thinking skills in all aspects of the management of an individual with albinism. Learning objectives and key concepts bullets are shown in the Student Discussion Guide section of the article. This case has relevance for optometry students at any level of training. For example, students who are in the early part of their education will find relevance from aspects of refraction and trial framing as well as a review of refractive development issues regarding anisometropia. Students who are more advanced will find relevance from a review of the genetics, epidemiology, and pathophysiology of albinism as well as a brief review of infantile nystagmus syndrome. Students of all levels will find relevance from patient management issues, including the psychosocial aspects of working with individuals with differences. Last, an approach to pediatric low vision care and an understanding of vision educators is provided.

Although an exhaustive review of all aspects of this case is beyond the purview of the format and well beyond the space limitations of the article, it is important to engage the student in not only a discussion regarding the typical epidemiology and pathophysiology of individuals with albinism but to provide a foundation from which other, and often overlooked, issues can be discussed. These issues include knowledge of the vision educators who work with our patients and the single-parent households that may be commonly encountered when caring for children with visual and other impairments.

Student Discussion Guide
Case Description
Chief concerns/demographics
M is a Caucasian female aged 8 years, 2 months who presented to the clinic with her mother for an additional opinion regarding the functional management of her case. Specifically, her mother was concerned about the need for glasses, her head posture when fixating, optical and/or nonoptical approaches for her low vision needs and a review of the environmental considerations for M.

Figure 1
Picture of Patient M With Final Prescription, Provided by Her Mother
Medical history
M had a confirmed case of oculocutaneous albinism (OCA) with pendular nystagmus and transillumination defects. Other medical history included premature birth at 25-weeks gestation, with a 3-month stay in a neonatal intensive care unit (NICU). Retinopathy of prematurity was not observed. M had delays in overall development, speech, walking, and fine-motor skills. M was not taking any medication, nor did she have any known allergies.

Ocular history
M had been seen by two pediatric eye care groups for diagnosis and care and had been registered with the state blindness agency. Spectacles were rejected and patching was recommended but not successfully implemented. Spectacles were attempted a few times early in life and again at 4 years of age. First spectacle prescriptions were unknown, but mother reported that one lens was much thicker than the other. The last prescription was +2.50 OU filled in a polycarbonate transition material. M preferred nonprescription sunglasses for outdoor use.

Educational history
Due to her prematurity and developmental delay, M was eligible for early intervention services, which were provided from birth until 3 years of age. M received program/school-based care from a teacher of the visually impaired (TVI), an occupational therapist, and a physical therapist. M was reported to have also received some of these services through preschool (age 3 to 5) and at the last visit was still receiving occupational and vision services.

<table>
<thead>
<tr>
<th>Examination Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DVA (without correction (sc), translucent occluder utilized, Feinbloom chart, eyes tested in order shown):</strong></td>
</tr>
<tr>
<td>OU: 10/140</td>
</tr>
<tr>
<td>• Chin-down, eyes-up posture with nystagmus substantially reduced</td>
</tr>
<tr>
<td>OD: 10/160</td>
</tr>
<tr>
<td>• Pendular nystagmus; increased amplitude and frequency compared with OU</td>
</tr>
<tr>
<td>OS: 10/120</td>
</tr>
<tr>
<td>• Pendular nystagmus visible (but quite reduced compared with OD); eyes shifted to left gaze</td>
</tr>
<tr>
<td>NVA: (Reduced ETDRS, sc)</td>
</tr>
<tr>
<td>OU: 0.05/1M</td>
</tr>
<tr>
<td>• Eyes-up, chin-down posture</td>
</tr>
<tr>
<td><strong>Cover test:</strong></td>
</tr>
<tr>
<td>20∆ right intermittent exotropia at both distance and near when not in chin-down, eyes-up posture (null point)</td>
</tr>
<tr>
<td><strong>Assessment of nystagmus in different positions of gaze</strong></td>
</tr>
<tr>
<td>Deferred due to preexisting diagnosis and assessment.</td>
</tr>
<tr>
<td><strong>Retinoscopy:</strong></td>
</tr>
<tr>
<td>Dry:</td>
</tr>
<tr>
<td>OD: +8.50 DS</td>
</tr>
<tr>
<td>OS: +2.00 DS</td>
</tr>
<tr>
<td>Cycloplegic:</td>
</tr>
<tr>
<td>OD: +9.00 = -1.00 × 180</td>
</tr>
<tr>
<td>OS: +2.50 DS</td>
</tr>
<tr>
<td><strong>Trial frame/DVA (Feinbloom and translucent occluder):</strong></td>
</tr>
<tr>
<td>OD: +7.00 DS (10/120)</td>
</tr>
<tr>
<td>OS: +1.00 DS (10/80)</td>
</tr>
<tr>
<td>OU: 10/100</td>
</tr>
<tr>
<td><strong>Trial frame with yoked prisms:</strong></td>
</tr>
<tr>
<td>OD: +7.00 DS</td>
</tr>
<tr>
<td>OS: +1.00 DS 7∆ BD</td>
</tr>
<tr>
<td>• Head posture improved significantly</td>
</tr>
<tr>
<td>• Patient able to easily navigate through space</td>
</tr>
<tr>
<td>• Played catch with softballs and was able to accurately catch the 2.5” diameter balls (no mismatch between seeing and reaching secondary to the prism)</td>
</tr>
<tr>
<td>• No symptom suggestive of maladaptation to either the refractive or the prismatic component of the prescription.</td>
</tr>
<tr>
<td><strong>Ocular health assessment:</strong></td>
</tr>
<tr>
<td>External: Normal including iris transillumination OU</td>
</tr>
<tr>
<td>Internal: Albinotic; typical blond fundus with lack of a foveal reflex. No other significant ocular findings</td>
</tr>
</tbody>
</table>

Learning Objectives
At the conclusion of this case discussion, participants should be able to:

1. Understand and be able to describe the basic epidemiology and genetics of albinism
2. List and differentiate key ocular and visual characteristics associated with albinism
3. Describe the importance of the trial frame beyond the determination the best binocular balance
4. Describe the pros and cons of different management options for individuals with nystagmus
5. Discuss options for a team approach to the care of the child with impaired vision

Key Concepts

1. Determination of an appropriate anisometropic spectacle prescription
2. Various concepts around null point management
   a. Awareness of the individual during general discussion and when measuring acuity
   b. Noting of changes as threshold is approached at both distance and near
   c. Impact of the prescription on the null point/posture
   d. Utilization of Prentice’s rule when designing yoked prism spectacles
3. Awareness of psychosocial and educational team issues for the student with albinism
Discussion Questions

A. Critical Appraisal of Professional Literature: Lifelong Learning
1. What are some of the classic findings in an individual with albinism?
2. How common is the condition in the United States?
3. What are the genetics and inheritance patterns associated with albinism?
4. What are the options for controlling or minimizing nystagmus?
5. Who are the other professionals who can assist in the care of the child with impaired vision, and what are their roles?
6. What additional resources are available for patients with albinism, their families, or eye care providers who wish to know more about this condition?

B. Critically Assessing Pros and Cons of Different Strategies: Patient Management Options
1. When a young child presents with hyperopic anisometropic amblyopia, what is the recommended remediation? What if the preferred method is not tolerated? What are some other options to consider?
2. What are some ways of occluding a patient that may minimize the latent component of the nystagmus? How might this adaptation impact the utilization of a bifocal or spectacles in general?
3. What is Prentice’s rule and how might it be utilized in a case of anisometropic amblyopia and null point management?
4. When should low vision rehabilitation be considered for a child? What is your assessment and plan for this patient? Be complete in your documentation.

C. Critical Analysis: Generating Hypotheses and Solutions
1. Why do patients fail to keep follow-up appointments? What strategies can be used to improve patient follow up?
2. Why do spectacle remakes occur? What strategies can be used to reduce the frequency of remakes?
3. What psychosocial issues might be faced by this patient? How might these issues be mitigated and what types of support services are needed?
**Educator’s Guide**

**Case Description**

The entire case, except for the case disposition, is presented in the **Student Discussion Guide**.

**Educational History**

The following provides the educator with basic information regarding vision educators. Please see the following resource for more detailed information:


**Teacher of the visually impaired (TVI):**

- A university-trained, certified teacher who has pursued additional coursework to meet the educational needs of children whose level of vision can range from being impaired to totally blind.
- Teachers of the visually impaired may work in a public or private school system or at a school for the blind. It is not uncommon for a TVI to be dual certified in orientation and mobility.

**Orientation and mobility (O&M) specialist:**

- An individual who has completed an accredited university program with a master’s degree or national certification to teach orientation and mobility. O&M specialists teach the concepts, skills, and techniques necessary for a person with a visual impairment to travel safely and efficiently in any environment under all conditions and situations.
- O&M specialists work with clients of all ages and may work in public or private schools, privately contract with individual school systems, state commissions, or agencies for the blind, or residential rehabilitation agencies.

**Brief Literature Review**

**Albinism**

It is believed that there are over 100 genes that code for pigment in the human genome and that mutation in these genes could be responsible for hypopigmentation of the skin, hair, and/or eyes.

There are many hypopigmentation conditions; however, albinism includes the presence of hypopigmentation of the iris or retina, foveal hypoplasia, misrouted visual pathway fibers, and nystagmus.

**Genetics and classification**

Albinism is a heterogeneous condition with varied phenotypic expression caused by a mutation in any of at least 13 genes that impacts various aspects of the biosynthesis of melanin in the melanosome, transportation of melanin within the melanocytes, melanosome maturity, and the number and distribution of melanocytes themselves.

Marble noted the following classification based on both genetic and etiologic points of view.

- Tyrosinase deficiency: ocular cutaneous albinism type 1 (OCA1)
- Defects in the P gene (OCA2): Which codes for a melanosomal membrane protein (formerly known as tyrosinase positive)
- Defects in the tyrosinase-related protein 1 (OCA3): Which stabilizes a melanosomal enzyme complex
- Defects in a membrane-associated transport protein (OCA4)
- Defects in the OA1 gene (OA1): Which is a melanosomal membrane glycoprotein

Conditions that have an impact beyond hypopigmentation:

- Hermansky-Pudlak syndrome (HPS): A multisystem disorder that seems to be linked to at least four different genes. Aside from OCA, patients have a mild bleeding disorder, ceriod storage in multiple tissues, and pulmonary fibrosis.

All of the above conditions are inherited in an autosomal recessive manner except for ocular albinism (OA), which is X linked.

**Epidemiology**

The prevalence of albinism worldwide varies between 1 in 10,000 to 1 in 20,000. In the United States, the prevalence is approximately 1 in 17,000 to 1 in 18,000. In addition, albinism is the most common inherited form of pediatric vision impairment. OCA2 (which was previously known as tyrosinase positive albinism) is the most common form of albinism in the United States among African Americans and Caucasians, with a prevalence of 1 in 10,000. OCA2 is also the most prevalent form of albinism within several American Indian tribes such as the Navajo, Hopi, and Zuni. OCA1 is found in approximately 1 in 28,000 African Americans and Caucasians. OCA3 is very rare in the United States. Hermansky Pudlak Syndrome (HPS), though rare, is the most common form of albinism in Puerto Rico, with a prevalence of 1 in 1,800. OA, which can appear as a mosaic in females, has a prevalence among men of 1 in 50,000.
Case Disposition

1. Prescription of trial frame (polycarbonate, Transitions [Transitions Optical, Pinellas Park, FL] material)
2. Patient education regarding the proper correction and its full-time use is the first line of treatment for anisometropic amblyopia; this was reinforced. Call office as soon as possible if glasses are not tolerated
3. Patient education regarding need for a thorough low vision device assessment
4. Discussed the possibility of contact lenses but need to first establish a viable spectacle prescription because contact lenses should not be the sole form of vision correction. Related possible benefits of contacts discussed (eg, further decrease in nystagmus, improved acuity compared with spectacles). Negative aspects discussed as well (eg, initial feeling of lenses, responsibility for care and increased risk of eye infection, and possibly the continued need for spectacles with prism overcorrection to improve posture while maintaining null point)
5. Advocated for the continued need for TVI direct and consultative services
6. Requested an orientation and mobility assessment to be sure environmental considerations in familiar and unfamiliar environments are appropriately addressed and to be sure that M had age-appropriate travel skills
7. Family education regarding psychosocial issues and gave references for M’s mother (see Resources Box).
8. Scheduled a follow-up visit.
9. Postscript: A 3-month follow-up telephone conversation with the mother revealed that glasses had been well tolerated, but the family was moving out of state and was lost to direct follow up. Several doctors were recommended for local care.

Table 1
Summary Table of Ocular and Visual Characteristics Associated With Albinism

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acuity/refraction</td>
<td>Best-corrected acuity: 20/40-20/400 (^1,2) Proportion of hypopigmentation is not predictive of acuity. (^9) Atypical emmetropization, resulting in higher incidence of significant refractive error. Significant with the rule astigmatism not uncommon. For full background see references 10-17.</td>
</tr>
<tr>
<td>External</td>
<td>Pale complexion (OCA), light-colored hair (OCA), iris transillumination (most always evident) (^1)</td>
</tr>
<tr>
<td>Internal</td>
<td>Foveal hypoplasia, &quot;blond&quot; fundus, possible optic nerve hypoplasia</td>
</tr>
<tr>
<td>Ocular motor</td>
<td>Strabismus common, nystagmus along with probable null point and anomalous head posture</td>
</tr>
<tr>
<td>Electrodiagnostic findings</td>
<td>ERG: normal VEP/FMR: demonstrates significant aberrant crossing of temporal fibers (^1,18,19)</td>
</tr>
<tr>
<td>Visual field</td>
<td>Appears to be normal, implying cortical reorganization (^12,13,20)</td>
</tr>
</tbody>
</table>

Figure 2
Prominent Iris Transillumination

Figure 3
Foveal Hypoplasia (With a Potential Vessel Coursing Over the Macula Area), Prominence of Choroidal Vessels Due to an Absence of Retinal Pigment Epithelium

Note: Photo courtesy of Anne Fulton, MD.
Diagnosis of Albinism

A general diagnosis can be made based on the appearance of the individual, the associated ocular findings, and family pedigree. Genetic testing has replaced the previously used inexact hair bulb test as the “gold standard” of determining the precise hypopigmentation entity.

Visual System Findings Associated With Albinism

The lack of melanin in the retinal pigmented epithelium during embryogenesis may be responsible for the misrouting of visual pathway fibers (some temporal fibers from each eye cross at the chiasm) and foveal hypoplasia. The impact of decreased melanin results in decreased acuity, nystagmus, altered emmetropization, and an increased incidence of strabismus (both eso and exotropia). However, the proportion of retinal hypopigmentation is not predictive of visual acuity.

Nystagmus

Nystagmus is an involuntary, rhythmic oscillation of one or both eyes. There are numerous types of nystagmus, some physiological (e.g., end-point nystagmus) and some pathological (see-saw nystagmus).

The type of nystagmus associated with albinism has previously been described as a congenital nystagmus. Newer nomenclature describes it as infantile nystagmus syndrome (INS), in which the incidence is 1 in 6,550. INS characteristically presents as a large-amplitude pendular nystagmus, which is often noted postnatally within the first few weeks. Head bobbing may be noted as well and tends to resolve in infancy, whereas the nystagmus will typically become less noticeable to the casual observer during childhood. Pendular nystagmus will have a smaller amplitude over time and will appear to diminish dramatically as a null point/anomalous head posture is established. In addition, it is not uncommon for the waveform to change from a pendular to a jerk nystagmus over time. It is also common to have a latent component in which the jerk is in the direction of the fixing eye. Strabismus is found in approximately 50% of the individuals with INS. When examining a patient with nystagmus, an assessment of the type and characteristics in all nine positions of gaze should be obtained and recorded.

INS is thought to result from a mismatch between the developing motor and sensory systems (or to an injury yielding a mismatch between the systems). In the case of albinism, it is believed that the aberrant sensory system impacts the calibration between the sensory and the motor systems, resulting with the observed nystagmus.

When the onset of the nystagmus can be ascertained to have been noted in the first 2 months and the diagnosis is relatively apparent (albinism or aniridia), neurologic imaging is not necessary. However, if onset is later or if it is associated with optic nerve hypoplasia (ONH) without an otherwise obvious cause such as albinism or aniridia, then referral to a pediatric neuro-ophthalmologist is warranted.

Nystagmus may be exacerbated when the individual is tired, stressed, or not feeling well. This fact has significant functional implications for school, work, and visually based evening activities. Using a student as an example, depending on just how much of a visual learner she is and what the educational demands are for her, it is possible that this behavior would impact her ability to complete visually based homework unless accommodations are used. The accommodations may vary from one year to the next and may be needed at home, at school, or in both environments. Several professionals would be involved in determining the best approach to learning, including the student’s TVI, a low vision optometrist, a speech and language professional, an expert in assistive technology, and an O&M specialist. The goal of this coordination is to maximize both the individual’s potential and his/her access to information in the most effective manner.

Photophobia

It has been noted that there are fewer photoreceptors in individuals with albinism compared with the general population. Individuals with albinism are not night blind, tend to be more light sensitive than the general population, and benefit from sunglasses, photosensitive lenses, a brimmed hat, and proper placement in a classroom. Clinically, there is a range of expressed or observable light sensitivity and photophobia.

Discussion

Patients with albinism may not always exhibit significant signs of photophobia in many everyday situations or in some familiar environments. However, in the clinical setting, examination techniques should be adjusted to maintain patient comfort. Students need to be alert to possible clues signaling patient discomfort and photophobia even before they begin the history with the patient. Clues may include, change in squinting pattern related to level of room illumination, use of a baseball cap indoors, or the use of sunglasses indoors. If patients are sensitive to light, then the students need to think about how they may adjust their examination to minimize this issue. For example, they may choose to assess ocular motilities with a small object but not the transilluminator, perform slit-lamp biomicroscopy with a lower level of illumination and not begin at the cornea, and similarly, when performing binocular indirect ophthalmoscopy, also decrease the illumination and start at the periphery. Additional techniques to enhance patient comfort include demonstrating the brightness of the light on the wall or the patient’s hand prior to conducting the procedures and discussing the ways in which you will attempt to minimize their light sensitivity throughout the examination process.

Assessment of acuity

Given the patient’s obvious nystagmus and knowledge of a probable latent component, it was important to begin by measuring the visual acuity with both eyes open. You may find it instructive to point out to the students that, when patients are not binocular, it is not technically correct to say binocular acuity. Many educated parents take offense at the improper use of the term. Although it takes longer to say and write “both eyes open,” it is technically correct. Measuring the patient’s visual acuity with both eyes open first allows for increased comfort on the part of the patient, observation of any changes in
null point management

full spectacle prescription is the first and often best place to start. Contact lenses have been considered, and there is some thought that the combination of always viewing through the optical centers or the mass of the lens itself provides an improvement in acuity and a reduction in visible nystagmus in some cases compared with a spectacle prescription. There are various surgical techniques such as Kestenbaum's or Anderson's (which have been described as two-muscle surgery), a combination approach, or even four-recti muscle surgery.23 The goal of these procedures is to essentially move the null point from anomalous head posture and eye positions to a head posture that would approximate a straight head and straight eyes.23 Due to the poor success rate, these procedures are not often performed.23 A nonsurgical approach to null point management is the use of yoked prisms. Prisms are placed base up, down, left, or right to affect the proper change head alignment.

M had a posture in which she placed her chin down and her eyes up; so to maintain the eyes-up posture, base-down OU needs to be applied. When considering changing head posture, Weiss and Brown recommended starting with 6Δ in front of each eye. The direction of the base is dependent on the posture one is looking to correct.24 In M's case, her eyes were in an upward gaze. As such, the prism would be applied base down such that it would keep her eyes in an up gaze yet bring her chin up (to maintain fixation). Given the history of missed follow-up appointments, it was decided to attempt to trial frame the possibility using yoked prisms to affect a change in posture and consider its incorporation into a final prescription.

management of anisometropia/ determining the best correction for this patient

this aspect of the case is instructive, as it requires some sleuthing and educated guess-work to ascertain what was provided to the patient. Students may benefit from a discussion regarding prescribing options and how to make an informed decision with the data collected during the examination. More advanced students may also benefit from a discussion to include ways in which prescriptions may be modified over time or how adaptation may be required prior to the final and most optimal prescription choice. Conventional wisdom states that full correction should be provided early on to a patient with anisometropia. There is little concern regarding acceptance, and size differences are not believed to be problematic for most young children. This combined with Hertle's quote, “Correction of significant refractive errors in both children and adults with nystagmus is the single most powerful therapeutic intervention for improving vision and visual function in these patients”22 are strong reasons to attempt full correction for the patient.

however, based on mother's report, a full prescription was unsuccessful, and, essentially, a full prescription for the better-seeing eye was also not tolerated. Should the doctor stand on principle and provide a full prescription? Or should a prescription that would be tolerated be provided with a plan to modify the amount of correction over time? It was also clear that follow up with previous eye care providers was not maintained. Therefore, the safe choice (ie, the compromised prescription) was pursued.

students may benefit from a discussion about the relationships between the prescription, accommodation, and binocular status.

procedure for obtaining a tolerable prescription

a stepwise approach was taken to obtain a probable tolerated spectacle prescription:

1. objective and subjective refractions (cycloplegic and dry)
2. sphero-equivalent with equal reduction in plus provided for each eye, with the premise that some accommodation with the left eye would be preferred
3. static then dynamic trial frame of the prescription
   a. static
      i. while seated
      ii. while seated with head movement
   b. dynamic
      i. while moving through space and involved in a hand-eye game (ball toss)
   c. observation of patient
      i. does she tolerate the heavy trial frame?
      ii. does she appear to be nauseous or lightheaded
      iii. does her face brighten up with the trial frame?
      iv. does the frequency or amplitude of the nystagmus change for the better?
      v. is there a positive change in head posture?
   d. listening to patient
   e. adjust as necessary
   f. note acuity with both eyes open with “optimal Rx”
Psychosocial Aspects of Pediatric Low Vision Care

It is important to understand the psychosocial aspects of a child with low vision. When there are other markers, such as appearance, it can add a layer of resistance to intervention. Some individuals with albinism seem to embrace their difference and advocate strongly for their needs, whereas many others want to not be different and, as such, will reject the use of spectacles. Our sense of M, however, was that she was comfortable with who she was and was not afraid or unwilling to wear glasses. Her mother seemed to have accepted that she has a daughter with albinism but that it was not going to define limitations for her. The two also had a good relationship with one another. Fortunately, albinism is relatively common and there are active organizations present throughout the world. In the United States, organizations such as the National Organization for Albinism and Hypopigmentation (NOAH; www.albinsim.org) are a vital resource for parents and for individuals with albinism. There may be local active chapters or outreach by local blind agencies that offer programs designed for children and their families. Another resource to look into is the National Association of Parents of Children With Vision Impairments (www.spedex.com/navpi). Last, it may be instructive for the family to view Positive Exposure (www.postiveexposure.org) as well.

Had we had the privilege of follow-up, more in-depth low vision care would have been provided. The box below provides an outline of the general approach to pediatric low vision care as practiced at the New England Eye Perkins Low Vision Clinic.

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Student Exercise

How much prism should be prescribed for M and what is the actual prism in front of each eye? After students see how much induced prism there is in the right eye, prism power selection for the left eye becomes obvious.

1. Use trial frame as the spectacle component
2. Assume Frame B measurement is 20 mm
3. Given the weight of lens in front of the right eye, and frames in general, assume ~2-mm slippage
4. Apply Prentice’s rule given that M’s eyes will remain in up gaze
5. Prentice’s rule:
   a. Induced prism (∆) = lens power (D) × distance from optical center (cm)
   b. Induced prism with 2 mm of slippage (and patient looking toward top of frame): (BD): OD: 1.2(7) = 8.4∆ OS: 1.2(1) = 1.2
   c. Ground in prism (BD): OS: 7∆
   d. Total prism in front of each eye: OD: 8.4∆ BD; OS: 8.2∆ BD
6. Trial frame of proposed prism glasses—was successful, both statically and dynamically

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Pediatric Low Vision Care

1. Provide what the child needs at the moment (whether it is for something in or out of the classroom). Ensure that any assistive devices will be embraced by the child now, while keeping an eye on tasks and devices that should be considered in the near future.
   a. Engaging the patient in this process is most critical
   b. Communication among the doctor, parents, patient, teacher, and vision educators is imperative to use a positive, well-conceived remediation plan. Advocate for services to be provided by TVIs, as well as orientation and mobility specialists as needed.
   c. With the parents and educators, inculcate positive (and appropriate) self-advocacy by the child to ensure that his/her needs are met.
2. Prescribe for significant ametropia; however, if extremely tactile-defensive, recommend a desensitization program to increase the likelihood of wearing a spectacle prescription successfully.
3. Consideration could be given to environmental and positional modifications in the classroom both at school and in the home. After the recommendations for modifications are made by the doctors, assessment can be made by the vision educators.
4. Nonoptical aids such as a reading stand or line guide could be used.
5. Exploration of the use of a monocular telescope or near-magnification device (even as simple as a pair of reading glasses) could be explored. The use of the monocular telescope, even for nonacademic spotting tasks, should not be underestimated in its ultimate acceptance by the patient.

Additional Resources

Parents
2. www.AFB.org: Cite for exploring vision educators resources and an excellent listing of other resources
3. www.tsbi.edu: Search engine and repository of information
4. www.e-advisor.us: A collaborative site between a medical center and various blindness agencies that provides a wealth of information

Students
(in addition to the references cited)

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Conclusion
M’s care required knowledge of her condition, low vision rehabilitation, binocular vision (including eye movement assessment, ocular motor assessment, and use of yoked prisms), optical principles, as well as a sense of how the educational system can work with optometry to help an independent person with maximal access to the environment. It is important that we were also aware of the typical psychosocial issues that impact children with differences and were able to provide appropriate resources for M. This case is an excellent teaching case because it covers a genetic condition that impacts emmetropization, acuity, binocular vision, and psychosocial aspects of patient care. The realities of patient management in a busy, single-parent household are also covered. Based on the telephone call with the mother 3 months after our visit, it seems that we provided M with an appropriate prescription that positively impacted her visual function and her head posture. The next step is the provision of appropriate magnification (optical, electronic, video) and nonoptical (correct print size, reading stands, etc.) devices to meet her academic and her leisure time needs.

References
A Case of Bilateral Ocular Ischemic Syndrome: A Teaching Case Report

Andrea L. Murphy, OD
Richard Frick, OD, FAAO
Dorothy Hitchmoth, OD, FAAO

Abstract

Ocular ischemic syndrome (OIS) describes a rare condition wherein there is widespread ischemia of the eye due to ipsilateral carotid occlusive disease. Eighty percent of cases are unilateral and characterized by a gradual loss of vision, eye pain, or headache. OIS is more frequently seen in older men. Studies predict a 5-year mortality rate of 40% and poor visual prognosis with OIS. This teaching case demonstrates many classic findings of OIS and the associated management considerations; it is unusual because the patient has bilateral OIS. Accurate diagnosis of OIS is challenging, but imperative, to prevent morbidity and mortality.

Key Words: Ocular ischemic syndrome, carotid artery disease, peripheral retinal hemorrhages, neovascularization, carotid artery stenting, carotid endarterectomy

Background

The following case report is to be used as a teaching guide for 3rd- or 4th-year optometry students and optometry residents. It outlines many of the classic findings in ocular ischemic syndrome (OIS). In addition, it explores the complications associated with this condition and gives a thorough review of the most current treatment options available. OIS can be challenging to diagnose. It is important to review case reports such as this with students and residents to enable them to make a quick and accurate diagnosis, which can decrease morbidity and mortality rates in patients with OIS (i.e. prevent vision loss, myocardial infarction [MI], cerebral vascular accident [CVA]). This is a unique case as it illustrates a bilateral presentation of OIS.

Student Discussion Guide

Case Description

Patient JS, a 62-year-old Caucasian male, first presented to the White River Junction Veterans Affairs Medical Center (VAMC) eye clinic on December 28, 2006. His chief complaint was that he experienced a “black dot” in the vision of his right eye, beginning just before he underwent a cardiac catheterization in October 2006. This phenomenon had been stable for approximately 2 months, with only a few intermittent light flashes in this eye. He also noted glare with night driving and blurry vision in bright sunlight. There was no known ocular history. His medical history was significant for atherosclerotic cardiovascular disease; benign hypertension; hyperlipidemia; diabetes mellitus type II (diagnosed 2002); status-post MI × 2 (April 1999, March 2005); s/p coronary artery bypass graft surgery (May 1999); occlusion and stenosis of the carotid arteries; s/p placement of taxus-drug eluding stent (March 2005); left heart catheterization with unsuccessful attempt to deliver short-taxus stent (November 2006); chronic kidney disease (stage III); hypertriglyceridemia; and intermittent claudication. Patient JS had a history of smoking but quit in 1998. His current medications included: clonidine hydrochloride, clopidogrel bisulfate, Digoxin (GlaxoSmithKline, London, UK), diltiazem, finasteride, furosemide, gemfibrozil, glimepiride,
glipizide, hydrochlorothiazide, isosorbide mononitrate, lisinopril, lovastatin, metformin, metoprolol succinate, nifedipine, nitroglycerin, omeprazole, pantoprazole sodium, terazosin hydrochloride, warfarin, aspirin 325 mg, and fish oil gel caps. Patient JS had no known drug allergies; however, he did report adverse reactions to bee stings.

**Examination Findings**

**Follow-up #1: 4/4/2007**

- Complained of extreme photophobia, frequent headaches that he associated with the extreme photophobia—stated he felt as if “he is looking through a fog” when these headaches occur, and intermittent diplopia over the last few months.
- Reported having a stroke and heart attack on March 17, 2007. Review of medical records revealed that he had experienced a seizure and an episode of atrial fibrillation.

**Follow-up #2: 6/15/2007**

- Reported extreme light sensitivity, with greater intensity following stroke in March 2007.
- Reported daily episodes of a variety of visual changes to include: loss of central visual field, loss of peripheral visual field, and a graying and washing out of vision that lasted for several minutes prior to resolving.
- Also complained of persistent headaches since his stroke.

**Follow-up #3: 8/10/2007**

- Reported continued episodes of transient loss of central vision OD, lasting from 10-15 min up to 12 hr and being more prominent when his blood pressure levels were subnormal.

### Table 1

**Initial presentation: 12/18/2006**

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best-corrected visual acuity</td>
<td>20/30</td>
<td>20/25</td>
</tr>
<tr>
<td>Pupils</td>
<td>ERRL, -APD</td>
<td>ERRL, -APD</td>
</tr>
<tr>
<td>Extraocular motility</td>
<td>Full, extensive</td>
<td>Full, extensive</td>
</tr>
<tr>
<td>Confrontation fields</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>Biomicroscopy</td>
<td>Normal, no NVI</td>
<td>Chalazion LL, no NVI</td>
</tr>
<tr>
<td>Intraocular pressures (GAT)</td>
<td>14 mmHg</td>
<td>14 mmHg</td>
</tr>
<tr>
<td>Dilated fundus exam</td>
<td>2+ cortical spoking, invading visual axis with mild NS; vitreal syneresis; 2+ vessel tortuosity</td>
<td>2+ cortical spoking, invading visual axis with mild NS; vitreal syneresis; 2+ vessel tortuosity; multiple blot hemorrhages in mid-periphery (see Figure 1)</td>
</tr>
</tbody>
</table>

### Table 2: Follow-up #2: 6/15/2007

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best-corrected visual acuity</td>
<td>20/40</td>
<td>20/30</td>
</tr>
<tr>
<td>Intraocular pressures (GAT)</td>
<td>9 mmHg</td>
<td>9 mmHg</td>
</tr>
<tr>
<td>Biomicroscopy</td>
<td>Stable to previous, no NVI</td>
<td>Stable to previous, no NVI</td>
</tr>
<tr>
<td>Dilated fundus exam</td>
<td>Multiple blot hemorrhages in mid-periphery</td>
<td>Multiple blot hemorrhages in mid-periphery</td>
</tr>
</tbody>
</table>

### Table 3: Follow-up #3: 8/10/2007

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best-corrected visual acuity</td>
<td>20/60+1</td>
<td>20/25-2</td>
</tr>
<tr>
<td>Intraocular pressures (GAT)</td>
<td>10 mmHg</td>
<td>10 mmHg</td>
</tr>
<tr>
<td>Gonioscopy (Goldmann 3-mirror)</td>
<td>Ciliary body band visible 360° with slightly engorged posterior iris vessels, no NVA</td>
<td>Ciliary body band visible 360 degrees with slightly engorged posterior iris vessels, no NVA</td>
</tr>
</tbody>
</table>

**Figure 1**

Mid-Peripheral Intraretinal Hemorrhages Seen Bilaterally in Patient JS
Learning Objectives
At the conclusion of this case discussion, participants should be able to:

1. Understand and be able to describe the basic signs and symptoms of OIS
2. List and differentiate key ocular, visual, and systemic characteristics associated with OIS
3. Develop an appreciation for differentiating individuals with OIS from other retinal vascular conditions
4. Describe the risks and benefits of different management options for patients with OIS
5. Apply guidelines set forth by the American Heart Association in the management of carotid artery disease
6. Understand treatment options for OIS and carotid artery disease

Discussion Questions
A. Knowledge/Facts/Information Required for Critical Review of Case
1. What are some of the classic clinical findings in an individual with OIS?
2. What are the main risk factors for OIS?
3. What are some of the characteristic symptoms an individual might present with in OIS?
4. What diagnostic tests can be ordered in a patient with presumed OIS?

B. Critically Assessing Implications of Treatment: Patient Management Options
1. What treatment options are available for patients with OIS and/or carotid artery disease?
2. What are the current treatment guidelines set forth by the American Heart Association for carotid artery disease?
3. What treatment options are available for patients who develop neovascularization?
4. What oral medications are available for the treatment of carotid artery disease? What are their roles in treatment?

C. Critical Analysis: Questioning and Generating Hypotheses and Solutions
1. Can an individual develop OIS if there is no known stenosis of the internal carotid arteries? If so, in what manner and what diagnostic tests do we have to determine this?
2. What is the prognosis for an individual with OIS?
3. Are there any means by which an individual’s eyes could be “spared” from developing ischemia?
4. In which subset of patients would carotid artery stenting be more appropriate and why?

D. Differential Diagnosis Skills
1. How would you differentiate OIS from central retinal vein occlusion (CRVO)?
2. What other condition(s) can cause OIS?
3. What is the key diagnostic factor in differentiating OIS from other conditions with mid-peripheral retinal hemorrhages as a clinical finding?

Key Concepts
1. Known causes/risk factors for developing OIS
2. Understanding the pathophysiology of anterior and posterior segment findings in OIS
3. Determination of proper auxiliary testing and ruling out other comorbidities in a patient with presumed and/or known OIS
4. Awareness of the guidelines set forth by the American Heart Association for carotid endarterectomy and carotid artery stenting
5. The role of anticoagulants and antiplatelet medications in the management of patients with OIS
6. Understand the significance of a multidisciplinary approach when managing an individual with OIS
**Learning Objectives and Key Concepts**

**Case Description**

Listed below is a brief summary of the management and treatment plans for each encounter with Patient JS, in addition to other salient information relevant to this case. Please refer to the **Student Discussion Guide** for patient ocular/medical history and examination findings.

**Literature Review**

OIS, a manifestation of carotid artery disease, is associated with severe bilateral or unilateral carotid artery obstruction and affects both the anterior and posterior segments of the eye. Eighty percent of cases are unilateral. The signs and symptoms of OIS are variable and may be subtle, so that the condition may be either misdiagnosed or overlooked entirely. Carotid artery disease is also associated with disturbances in the ophthalmic artery blood flow and velocity, which may exacerbate the signs and symptoms of OIS. Ocular symptoms are often the first indication that a vascular insufficiency exists.\(^1,2\)

OIS is most prevalent in patients between the ages of 50 and 70 years of age and shows a 2:1 gender predilection towards men.\(^2\) Other risk factors include a history of hemispheric TIA or stroke, a history of intermittent claudication, ipsilateral internal carotid artery (ICA) stenosis of 80-94%, and an absence of collateral vessels on angiography.\(^3\) The following is a list of known causes of OIS: carotid artery occlusion or stenosis, with hypertension being the most common underlying disorder; ophthalmic artery disease, which is identical to carotid artery disease, however there is no evidence of significant hemodynamic changes in the ipsilateral common or internal carotid artery; vasculitis, such as giant-cell arteritis or Takayasu disease, which results in inflammatory occlusion of the carotids. In Takayasu disease, generally bilateral OIS occurs associated with aortic or bilateral common carotid artery occlusion; vascular disorders affecting small blood vessels, such as scleroderma; previous radiotherapy to the head and neck and proximal to the carotids; and compres-

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**Initial presentation: 12/18/2006**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Plan</th>
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<tbody>
<tr>
<td>1. OIS OS secondary to carotid stenosis</td>
<td>Patient educated on findings and told to</td>
</tr>
<tr>
<td>2. Photopsia OD</td>
<td>Return to clinic immediately if any eye</td>
</tr>
<tr>
<td></td>
<td>pain, redness, or vision loss occurred.</td>
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<tr>
<td></td>
<td>Continue clopidigrel bisulfate and aspirin</td>
</tr>
<tr>
<td></td>
<td>as prescribed by vascular surgeon. Return</td>
</tr>
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<td></td>
<td>6 months for dilated fundus exam.</td>
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</table>

**Follow-up #1: 4/4/2007**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Persistent ocular ischemia OS</td>
<td>Return immediately if eye pain, redness,</td>
</tr>
<tr>
<td>secondary to carotid stenosis</td>
<td>or vision loss occurred.</td>
</tr>
<tr>
<td>2. Photopsia OD</td>
<td></td>
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**Follow-up #2: 6/15/2007**

<table>
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<tr>
<th>Assessment</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1) Bilateral OIS secondary to completely</td>
<td>Return to clinic immediately if eye pain,</td>
</tr>
<tr>
<td>occluded right and left internal carotid</td>
<td>redness, or vision loss occurs. Return 4</td>
</tr>
<tr>
<td>arteries</td>
<td>weeks for careful anterior segment</td>
</tr>
<tr>
<td></td>
<td>evaluation, gonioscopy, and intraocular</td>
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<td>pressure check.</td>
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**Follow-up #3: 8/10/2007**

<table>
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<tr>
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<tbody>
<tr>
<td>1. Bilateral OIS OU without neovascularization.</td>
<td>Patient educated that visual phenomena he</td>
</tr>
<tr>
<td></td>
<td>experiences are a result of severe carotid</td>
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<td></td>
<td>stenosis, which will most likely remain</td>
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<tr>
<td></td>
<td>as long as the occlusions are present.</td>
</tr>
<tr>
<td></td>
<td>Return to clinic 6-8 weeks for anterior</td>
</tr>
<tr>
<td></td>
<td>segment evaluation and Humphrey visual</td>
</tr>
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<td>field.</td>
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</table>

**Note.** Other salient information: carotid duplex (6/28/06)—95% stenosis of right carotid; 100% occlusion of left carotid.

---

**Student Discussion Guide**

**Assessment**

1. Persistent ocular ischemia OS secondary to carotid stenosis
2. Photopsia OD

**Plan**

Return immediately if eye pain, redness, or vision loss occurred. NoIR amber filter ordered to relieve symptoms of photophobia.

**Note.** Other salient information: extracranial cerebrovascular duplex exam (1/17/2007): <50% stenosis of the right common carotid artery (CCA), right internal carotid artery (RICA) stenosis 70-99%; right external carotid artery (RECA) stenosis >50% (with high-grade stenosis or a short occlusion with reconstitution); left CCA <50% stenosis, LICA completely occluded, and left external carotid artery (LECA) occluded (with reconstitution). The left CCA remained patent because of a patent superior thyroid artery. 2. Carotid artery stenting was then recommended by vascular surgeon over a carotid endarterectomy with a right ICA stent placement performed 3/6/2007. 3. Extracranial cerebrovascular duplex exam following RICA stent: right CCA stenosis <50%; RICA stenosis 50-69%; RECA stenosis >50%. A patent carotid stent was noted as well as improved velocities compared with the previous study. 4. 3/19/07: left cardiac catheterization performed, revealing 90% stenosis of the ostial segment of the left circumflex artery. No surgery was recommended. Patient was advised to continue with anticoagulation medications and blood pressure management.

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**Follow-up #2: 6/15/2007**

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<tr>
<td></td>
<td>pressure check.</td>
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**Note.** Other salient information: 1. Extracranial cerebrovascular duplex exam (4/12/2007): right CCA stenosis nearly occluded, the RICA completely occluded, and RECA >50% stenosed; left CCA >50%, left internal carotid artery (LICA) occluded, LECA occluded with reconstitution. Impression by primary care physician was noted as early postprocedure carotid stent thrombosis (closure at 2 weeks s/p right carotid stent). 2. Repeat carotid duplex of the right side (5/31/2007) revealed that the right CCA and RICA were occluded. The RECA was reconstituted.

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**Follow-up #3: 8/10/2007**

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<td></td>
<td>segment evaluation and Humphrey visual</td>
</tr>
<tr>
<td></td>
<td>field.</td>
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</tbody>
</table>
tion caused perioperatively, by severe
thyroid orbitopathy or by a neck
tumor.4-6 Studies have shown a 40 per-
cent 5-year mortality rate in individuals
diagnosed with OIS and a poor visual
prognosis.7 It is interesting to note that
the primary cause of death in OIS is
myocardial infarction (63%) and not
cerebrovascular accident (CVA) or a
stroke. Although, strokes are the sec-
ond leading cause of death in this pa-
tient population (19%)1

Signs and symptoms of OIS are usu-
ally elicited when the ipsilateral carotid
artery is greater than 90% occluded.
The most common symptom of OIS is
slowly progressive loss of vision, though
10% of cases describe a sudden visual
decline. A number of patients present
with amaurosis fugax only and, more
rarely, light-induced amaurosis.1,8 An-
other phenomenon one might expe-
rience is increased teichopsia, which is
depicted as positive after-images of
varying shapes and colors.1 A dull ache
or pain in the eye or orbit is another
presenting feature in nearly half of pa-
tients with OIS and may be caused by
ischemic damage to the ophthalmic di-
vision of the trigeminal nerve, anterior
segment inflammation, or elevated in-
traocular pressure.1,4

Exact presentations of OIS depend on
the extent of ischemia and the degree
of secondary neovascularization. As
mentioned previously, OIS can mani-
fest signs in the anterior and posterior
groups of the eye. The most prevalent
anterior signs of OIS are: ruberosis iri-
des, uveitis, episcleral vascular conges-
tion, mid-dilated and sluggish pupils,
corneal edema/striae, and lowered IOP.
These findings are a result of hypop-
erfusion to the long and anterior cili-
ary arteries.4 Low intraocular pressure
in the presence of ruberosis irides has
been described by some practitioners
as pathognomonic for OIS. Typically,
neovascularization of the iris, along with
retinal ischemia, will induce neo-
vascular glaucoma; however, if the ca-
rotid has significant stenosis, then the
ciliary body is hypoperfused and the
IOP may be lower than normal. Some
patients with the latter will develop an
IOP spike if they have a carotid endar-
terectomy that results in increased cili-
ary body perfusion.

Characteristic posterior segment find-
ings include: narrowed retinal arteri-
oles, dilated and irregular retinal veins
(not tortuous), and mid-peripheral in-
traretinal hemorrhages (see Figure 1).
These findings are collectively referred
to as hyperperfusion retinopathy and
occur as a result of decreased arterial in-
flow secondary to significant stenosis of
the ipsilateral carotid artery, leaving reti-
nal capillary beds in the mid-periphery
and periphery starved for oxygenated
blood. Neovascularization of the disc
and/or retina, cotton wool spots, col-
laterals, cystoid macular edema (CME),
and a macular “cherry red” spot may
also be present as further consequences
of ischemic damage to the surround-
ning retinal capillaries. “Sludging” of the
blood column within the retinal veins
can occur as well due to an overall lack
of perfusion pressure, a finding known
as venous stasis retinopathy.1,4,7

The sequelae of carotid artery disease
can progress quickly, especially if bi-
lateral carotid stenosis is present. The
development of collateral vessels in re-
sponse to chronic ischemia spares most
eyes in cases of severe carotid stenosis.
It is possible, however, that the devel-
opment of these vessels may produce a
“steal syndrome,” diverting blood away
from the eye and to the brain instead,
thus actually causing OIS.1 Collateral
flow to the eye may be supplied by the
posterior circulation of the brain or
by branches of the external carotid ar-
tery.13

A variety of diagnostic tests and imag-
ing are available to aid in the diagnos-
is and treatment of OIS. Intravenous
fluorescein angiography (IVFA) is
helpful in determining the appro-
piate treatment for patients with OIS.4
In patients with OIS, IVFA will reveal
delayed choroidal filling, prolonged arteriovenous transit time, and retinal
vessel staining.1 Ophthalmodynamom-
etry measures ophthalmic arterial pres-
sure and can be used to distinguish OIS
from a central retinal vein occlusion.
In OIS, retinal artery pressure is usu-
ally low and pulsations of the central
retinal artery may be present sponta-
nously or be elicited with light digital
pressure.1,4 Electroretinography (ERG)
is another diagnostic tool. Patients with
OIS will exhibit decreased amplitude of
the a and b waves due to a reduction in
central retinal artery and choroidal
perfusion.1,4 Carotid duplex scanning
and angiography are excellent imag-
ing modalities that visualize ulcerative
vascular lesions, the grade of steno-
sis or occlusion, and the formation of
mural thrombus. They also assist in
demonstrating collateral circulatory
patterns within the carotid system.10
Another option is intra-arterial digital
subtraction angiography (DSA), which
uses computer image enhancement to
determine blood flow.1 Orbital color
Doppler imaging can help facilitate the
study of the orbital vasculature and will
display reduced peak systolic velocities
of central retinal and/or posterior cili-
ary arteries in OIS.10,11

Differential Diagnoses

The differential diagnoses considered in
this case included:

• CRVO shows similar signs; how-
ever, there may be optociliary shunt ves-
sels and dilated retinal veins that are
tortuous and regular in caliber. CRVO is
generally characterized by the presence
of optic disc swelling. Ophthalmom-
dynamometry may distinguish CRVO
from OIS. Ophthalmic artery pressure is
normal to increased in CRVO.1,2,4,7

• Diabetic retinopathy is usually
senseen bilaterally and is typically
more symmetrical in appearance
than OIS. Retinal hemorrhages are
usually concentrated in the
persistence pole. Hard exudates
are generally present in diabetic
retinopathy but conspicuously
absent with OIS. If anterior seg-
ment signs are also visible, one
should be more suspicious of
OIS.1,2,4,7

• Hypertensive retinopathy has
similar findings to OIS, such as
retinal arteriolar narrowing and
cotton-wool spots. Patients with
these ocular changes tend to be
asymptomatic.5,7,12

• Venous stasis retinopathy (VSR)
is a milder form of nonischemic
CRVO. Presenting signs include
dot and blot and flame-shaped
hemorrhages, along with dilated
and tortuous retinal vessels and
microaneurysms. The condition
is usually bilateral and is associ-
ated with hyperviscosity syn-
dromes such as polycythemia
vera, multiple myeloma, and
Waldenstrom’s macroglobuline-
mia. Patients with VSR tend
to have better overall perfusion
compared with patients with
OIS.2,7
Anemic retinopathy is classified by the presence of superficial flame or blot-shaped, intraretinal hemorrhages, cotton-wool spots, and, rarely, exudates, retinal edema, and vitreous hemorrhage. These findings will usually resolve once the treatment of anemia is initiated.

Nongranulomatous anterior uveitis shares a few presenting signs with OIS, including dull orbital pain, decreased vision, and anterior chamber inflammation. The two can be easily differentiated, however. In a patient with uveitis, the condition normally resolves rapidly to treatment with topical corticosteroids, whereas it is often refractory in OIS.

OIS is most commonly recognized by its retinal findings, including dilated retinal veins that are irregular in caliber and are not tortuous. Narrow arterioles, cholesterol plaques, mid-peripheral retinal hemorrhages, iris neovascularization, and posterior segment neovascularization are other characteristic signs. A key diagnostic factor is the presence of asymmetric vascular disease in the anterior and/or posterior segment of the eye.

**Discussion**

There are several treatment options one may consider when determining the proper management for a patient with OIS. Carotid endarterectomy has been used for many years in the treatment of carotid artery disease and patients with OIS. It is an invasive procedure where the internal, external, and common carotid arteries are clamped. The lumen of the internal carotid is then surgically opened and the atheromatous plaque substance is removed from the vessel wall. Several studies have exhibited the benefits of endarterectomy. Two such studies include the North American Symptomatic Carotid Endarterectomy trial (NASCET) and the European Carotid Surgery Trial (ECST). These trials showed that carotid endarterectomy was beneficial in reducing the risk of stroke in patients who had 70-99% stenosis of the ICA, as long as it was noted within 180 days after hemispheric or monocular TIA or minor hemispheric stroke. As stated in the American Heart Association guidelines, it is suggested that patients with 70% to 90% ipsilateral stenosis, who have a history of TIA or ischemic stroke within the previous 6 months, undergo carotid endarterectomy of the occluded artery. This procedure is also recommended for patients with moderate ipsilateral stenosis (50-69%), if they have recently experienced TIA or ischemic stroke. Carotid endarterectomy is not indicated in patients with less than 50% stenosis.

One case report by Kaiboriboon et al described an incidence of bilateral carotid stenosis treated with carotid endarterectomy. Following a right carotid endarterectomy, visual symptoms resolved and photostress test results were found to be normal. Some professionals are now questioning the effectiveness of carotid endarterectomy, stating that the current research is inadequate to determine if it is truly beneficial in the treatment of carotid artery disease. One disadvantage of carotid endarterectomy is its association with increased systemic oxidative stress, which has been shown to be a predictor in the development of recurrent stenosis. Nonetheless, it is still considered to be the standard of care for significant carotid stenosis.

Carotid artery angioplasty with stent placement (CAS) is emerging as a safe, less invasive alternative to carotid endarterectomy in restoring cerebral perfusion pressure as well as ocular circulation. Many studies are underway, some with conflicting findings, but all are focused on determining the efficacy and benefits of stenting compared with endarterectomy. According to the American Heart Association guidelines, carotid stenting is a viable option for patients with symptomatic severe stenosis (>70%) and in whom the stenosis is too difficult to access surgically, those who have medical conditions that increase the risks for surgery, or when re-stenosis has occurred. The ECST included 125 patients who fit this criteria and found angioplasty with stent placement to be more efficacious in this subset of high-risk patients than carotid endarterectomy. In recent years, angioplasty of the external carotid arteries with drug-eluting stents has been under investigation in the treatment of symptomatic carotid stenosis and has been associated with a 70-80% reduction in the rate of re-stenosis compared with bare metal stents. Stents included in these trials are the sirolimus-eluting Cypher stent (Cordis Corp., Warren, NJ) and the Boston Scientific's (Natick, MA) paclitaxel-eluting Taxus stent. The benefits of carotid artery stenting exclusively on ophthalmic blood flow are also being studied. Kawaguchi et al discovered that, within 24 hr of undergoing carotid artery stenting, patients who initially had retrograde ophthalmic artery flow as a result of carotid artery stenosis were shown to have increased velocity in blood flow and resolution of flow in the antegrade direction. In addition, these patients showed marked improvement in visual symptoms and signs of OIS, revealing that this procedure has potential to be another safe and effective method in minimizing the ocular manifestations of carotid artery disease. Findings from the CREST study have encouraged the cautious approval of carotid artery stenting in patients with neurological symptoms (i.e., ipsilateral stroke, TIsA, and amaurosis fugax) in association with severe medical comorbidities. For Patient JS, it was determined that angioplasty with carotid artery stenting was a more appropriate route of treatment over carotid endarterectomy, given his high-grade bilateral internal carotid stenosis.

One consequence of OIS is neovascular glaucoma. The management and control of IOP can be extremely challenging after a patient presents with neovascularization of the angle. Topical and oral glaucoma medications, with the exception of prostaglandins and pilocarpine (as they may exacerbate ocular inflammation), can be initiated to manage elevated IOP levels. In severe cases of neovascular glaucoma, surgery may be considered. Trabeculectomy with antimetabolites, aqueous tube shunts, and diode laser cyclocdestruction are possible surgical options. Photodynamic therapy (PDT) with verteporfin recently has proven to be effective in partially obliterating anterior segment neovascularization in certain cases. Other surgical options emerging include a combination pars plana Ahmed valve implant with vitrectomy and panretinal photocoagulation (PRP) or a complete PRP in combination with a trabeculectomy and mitomycin C. Panretinal laser photocoagulation is another method of treatment considered in patients with OIS and is indicated when areas of anterior and/or posterior neovascularization are observed. Most evidence supporting the use of PRP...
in the treatment of OIS stems from its effects on patients with diabetic retinopathy and retinal vein occlusions. One study comparing treatment modalities for neovascularization in the event of ischemic CRVO showed no prevention of angle or iris neovascularization if PRP was initiated prophylactically. However, it did show regression of angle and iris neovascularization and reduced progression to neovascular glaucoma. PRP does have the potential to cause some adverse side effects, including increased ocular pain and a severe deterioration of the visual field in eyes already having a low central visual acuity. It should be noted, however, that PRP is currently the standard of care for treating neovascularization and, therefore, should be administered to any patient showing progression of neovascularization.

Intravitreal bevacizumab (Avastin; Genenteche/Roche, South San Francisco, CA), an antivascular endothelial growth factor (VEGF) monoclonal antibody, has recently been trialed in patients who develop iris neovascularization and cystoid macular edema (CME) as a result of ocular ischemia. VEGF is recognized as a key regulator of pathological ocular neovascularization. In OIS, retinal ischemia triggers the release of a number of angiogenic factors, including VEGF. In one study, only 1 week after treatment with Avastin, 2 patients were observed to have regression of iris neovascularization and some resolution of macular edema but without changes in their best-corrected visual acuity or IOP. After the development of neovascular glaucoma following a central retinal artery occlusion, a single intravitreal injection of Avastin led to the dramatic regression of new iris and angle vessels as well as a sharp drop in 1 patient's intraocular pressure. Moreover, three cases of angle closure secondary to neovascularization were treated with a sole injection of Avastin and showed rapid resolution in as early as 1 week. For these reasons, intravitreal anti-VEGF agents may be used as an adjunctive therapy for this subset of patients. It is a fairly noninvasive method for treating these manifestations of OIS and can be administered in an outpatient setting.

Anticoagulants and antiplatelet agents can be initiated in the advent of carotid stenosis, especially if stenosis is noted bilaterally and is so severe that surgical intervention is contraindicated. As in the case of Patient JS, it may be recommended that patients be maintained on an anticoagulant medication such as warfarin and/or an antiplatelet medication such as clopidogrel bisulfate. The American Heart Association recommends antiplatelet agents over anticoagulants to reduce the risk of recurrent stroke and other cardiovascular events for patients with noncardioembolic ischemic stroke or TIA. A low daily dose of aspirin, usually between 50 and 325 mg, is also recommended in preventing further TIA or strokes in symptomatic patients. The use of this medication is somewhat controversial, as there is an increased risk of bleeding complications with long-term use, such as nose bleeds, bruising, and excessive bleeding after minor injuries. More severe problems, such as spontaneous bruising, bleeding that is difficult to arrest, frank hematuria, gastrointestinal bleeding, and hemoptysis can also occur and require urgent assessment. Patients with nonhemodynamically significant stenosis (<50-60%) may benefit from chronic low-dose aspirin treatment; however, anticoagulant and antiplatelet agents are generally reserved for patients with inoperable carotid disease.

Conclusion
OIS is most likely an underdiagnosed condition and provides many diagnostic and therapeutic challenges due to the spectrum of signs and symptoms that patients may present. The diagnosis of OIS is indicative of an individual's poor systemic health and carries significant visual consequences. Fortunately, in the case of Patient JS, his visual outcome remains good at this time. However, he is at high risk for rapid vision loss. Studies have shown that vision can progress to “counting fingers” or worse after 1 year, even with maximal therapeutic intervention. The management of OIS is tedious and the primary goal is to prevent further ocular damage and vision loss. A 90% relative risk reduction for stroke, and ocular consequences such as OIS, can be achieved through the treatment of this and other systemic comorbidities. A multidisciplinary team of physicians, including an optometrist or ophthalmologist, cardiologist, neurologist, vascular surgeon, and, in some cases, an interventional neuroradiologist may be necessary to ensure maximum patient outcome.

There are a variety of treatment options available for patients if the signs of OIS are recognized early. Some treatments prevent further damage without visual improvement, whereas others can help maintain or improve visual outcome as well as the overall systemic well being of the patient. As primary care optometrists, it is our duty to recognize the subtle ocular signs and symptoms of OIS and proceed with prompt medical treatment and referral when necessary.

References
Initial Experiences With an Audience Response System in the Optometric Classroom

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Elizabeth A. Steele, OD, FAAO

Abstract

Background: This study assessed the advantages and disadvantages of an audience response system (ARS) in the optometric classroom and its effectiveness as a teaching aid. Methods: Data were gathered from a survey of students and faculty members regarding the use of the ARS in the optometric classroom. Results: The results of this survey study showed that when effectively integrated into a lecture, the ARS can provide an incentive for student attendance, increase class participation, promote active thinking, and make lecture time more enjoyable. Conclusions: The ARS is an effective way to promote active learning in the optometric classroom.

Key Words: TurningPoint, PowerPoint, audience response system, ARS, clickers, active learning

Introduction

With the ever-expanding volume and complexity of the optometric curriculum, faculty members have been given the responsibility of presenting a greater amount of information to students, almost invariably without an increase in lecture time. The need for innovative teaching strategies is of utmost importance to facilitate active learning and retention of the material that is being presented.1 Growing in popularity among universities and graduate programs, audience response systems (ARS) create an enjoyable learning environment, which enables instructors to instantaneously “poll the audience” and to display the responses in real time on the projector screen. The ARS (also known as classroom response system, electronic voting system, polling technology, or “clickers”) assists in animating lectures, generating discussion, improving attendance, and enhancing student involvement in a nonthreatening yet interactive atmosphere.2,3 It has been shown that using this technology can increase long-term retention of knowledge and possibly even improve health care outcomes.4-7 Currently, there are publications reporting ARS use in many health care programs, including medicine, dentistry, nursing, veterinary medicine, and psychology.8 However, no data have been presented related to optometric education.

Immediate feedback provided by audience response technology allows the instructor during his/her lecture to determine if more elaboration is necessary or if proceeding to a different topic is appropriate. This feedback reveals to the student his/her own understanding of the concepts questioned, particularly compared with classmates.9,11 The anonymity provided by the ARS onscreen display allows for enhanced student engagement and participation, providing an active learning environment, especially for the less vocal students.9,11

ARS technology has existed since the 1970s and has undergone several generations of improvements.7 Earlier systems were costly, with limited portability due to the need for a wired connection to the receiver. Later, wireless infrared (IR) technology became available that improved portability, but these systems were not able to accurately accommodate class sizes of over 100 students.2,7
In 2005, lower cost radiofrequency (RF) systems were introduced, which in addition to improved accuracy, were able to overcome the limitation of the IR technology and to handle class sizes on a much greater scale.\(^2,7\)

The purpose of this study was to investigate initial experiences with an ARS in the optometric classroom. Perspectives of students and faculty members were obtained on the advantages and disadvantages of the ARS and its effectiveness as a teaching aid.

**Methods and Materials**

In November 2007, the University of Alabama at Birmingham (UAB) School of Optometry purchased the TurningPoint (Turning Technologies, Youngstown, OH) ARS. This particular ARS was chosen because it was already being used by the UAB School of Medicine. Because medical and optometry students share basic science courses at UAB, synchronization was the driving factor in selecting TurningPoint. Students were required to purchase one response device (clicker) that can be used for all courses within the 4-year curriculum. Turning Point receivers were purchased by the optometry department for the classroom computers.\(^3\) Program software and technical support were obtained online at www.turningtechnologies.com. In addition, onsite training workshops were held for the faculty to assist in learning the features and capability of this audience response program.

The TurningPoint ARS (Figure 1) utilizes a portable, credit-card sized, hand-held keypad known as a clicker with which the user can answer questions displayed on the projection screen. Data from the students’ responses are sent by way of a RF signal to a receiver connected to the presenter’s computer. The data collected are interpreted by the installed software and are displayed on the screen anonymously and instantaneously (Figure 2). The system is fully integrated into PowerPoint (Microsoft, Redmond, WA), allowing the presenter to create question slides into an existing PowerPoint presentation and to present a lecture with ARS using a single program. Question slides can be enhanced with graphics, pictures, and sound clips.

Each clicker has a unique identification number that is linked to a particular student enrolled in the course, allowing instructors to collect individual student data regarding the questions answered. Data collected during the session can be used to generate 35 different types of reports, including participant lists, demographics, and percentage scores based on correct answers. All reports are created as Excel (Microsoft, Redmond, WA) documents, and the information gathered can also be imported into Web-based course management systems such as Blackboard Vista (Blackboard, Inc., Washington, DC).\(^3\) Clinical Evaluation of the Visual System (CEVS) is a four-quarter course sequence for teaching optometric clinical skills and methods. This course was one of the first in the optometry program at UAB to integrate the use of clickers into its lectures. In this course, the instructors typically include 3–4 clicker questions per lecture hour, reinforcing the key points of the lecture topic. The types of questions asked require critical thinking and encourage the interpretation and correlation of patient data. At the end of each lecture, the data col-
lected from student participation are used to monitor attendance and to provide students with bonus participation points toward their overall course grade. The clicker questions are omitted from the lecture handouts of the PowerPoint slides, providing students with an incentive to attend lectures in addition to the bonus points. The instructors have also used the “fastest responder” feature of the TurningPoint software to create a “Jeopardy”-style review game at the end of each term of the course, in which prizes are given to the students with the highest scores. The fastest responder feature is an advanced tool that identifies the student who responded first and makes his/her name and response time visible on the projection screen. The response time is shown to the nearest hundredth of a second.

After the first of a four-quarter course sequence, students enrolled in CEVS were surveyed on their perceptions of clicker use during lectures. The data collected from the survey were used to assess the students’ satisfaction with the ARS and its ability to enhance their learning environment. In addition, faculty members of the UAB School of Optometry were surveyed on their experiences with the TurningPoint software and utilization of the technology in their courses. Voluntary anonymous participation was obtained for both surveys.

### Results

Of 47 students enrolled in the CEVS course, 47 students (100%) responded to the survey. Of the responses received, 46 students (97.9%) felt that the ARS was a helpful learning aid, and 40 students (85.1%) preferred lectures that used the ARS over those that did not. The perceived ease of use of the TurningPoint response device was an average of 1.74 on a 5-point Likert scale (1, very easy; 2, moderately easy; 3, neither easy nor difficult; 4, moderately difficult; and 5, very difficult). The students’ experiences with the ARS are shown in Table 1. The eight-question survey demonstrates that students enjoyed and benefited from ARS use in the classroom. Eighty-seven percent of students either agreed or strongly agreed that the ARS improved retention of material presented in lectures and favorably affected their engagement and participation in lectures. Overall, clicker use increased student understanding of lecture material, made classes more enjoyable, and helped students apply concepts learned in class. Forty-seven percent of students felt that they performed better on exams and quizzes because of the ARS.

Most students (83%) preferred that clicker questions be used only for bonus points, in which their responses did not adversely affect their grade. When asked if they felt the cost of the clickers was reasonable, 32 students (68.1%) felt that it was, whereas the remaining 15 students (31.9%) felt the clickers should be provided at a lower price or at no charge. One student commented that the first clicker should be free, but if a student were to lose or break his/her clicker, he/she should be charged a replacement fee.

### Table 1

Student Survey Results on Experiences Using the Audience Response System (ARS)

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Mean (n=47)*</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ARS improves my retention of material presented in lecture</td>
<td>32%</td>
<td>55%</td>
<td>13%</td>
<td>0%</td>
<td>0%</td>
<td>4.19</td>
<td>0.65</td>
</tr>
<tr>
<td>The ARS affects my engagement and participation in lectures</td>
<td>66%</td>
<td>21%</td>
<td>9%</td>
<td>4%</td>
<td>0%</td>
<td>4.49</td>
<td>0.83</td>
</tr>
<tr>
<td>The ARS increases my understanding of the subject content presented in lecture</td>
<td>34%</td>
<td>38%</td>
<td>24%</td>
<td>4%</td>
<td>0%</td>
<td>4.02</td>
<td>0.87</td>
</tr>
<tr>
<td>The ARS makes the lecture more enjoyable</td>
<td>23%</td>
<td>34%</td>
<td>26%</td>
<td>11%</td>
<td>6%</td>
<td>3.57</td>
<td>1.16</td>
</tr>
<tr>
<td>The ARS encourages me to clinically apply material learned in lecture</td>
<td>47%</td>
<td>32%</td>
<td>19%</td>
<td>2%</td>
<td>0%</td>
<td>4.23</td>
<td>0.84</td>
</tr>
<tr>
<td>The ARS helps me to think throughout the lecture and stay more alert</td>
<td>47%</td>
<td>23%</td>
<td>24%</td>
<td>2%</td>
<td>4%</td>
<td>4.06</td>
<td>1.09</td>
</tr>
<tr>
<td>I feel more prepared and perform better on quizzes and exams because of the ARS</td>
<td>13%</td>
<td>34%</td>
<td>42%</td>
<td>9%</td>
<td>2%</td>
<td>3.47</td>
<td>0.91</td>
</tr>
<tr>
<td>Anticipating ARS questions in class motivates me to prepare in advance of the lecture</td>
<td>30%</td>
<td>34%</td>
<td>21%</td>
<td>13%</td>
<td>2%</td>
<td>3.77</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Total number enrolled in course=47; Total number of responses=47 (100% participation).

*Strongly Agree=5; Agree=4; Neither Agree nor Disagree=3; Disagree=2; Strongly Disagree=1.
Of 34 faculty members, 32 responded to the survey (94.12% participation). Of those that participated, 17 (53.1%) reported that they currently integrate clicker questions into their lectures, 15 (88.2%) of whom had attended a TurningPoint training workshop. Of the 15 faculty members who did not integrate clicker questions into their lectures, 5 (33.3%) had attended a TurningPoint training workshop and 13 (86.7%) were planning to integrate clicker questions into their lectures or were willing to consider it in the future. Of the 15 faculty members who did not use TurningPoint in their lectures, 2 did not plan to implement the ARS technology in the future. This represents 6.3% of the total faculty surveyed (n=32). Faculty members not using the technology perceived the major challenges to be that the ARS slowed the pace of lectures and/or that the software was difficult to learn. Approximately 82% of those faculty currently using TurningPoint (n=17) reported utilizing the technology to encourage student interaction in class and to gain feedback about the students’ understanding of difficult concepts. Other reported uses included keeping track of and encouraging attendance (41%) as well as administering in-class quizzes (24%). Approximately 25% of the faculty using the ARS in the classroom reported that the students’ responses to the questions could affect students’ grades in various ways such as through participation points, bonus points, or quizzes. The ease of use of the TurningPoint software was scored as an average of 2.84 on a 5-point Likert scale (1, very easy; 2, moderately easy; 3, neither easy nor difficult; 4, moderately difficult; and 5, very difficult).

Students and faculty were asked to comment on the positive and negative aspects of their experiences with the TurningPoint ARS in the classroom. More advantages were noted than disadvantages, and the most common responses are listed in Table 2.

### Table 2
Feedback From Optometry Faculty and Students Regarding Use of Audience Response Technology in the Classroom

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Faculty Comments</th>
<th>Student Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increased class alertness and participation</td>
<td>• Easy to use</td>
<td></td>
</tr>
<tr>
<td>• Provides active learning environment</td>
<td>• Helps hold my attention in lectures</td>
<td></td>
</tr>
<tr>
<td>• Immediate feedback to confirm whether or not my students are grasping the material being presented</td>
<td>• Immediately confirms my understanding of presented material</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Anonymously able to compare my answers to the class</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Motivates me to review lectures daily and come to class more prepared</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Faculty Comments</th>
<th>Student Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Slows down pace of lecture</td>
<td>• Fear that the system did not accept or register my response, especially when the response affects my grade</td>
<td></td>
</tr>
<tr>
<td>• Requires time up front to learn how to use the program and write questions to integrate into lectures</td>
<td>• Takes away from lecture time</td>
<td></td>
</tr>
<tr>
<td>• Concerns about academic dishonesty when using clickers for a graded exercise</td>
<td>• If my clicker is not functioning properly (such as a dead battery), then I cannot receive credit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cost of the response devices</td>
<td></td>
</tr>
</tbody>
</table>

### Discussion
The results of this survey study showed that, when effectively integrated into a lecture, the use of an ARS can provide an incentive for student attendance, increase class participation, promote active thinking, and make the time spent in lecture more enjoyable for students. Successful use of the audience response technology in lectures is best achieved when questions are used as a review (i.e., posing several questions in a row either at the beginning or end of a presentation) or to stimulate audience attention (i.e., scattering questions throughout the lecture). It has been shown that adult attention tends to peak at the beginning of a presentation, but quickly falls after 15–20 minutes (Figure 3), which greatly impacts long-term retention and recall of presented information. Reinforced by literature previously cited, our survey results and personal experiences showed that both students and faculty members generally perceived a benefit from clicker use in the optometric classroom. Using ARS in the classroom provides immediate, real-time feedback to student and presenter, a suggested advantage to both parties. The enhanced realization of students’ thinking and conceptual understanding allows the presenter to adjust the lecture content or format if necessary. If most students have a thorough grasp of the material based on the responses, the instructor can proceed to the next topic. However, if there are several students who answered incorrectly, the instructor can provide further explanation as necessary. This feedback also provides a means by which students can compare their own knowledge with that of their classmates in a nonintimidating manner. If a particular student answered incorrectly, and most others did not, that student is provided with increased motivation to study in the area of concern. On the
Optometric Education

Volume 34, Number 2 / Winter 2009

Optometric Education

lic humiliation and increasing the likelihood of participation among less assertive and vocal students.8,9,18 Especially applicable to this technically advanced generation of students, ARS also provides a game-based learning approach that makes lectures more enjoyable.5,9 This approach is particularly appropriate when the lecture is on a topic that is less interesting to the student.

Active learning, generally provided by discussions in lecture or small-group format, has long been shown to improve the retention of knowledge.9,17 Clickers in the classroom provide an alternative method of active learning in that all students are expected to follow along and respond to questions that appear during the presentation. Class participation is greatly increased, especially when clicking affects a student’s grade.9,10,16,19 Furthermore, the participation created by the integration of audience response systems has been shown to improve long-term retention.4,5,15,20 Multianswer questions can be placed strategically throughout a lecture to not only test key concepts but to generate discussion, providing further engagement.15,17,19 Compared with class discussions alone, the use of ARS allows students to anonymously visualize their responses in class compared with their classmates, eliminating the fear of public humiliation and increasing the likelihood of participation among less assertive and vocal students.8,9,18 Especially applicable to this technically advanced generation of students, ARS also provides a game-based learning approach that makes lectures more enjoyable.5,9 This approach is particularly appropriate when the lecture is on a topic that is less interesting to the student.

Although clicker use is perceived to provide many benefits, our survey results revealed some disadvantages, mainly of the technical type. Instructors must learn the software, and additional time is required ahead of time to create the clicker questions and to effectively integrate them into a lecture.6,10 The potential for technical problems during the lecture varies between different ARS systems and can be intimidating, especially to less computer-savvy instructors.15 As shown in our faculty survey, TurningPoint has been reported to slow the transition between PowerPoint slides and may occasionally overload a computer system. Although compatibility with different computers can be an issue, we have found that TurningPoint is able to function on both PC and Mac machines through the Windows operating system. Online and hands-on workshops as well as trial runs can assist in preparing instructors and help them learn what to expect during a presentation. Depending on the ARS system used and the type of clicker purchased, battery life and malfunctioning clickers can be an issue as well.18

As found in our survey, clicker use has been reported to create anxiety for some students, especially when data are used to influence their grade in a course. Some concern has been expressed regarding the potential for cheating using clickers (if used for class quizzes and other grading) and how to deal with lost or forgotten clickers.8,18 To help reduce this anxiety among students, it is important to stress in the course syllabus how the clickers will be utilized (e.g., for grades, participation, or attendance) and the consequences of academic dishonesty. If the clickers are to be used for examinations or quizzes, additional proctors or policies may be needed.18

While the use of ARS in the classroom allows for creative reinforcement of important concepts, it may impede the lecture format by reducing flexibility and decreasing the available time to cover required material.19 It has been estimated, and found from our personal experiences, that approximately 5–10 minutes per hour should be allowed for clicker questions if one question is included for every 15–20 minutes of lecture material.7 Generally, question slides are created ahead of time and arranged within the presentation in a specific order, generating a less flexible lecture style for some instructors. Awaiting the students’ responses to clicker questions and adjusting the lecture material accordingly may, in some cases, also contribute to a decrease in available lecture time. Some instructors, however, have described that this loss of breadth is compensated for by the gain in depth, when considering the class participation and discussion generated from clicker use.5,8 Improved depth of learning and increased long-term retention of material that may be provided by audience response technology can be influential for the optometric student. As future health care providers, it is of utmost importance that optometry students retain material taught in lecture for patient care instead of solely for a course examination. This transition of the traditional style of “teaching by telling” to “teaching by questioning” may be difficult for some instructors at first.15,21

Instructors concerned about time management during the lecture may wish to prepare an outline or script in advance to be ready for possible discussion that may arise from clicker usage.\(^3,\(^8\)\)

In addition to creating questions that will either reinforce important concepts or review a previous lecture’s key points, TurningPoint and other ARS systems have additional capabilities. Clickers can be used for attendance records, anonymous voting or polling, and for getting to know the audience.\(^8\)

Small groups can be assigned into teams within TurningPoint for group exercises, competitions, data slicing, and discussions. Feedback from our survey showed that students perceived a greater benefit, as expected, when answering questions incorrectly did not inadvertently affect their grades.

Based on our experience, we offer the following suggestions for faculty interested in introducing ARS technology into the classroom:

- Research commercially available ARSs and select the best one for your academic program. Strive for synchronization within the college or university. Using a single audience response program will help keep costs down for students (only need to purchase a single response device) and for the university (only one type of receiver is needed). Technical support is also simplified.
- Define your goals for using the ARS. Decide ahead of time how you want to incorporate the questions into your lecture (e.g., for review or to regain audience attention) and how you will use the data generated. Do you want to use the questions for a grade or participation credit?
- Practice using the technology before implementing it with your students. Many of the ARSs offer online training courses or will provide a representative to travel to your college or university for a demonstration and training workshop. Become comfortable with the many different options available within the program and select which function(s) would work best with your teaching style.
- Share your ideas and experiences with other faculty members. Attend a lecture from another instructor who is currently using an ARS in an active learning environment. Discuss what has and has not worked for him/her.
- Plan on devoting time during your lectures for extra questions and potential discussions. If you are inflexible with time and on a strict schedule, then the ARS may not work well for you. If your purpose for using the ARS is to help maintain students’ attention, approximately one clicker question per 15–20 minutes of lecture is recommended.
- Enjoy the technology and get creative. The benefits of providing an enjoyable, active learning environment for your students can result in improved attendance, greater participation, and increased comprehension of presented material.

**Conclusions**

Integrating new technology such as the ARS into the optometric classroom is a way to promote active learning and to enhance personal teaching style. With careful planning and creativity, faculty can help meet the needs of this generation of technically competent students while becoming more effective educators. We have found that successful integration of an ARS requires motivation and flexibility from the instructor. As our survey showed, optometry students valued the benefits of clicker use in the classroom. Although studies from various health care disciplines have shown an improvement in long-term retention of knowledge, additional analysis of optometric student learning outcomes with and without this technology is also needed.

**Acknowledgment**

The authors have no affiliation with or financial interest in any of the products mentioned.

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Supplementing Traditional Lecture-Based Pedagogy With Online Discussion Boards and Assessment Tools

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Abstract

Promoting active engagement in a lecture setting often can be challenging; however, course management systems offer a discussion forum tool to foster social learning through instructor-to-student as well as peer-to-peer collaboration. The publicly shared aspect of discussion boards then allows for multiple interpretations and learning that are individually mediated by the learner. This is a descriptive study of using online discussion boards and online assessment tools to supplement the traditional classroom for a pediatric optometry course.

Key Words: Problem-based learning (PBL), pedagogy, course management systems, discussion boards

Background

Undergraduate and traditional health care education teaching models too often emphasize memorization of facts as the foundation for basic and clinical science course work. To address this pedagogical challenge, a growing number of institutions have adopted the pedagogy of problem-based learning (PBL) where students engage in true to life problems as a forum for learning. PBL was first implemented in McMaster University medical program in 1969 and gained more widespread adoption in 1985, when Harvard Medical School adopted PBL pedagogy. Instruction included small-group case discussions centered on cases of increasing complexity, each with their own learning objectives. Supplemental information was delivered in lecture, labs, readings, and computer-aided instruction sessions. Although there continues to be disagreement in measurable outcome differences between traditional and PBL, students have reported PBL to be more challenging, stimulating, relevant, and an improvement in their ability to relate to patients. However, the substantial institutional resource demands for such a curricular reform preclude more widespread adoption of PBL pedagogy.

A growing trend in campus-based institutions has been a hybridization of content delivery where classroom instruction has been supplemented with online content delivery as an instrument to enhance student-centered learning. By 2005, Herse and Lee found among all known schools and colleges of optometry in North America only two institutions had not been using a course management system. A course management system, such as Blackboard Academic Suite (Blackboard Inc., Washington, DC) is a Web-based software tool designed to help educators streamline delivery of course content. All course management systems share core components, including tools for digital content storage and delivery, synchronous and asynchronous communication, online assessment and survey tools, grade book, whiteboard, digital drop boxes, and email communications. Synchronous and asynchronous discussion boards enable instructors to create forums and threaded discussions. Assessments and surveys allow instructors to deliver automatically scored as-
Discussion board topics were selected based on the clinical application of lecture content. For example, following a lecture on developmental visual milestones, students were asked to post a patient education script on how they would educate a future parent on why it would be important to bring their child in for a comprehensive eye examination at 6 months of age. An example of a discussion thread dialogue can be found in Figure 1. Students were instructed to make their initial post no later than 11:59 p.m. on the Monday following the Thursday lecture. Students were also required to provide feedback and commentary to at least one other member of their assigned discussion thread prior to the start of the following week’s lecture. Students were given the additional instruction that replies such as “nice job” or “good website” without additional qualification would not be awarded credit.

Online discussion boards for instruction have been known to help foster independent learning through active engagement of the course material, peer collaboration, and continually refining and building new knowledge. Online discussion boards as instruction for promoting the application of basic sciences within the context of clinical cases within the 1st-year curriculum at the State University of New York, State College of Optometry. Through their experiences, the use of online discussion boards for clinical case teaching was a marginally successful teaching tool due to the student’s limited clinical exposure. To determine if discussion boards would be more successful with students who have more clinical experience, 3rd-year students in the pediatric optometry course at the Southern California College of Optometry were required to participate in weekly online assignments. The goal of this descriptive study was threefold: (1) to describe how the basic tenets of PBL were applied within the familiar structure of traditional, lecture-based pedagogy; (2) to report on the student’s perception of this curriculum modality; and (3) to quantify the faculty resources necessary to incorporate the hybrid PBL and traditional lecture approaches.

Methods

Students in the pediatric optometry course were required to participate in online assignments, including patient education discussion threads, case analysis discussion threads, question-and-answer discussion threads, and a laboratory assessment [Appendix A].

*Figure 1*

**Explain Why Your Pregnant Patient Should Bring Her Daughter in for Her First Comprehensive Eye Examination When She Turns 6 Months Old**

**Student #1 reply to discussion prompt:**
I encourage you to bring in your baby for an eye exam when he/she is 6 months old. The reason is because we want to check if your baby’s visual system is developing normally and to see if your baby is at risk for any eye disorders. It is important to diagnose visual problems early because children are more responsive to treatment. In fact, many disorders can be detected, treated, and prevented if it is caught early. We recommend your child to have an eye exam at 6 months, again in 3 years, and another before starting school. Do you have any questions?

**Student #2 reply to Student #1:**
I think that explanation is a good start but if I was a new mother I would want to know what are the disorders that you are talking about and how they can affect my baby.

**Student #3 reply to Student #2:**
I agree. I think if I was a mom I would want to know what particular disorders I would want to prevent as well. But, I had a hard time trying to explain that part. I wanted to tell the patient what we are trying to prevent such as amblyopia, but I also don’t want to really scare the patient. Pregnancy is already a little scary and stressful...Maybe Dr. Chu has some advice as far as how we can give more information to the patient without scaring the new mom.

**Student #4 reply to Student #3:**
I agree that it’s difficult to express the consequences if such abnormalities are left untreated without scaring a new mother. But maybe we can just concentrate on how beneficial an eye exam is, and let them know that the sooner an abnormality is found then the easier it is to correct, then we can provide them with pamphlets or links to websites, so they can read for themselves what visual disorders can lead to. After hearing your recommendations and reading about it themselves, they may feel so relieved they have you as an optometrist who’s informed and who’s providing the correct recommendations for a child’s visual development.

**Doctor reply to Student #3:**
In this patient education piece you would not want to get too bogged down on specifics, but if the patient asked as far as possible disorder. I would talk about amblyopia, what it is and the importance of early detection. I would also talk about refractive error, what it is and why it would be important to monitor closely if it fell beyond our expectations.
Figure 2
Discussion Thread on Two Patient Cases

Student #1 reply to Discussion prompt:
Assessment: Left Intermittent Esotrope and reduced VA’s secondary to uncorrected simple latent hyperopia
Plan: New Rx: +3.00 OD, OS
Polycarbonate, Full time wear
Pt Ed: Adaptation to new Rx and full time wear schedule, esotropia, hyperopia and possible benefit of VT if symptoms unabated. RTC 4-6 weeks to re-asses tropia, re-measure objective findings and monitor compliance or PRN. Schedule DFE and RTC 1 yr for regular PCE.

Doctor reply to Student #1:
can’t have strabismic amblyopia with an intermittent eye turn

Student #2 reply to Doctor:
So amblyopia is only possible with a constant strabismus? How long does a strabismus have to be present for amblyopia to occur? We haven’t learned yet...

Student #3 reply to Student #1
I like your VT option and you can also mention BF for the next visit if there is still some residue of strabismic left after correction.

Figure 3
Dennis, a 4-Year Old Caucasian Male With a Chief Complaint of a Left Eye Turning Inward
help students visualize difficult to understand concepts. This type of educational media can potentially promote transfer of learning by maintaining attention and facilitating comprehension of new content. Following a lecture on pediatric eye examination diagnostic techniques, students were assigned to answer a series of questions interpreting clinical data presented in text, pictures, or video (Figure 4). Questions were presented in short-answer or multiple-choice format to aid in the instructor’s efficiency of timely feedback.

The assignments accounted for 20% of the student’s overall grade. Each week’s assignment was awarded 1 point for the initial post and 1 point for the feedback post. To receive full credit, students were required to make their two minimum posts prior to the specified deadlines. To make the discussion threads more manageable, separate threads were created with approximately 16 students each. A teaching assistant and the instructor monitored and facilitated each thread to encourage deeper thinking and dialogue.

Ultimately, careful analysis by the instructor of the learning objectives should govern the appropriate use of a course management system. The course management system can serve as a repository for a variety of course information or as a medium for collaborative learning. To investigate the amount of time needed by the instructor to develop novel material on Blackboard, we attempted to quantify the amount of time spent on curriculum development and implementation. This included the one-time training sessions and setup of a course within Blackboard Academic Suite as well as the recurring faculty resource demands with each successive administration.

Results

During the final online assignment, students were given the following instructions:
The assignments that you completed this quarter serve to stimulate thought and understanding from the presented lecture material. This week’s discussion is a self-reflection of the quarter on: which assignment/s you felt best matched the learning objectives of the course [Appendix B], which assignment/s least met the learning objectives, and why. In addition, explain what you got out of participating in the discussion.

Results were manually tabulated by the instructor, with students having the ability to make more than one selection in each of the categories of learning tasks that either met or did not meet the course learning objectives. All 94 users accounted for 100 responses in each category. Based on the characteristics of the learning task, each assignment was grouped into one of the following topic areas: patient education, role playing, assessment, case analysis, question and answer, and posting replies.

The most frequently cited activity that best met the learning objectives was the development of an assessment and plan, with 33% of responses (n=33). The second most frequently cited was the online laboratory assessment (Figure 4), with 26% of responses (n=26).

Reasons for citing these assignments generally referred to the perceived clinical relevance of the assignment.

The topic area that least met the learning objectives was the prescribing of antibiotics, with 46% of the responses (n=46). The most frequent reason students gave was the redundancy with previous coursework as well as the limited number of possible ways that the discussion prompt could be considered. See Figure 5 for a complete breakdown of student responses to the online assignments.
the educational experience due to the lack of opportunity for dialogue. This was further evidenced in our study, where students felt the assignment least meeting the course learning objective was the prescribing of antibiotics because it was not conducive for dialogue. Although the online laboratory assessment was a question-and-answer format, students felt that the use of multimedia to interpret clinical information was an accurate simulation of clinical care that helped solidify their understanding of the lecture content.

A key component to PBL is the use of small-group (8–12 students) case discussions facilitated by a faculty member. However, the amount of additional faculty required, the complete restructuring of an institution’s curriculum, and the lack of formal training for students and faculty often override the benefits of its use. Students have often reported satisfaction with the PBL learning experience; however, the common limitation within medical education has been the lack of depth in basic science knowledge as measured by professional qualification examinations. In this cohort, overall student didactic and clinic performances did not differ from previous class years; however, an increase in didactic and clinical performance among PBL medical education institutions has also not been widely evidenced. Additional changes in clinical and didactic performance through use of online discussion forums may also be muted based on the larger body of courses taken previously and concurrently that were of traditional pedagogy.

One critical issue is whether the time required setting up and implementing a hybrid PBL and traditional pedagogical model is reasonable, given institutional time constraints on faculty. Although the initial start up of a course management system may seem daunting for faculty, after the initial set up is complete, the recurring time requirement for administration is quite manageable. We recommend that faculty use more senior students as teaching assistants to help facilitate the discussion forums. This approach has the advantage that the instructor does not dominate the discussion boards and participants may feel more at ease and willing to participate when dialoguing with a senior student. Last, we feel that the students’ positive responses to this instructional modality justify the time needed to set up and implement the hybrid approach to education.

When evaluating the traditional pedagogy of lecture-based content delivery, we find the advantage being an efficient use of a faculty member’s time in delivering content to all students in attendance. The criticism of lecture-based content delivery has been the overemphasis on rote memory and lack of students’ deeper understanding; as nicely summarized by a student, “In clinic, sometimes I’ll get questions about certain topics, but the answers in my head are all in multiple choice format.” Although measurable benefits of PBL pedagogy are not entirely apparent, they contribute to an improved student satisfaction of the learning experience.

The use of discussion forums inherently adopts aspects of PBL pedagogy by providing the framework for active interaction, collaborative learning, socially constructed meaning, sharing of resources, and the development of critical evaluation. However, its use alone does not guarantee successful student acceptance. We have learned through student feedback that acceptance was dictated based on the types of instructional activities. Thus, the charge to us and to instructors that choose to adopt this methodology is to continually refine the types of activities to open-ended type of questions where multiple viewpoints can be expressed. In future course administrations, the instructor of record plans to (1) offer more than one question for each week’s assignment so students can choose which question to respond to, (2) retain the services of at least two teaching assistants to improve ease of course administration, and (3) encourage other instructors to adopt this methodology to better acclimate the students to this learning style.

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A preliminary version of this research was presented as a poster at the 2008 meeting of the American Academy of Optometry.

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References


Appendix A

Online Assignments

Discussion #1:
Your 30 year old patient is pregnant with her first child. Explain to the patient why it is important that she bring her daughter in when she turns 6 months for her first comprehensive eye examination. (Figure 1)

Discussion #2:
Your schedule in the pediatric vision service indicates that you have a 6-month-old girl coming in for her first comprehensive eye examination at the 4 pm hour and afterwards a 3-year-old boy at the 6 pm hour. Your initial post should indicate the specific tests you would do and in what sequence for each patient. Sequence your examination up to the ocular health evaluation.

Discussion #3:
Online laboratory assessment (Figures 4)

Discussion #4:
Draft an assessment and plan for Dennis, 4-year-old Caucasian male, and Justin, 18-month Caucasian male (Figure 2-3).

Discussion #5:
Draft an assessment and plan for Eddy, 4-year-old Hispanic male, and Sara, 3.5-year-old Hispanic female.

Discussion #6:
You are examining an 8-year-old boy with Down syndrome. What history questions will you ask the parent to try and determine the patient’s developmental level? What modifications will you make in your examination techniques and why? Be sure to include in your post why you chose certain tests and a certain order.

Discussion #7:
What antibiotic would you prescribe to treat an acute bacterial conjunctivitis and why to the following patients: 6-month old, 3-year old, and a 10-year-old. Be sure to include in your post what you would write on the prescription pad.

Discussion #8:
Your 9-year-old Asian female has a chief complaint of distance vision blur. On your examination you find that her myopia has increased 0.50 D since her last examination. This time her mother voices concern over her continually changing prescription and asks you what can be done to stop her myopia from getting worse. What would you tell her?

Appendix B

Pediatric Optometry Learning Objectives

The student will:
1. Describe important visual developmental milestones and define emmetropization
2. Select age-appropriate diagnostic tests for a pediatric eye examination
3. State the prescribing guidelines for management of refractive conditions and binocular anomalies
4. Explain and accurately apply the results of clinical trials on myopia
5. Describe the management of frequently encountered visual and ocular findings associated with individuals with special needs
6. Describe the diagnostic findings and management of ocular abnormalities common to the pediatric population