Deriving Sight & Insight from the NSIGHT Study: The Vision

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One could say that optometry evolves at the speed of light but we know that, in reality, we have to be more pragmatic. Although technology expands our scope at an unprecedented rate and we live in the femtosecond domain, the reality is that, at the coalface of eye care, we still have real patients who demand real things, now. The NSIGHT study—from which this special edition has arisen—had one resounding message: Patients and consumers seek one thing as a priority—Vision.

We owe thanks to Review of Optometry for the editorial space and Bausch + Lomb, sponsors of the NSIGHT study, for the data. This provided the impetus to gather some interesting contributions from some rather interesting people.

The introductory article covers the study design, market surveyed, data analysis and results that this enlightening Needs, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) Study investigated. The rest of this edition is dedicated to articles that drill down into the issues and concepts the study highlighted. The result is a blend of the esoteric and high tech with the practical, anthropological realities that face eye care providers today. The importance of communication, being a good listener, and understanding both the psychophysics of perception and psychology of patients is clear from these in depth analyses.

It’s an honor to be involved in this project—all the more so considering the caliber of the people involved. They cover diverse regions and backgrounds, yet all have that critical element of passion for what they do. I am sure you will find their contributions enlightening.

Because “vision” (in the view of the consumer) was such a critical element, a number of contributions delve into the various aspects that such a broad term encompasses.

In “The Sense of Vision,” Greg DeNaeyer looks into complex concepts such as visual performance testing, contrast sensitivity, higher order aberrations, neural adaptation and the role they play now and in the future.

Susan Gromacki investigates the modern approach to optimizing vision in astigmats. She looks at the numbers, challenges, limitations and solutions. Astigmatism correction was limited to spectacles until the mid 1900s. Since then, hard lenses, hydrogels and refractive procedures have also been used to correct this malady. Indeed, improvements in soft lens technology allow for great success.

Kathryn Richdale and Nidhi Satiani provide insights on how to enhance your contact lens practice through the use of aspheric designs. They summarize aberrations and the benefits of aspheric designs while providing case histories. Again we see the scientific and technological prowess that allows high definition vision through precision design and manufacture.

Shehzad Naroo gives spherical aberration (SA) a Quixotic tilt and provides insights into the optics thereof and some clinical manifestations. He walks us through the seemingly complex realms of the various orders of aberrations, tear film and contact lens influences, practical aspects of correction and the effect of scotopic conditions. He stresses that practitioners need to embrace a more detailed visual task analysis for each of our patients.

A panel of experts—Jim Kokkinakis (Australia), Dominick Maino (USA) and James Wolffsohn (UK)—answer questions and provide their clinical and academic perspectives on many aspects of vision, including lenses, multifocals, patient dissatisfaction, kids, sport, night vision, health, comfort and much more. The panel also discusses integrating technology using the multitude of tools at our disposal.

Environment was the third most important aspect the NSIGHT study identified. Jennifer Craig and Alexis Vogt provide their analysis of this wide-ranging concept. Sick building syndrome, air quality, tear film stability, air conditioning, contact lenses, allergy and more are detailed. The effect degradation of the environment can have on quality of life, the management of various factors and resultant satisfaction, are discussed. The increasing demands that modern life places on the eye and its adnexa is an unfortunate side effect of technological advancement. Now, we seek to use technology to try and compensate and improve satisfaction and health.

Kate Johnson (Australia), Thomas Quinn (USA) and Shelly Bansal (UK) consider questions and provide their tailored answers and approach. Again we see regional variances but the essential visual...
and eye health needs have commonality. The individual approach of the contributors makes one consider the merits of one’s own way of saying and doing things. There are many useful ‘take-home’ tips. Some aspects covered are personalized eye care, relationships, tools, emotions, age, electronic health records, refraction and more.

Sport and its relationship to eye care are well explored by Nick Dash. Considered the second largest industry in the world, sport certainly rates on some scales! A significant proportion of people take part in sporting activities. The effect of vision on sport is detailed, as are specifics such as swimming, contact lenses, age, region, frequency and modality. Some practitioners build very successful sports vision practices and increasingly national and international sporting groups integrate sports vision awareness and training into their structures.

Performance is an important consideration. The integration of neurological, psychophysical and technological aspects is a challenging but rewarding sphere of interest.

Dominic Maino pops up again in partnership with Christopher Chase in another feature article; “Asthenopia: A Technology Induced Visual Impairment.” They take us on a journey to illustrate how we have evolved as a species and have developed increasing symptoms of asthenopia. They go on to detail causes, symptoms and prevalence and consider treatment and management strategies. They also consider the influence the current swing to 3D TV will have on asthenopia and evolution.

We trust you will enjoy this special edition. It certainly provides food for thought and strategies you can implement right away.

The PEDIATRIC CATARACT INITIATIVE

The Bausch + Lomb Early Vision Institute was established in 2010 to provide funding for children’s vision research including the promotion of treatment, prevention, and advocacy. The Institute’s first program, conducted in partnership with the Lions Clubs International Foundation, is The Pediatric Cataract Initiative. Pediatric cataract affects approximately 1.4 million children worldwide and can result in childhood blindness that is preventable.

The Pediatric Cataract Initiative will focus its efforts in the People’s Republic of China, where this disorder affects an estimated 40,000 children, or nearly 20% of China’s blind children. Bausch + Lomb will contribute $350,000 in the first year of this initiative for education, training, and materials. This program will ultimately be expanded to other countries.

A Global Advisory Council will lead this effort and includes an esteemed group of eye health professionals from China, India, Singapore, the United Kingdom, and the United States. This Global Council will help the Pediatric Cataract Initiative to achieve its goals so that all children have the chance to grow up and witness the wonders the world has to offer.

If you would like to know more about this important initiative, please go to www.pediatriccataract.org or search for The Pediatric Cataract Initiative on Facebook.
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By Montgomery Vickers, O.D.

I was educated with SOAP. And, yes, my mouth was the recipient in my early years. My mother told me that one day, when I was about nine years old, she saw me walking down our driveway to lunch with my baby brother and she says I was cussing up a storm. When we came in and sat down at the table, she asked me if I wanted to say a prayer to bless the food. Now, I never wanted to do that! Except, this time, I kinda knew I should. Mom says the prayer went just like this:

“God, I wasn’t talking about you. Amen.”

Yes, I was educated by SOAP. In optometry school, I learned more about SOAP. In clinic, I was told that we would be using SOAP in the examination of patients. Hmm… OK…some of them probably could use a little but, I mean, this is NOT what I signed up for, was it?

As was common in the 1970s, and as a first-year optometry student, I was so smart I was stupid. Thankfully, and prior to any embarrassing patient/doctor shared showers, I was officially informed that a patient’s overall hygiene was not, in fact, my responsibility. I put away my washcloth in the nick of time, but SOAP was a major part of my life from that time until today.

S – Subjective. What is the chief complaint?
O – Objective. What data and findings are there?
A – Assessment. What does this information confirm, or at least suggest, the problem might be or what additional testing must be done to come to a conclusion?
P – Plan. What’s the treatment plan?

This served me very well for many years. The only problem is this: Patients very often do not tell you what they really should tell you …unless you SPECIFICALLY ask.

A good example is droopy eyelids. Unless a patient comes in with skinned knees because he tripped over his floppy upper lid while jogging, he will not bring it up. In my first 25 years of practice, I referred out about 10 patients a year for blepharoplasties. In my last six years of practice, I average about 150 referrals per year. What changed? I looked in a mirror and saw my own droopy eyelids. No longer needing a cap to keep the sun out of my eyes got my attention!

Now, when I bring it up, patients spend a good 10 minutes railing about how their eyelids drive them crazy but they didn’t think they could do anything about it. Contact lenses are another great example. I am talking about lifelong glasses wearers and also middle-aged presbyopes who are ready to jump off a cliff every time they check their text messages. This group will do anything to get out of glasses EXCEPT mention contact lenses. So, I bring it up. And guess what? Although they do not all jump in the cold cold water of bifocal contacts, some of my most satisfied contact lens wearers are now sitting in a tree stand above a big ol’ deer without steamed up glasses.

My point? We gotta actively SOAP our patients. This means asking them more specific questions than “Whassup?” Oddly enough, in our doctorly search for extremely sexy eye conditions, we sometimes do forget vision. Humans want to see. And seeing today is way different than your Grandma’s seeing. Visual demand is at an all time high. Computerization and miniaturization mean people have to have better vision than the bare minimum.

Doctors, when you (emphasis on YOU, not Debbie at the front desk) SOAP your patients, please be an active participant in the SOAPing process. Make ‘em see better.
Vision care, like all clinical specialties, entails a blend of art and science. Artistry comes to the fore as the phoropter swings aside and the eye care professional (ECP) attempts to fold the patient’s real-world needs and preferences into specific treatment decisions and recommendations.

The groundbreaking Needs, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) study, an online survey of thousands of vision-corrected patients worldwide, can supplement the clinician’s artistry through its rigorous quantitative assessment of patients’ self-reported vision and eye care experiences. The study provides a detailed look at patients’ eye- and vision-related symptoms and product needs, both globally and by geographic and other subgroupings of interest. These findings can help ECPs cultivate a deeper understanding of, and communication with, their patients while providing valuable clues on how to ensure patient satisfaction with vision care products and treatment decisions.

Conducted by the independent research firm Market Probe Europe, with funding from Bausch + Lomb, NSIGHT surveyed 3,800 vision-corrected patients, 15 to 65 years of age, from seven different countries (China, France, Italy, Japan, Korea, United Kingdom, United States). Participants included spectacle and contact lens wearers. NSIGHT gathered comprehensive baseline data on all respondents, including gender, age, social class, education, community type (city, villages, etc.), occupational status, work environment and physical activity level. Vision and eye care data included type of vision disorder and method of correction.

**Study Methods**

NSIGHT respondents reviewed a list of 40 potentially beneficial attributes of eye/vision care products (e.g., “provides vision that is as close to natural as possible,” “protects eyes in dry environments,” “makes eyes feel fresh”). The features were presented in multiple groupings of six. For each group of six features they were shown, respondents were asked to rank one feature as the most compelling of

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**Figure 1.** Dark blue corresponds to high importance; light blue to medium importance; and green to low importance.
the group and one as least compelling when choosing products for their eyes. Each feature was viewed three times in differently combined groupings. The results allowed creation of a Hierarchy of Needs—a rank ordering from most to least compelling of the 40 individual features and the eight categories into which they can be grouped. (The eight categories are Vision, Health, Environment, Eye Condition, Convenience, Comfort, Personal Performance and Personal Appearance.)

This sequence of repeated evaluations, or MaxDiff analysis, generated a data set from which a utility index (UI) score was calculated for each feature and category. According to study criteria, a score of 151 or higher signified “high importance,” 100 to 150 signified “medium importance,” and less than 100 signified “low importance.” A UI score of 200 would signify a feature twice as compelling as one scoring 100.

**Vision Comes Out on Top**

What was probably the most striking response in terms of absolute numbers was an overarching importance placed by patients/consumers on vision. Figure 1 shows the hierarchical importance placed on various core needs categories. In fact, vision was the only category with a UI score that ranked above 150, signifying high importance to patients.

Interestingly, when broken down by the 40 individual potential product features, six of the top eight features fell into the vision category (figure 2), with the top three vision-related features as follows:

- Provides the best possible all-round vision (UI 192).
- Renews lost vision (UI 188).
- Provides vision that is as natural as possible (UI 182).

The study also shows that vision is six times more important than appearance and twice as important as comfort. This adds some perspective from the patient as it shows relative importance of vision to other categories as they were asked to make a choice of one most compelling and one least compelling feature from each group of six presented. When broken down by region, the same trend exists for the U.S., Europe and Asia. Vision remains the most important feature. There are subtle regional differences though, as visualized in figure 3.

Vision is a global term and can be used in many contexts. For example, one useful clinical concept is to explain to patients the difference between the concepts of vision as far as resolution and needs hierarchy categories by region.

**Figure 2.** Dark green shading indicates features with UI scores greater than 150 (high importance). Light blue shading indicates features with UI scores between 100 and 150 (medium importance).

**Figure 3.** There are subtle regional differences when comparing U.S., Europe and Asia.
quality are concerned.

Patients are the ultimate judge as to whether their vision is good, irrespective of the quantitative measure that acuity charts may provide. For example, there are some patients who achieve 20/20 (6/6) on the Snellen chart post refractive surgery or with multifocal soft lenses, yet when you ask them how they see, they say their vision is “lousy.” It may be ghosting or hazy or variable in nature, and this equates to poor quality. Cataracts, irregular corneas and epiretinal membranes are some other causes of poor quality vision. It is our skill in interpreting these findings that helps us to know what to look for as a cause, or indeed how to improve the visual quality.

Many factors may contribute to reduction in vision. The skill comes in minimizing impact of all factors that can reduce vision. For spectacle and contact lens wearers alike, a change in lens form or function may improve qualitative results. These are some of the things that skilled eye care professionals can embrace in the quest to provide excellent visual outcomes, the eye care feature most desired by our patients.

**Health and Environment**

As a category, health ranked second out of the eight. With the top two health-related features as follows:

- Improves the health of your eyes (UI 182).
- Mimics the natural action of your eyes to preserve their long term health (UI 163).

One can see from figures 1 and 2 what patients may go for if they had to trade off certain things to attain another. As I explain to my complex patients, some things are mutually exclusive and a contact lens that provides the best comfort in say a keratoconic patient, may not provide the best vision or the best health. However, it is critical that we keep our patients’ emotional, functional and health needs top of mind as we consider the best treatment options.

As we also saw in figure 1, environment rated third most important in the hierarchy. In this study, environment encapsulated issues such as comfort in dry, air conditioned rooms and relief of asthenopia while working at a computer. Protection of the eyes from pollution, UV light, dryness and allergy were other environmental considerations. The correct form of spectacle lens is critical in specific environments, as are ideal contact lenses. The best vision correction option for night driving may not be the same as the one needed for efficient visual function and comfort with computer use. Similarly, an occupational lens would likely be better than an all-purpose progressive for computer use. This supports the provision of multiple modes of correction (whether it be spectacles or contact lenses), specialized for work, sport, fashion, fishing, and a multitude of other occupational or recreational uses. Of course, with contact lenses, management of dryness with prolonged computer use and air conditioning is critical. Modern moisture retaining disposable lenses have provided significant improvements. Contact lenses are, of course, highly desirable for sports and recreation and multifocal lenses should be considered for asthenopic relief.

**Needs Hierarchy by Demographic Groups**

When one considers age, it again seems obvious—and the data confirm it. Vision ranks as the most important category for all age groups and vision and health become even more important with increasing age (figure 4). Knowing this allows us to address these needs relative to lifestyle and ask appropriate vision questions related to age group.

Additional analysis broken down by type of ametropia showed that,
while once again all refractive groups ranked vision as the most important category, presbyopes and hyperopes were slightly more concerned with vision and health compared to myopes and astigmats.

There did not seem to be major differences in the importance placed on different items as far as social class (upper, upper middle, lower middle, lower) was concerned. Respondents who reported lower social class status did however place a greater emphasis on appearance and performance.

That’s a look at the global hierarchy of needs data. Now let’s take a look at some specifics that relate to contact lenses and lens care.

**Contact Lens Trends in the NSIGHT Study**

Nearly half (45%) of study respondents reported having worn contact lenses at some point, 30% were currently wearing them at the time of the study, while 21% used them “most often.” The data tell us that the most common contact lens modality reported by participants in the NSIGHT study was in the two week replacement category. However, with this study covering Europe, U.S. and Asia, some differences were borne out by the data. For example, Asian wearers had a higher incidence of rigid gas permeable lens (RGP) wear compared to Europe and the U.S., albeit a distant second to soft lenses.

For soft contact lens care products, as expected, multipurpose disinfection solutions (MPS) have the lion’s share of the market. However, 14% of patients reported using peroxide systems. Almost 30% more Americans than Asians consider the brand of their MPS as important.

In Europe and the U.S., three in four contact lens wearers were satisfied with their lenses, whereas in Asia just 56% were satisfied. Sixteen percent (16%) of the vision-corrected population wore contact lenses in the past but stopped wearing them. In the NSIGHT Study, the main reason for discontinuing lens wear was the inconvenience to remove or to insert lenses (39%). Other frequently stated reasons were that maintenance was perceived too cumbersome (29%), they considered it too expensive (25%) or they thought lenses were uncomfortable to wear (25%). Of those who discontinued contact lens wear, 21% ceased wearing contact lenses within six months of fitting (34% in Europe, just 7% in U.S.), and half stopped wearing them after two years or more.

Interestingly, we hear a lot about comfort as a leading reason for dropout with contact lens wear. We need to be mindful of other reasons as posed by those surveyed. It is important to recognize that inconvenience in handling and care of contact lenses is a major cause for drop out. Having a well-trained staff member who conducts the contact lens care and handling instruction sessions for patients is a key element of a successful contact lens practice. They are a key coach for successful contact lens fitting. It is also important to recognize that dropouts can occur early (within six months of fitting). Reach out to newly fit patients early and routinely to help them with any challenges they may have with adaptation.

Despite the fact that a portion of contact lens wearers discontinue lens wear for various reasons, nearly 90% of contact lens wearers would be bothered if they could no longer have contact lenses. Now that’s loyalty!

**Summary**

The NSIGHT Study provides the global eye care community with new, and in some cases unexpected, insights that ECPs can take into account in discussing vision and eye care options with their patients. Most notably is to consider and not underestimate the importance of vision to our patients no matter their age, correction type or where they live. The findings provide an evidence-based framework that will enrich ECPs’ abilities to meet their patients’ vision and eye care needs.

Whether you are an eye care professional who practices as a pure refractionist, in a mainly medical model or a combination of the two, there is plenty to learn from our patients through this study. ECPs should expect that achieving the best vision possible is of paramount importance to their patients—crucial information in evaluating product and treatment options.

It is important that we address and, if possible, resolve our patients’ needs. Before we can do that, we must effectively communicate with our patients. By taking note of this desire of patients to put vision first, maybe we can also start tweaking our practices to re-focus more on this area of practice. We can thus be more successful, and claw back some of our traditional bread and butter. Refraction, spectacles and contact lenses are not dirty words: They are core services needed to ensure successful practice and provide the vision consumers so clearly state is their number one priority.

The people have spoken.
As eye care professionals are quick to point out, no two patients are ever alike. The diversity of patient experiences, expectations and visual needs can lead to a sprawling domain of individualized solutions. In this special report, three prominent eye care professionals answer a rich variety of questions on critical issues. Their responses help present a tapestry of interventions that you may want to consider for application in your practice.

Q: What measures do you take to identify patient interests, needs and dissatisfaction related to vision correction?

Dr. Kokkinakis: We use an entry survey to identify the vision needs, expectations and perceived problems of new patients. Existing patients tend to tell us about new problems or changes in lifestyle.

Dr. Maino: I ask the right questions, pay attention to the answers, and do everything I can to solve problems perceived by patients. If necessary, I refer to colleagues.

Dr. Wolffsohn: History, symptoms and casual conversation help best.

Q: What types of spectacle lenses do you recommend and why?

Dr. Kokkinakis: I tend to prescribe premium quality lenses, which are cosmetically more appealing and can correct for optical aberrations.

Dr. Maino: I prefer the latest lens technology as a part of my visual therapy program. I often use progressive addition lenses (PALs) to improve appearance and functionality. I also use single-vision spectacles for specific tasks, such as computer use.

Q: What are the primary reasons for patient dissatisfaction with vision correction in your practice?

Dr. Kokkinakis: We see two main causes: night vision aberrations due to increased pupil size and irregular corneal shapes, such as keratoconus. Both issues are best corrected with aberration-controlled contact lenses. We also deal with dryness, eye strain or other ocular symptoms of computer vision syndrome.

Dr. Maino: Squinting, headaches and other discomforts are associ-
ated with myopia but are well addressed with new light-weight and thin lens materials, as well as the various tints, coatings and finishing options that make even the higher magnitude prescriptions acceptable. Those with hyperopia often need ongoing patient education to help them realize the benefits of corrective eyewear.

Dr. Wolffsohn: Patients complain of end-of-day dryness and resulting restriction of lens wear, especially if they have worked on computers all day. Being required to stop lens wear due to illness or infection is another concern. Uncorrected astigmatism and presbyopia are also patient concerns.

Q: What can be done to reduce or eliminate focusing problems?

Dr. Maino: Non-presbyopic adults can experience focusing problems, just like children, frequently for the same reasons. Single, clear, comfortable, binocular, and pathology-free vision should be sought for all our patients. If a binocular vision problem is suspected, a visual efficiency evaluation should be scheduled. If tear film anomalies and their associated symptoms are being confused by a patient as representing a focusing problem, a further evaluation of tear production and quality may be required.

Dr. Wolffsohn: Generally, patients overcome presbyopia in one of the following ways:

- Wearing reading glasses (replacing contact lenses or supplementing distance-correcting refractive surgery)
- Wearing multifocal spectacles (although peripheral vision is distorted)
- Turning to multifocal contact lenses, intraocular lenses or refractive surgery (although light passing through the pupil needs to be split between different distances, reducing the ability to distinguish low contrast and also causing glare and halo effects in many cases)
- Adopting monovision
- Using a combination of the methods mentioned above.

Future technologies will include better multifocal designs that will minimize visual compromise.

Q: What is your typical approach to treatment of visual dysfunction?

Dr. Maino: I tweak the treatment program to meet the individual needs of each patient. This approach continues until the problems are resolved.

Dr. Wolffsohn: I add one element at a time, under-promise, over-achieve and monitor regularly.

Q: How important is it to have rotationally stable designs for soft and hard contact lenses that can be imprinted with an individual’s aberration profile?

Dr. Kokkinakis: Nearly three-quarters of the patients in my practice could benefit from such a lens. A significant minority of contact lens patients fail or complain due to uncorrected aberration profile. Also, if we could customize contact lenses every year or two, we could curb loss of patients to the Internet.

Dr. Wolffsohn: These lenses would be essential, as would centration and a stable tear film.

Q: How does contrast affect vision and how can vision be optimized for low-contrast tasks?

Dr. Kokkinakis: Contrast may prompt me to recommend cataract surgery, a change from soft contact lenses to rigid gas permeable lenses or the addition of anti-reflective coating to spectacle lenses.

Dr. Maino: After personally experiencing cataracts, I know that contrast plays a significant role in our daily ability to function. We need to make sure patients affected by this problem know to use extra caution when driving, especially when it rains or when it is foggy.

Dr. Wolffsohn: Contrast can usually only be directly altered on electronic devices, but can be affected by lighting. Adjustable, focal lighting is important.

Q: How much of an issue is the presence of glare and halos, particularly when encountering high intensity headlights?

Dr. Kokkinakis: When probed, most patients will at least say they have noticed this.

Dr. Wolffsohn: Many patients reduce their night driving. Problems can go under-reported.

Q: What solutions do you recommend for glare and halos?

Dr. Kokkinakis: The solution depends on what is causing the problems.

Dr. Wolffsohn: I use anti-reflective coatings, full visual correction (including astigmatism) and careful selection of multifocals.

Q: What visual correction for presbyopia provides the least strain on vision and the best range of clear vision?

Dr. Kokkinakis: Any patient who works for more than a couple of hours on a computer each day is best suited for an intermediate or near office lens.

Dr. Maino: I use the most appropriate PAL available for the visual demands of the patient. Then I move on to standard bifocals and/
or multiple pairs of glasses and contacts.

**Dr. Wolffsohn:** I use multifocals, but I expect that they will be surpassed by accommodating intraocular lenses in 5 to 15 years.

**Q:** How does standard measurement of visual acuity relate to everyday vision on the move?

**Dr. Kokkinakis:** There is some correlation, especially for the young. As the patient ages or if he or she has some irregularity anywhere in the ocular media, the correlation seems to drop off.

**Dr. Wolffsohn:** Dynamic vision is influenced by cortical factors, quality of the tear film and stability of the visual correction.

**Q:** Why do patients want vision that is as natural as possible and how do you provide correction that will create this effect for them?

**Dr. Kokkinakis:** Patients who have achieved good vision in contact lenses prefer contact lenses because it spares them peripheral distortion. This desire increases with higher levels of ametropia and even small levels of astigmatism. However, many first-time multifocal wearers are quite distressed at the small reading areas and peripheral distortion associated with most designs.

**Dr. Maino:** All patients want natural vision. For adult presbyopes, PALs usually represent the best approach. I also use PALs for non-presbyopes who have binocular vision dysfunctions.

**Q:** What can be done to decrease or eliminate asthenopia?

**Dr. Kokkinakis:** Patient education can play a significant role. I also recommend careful binocular vision assessment and careful refraction, looking for small refractive errors combined with small adds and prisms.

**Dr. Maino:** Diagnose and address the problems you find. Improve the tear film layer and conduct optometric vision therapy.

**Dr. Wolffsohn:** Optimize the visual correction and oculomotor function.

**Q:** If someone has noticed decreased performance at school, work or play due to vision problems, what can be done to diagnose and treat these problems so that outcomes improve in all areas?

**Dr. Maino:** Assess the presence of any vision information processing anomalies. Research sponsored by the National Eye Institute at the National Institutes of Health has clearly shown that optometric vision therapy is the most efficacious and longest-lasting intervention for binocular vision problems. Either enroll your patient into a therapy program or refer them to someone who provides therapy.

**Q:** How do the vision problems that affect school, work or play differ?

**Dr. Kokkinakis:** Vision problems depend on environment, lighting, concentration times, refractive and binocular status and age of the patient. Some vision needs require stability. Others require excellent peripheral vision.

**Dr. Maino:** Learning-related vision problems can affect all areas and will take many forms. Some of these problems involve binocular vision anomalies. Others, such as strabismus and amblyopia, can be more complicated. A third possibility can include dysfunctions associated with vision perception. Finally, a combination of any of the above can occur. As primary eye care providers, we must diagnose, treat and refer patients suffering from this disorder, which is frequently encountered and affects quality of life.

**Dr. Wolffsohn:** The severity of visual problems is dictated by lighting, contrast, dynamics, resolution, complexity and distance of task, so they will differ between work and play, depending on the environment in which the activity occurs.

Vision is of paramount importance to patients. And it is essential for eye care professionals to remember that vision is more than just high contrast letter acuity. Measurement of visual function and vision correction should be targeted toward each individual patient’s lifestyle and concerns. Whether it is for school, work or play, patients want the best vision for the task.
Out of the five senses, patients generally consider vision to be the most important. The 2007 American Eye-Q survey showed that almost half of respondents indicated that eyesight was the sense they worry most about losing.\(^1\) The Needs, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) study indicated that, among a spectacle or contact lens corrected population, vision ranked at the top of the hierarchy according to patient needs.\(^2\) Eye care professionals (ECPs) are responsible for maintaining this valuable sense, which can include a number of clinical duties—for example, correcting ametropia and/or presbyopia to improve a patient’s range of vision, diagnosing and treating ocular disease to preserve vision, and prescribing visual aids to rehabilitate vision.

As technology continues to improve, what will ECPs need to advance vision care into the 21st century? This article explores how visual performance testing, contrast sensitivity, higher-order aberrations, and neural adaptation all play a role in the future of vision.

**Visual Acuity Testing and Subjective Performance**

The vast majority of testing for visual acuity takes place in the confines of an exam room. The universal method involves having the patient read a standardized high contrast eye chart to determine best corrected acuity. A patient’s real-world performance is then gauged from this measurement. Examples of this include determining visual eligibility in order to qualify for a driver’s license or candidacy to be a police officer. A limitation of standardized visual acuity testing is that the testing does not take into account a number of environmental factors that patients encounter the moment they leave the exam room. Some of these factors may include variances in illumination and contrast, glare, and movement.

Of course, contrast sensitivity and glare testing are done for select patients, but they are not routinely done for everyone. In addition, ECPs make recommendations of spectacle or contact lens prescriptions based upon objective in-office visual acuity measurements. Too often, when a patient indicates he is having a vision problem, we measure good high contrast VA but we don’t consider problems such as low contrast visual acuity, glare, or halo.

Some interesting research involving multifocal contact lens wear addresses the differences and relevance of standardized testing vs. subjective real-world performance. A 2009 study by Papas et al. concluded that static acuity-based measurements were insensitive indicators of performance compared to a subjective alternative when evaluating multifocal contact lens performance.\(^3\) Generally, the objective testing data did not reflect a patient’s change in visual experience after a four-day trial period of multifocal soft contact lenses. The authors point out that if the subjective responses are perceived as meaningful, then the in-office visual acuity measurements lacked sensitivity for this particular application.

Another study by Woods et al. evaluated objective and subjective visual performance for patients trialing multifocal contact lenses vs. other soft lens correction modalities.\(^4\) Office testing included objective standardized acuity testing and...
simulated real-world tasks. The participants were then sent outside the office to carry out real-world tasks, such as driving, using a computer and reading. A novel aspect of the actual real-world tasks was that participants provided real-time subjective ratings through the use of a Blackberry device. The measured performance in the exam room generally showed monovision to objectively perform better, while real-time assessment of real-world tasks showed multifocal lenses to have better overall subjective performance. The authors reason that the real-time subjective assessment is probably a better indicator of performance than objective acuity taken in an exam room.

The conclusions of these studies point out the weaknesses of standard objective acuity testing. Although we may query patients at follow-up exams when assessing new prescriptions, the Papas et al. study points out that generalized questioning can be too vague to be accurately analyzed. More sophisticated subjective questionnaires that the patients can take with them or the use of electronic devices may improve accuracy.

A recent quality of vision questionnaire has been used to measure quality of vision in patients with all types of refractive correction, eye surgery, and ocular disease. As well, perhaps novel computer-based in-office visual simulation testing could be developed to better determine real-world performance. Crucial aspects to this will be the ability to standardize these tests and make them efficient so that they don’t dramatically increase chair time.

Contrast Sensitivity

Contrast sensitivity is an important indicator of the quality of vision that a patient has and significantly affects visual performance. Contrast can be defined as the difference between a test stimulus’ maximum (light) and minimum (dark) luminances divided by their sum. Contrast threshold is determined for a given spatial frequency by lowering the contrast until detection is impossible. The inverse of contrast threshold is contrast sensitivity, which can be plotted vs. spatial frequency to give the contrast sensitivity function. Although optics plays a prominent role in determination of contrast sensitivity function, retinal and brain processing are also factors.

In general, most ECPs do not include contrast sensitivity testing during a comprehensive eye examination. Typical projected charts that are used to measure visual acuity use optotypes that are near 90% contrast. Thus, the practitioner is not measuring an important component of a patient’s visual perception. A patient may read the 20/20 row, but complain that it’s dim. Without additional information, this patient would appear to have equal quality of vision as a patient who has 20/20 vision and near normal contrast sensitivity. However, their visual performance in real-world situations will be vastly different, as they have to recognize and detect a variety of targets of varying illumination, size, and shape.

Age-related changes, such as cataracts, also result in significant declines in contrast sensitivity. However, ocular disease such as glaucoma, macular degeneration, and diabetic retinopathy also can significantly lower contrast sensitivity function. Conventional refractive laser procedures that induce higher-order aberrations and diffractive multifocal IOLs may also negatively impact a patient’s contrast sensitivity. Measurement of these patients’ low contrast acuity or contrast sensitivity can be done in the exam room with relatively inexpensive wall charts and monitors.

However, is contrast sensitivity testing really necessary or useful for clinicians as they examine and follow particular patients? There are published studies that show contrast sensitivity testing can be used not only to detect subclinical ocular diabetic eye disease, but also to assess treatment outcomes in macular degeneration. Also, Richman et al. reported in a 2010 study that visual acuity and contrast sensitivity best predicted the ability of a patient with glaucoma to perform activities of daily living. It has also been suggested that, because contrast sensitivity provides significant information regarding visual performance, these measurements should be included in presbyopic contact lens fitting. Contrast sensitivity testing may also be a more accurate indicator of increased higher-order aberrations after refractive surgery than visual acuity testing. Low contrast acuity is a fast way of gathering substantial information on a patient’s overall performance at the resolution threshold. We know that most keratoconus patients have worse low contrast visual acuity even in the presence of good gas permeable contact lens correction compared to normals.

Another important issue with regard to contrast sensitivity testing is whether the ECP can provide significant help to improve visual performance for those patients with decreased contrast sensitivity function. There is some suggestion that short wavelength filters would improve visual function. Interestingly, enhancing contrast sensitivity through neural plasticity by way of action video game training may help some individuals. Low vision reha-
bilitation is probably the best course for patients with severe declines in contrast sensitivity.

**Higher-Order Aberrations**

Ocular aberrations that degrade retinal image quality are divided into two main categories: monochromatic and chromatic aberrations. Monochromatic aberrations can be further subdivided into lower and higher-order aberrations. Lower-order aberrations include defocus and cylinder. These are the aberrations that ECPs typically correct with conventional spectacles, contact lenses or refractive surgery. The advent of the aberrometer has enabled us to measure higher-order aberrations, which has led to investigations of how they affect visual performance. The higher-order aberrations can be represented mathematically by Zernike polynomials, which can be modeled three-dimensionally to show how a perfect wavefront is distorted.2 The common Zernike modes have been given names such as coma and trefoil. A point spread function, which shows how aberrations affect a point source of light, can be another way to represent how these aberrations cause optical disturbances.

One interest in measuring and correcting for higher-order aberrations centers around whether or not we can improve upon the visual performance of patients with normal visual acuity or, in other words, give the patient “super vision.”

The higher-order aberrations are affected by increased pupil size. The benefits of correcting for HOAs on a healthy eye with a pupil less than 3mm are negligible.22 The predominant HOAs for normal individuals include coma and spherical aberrations.23, 24 Coma will cause the patient to see points of light as doubled or with a comet-like tail, while spherical aberrations will cause halos around point sources of light.21 Although aberration levels increase with age, these degradative changes may be offset by senile miosis.25-28 Although, in theory, correcting for all higher-order aberrations is complicated because not all aberrations affect the visual system equally and some Zernike modes may interact when combined to improve acuity despite increasing the total wavefront error, correction of individual aberrations, such as spherical aberration, may improve visual quality.29, 30

One way to correct for aberrations in spectacle lens wearers has been available for several years; however, spectacle lenses are somewhat limited because the optimal effect is diminished when the visual axis is off optical center. The increased cost of the spectacle lenses for a small benefit is a further deterrent for some patients. Contact lenses may be a better alternative because they stay relatively central to the visual axis with eye movement for the correction of spherical aberration; however, limitations may result from lens rotation and/or translation when correcting rotationally asymmetric aberrations like coma.31, 32

There are commercially available GP and soft contact lenses that incorporate asphericity to improve visual performance in patients based on correcting the population average of spherical aberration. These lenses may allow for better vision in low light situations. Custom wavefront guided soft contact lenses are also being developed. These may help with corneal irregularity and secondary higher-order aberrations in patients who cannot tolerate GPs or where GP lenses have insufficiently corrected aberrations.33-38

In addition, wavefront-guided refractive surgery has improved results for some patients over conventional treatments by reducing the amount of aberrations induced during the treatment.31 And, cataract patients who have significant amounts of positive corneal spherical aberration may have visual improvement with commercially available aspheric IOLs.31, 39

**Neural Adaptation**

ECPs emphasize optics when assessing and correcting patients for their visual needs. However, retina and cortical processing are contributing factors. This neural component is an important part in determining a patient’s visual perception. Subjective interpretation is why most glasses scripts are prescribed from a manifest refraction and not a retinoscopy or auto-refractor measurement. There isn’t a computer system or test that can determine what a patient perceives.

Evidence is beginning to accumulate that the neural visual component has the ability to adapt to optics that are less than ideal in order to give the perception of visual clarity. George et al. reported a study where patients looked through a +2.50D spherical lens over their best correction for two-hour time period.40 Participants demonstrated a perceptual adaptation to the sustained blur and improved acuity through the blur that was equivalent to a 1.00D reduction of myopia. This adaptation has been hypothesized to take place in a central binocular site within the visual cortex.40 This is supported by another study that showed a 35% improvement in an occluded eye after the fellow eye was allowed to adapt to a blur-inducing lens.41 Additional studies suggest that the improved resolution may last up to 10 days and is not
affected by brief periods of correct vision.40, 42, 43

This type of adaptive process may help patients with low amounts of myopia and cataract formation.31, 44 There are data that suggest patients who have had LASIK undergo an adaptive phase after about 10 weeks that improves their unaided visual acuity.44 The phenomenon is most likely similar to what happens for patients whose vision improves after new multifocal soft lens fitting or patients whose vision improves after brief periods of corneal decompensation and neural adaptation will be necessary to determine how best to utilize new corrective devices and procedures.44

Aberrometers are devices used to measure monochromatic aberrations. They can represent this information in either graphical form or as departure from an ideal wavefront. The root mean squared value (RMS) represents the difference between the ideal wavefront and the aberrated wavefront. In general, if the value of the RMS error is low, then the aberrations in the optical system are also low. The RMS error is a good indicator of the general level of aberration in the eye and allows a quick comparison of aberrations between individual eyes with similar aberration profiles. However, RMS is not a good metric of overall image quality because not all aberrations degrade image quality the same. There are other common methods of displaying higher order aberrations, for example Tscherning ellipses or Zernike polynomials. Here, the complex information is broken down into bite size pieces of information. To discuss the methodologies of these here would be beyond the realm of this article. However, it is important to know what pupil...
diameter or entrance pupil the aberrometer is taking its measurements over. Usually the measurement is given for a 6-mm pupil. If the pupil size is larger, more off-axis light will enter the system, giving an increase in higher order aberrations (such as oblique astigmatism for example). Conversely a smaller pupil size will result in lower levels of higher order aberrations. This is particularly important for some patients who experience visual symptoms such as glare or halos under low light conditions like night driving. Under these mesopic or scotopic conditions the pupil diameter will be larger and the induced higher order aberrations greater.

The eye is essentially an optical system made up of different powered or refracting surfaces—the front and back of the cornea and the front and back of the crystalline lens. The image formed by these surfaces is created on the retina. Altogether the eye has a refracting power of around 60 diopters, it seems to have built-in mechanisms to reduce its own aberrations from this high power. For example, the prolate shape of the anterior cornea and the steeper central curvature of the posterior cornea help to minimize spherical aberration. Similarly, the unique shape and structure of the crystalline lens can also help to reduce spherical aberration; the lens has prolate surfaces on the front and back, the back being steeper and curved in the opposite direction to the front, plus the center of the lens is denser and with a higher refractive index than the cortical regions.

If an optical system had perfect refracting surfaces, the image formed would still be subject to chromatic aberrations. This is caused by the fact that the refractive index depends on the wavelength of the light and, since visible light is polychromatic, the formed image will suffer this type of aberration. An example of chromatic aberration in spectacle lenses would be the fringes on a high contrast border. In an optical system such as a telescope, the chromatic aberration can be corrected with a lens system like an achromatic doublet—where materials of differing refractive indices are cemented together to complement each other.

When observing side-by-side images simulating uncorrected aberrations and partially corrected variant images, a significant difference of subjective preference was found with either a partial (50%) or full correction of both spherical aberration and coma. This gain was comparable to 1/8 D of defocus blur. Piers explored the impact of spherical aberration on contrast sensitivity and found that peak performance was achieved when spherical aberration was completely corrected.

Spectacle correction of some higher order aberrations is possible. In fact, the shape factor of the correcting spectacle lens is considered during manufacture when deciding on the base curve of a spectacle lens. Aspheric spectacle lenses are also used for higher prescriptions to minimize spherical aberration. However, to try and correct some other higher order aberrations is more problematic. The spectacles would need to be adjusted and fit to the exact vertex distance and pantoscopic tilt. Fixation through spectacle lenses would need to be steady and any eye movements behind the lenses would degrade the retinal image. Laser refractive surgery to correct higher order aberrations was first performed over a decade ago and is now used as the treatment of choice for many patients undergoing laser vision correction. The initial excitement of giving patients hyperacuity—hawk eye vision or super vision—was soon found impossible. However, it did highlight the need for caution in altering an individual’s higher order aberrations since patients often adapted to their own aberrations. Similarly, patients with symptoms that could be related to higher order aberration may benefit if their aberrations were brought into a ‘normal’ range. Another good use for wavefront
laser vision correction is to help patients with unusual corneal shapes since these induce higher order aberrations too. In general terms in myopic laser vision correction, the central cornea is flattened, reducing the amount of spherical aberration, whereas in hyperopic laser surgery, the central cornea has an effective steepening that increases spherical aberration.

Similar changes to spherical aberration can occur during accommodation. When the crystalline lens steepens to accommodate for near objects, the resultant increase in the overall refractive power of the eye would show an increase in spherical aberration. But this is not necessarily so since during accommodation we also see a decrease in pupil size, miosis, and as mentioned above, we would see a reduction in the higher order aberrations with a smaller pupil. The net result is that during accommodation, the higher order aberrations do not change significantly.9

Contact lenses can also affect our higher order aberrations for better or for worse. A keratoconic patient for example may have poor vision with spectacles and soft lenses but better visual acuity with gas permeable lenses as the tear lens may neutralize the irregularities from the corneal surface, thereby reducing higher order aberrations. Research carried out by de Brabander and associates, demonstrates that the deformed surface of the cornea is neutralized by the spherical anterior surface of the rigid lens.9 A high-powered positive contact lens may increase a patient’s spherical aberration and a high-powered myopic lens could decrease the spherical aberration in the eye (in the same way as laser vision correction). However, lenses designed with aspheric front and/or back surface asphericity may induce less spherical aberration. Aberrations from soft contact lenses were shown to be predictable and the main limitations for precise correction of aberrations were the rotations and translations of the lens with respect to correct position on the eye.10

Dietze and Cox showed that negative lenses induced less spherical aberration than their equivalent positive powered lenses.11 However, their results showed that lenses that still induced small amounts of negative spherical aberration gave better visual performance than the lenses that induced no spherical aberration at all. The majority of the subjects that took part in this study had positive spherical aberration. The main finding was that the spherical aberration of soft contact lenses placed on the eye is similar to the spherical aberration of the lenses produced in air. A conclusion was reached that soft contact lenses with aspherical front surfaces would be free from aberration on eye if corrected for spherical aberration in air with negligible back vertex power changes.

Due to the advances made in measuring wavefront aberrations, some lens manufacturers have introduced contact lenses that aim to compensate for the reduction in image quality caused by higher order aberrations. Spherical aberration is the aberration targeted by many manufacturers to be corrected and counterbalanced with soft contact lenses. Since spherical aberration is rotationally symmetrical, the contact lens required for correction does not require any stabilization criteria to prevent rotation. If the soft contact lens is decentred, coma aberration is induced.12 Contact lenses need to have rotational and translation stability. Lopez-Gil and associates found that the correction of aberrations was limited by rotation and translation despite the correct fitting of the lens.10 However all lenses need to move to a degree to enable tear exchange.6 Soft lenses, although inhibited to an extent by lens flexure, are favored over gas permeable lenses because they move and rotate less on the cornea than gas permeable lenses.11 However, the tear lens effect in gas permeable lenses may compensate for some aberrations. Furthermore, Lu et al. showed that GP lenses could bring about a reduction in aberrations.13 The amount of reduction in aberrations that can

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**Figure 2. The percentage of patients who reported various visual symptoms.**

- Halo
- Glare
- Blurry or hazy vision

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<tr>
<th>Visual Symptoms among Spectacle and Contact Lens Wearers</th>
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**Note:** The visual symptoms data is hypothetical and for illustrative purposes only.
be achieved by a contact lens is dependent upon the baseline aberration of the eye. Research has shown that image quality is compromised if the lens decentration is more than 0.5mm and rotation is more than 10 degrees. These tolerances are dependent on the type and magnitude of the aberrations and size of the pupil diameter in each individual. Higher order aberrations induced are variable amongst different lens types. These variations can be attributed to the different manufacturing techniques of each lens type. The material and method of manufacture therefore also influence higher order aberrations in terms of the regularity of lens surfaces and refractive index. Hong and associates found similar results; their study concluded that visual performance was found to be slightly better when viewing through an aberrated contact lens compared to an aberration free contact lens.

Custom wavefront designed contact lenses that are fabricated to neutralize each individual’s measured higher order aberrations may be beneficial. It is possible to produce such lenses with the use of rotationally asymmetric lathe techniques or excimer laser ablation.

The tear film plays an important role in influencing wavefront aberrations due to differences in tear layer thickness and refractive index, which result in optical path differences presented as variations in wavefront aberration. Aberrations reduce after a blink as the normal tear film becomes stable. When the tear film becomes irregular and breaks up, aberrations increase—especially in dry eye patients who present with higher levels of aberrations than normal. With contact lenses, the tear break up time is shorter and irregularities have a more profound effect on visual performance.

### Clinical Manifestations of Spherical Aberration

The visual needs of our patients are ever changing. The need for reading spectacles alone, for example, may no longer be enough to help a presbyopic patient. They may now require additional corrections for reading/computer distances or under certain lighting conditions. For example, between 50% and 75% of people surveyed state that they watch television or use the computer or read before they sleep, and around 20% of respondents reported that they commute to work between mid-night and sunrise. Over 50% of frequent fliers on American Airlines stated that they read while traveling on an airplane.

Patients in need of vision correction due to refractive errors may experience a wide range of eye-related symptoms that they expect vision care products to address. Despite differences between men and women and individuals of different ages, some common symptoms stand out. Recognition of these symptoms, who suffers and how often, and their impact on quality of life affords eye care professionals (ECPs) the opportunity to tailor management strategies and better ensure patient satisfaction with prescribed treatments.

As part of its comprehensive survey of 3800 vision-corrected patients worldwide, the Needs, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) study sought to identify the incidence, frequency, and perceived severity of 14 eye-related symptoms, as well as how those symptoms are currently addressed and with what degree of success. Among the symptoms most frequently reported by both spectacle and contact lens wearers were halos (the appearance of rings around sources of light, especially at night) and glare (difficulty seeing in the presence of bright light). One possible source of these symptoms is spherical aberration.

Globally, one third (34%) of patients surveyed reported experiencing halos, while more than half (53%) reported experiencing glare (Figure 1). These incidences were generally similar among patients irrespective of the type of vision correction: spectacles (34% and

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**Figure 3. The percentage of various visual symptoms across different age groups.**
54% for halo and glare, respectively) and contact lenses (39% and 46%, respectively) (Figure 2).

Halos and glare were commonly reported by both men and women, and young and old patients. While the incidence of halos was fairly consistent between men and women (32% and 37%) and among patients of all ages (33%–36% for the age categories of 15–19, 20–30, 31–45, 46–65), glare was reported by a greater proportion of women and patients in older age groups (Figure 3). Among female patients, 61% reported experiencing glare, compared with 46% of male patients. Similarly, the oldest group of vision-corrected patients in the survey (age 46–65) were more likely to experience glare than were members of the youngest cohort (age 15–19), 59% versus 41%.

More than half of the patients experiencing symptoms of halos and glare reported encountering them in the evening or late at night, and several common circumstances were identified as leading to their cause. Halos and glare shared an association with bright lights, sunlight, driving, and being in the dark or night-time viewing. Overall, more than half of the patients reporting glare (52%) experience the symptom in the presence of bright light, while 39% reported the problem when driving and 22% at night. Although less common, halos occurred most frequently for patients while in the dark or in bright light (31% and 30%, respectively), and at a slightly lower rate (25%) when patients were driving.

NSIGHT provided valuable details on how often patients experience halos and glare and the degree to which they found them bothersome. About half of the spectacle and contact lens wearers reported suffering from the symptoms of halos (52%–56%) and glare (47%–50%) more than three times a week, and more than four of five patients found each symptom bothersome (84% and 89% for halo and glare, respectively). Clearly, the severity of these symptoms is sufficient enough to impact patient satisfaction with prescribed vision correction.

Coupled with how bothersome patients tended to find halos and glare, about 90% of patients (90% for halos, 91% for glare) reported having either no solution or one that was unsatisfactory or less than complete. Moreover, about the same rates of patients (89% for halos, 87% for glare) expressed interest in an intervention that more adequately addressed these symptoms.

There are numerous causes and solutions to halo and glare complaints including ergonomic factors and optical approaches. Because spherical aberration often contributes to these two symptoms (particularly halos), ECPs should give close consideration to options such as aspheric lenses. With nearly 90% of spectacle and contact lens wearers lacking a solution and looking for better ways to relieve or prevent symptoms of halos and glare, ECPs have the opportunity to provide optimal visual correction for their patients by addressing these common and bothersome symptoms, especially in low-light situations.

One thing ECPs must consider is the relevance of a more detailed visual task analysis for each of our patients. Thinking about the tasks that patients perform and under what conditions as well as thinking beyond the high contrast, highly illuminated consulting room is important. Likewise, thinking about those situations where higher order aberrations start to cause effects such as halos and glare will aid ECPs in formulating a treatment plan for each patient.
Improving doctor-patient relationships is a continuous goal. The right steps can contribute significantly to patient and provider satisfaction. Special communication, a superior office environment, well-rehearsed staff routines, and other techniques can help you elicit pointed data that will help you formulate a precise diagnosis and a targeted treatment plan. Of course, relationship-building also keeps patients coming back to see you. In this question-and-answer article, three optometrists who have focused much attention on personalized eye care provide advice that you can translate to success in your setting.

Q. The tone of any relationship is often set by initial interactions. What do you and your staff do to help patients feel valued and welcome?

Dr. Johnson says her staff members greet each patient as soon as the patient enters the office. The frame display and waiting area are clutter-free and inviting while background music promotes a relaxed but dynamic environment. The names of the practice’s many pediatric patients are listed on patient files so that both children and their parents can be greeted by name. Also recorded in the file are details about upcoming holidays, pets, or favorite subjects at school.

Meanwhile, Dr. Quinn says he coaches his staff to greet patients with a smile. “The initial interaction also goes more smoothly if we’ve had patients provide demographic, insurance and medical history information prior to their arrival,” he notes.

Shelly Bansal says his practice offers curbside appeal, featuring an attractive and clean window display. “When patients enter the practice, we welcome them without being overbearing,” he adds.

Q. What techniques do you employ to get acquainted with a patient’s visual needs, emotional needs and expectations?

Patients at Quinn, Quinn and Associates are asked to identify their occupations and to describe how they use their eyes so that they can be matched with suitable correction options. “I always finish up by asking, ‘Do you have any other concerns about your eyes or your vision?’” says Dr. Quinn. “This helps me better meet the patient’s needs and helps prevent any surprises at the end of the exam.”

Meet the Experts
Shelly Bansal, FBDO (Hons), CL, FBCLA, qualified as a dispensing optician in 1982 and went on to complete his Hons Diploma in Contact Lenses in 1989. Shelly was then the main contact lens practitioner and manager of a flagship London practice for a large multiple. In 1994 he opened his own independent practice. His special interests include orthokeratology and fitting younger patients. He currently serves as the President of the British Contact Lens Association (BCLA).

Kate Johnson, BAppSc(Optom) Hons, GradCertOcTher, FBCLA, FIACLE, is in specialty contact lens and binocular vision/pediatric practice in Brisbane, Australia. She teaches at the Queensland University of Technology (QUT) and holds three professional fellowships in contact lens practice and teaching.

Thomas Quinn, O.D., MS, FAAO, is in private practice in Athens, Ohio. He is a graduate of the Ohio State University’s specialized postgraduate contact lens program. Dr. Quinn is also a fellow of the American Academy of Optometry and a Diplomate of the Cornea and Contact Lens Section. He is a member of the American Optometric Association and currently serves on its Cornea and Contact Lens Section Council.
Shelly Bansal emphasizes questioning and listening skills. “Ask plenty of open questions to understand your patient’s lifestyle,” he says. “My favorite question is, ‘If I had a magic wand, what would be on your wish list for vision correction?’ This question helps me understand if my patient’s expectations are realistic.”

Dr. Johnson explains tests and observes the patient to ensure that he or she appears to understand the examination. “I will always ask patients what concerns them about their eyes,” she says. “It is extremely important to ensure that you relate your findings back to the patient’s initial concern, no matter what your findings.”

Q: How do you bond with a patient?

“The key to bonding is to show patients that you truly care about them as individuals,” says Shelly Bansal. “The real bond occurs when our patients realize that we offer this personalized care.”

Dr. Quinn shares personal experiences that relate to patients’ experiences. “Be respectful of their language, and that you are on the same level. It also creates an opportunity to re-assess in case you misunderstood something.”

Research has shown that 80% of patients are satisfied with the communication they receive from their eye care providers. But, according to a recent patient communications study, patients want to be more involved in their visits. How do you involve your patients?

“Explanations keep patients involved and aware of the eye examination process,” says Dr. Johnson. “My reception staff members also explain their tasks to make the whole experience clear and hassle-free.”

Dr. Quinn recommends probing more deeply when concerns are expressed. During testing, he and his staff tell the patient what procedures are being performed and why. “Keep your explanations simple,” says Dr. Quinn.

“The whole experience should always be about the patient—not the practitioner or the products,” says Shelly Bansal. “Patients need to know that they are actively involved in the decision-making process.”

Q: Patients want their eye care providers to understand their eye histories and problems. How do you accomplish this?

“For my returning patients, I refer to past tests, events or concerns,” says Dr. Johnson. “Listening and giving a patient time to ask questions accomplishes this goal for new patients.”

Shelly Bansal starts with a comprehensive history and examination and always refers back to the previous record. He also repeats chief complaints to the patients, using the same words that they used. “This shows them that you listened to them, that you understand their language, and that you are on the same level. It also creates an opportunity to re-assess in case you misunderstood something.”

Q: In one study, primary care physicians gave their patients an average of only 23 seconds to describe their concerns before interrupting. Patients want to be heard. What suggestions do you have for being a good listener?

“Making eye contact with your patient forces you to listen rather than take notes,” says Dr. Johnson. “It also helps them see that you are paying attention. Reaffirming their concerns before skipping to the ‘standard’ questions also ensures that the patient feels they are getting a personalized experience.”

Dr. Quinn recommends asking open-ended questions that can’t be answered with a yes or no. “You’ll learn more,” he says.

Shelly Bansal types the responses to open-ended questions, word for word, into the computer record. “It stops me from interrupting them,” he says.

Q: Electronic health records (EHR) have been mandated for all providers in the United States. Do you see EHR affecting your ability to personally connect with patients? If so, how can you minimize any negative impact?

“Facing a computer instead of your patient can interfere with your connection,” says Dr. Quinn. “We have attempted to position the computer so that I can be partially facing the patient as I face the computer. I have also considered employing a scribe to enter the information into the computer as I interact with the patient.”

Shelly Bansal, whose office is paper free, says he is a firm believer in EHR. “The only issue that I have is that I cannot maintain eye contact,” he notes. “To cover this, I let my patients know that I am still listening to them.”

Q: What role does your staff play in communicating with patients?

“My staff members play an
Communication

Q: Does the age of patients affect how you communicate with them?

“Younger patients speak with an informal, urban dialect, whereas older patients may use language in a more formal way,” says Shelly Bansal, who adapts his communication style to the patient’s style to gain trust.

Dr. Johnson says she is energetic around children, explaining their results and involving the parents. “Ice-breaker questions help for the child, before I talk to parents about their concerns,” says Dr. Johnson. “It’s important to determine how much detail patients want and how concerned they may be about their vision. I involve them in the decisions we make. For elderly residents, I reiterate results and try to bring the message down to a couple of key points.”

“I think it is sometimes easy to find yourself talking to a parent, instead of the child being examined, or to a care-giver, instead of an elderly patient,” says Dr. Quinn. “I like to have the ‘support team’ present, but I address the patient directly.”

Q: Does age influence how or whether you recommend contact lens correction for a patient?

Dr. Johnson says the personalities of a child and parent are more important than age when deciding on a contact lens fitting. “I have seen amazing seven-year-olds with perfect handling skills and then incompetent teens and adults,” she notes, adding that many elderly patients wear contacts as well. “Age is just a number,” she adds.

Shelly Bansal says age is not a factor in recommending contact lenses. Dr. Quinn says he recommends daily disposable lenses for most adolescents.

Q: Studies have found that patients interested in contact lenses never mention this interest to their eye care providers and that their eye care providers never mention it. How can we bridge this gap?

Shelly Bansal says he and his staff mention contact lenses to all patients with suitable prescriptions. “We don’t wait for patients to ask us,” he says.

Dr. Johnson and her staff ask every patient about interest in contact lenses. Presbyopes are ripe candidates because many resist wearing spectacles, she says. “It is up to the eye care professional to describe every vision correction option to their patients, and contact lenses are among those options for a majority of the people we see,” she says.

It also helps to include it in the pre-examination questionnaire, says Dr. Quinn.

Q: Vision is the most highly valued of the senses, yet many low-astigmatic patients are prescribed spherical soft lenses. What are your thoughts on this?

“We would never leave a 0.75D cylinder out of a spectacle prescription,” Dr. Johnson points out. “Why would you do the same to a contact lens wearer? There are so many consistent, reliable contact lens options available for our astigmatic patients.”

Dr. Quinn says studies have found that patients benefit visually when astigmatism as low as 0.75D is corrected with toric contact lenses. Low astigmats are often fit successfully on the first try. “It’s effective and efficient,” he notes.

Q: What is your attitude toward today’s presbyopic contact lenses? Who are good candidates? How do you present presbyopic contact lenses to patients?

Dr. Quinn finds that patients seeking freedom from spectacles are ideal candidates. Many are already in single-vision contacts. He uses what he calls the “sandwich” approach, offering a positive comment before and after the “meat” of his presentation. For example:

Positive comment one: “Mrs. Smith, you’ve enjoyed the freedom provided by contact lenses for many years, but I have noticed changes in your near vision. I have great news for you. We have multifocal or presbyopic contact lenses that can provide you with clear vision at distance and near.”

Meat of presentation: “Any time we use a lens, be it in glasses or contact lenses, some give-and-take is required. For example, in your glasses, you must move your head or eyes to ensure you are looking through the correct part of multifocal glasses to see at the desired distance. With multifocal contact lenses, you may find that glasses work better for you than contact lenses during a long night drive or...
How Do You Obtain a Patient’s Eye History?

Dr. Quinn learns about a patient’s eye history and problems in a step fashion. “Each step builds on the other,” he says. Here are the four steps he employs:

**Step 1:** Ask the patient to complete a pre-exam (frequently pre-appointment) questionnaire. This provides the basic information.

**Step 2:** Gather a pre-exam history. At the time of the appointment, the technician takes a verbal history that builds on what was completed in the pre-exam questionnaire.

**Step 3:** Conduct a pre-exam doctor interview. The doctor reviews the information gathered by the pre-exam questionnaire and by the technician, then interviews the patient to explore areas of concern in greater detail.

**Step 4:** Perform an intra-exam doctor interview. The history continues throughout the visit. As the examination takes place, new data often emerges, prompting further questioning of the patient.

in a dimly lit restaurant.”

**Positive comment two:** But I believe I can meet most of your needs most of the time with these multifocal contact lenses.

Dr. Johnson takes an equally sophisticated approach. “I present presbyopic contact lenses to patients with diagrams and in-depth explanations of the process and results,” says Dr. Johnson. “I tell my patients that any presbyopic contact lens correction will accomplish 80% to 90% of what their spectacles can accomplish.”

**Q:** Do you examine or prescribe any differently for patients who spend a lot of time on the computer?

“We want computer users to be no different than for other patients,” says Shelly Bansal. “There are very few people who don’t use computers today. We do, however, prescribe a lot of occupational lenses for patients who spend a lot of time on computers. We also start to use these lenses at the earliest signs of asthenopia.”

“I recommend that any spectacle-wearing presbyopes that spend six hours or more on the computer get occupational lenses, such as the Office Lens, in addition to their multipurpose progressive lenses,” says Dr. Quinn. “The Office Lens provides a much larger window for clear viewing of the computer screen.”

**Q:** How do you share your treatment plan with patients?

Shelly Bansal says this communication results from taking a good history and understanding a patient’s chief complaints. “I refer back to the patient’s chief complaint and then offer the remedy,” he says.

“I use written reinforcement, information sheets and emails to patients when required,” says Dr. Johnson. “I also summarize the treatment plan in two to three points and make sure patients know when and why I wish to see them again.”

**Q:** Research has shown that patients want to know about new products that could help improve their vision, but too often this does not happen. Why? How can we close this gap?

“We need to make enough time in our schedules to talk to our patients,” says Dr. Johnson. “They will return if they know you will be telling them about the latest information and technologies.”

“Patients generally go by practitioner recommendations,” says Shelly Bansal. “I make it my mission to learn about new developments and explain them to my patients.”

Dr. Quinn theorizes that there are three reasons why practitioners don’t discuss new products frequently enough:

1. Practitioners are too busy.
2. The patient is doing well, so practitioners don’t think it’s necessary.
3. The patient is doing well, so practitioners don’t think patients will be receptive or will feel that you are being pushy. But, sharing new information is in the best interest of the patient, he says. “Patients who are doing ‘fine’ often pursue new technology.”

**Q:** What do you think keeps a patient coming back to your practice?

“Patients come back because they perceive value in the services we offer,” says Dr. Quinn. “They feel we have taken a personal interest in them, listened to their concerns, have proposed reasonable solutions, and solved their problems efficiently.”

“We let them know that their success is our success,” Shelly Bansal says.

“Patients come back because we treat them as people, not just eyes to test,” says Dr. Johnson. “We make them feel important.”

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Asthenopia: A Technology Induced Visual Impairment

As technology advances, eye strain and other symptoms of asthenopia are on the rise.

By Dominick M. Maino, O.D., M.Ed., and Christopher Chase, Ph.D.

Vision systems evolve over generations based on the needs of the users and the environment. In humans, evolutionary pressures led to the development of the need for clear distance visual acuity and binocular three-dimensional (3D) stereoscopic vision. These visual skills enabled us to effectively respond to threats in the environment that were distant and constantly changing, and improved our odds of being the hunter rather than the hunted.

When Johannes Gutenberg developed the process for modern book printing in the mid 15th century, he set in motion the shift in visual demands away from the importance of seeing clearly at distance and toward a time intensive two-dimensional near-point task such as reading.

The emergence of mass-produced print materials, such as books and newspapers, has resulted in patients experiencing eye strain, and for some individuals, resulted in academic and work limitations. As technology advanced and electronic media became more dominant, eye strain has progressed to a problem encountered on a daily basis, with potentially serious health implications. This problem will continue to grow in scope as patients spend increasing amounts of time performing near-vision tasks via digital media and as advances in these devices result in viewing screens of diminishing size. For example, films that were once projected onto a screen that spanned the width of a wall can now be viewed on a handheld device.

### Figure 1. Symptomatology of Asthenopia
(modified from AOA Optometric Clinical Practice Guideline)

<table>
<thead>
<tr>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headaches (including migraines)</td>
</tr>
<tr>
<td>Nausea</td>
</tr>
<tr>
<td>General fatigue</td>
</tr>
<tr>
<td>Sleepiness</td>
</tr>
<tr>
<td>Diplopia</td>
</tr>
<tr>
<td>Photophobia</td>
</tr>
<tr>
<td>Blurred vision</td>
</tr>
<tr>
<td>Eye strain</td>
</tr>
<tr>
<td>Eye soreness/pain behind or inside eye</td>
</tr>
<tr>
<td>Burning/tearing of eyes</td>
</tr>
<tr>
<td>Dryness (although there are other causes of this, including prolonged computer use)</td>
</tr>
<tr>
<td>Difficulty reading</td>
</tr>
<tr>
<td>Irritability</td>
</tr>
<tr>
<td>Poor concentration</td>
</tr>
</tbody>
</table>
screen that is a mere 2” x 3.” The technology-induced visual impairments we are witnessing today are the result of our vision information processing system attempting to undo a millennia of evolution and adjust to a relatively sudden change in the demands placed upon our vision.

Asthenopia, which includes eye strain and several other symptoms (figure 1), often occurs in patients whose visual systems are capable of performing near-vision tasks for limited durations of time. It should be noted that asthenopia does not occur as a consequence of any weakness within the ocular musculature system, but rather from the sustained near point demands now placed upon a visual system primarily designed for distance tasks. This is frequently caused by a lack of appropriate cortical output that is necessary for accurate accommodative and fusional vergence system responses, and for the demands of the task.1 As seen in figure 2, there are a number of etiologies for asthenopia, but a recent study of 30 to 40 year-old myopic subjects with asthenopia (N=253) found that the most frequently encountered oculo-visual problem was ill-sustained accommodation (54%).1,5 These findings corresponded with a 2001 study of 18 to 38 year-old subjects that reported accommodative disorders in 61% of subjects.6

How Prevalent Is Asthenopia?

Gauging the prevalence of this disorder has proven difficult for three reasons: 1) If only one or two symptoms of a wide-ranging symptomatology are assessed, then the frequency and impact of asthenopia are bound to be underestimated; 2) Patients experiencing these symptoms may not always schedule an examination or report them while being examined due to the perception that no treatment options exist; and 3) Patients may perceive these symptoms as an expected result associated with the near task performed while wearing spectacles or contact lenses.

Research by Sheedy and associates shows two different afferent pathways for the symptoms of asthenopia. The symptoms can be divided into associations with either external or internal factors. External symptom factors (burn-
ing, irritation, tearing and dryness) are related to dry eye while internal symptom factors (ache, strain and headache behind the eyes) are related to accommodative or binocular vision stress.7

A study was conducted that included 3,800 vision-corrected (contact lenses or spectacles) patients from China, Japan, Korea, France, Italy, the United Kingdom and the United States that allowed for the determination of the prevalence, frequency and impact of asthenopia upon the individual.8 The next set of four figures show the findings from this study. Figure 3 shows the percentage of patients experiencing symptoms. Figure 4 identifies the symptoms by region. Figure 5 pinpoints the symptoms experienced three to seven times each week. And, figure 6 highlights the negative impact of symptoms.

Results show that patients frequently experienced asthenopic symptoms with as many as 58% experiencing eye strain and 69% tired eyes (figure 3). Many of the symptoms that involved a painful sequelae, such as headache after near work and pain inside the eye, occurred less frequently but still affected 29% and 19% of patients, respectively (figure 3). Patients from Asia demonstrated the greatest propensity for all symptoms of asthenopia (figure 4). These data suggest that the symptoms of asthenopia are prevalent and that practitioners should be proactively inquiring if their patients are experiencing any of these symptoms.5

Pain-related symptoms, such as headaches after near work and pain in the eyes, occurred in fewer respondents than the other symptoms listed, but high percentages of these respondents tended to experience these symptoms at least three times or more each week (headaches after near work 42%; pain inside the eye 33%) (figure 5). Not surprisingly, a pain-related symptom had the highest percentage of patients who found their occurrence to be very bothersome (headaches after near work, 44%), which was almost twice as high as the next symptom.8 This 3,800-patient survey shows that a large number of patients suffer from asthenopia and the associated symptoms are experienced repeatedly during the week and have a negative effect on the individual’s quality of life.

Which Patients Are At Greatest Risk?

All patients are at risk for developing asthenopia, but the extent of that risk varies from individual to individual. Most patients report symptoms of vergence dysfunction between the ages of 10 and 39, when the amount of near work is greatest.1 Many individuals with chronic problems have learned to live with their condition and may not voluntarily reveal their symptoms. Young children (preschool and early grades) may have fewer near-vision demands; more importantly, many children no matter their age are often unable to describe their symptoms. These children often do not report the symptoms associated with asthenopia because they consider them as being what is normally experienced by all.1

Those whose occupations require considerable amounts of close work are at an especially high risk. Studies have noted that computer operators are particularly susceptible to asthenopia because a high percentage of computer users with symptoms have binocular vision problems and ocular discomfort increases with the extent of computer use.9-12 In a study of 419 computer operators in India, 46% suffered from asthenopia during or after
working on a computer. In a study conducted in Japan, 72% of office workers who work with computers indicated that they suffered from eye strain and/or pain. These results were similar to another Japanese study, where 70% of computer users reported various degrees of visual fatigue. A Norwegian study of soft contact lens wearers and those who had undergone successful LASIK surgery also reported 70% of patients experiencing some symptoms of asthenopia, with 63% complaining of headaches.

Computer users are not the only professions that are at risk for developing asthenopia. A survey of 380 radiologists found that 36% reported eye strain. Professions (e.g., lawyers, accountants) that involve other types of intensive near work, such as extensive reading of printed materials, also increase a person’s risk for developing asthenopia. Those who are not employed, including retirees, should not be viewed automatically as being at lower risk, as they may be spending a substantial amount of time on the Internet seeking employment, playing video games, or keeping up with friends and family by using Facebook and other forms of digital social media.

Any individual with an undiagnosed binocular vision dysfunction is at significant risk for these technology-induced visual impairments as well. Research shows that up to 56% of those 18 to 38 years of age exhibit signs and symptoms associated with a functional vision anomaly and more than 40% of optometric doctoral students may have a binocular vision dysfunction. Gur, Ron and Heicklen-Klein found a significant reduction in accommodative and vergence function among computer office workers over a five-day work week, suggesting that those with dysfunctional binocular system may be particularly susceptible to symptoms due to computer use.

**Figure 5: Asthenopic Symptoms that Occur Every Day or Three to Four Times Each Week in Patients**

<table>
<thead>
<tr>
<th>Patients (%)</th>
<th>Eye Strain</th>
<th>Tired Eyes</th>
<th>Headache After Near Work</th>
<th>Pain Inside the Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>57</td>
<td>63</td>
<td>42</td>
<td>33</td>
</tr>
<tr>
<td>EU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td></td>
<td></td>
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</tbody>
</table>

*Figure 4: Percentage of Patients Experiencing Particular Asthenopic Symptom by Region* (NSIGHT 2009)

*N = Number of patients in the study (China, Japan, Korea, France, Italy, UK, USA).
†Age range: China, Japan, Korea, France, Italy, UK, USA.

What Factors Are Leading to an Increase in Asthenopia?

The performance of near-vision tasks occurs during school, at work and while engaging in recreational activities. Many individuals may not realize the cumulative effect that this can have on their visual system and general sense of well-being. The workplace is a significant source of demanding near-point tasks, with many jobs requiring the use of a computer for up to eight hours per day. In 2003, 56% of those employed (77 million employees) used a computer.
computer at work. Some occupations have a greater proportion of computer users, with the rates for managers (about 80%) and sales/office workers (67%) being particularly high.\textsuperscript{21} Additionally, 77% of those working from home were computer users as well.\textsuperscript{22} Computer use is not the only source of demanding near-vision tasks. Reading of work-related printed materials can also significantly contribute to the stressors placed upon the vision system.

An overabundance of work-related near-vision tasks is not the only reason why asthenopia is increasing in our patients. The use of various electronic media, including cell phones, electronic messaging and texting, the Internet, standard high definition and 3D televisions, and 3D movies and video games, increases the demands placed upon an already taxed vision system. Figure 7 lists useful statistics on the inroads that these electronic media have made into peoples’ daily lives.

The Future Is Now: 3D

With the success of the 3D film Avatar and the development of 3D television and video games, exposure to this form of entertainment is expected to increase in the near future. In 2010, more than 20 3D feature films were released. ESPN is already providing programming in 3D (e.g., 18 World Cup matches), and the Discovery Network will launch its own 3D channel in 2011.\textsuperscript{23} In 2010, DirecTV began offering its subscribers three channels dedicated to 3D.\textsuperscript{24} As Sony, Nintendo and other companies add 3D capabilities to their products, video game playing is also becoming a significant contributor to the amount of time spent viewing images in 3D.\textsuperscript{25} It should be noted that the Nintendo 3DS system is a handheld device, forcing users to view 3D images on a very small visually demanding screen.\textsuperscript{25}

Three-dimensional viewing contributes an additional level of burden to the overload of near-vision tasks that visual systems are already struggling to perform. Individuals who have poor convergence, accommodation, and visual tracking abilities—all of which are necessary for single, clear and comfortable 3D viewing—may experience blurred vision, diplopia, dizziness and headaches when exposed to this type of media.

Only now are we beginning to study those who experience symptoms while viewing 3D content. Patients with this newly coined “3D Vision Syndrome” require further clinical intervention and research.\textsuperscript{26} Even patients who haven’t required any kind of vision correction in the past can experience discomfort while watching 3D.\textsuperscript{27} In one study of young adults with normal binocular vision, almost half experienced significant visual fatigue and discomfort while viewing 3D.\textsuperscript{28} The American Optometric Association estimates that between three and nine million (and possibly more) Americans have problems appreciating the 3D experience.\textsuperscript{29} With an increase in these visually demanding tasks, not only will the time spent performing vision-intensive activities continue to add stress to our work day and recreational activities, it will also require greater effort on our part to appreciate these many new and quality of life-changing technologies.

Consequences of Asthenopia

Asthenopia often includes health-related consequences such as headache, diplopia, pain in and around the eyes and overall feelings of fatigue (figure 1). A person’s quality of life can be reduced as the pain and discomfort associated with accomplish-
ing particular activities can lead to patients no longer performing them. Hayes and associates found a small but significant relationship between ocular symptoms and global measures of quality of life and a large association between eye and physical symptoms.30

Symptoms associated with asthenopia not only negatively affect a person’s productivity and academic performance, but also our ability to perform work-related and recreational tasks in an efficient and comfortable manner.1

Treatment of Asthenopia

Treatments for asthenopia are available, but as with any health problem, the first step is diagnosis. The simplest way to assess the presence of asthenopia due to internal factors is to stress the accommodative and vergence systems during your examination.1

Practitioners need to be proactive in determining the full extent of their patient’s near-vision activities. It is also important to ask appropriate questions regarding any asthenopic symptoms typically associated with binocular vision dysfunction. Because the patient may not realize that not everyone sees the same way they do and that what they are experiencing is not normal, only a carefully taken case history can discover the problems your patients may have in this area. Answers received from the patient should then be reviewed together so it is clear that you and the patient are using the same words to define the same things.31,63

A comprehensive assessment of the individual’s binocular vision system should be conducted for patients experiencing adverse reactions when performing near-point activities. If the practitioner is not comfortable testing for binocular disorders or in providing optometric vision therapy, the patient should be referred to an eye care practitioner who is.63 Such practitioners have been certified by the College of Optometrists in Vision Development (an international organization) and can be found by logging on to www.covd.org.

All patients can be at risk for developing asthenopia, so practitioners should educate them on what it is and how it may develop. For those patients with a greater risk for asthenopia based on their visual demands, information should be provided concerning visual hygiene and various methods for modifying their near-viewing environment. Practitioners should advise their at-risk patients to do the following:32-33

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<table>
<thead>
<tr>
<th>Figure 7. Statistics on Electronic Media Use</th>
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<tbody>
<tr>
<td><strong>Internet</strong></td>
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<tr>
<td><strong>Electronic messaging</strong></td>
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<tr>
<td><strong>Cell Phone</strong></td>
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<td></td>
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<td></td>
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<tr>
<td><strong>Gaming</strong></td>
</tr>
</tbody>
</table>

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BL 028_RO0611_F6-FILM2[1].indd   33BL 028_RO0611_F6-FILM2[1].indd   33 5/26/11   2:56 PM5/26/11   2:56 PM
When performing computer work, schedule periodic breaks where they look away from the monitor (generally for every 20 minutes of computer use have them look away for 20 seconds).
- Make sure there is proper lighting for performing near-point tasks.
- Use proper ergonomics at the workstation.
- Use a larger font for onscreen text.
- Blink often.

Practitioners can also advise the patient that specially designed near-point corrective lenses can help relieve the symptoms associated with asthenopia. Strategies specific to computer operators should also be employed to reduce the incidence of asthenopia. In a study by Kotegawa and associates, computer operators (20-29 years of age) who had originally been undercorrected or overcorrected experienced a reduction in headache, eye strain and tired eyes after receiving accurate refractive correction. The use of antireflective film on monitors and the use of certain colors (e.g., blue and white rather than green and red) have also been shown to reduce the incidence of asthenopia in some computer users.

Asthenopia can be successfully treated with vision therapy. The goals of vision therapy are to ensure that the patient can visually function efficiently and comfortably in school, at work and/or in athletic activities, as well as to relieve any symptoms. For accommodative therapy, treatment increases the amplitude, speed, accuracy and ease of the focusing response. At the end of therapy, the patient should be able to make rapid and accurate accommodative responses without fatigue.

Vision therapy helps the patient to develop efficient visual skills and vision information processing. The therapeutic procedures re-educate the brain so that the individual can achieve single, clear, comfortable, binocular vision that improves eye coordination, focusing and eye movement, which ultimately enhances the 3D viewing experience. Studies have shown that office-based treatment (in addition to home-based activities) is efficacious and long lasting. In these studies, vision therapy intervention not only eliminated symptoms, but also improved functional abilities—both accommodation and vergence. These remarkable results lasted at least 12 months post intervention. For patients who cannot attend in-office weekly vision therapy appointments, out-of-office therapy using computer programs to improve vision function are also effective.

Non-presbyopic patients, who are otherwise healthy but have accommodative insufficiency, can benefit from using multifocal spectacles to reduce the asthenopia associated with this focusing dysfunction. Because some adult contact lenses wearers exhibit decreased accommodative abilities, consider using either near reading prescriptions in conjunction with the single vision contact lenses or multifocal contact lenses if asthenopia develops for these patients.

Conclusions
The world where people needed the ability to respond to stimuli that were distant, potentially dangerous and constantly changing has been replaced with one where sustained near-point tasks are dominant. This relatively new vision demand will continue to develop in magnitude as the time spent performing near tasks increases and as the size of electronic displays continue to decrease. The inclusion of 3D viewing technologies only further complicates the problem.

As a large proportion of patients are candidates for developing asthenopia, practitioners need to determine their level of risk by asking appropriate questions about their occupations, the activities they pursue in their free time, and the amount of time they spend performing near-point tasks. Practitioners also need to educate their patients about ways they can reduce their risk of developing asthenopia, such as by taking periodic breaks from watching a computer screen and paying attention to the ergonomics of their workstation. The use of corrective and therapeutic lenses will often help to relieve symptoms while implementing an individually prescribed program of optometric vision therapy can frequently completely eliminate the asthenopia.

Asthenopia is a frequently encountered visual impairment that can seriously threaten a patient’s quality of life. It interferes with the quality of our work, our performance in school and our enjoyment at play. Asthenopia is a prevalent condition that deserves our full attention so that, once diagnosed and treated, patients can pursue their interests to the best of their abilities without experiencing pain or discomfort.

Disclosure: Editorial assistance provided by BioScience Communications.
23. Saslow R. For a few, 3-D effects are not so special: Accessed September 1, 2010.

data.bls.gov/cgi-bin/print.pl/news.release.atus.nr0.htm.


A stigmatism is commonly found in patients all over the world. In the United States, approximately 30% of the general population has astigmatism of at least 1.00D. In Germany, an evaluation of more than 23,000 eyes demonstrated that 46.8% of astigmatic patients had with-the-rule astigmatism, 34.3% had against-the-rule astigmatism, and 18.9% had oblique astigmatism. In these patients, 64% had astigmatism of <1.00D, 33% had between 1.00D and 3.00D, and 3% had ≥3.00D.

Astigmatic patients who are contact lens or spectacle wearers may not be experiencing clear vision. In a global study of 3,800 vision-corrected patients across seven countries, 39% of patients reported having astigmatism. Of those with astigmatism, 46.5% reported that they suffer from blurry or hazy vision even with correction, and most (87%) of these individuals found it to be bothersome. These astigmatic patients also reported that they lacked a completely satisfying solution to resolving the symptoms of blurry or hazy vision, but were very interested in finding one.

The prevalence and variety of manifestations of astigmatism, and the impact that symptoms such as blurry or hazy vision can have on quality of life, highlight the importance of being familiar with all treatment options for astigmatism. There isn’t one option that is best for all cases.

Toric contact lenses are an underutilized modality for these patients—particularly low astigmats. This article will review the challenges to prescribing toric lenses and provide information that may help eye care professionals (ECP) effectively manage these patients and improve their quality of life.

Treatment Strategies for Different Patient Needs

For astigmats, spectacles can provide stable and consistent vision without rotational issues; however, they do have inherent limitations. Spectacles result in a narrower field of view compared with contact lenses and have a susceptibility to fogging.

The aesthetic aspect of spectacles is important and should not be underestimated. Patients who are unhappy or uncomfortable wearing spectacles may choose not to wear them in certain environments, such as during school or social events. In addition, some of these patients may not be seeing as clearly as they could be. Studies in both children and adults have shown that patients wearing spectacles score lower on quality of life (QoL) indices than those who wear contact lenses. According to Pesudovs and colleagues (2006), patients (16-39 years of age) wearing contact lenses had higher average QoL scores and were happier with their appearance than those wearing spectacles.

The Adolescent and Child Health Initiative to Encourage
Vision Empowerment (ACHIEVE) Study also examined the effect of contact lens wear on patients. In this study, subjects (8-11 years of age) wearing contact lenses experienced a significant improvement in how they felt about their physical appearance, their acceptance among friends, and their ability to play sports as compared with spectacle users. In addition, those who wore contact lenses felt more confident about their academic performance if they previously disliked wearing spectacles.

**Toric Soft Lenses: An Underutilized Treatment Option**

Surprisingly, not all candidates for toric contact lenses are presented the option of contact lenses. One factor in their underutilization is the practice of fitting spherical lenses on patients with low amounts of astigmatism, even though toric lenses provide better visual acuity. In addition, many patients believe that their astigmatism prohibits them from wearing contact lenses. This was seen in a survey of more than 900 astigmatic adults, where up to 42% of patients believed themselves ineligible for contact lens wear. Patients do not typically know to request toric contact lenses. It is up to the ECP and support staff to make this recommendation and provide the best possible vision for their patients.

**ECP Satisfaction with Current Toric Lens Designs**

Today’s toric soft contact lenses are available in spherical powers from +30.00D to -30.00D. They are more advanced than earlier lens designs, especially in terms of reproducibility. Some practitioners base their view of today’s toric lenses on experiences with previous designs and manufacturing capabilities, which were known for inconsistent quality and reproducibility. In a 1981 study, less than half (48%) of toric soft lens fittings were successful with the first lens ordered. Soon thereafter, practitioners improved their reorder rates by utilizing various techniques, including allowing at least a few minutes for lenses to equilibrate.

A recent study of 150 ECPs working in an independent practice, group or chain, who had been practicing between 2-35 years, were asked how satisfied they are with the toric contact lenses currently available. Although ECPs are satisfied with the current toric contact lens options overall, approximately half were not completely satisfied with various visual qualities of toric lenses. ECPs are least satisfied with the lack of clear vision after patients rub their eyes (21% not satisfied at all and 49% only somewhat satisfied.) This response is consistent with feedback from patients. When asked about comfort, ECPs rated the highest dissatisfaction to be a result of dryness/lack of moisture, which again is consistent with feedback from patients who currently wear toric lenses. Although ECPs are generally satisfied that toric lenses are easy

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**Table 1. Toric Lens Stabilization Designs**

<table>
<thead>
<tr>
<th>Design</th>
<th>Features</th>
<th>How It Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated Stabilization Design</td>
<td>• Four zones of stability concentrated outside of lids for minimal lid-lens interaction</td>
<td>When on-axis, the lens has minimal interaction with the lower lid through the use of zones of accelerated slope of thickness located within the interpalpebral fissure</td>
</tr>
<tr>
<td>Quick Alignment System®</td>
<td>• Prism ballast stabilizing geometry</td>
<td>On each blink, the upper eyelid moves across a gradually changing thickness profile of the lens and the resultant forces acting upon the ballasting geometry helps maintain the lens in its nominal rotational position</td>
</tr>
<tr>
<td>Optimized Ballast Design</td>
<td>• Constant horizontal thickness across the ballast area, which completely encircles the optic zone</td>
<td>Ballast area across optic zone maximizes the stability of the lens and provides consistency of fit across all cylinders and axes</td>
</tr>
<tr>
<td>Precision Balance 8/4 Design</td>
<td>• Low amount of prism in optic zone to reduce thickness</td>
<td>Low amount of prism in optic zone reduces thickness and maximizes Dk/t at 6 o’clock. Lens thickness at 4 and 8 o’clock positions minimizes lower lid interaction</td>
</tr>
</tbody>
</table>

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**ECP Satisfaction with Current Toric Lens Designs**

Today’s toric soft contact lenses are available in spherical powers from +30.00D to -30.00D. They are more advanced than earlier lens designs, especially in terms of reproducibility. Some practitioners base their view of today’s toric lenses on experiences with previous designs and manufacturing capabilities, which were known for inconsistent quality and reproducibility. In a 1981 study, less than half (48%) of toric soft lens fittings were successful with the first lens ordered. Soon thereafter, practitioners improved their reorder rates by utilizing various techniques, including allowing at least a few minutes for lenses to equilibrate.

A recent study of 150 ECPs working in an independent practice, group or chain, who had been practicing between 2-35 years, were asked how satisfied they are with the toric contact lenses currently available. Although ECPs are satisfied with the current toric contact lens options overall, approximately half were not completely satisfied with various visual qualities of toric lenses. ECPs are least satisfied with the lack of clear vision after patients rub their eyes (21% not satisfied at all and 49% only somewhat satisfied.) This response is consistent with feedback from patients. When asked about comfort, ECPs rated the highest dissatisfaction to be a result of dryness/lack of moisture, which again is consistent with feedback from patients who currently wear toric lenses. Although ECPs are generally satisfied that toric lenses are easy
Lens Design Impacts Toric Contact Lens Function

It has been suggested that stability after blinking, rotation estimation using the LARS (Left Add, Right Subtract) method, and recovery can all affect the outcome of toric lens fitting. It is well-known that the rotation of a soft toric lens off-axis has an effect on vision. The degree of rotation can be affected by a patient’s lid anatomy, how the lens fits the eye, and the thickness of the lens. Eye rubbing and blinking can also affect the rotation of toric lenses. According to a survey of 502 patients between 18 and 44 years of age (toric and spherical lens wearers), contact lens wearers regularly rub their eyes. The study reported that 77% of toric lens wearing patients experienced fluctuating, changing, or blurred vision after rubbing their eyes.

Toric lenses utilize a variety of lens stabilization designs to limit the frequency and impact of lens rotation. These different designs have varying levels of rotational recovery ability. Experiencing rotational issues does not make the patient a poor candidate for toric contact lenses. Lens rotation, by itself, should not prohibit a patient from successfully wearing soft toric lenses. But the presence of excessive rotation observed during the fitting process should alert the practitioner to select another lens with a different stabilization design.

Fitting the Toric Contact Lens Patient

Although fitting soft toric contact lenses can be more challenging than fitting spherical lenses, the overall chair time is not much greater. Tips on how to make the fitting process more efficient and productive are provided in Table 2. A precise, new refraction is the key to successfully fitting toric contact lens patients.

Because subtle variances between different lens designs are difficult to predict, empirical fitting is often necessary. Some practitioners enhance their chances of a successful fitting by ordering at least two different lenses per eye at different axes. When fitting a toric lens, the practitioner should consider the rotational stability of the lens. A slightly loose fit may allow the lens to reorient quickly but may provide less stability. A tighter fit may encourage stability but at the expense of reorientation ability. Ideally, a balance is achieved to allow excellent rotational recovery and stable vision. If chair time is used effectively during initial evaluation of rotation and over-refraction, the result is frequently a satisfied patient and fewer follow-up fitting appointments.

Astigmatism is a common vision problem that affects a significant portion of the population. However, many of these patients are not receiving the visual correction that best provides for their needs. This can result from a practitioner’s attempt to correct astigmatism with a spherical lens or a patients’ lack of knowledge that contact lenses are an option for them. Toric contact lenses offer good visual outcomes for astigmatic patients, including those with as little as 0.75D of astigmatism. With modern soft toric contact lenses, ECPs have the freedom to choose lens designs and materials that will best suit their patients’ needs. Patients with astigmatism should enjoy the full benefits of vision correction available with today’s toric lens designs.

Disclosure: Editorial support for this article provided by BioScience Communications.
Refraction has its limitations, but is perhaps the most widely used method to determine and correct for a patient’s prescription. However, variations exist in methods of refraction. Performing an accurate refraction is critical to correcting a patient’s vision for glasses or contact lenses. If you don’t start out with the most accurate subjective optical prescription, the patient will most likely end up unsuccessful and unhappy. As common sense as this may seem, around the world, patients do not always receive a quality refraction. This may be because refraction has been de-emphasized or delegated to unqualified staff members.

The goal of refraction is to achieve the best vision possible; however, 20/20 (6/6) is used as a standard endpoint. This assumes the patient has healthy eyes with potential for 20/20 (6/6) or better vision and normal binocular vision. If the patient has a medical condition where they cannot see the 20/20 (6/6) row, you should adjust accordingly.

Here are the proper steps to obtain an accurate subjective monocular refraction when using a phoropter:

1. Starting Point. Before beginning a refraction, use an objective test such as retinoscopy or autorefraction to obtain a starting prescription. At this point, the patient should be able to read at least the 20/40 (6/12) row of letters.

2. Best Sphere. Begin with the patient’s right eye by placing a +0.50D lens over the starting point. Continue to increase plus power in +0.50D steps until the line blurs. At this point, add -0.50D back into the phoropter.

3. Cylinder. Proceed with Jackson-Flip cross or other appropriate method of determining the patient’s astigmatic correction. This bracketing technique works best by starting with the axis component, then finding the power component.

4. Final Sphere. Change the chart to the 20/20 (6/6) row and add +1.50D sphere to the phoropter. Slowly add minus back (~0.25D per step) until the patient can read only one or two of the letters, even if the chart is still blurred. Continue to add ~0.25D steps, asking if the letters continue to improve. When the lens change makes the letters look “smaller and darker,” you have gone ~0.25D too far.

Repeat these steps for the left eye.

Perform a blur balance test to ensure the patient has equal stimulus to accommodation between the right and left eye. Using prism in the phoropter (6 prism diopters) over the right eye, move the image down. Add +0.50D to each eye and ask the patient if the images for the right and left eyes are equally blurred. If one image is better, add +0.25D over the eye and ask again. Continue until the eyes are equally blurred. Then, increase minus over both eyes simultaneously until the patient is able to once again clearly read the 20/20 (6/6) or better row of letters.

Special Tips:

- Retinoscopy is an excellent way to get fast and objective data regarding the patient’s refractive status. It also enables you to assess the optical quality of the visual system. This skill requires practice, but once you’re proficient, it takes less than a minute to perform.

- To avoid over-minusing the patient, add no more than ~0.75D from the point where the 20/20 (6/6) row is just readable.

- If a patient is not able to read the 20/20 (6/6) row well with the final refraction, recheck the patient for uncorrected astigmatism.

- If you have a hard time determining a patient’s astigmatism, take the patient’s keratometry readings and incorporate this measurement of astigmatic error into the phoropter.

- When in doubt, prescribe less, rather than more, cylinder or axis closer to 180 or 90.

- Make sure room charts are calibrated and that testing distance is set to 20 feet (6 meters). Computer screen-based charts still need to be optically folded using mirrors to give an equivalent testing distance of 20 feet (6 meters) in short exam lanes, otherwise you risk under correcting the patient for distance.

- Show the patient only one line on the visual acuity chart at a time. Showing patients multiple lines will only confuse some patients, which will increase testing difficulty.
Environmental Ocular Symptoms & Sensitivities

There is a very real need to be more active in addressing symptoms caused by environmental factors. By Jennifer P. Craig, Ph.D., MCOptom., and Alexis K. S. Vogt, Ph.D.

Outdoor environmental conditions, as well as indoor environmental conditions, influence eye health. In fact, the World Health Organization has defined “Sick Building Syndrome” (SBS) to include symptoms related to indoor air conditions, such as irritation of eyes, nose, and throat, dry mucous membranes, and skin. Such research has linked poor indoor air quality with eye irritation.1-8

Eye symptoms such as dryness, irritation, and tiredness are observed when the precorneal tear film is unstable.9 Destabilization of the tear film can result from a decrease in lacrimal gland secretion and other gland dysfunctions brought about, in part, by the ambient environmental conditions and interactions with any pollutants present.10 High room temperature and low relative humidity, for example, have been identified as risk factors that lead to tear film instability.7,11 In addition to adverse environmental conditions found inside offices and enclosed places, external pollutants such as smog affect eye health.12

Tear lysozyme, a critical component in ocular surface defense, has

<table>
<thead>
<tr>
<th></th>
<th>Experienced Symptom</th>
<th>Bothered by Symptom</th>
<th>No Solution for Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive Eyes</td>
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<td>88</td>
<td>50</td>
</tr>
<tr>
<td>Watery Eyes</td>
<td>27</td>
<td>74</td>
<td>66</td>
</tr>
<tr>
<td>Itchy Eyes</td>
<td>40</td>
<td>84</td>
<td>44</td>
</tr>
<tr>
<td>Puffy/Swollen Eyes</td>
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<td>79</td>
<td>57</td>
</tr>
<tr>
<td>Red Eyes</td>
<td>33</td>
<td>57</td>
<td>60</td>
</tr>
<tr>
<td>Eye Strain</td>
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<td>85</td>
<td>53</td>
</tr>
<tr>
<td>Dry Eyes</td>
<td>38</td>
<td>88</td>
<td>28</td>
</tr>
<tr>
<td>Tired Eyes</td>
<td>69</td>
<td>87</td>
<td>43</td>
</tr>
</tbody>
</table>

Figure 1. Percentage of patients who reported symptoms. Of those who experience the symptoms, the percentage reporting the symptom to be either slightly or very bothersome and percentage without a solution for the problem are included in the table.

<table>
<thead>
<tr>
<th></th>
<th>All Patients</th>
<th>Contact Lens Wearers</th>
<th>Spectacle Wearers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution</td>
<td>55</td>
<td>58</td>
<td>55</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>47</td>
<td>61</td>
<td>46</td>
</tr>
<tr>
<td>Computer Use</td>
<td>72</td>
<td>74</td>
<td>72</td>
</tr>
<tr>
<td>Long Days</td>
<td>72</td>
<td>79</td>
<td>72</td>
</tr>
<tr>
<td>Cosmetics/Make-Up</td>
<td>30</td>
<td>38</td>
<td>30</td>
</tr>
<tr>
<td>Pollen, Dust, Hay Fever</td>
<td>55</td>
<td>56</td>
<td>55</td>
</tr>
</tbody>
</table>

Figure 2. Percentage of patients who reported eye sensitivities to each condition overall, and differentiated into contact lens and spectacles wearers.
been shown to decrease in concentration with exposure to smog pollution, potentially increasing the risk of developing irritative red eye problems and infections. To identify common ocular symptoms with respect to incidence, impact on quality of life, management strategy and overall satisfaction with available treatments, the NSIGHT Study, a global online survey, was conducted by Market Probe Europe. Three thousand eight hundred (3,800) participants in a 15- to 65-year-old vision-corrected population across seven countries were enrolled in the study. Environment-related symptoms reported by patients included those associated with allergy/sensitivity (red eyes, sensitive eyes, itchy eyes), and workplace environment (dry eyes, watery eyes, tired eyes, eye strain). Patients were also asked to report the frequency of these symptoms and how bothersome they found the symptoms (reported as “not bothered,” “slightly bothered” or “significantly bothered”). Questions regarding availability of a solution for the problem were also solicited. The survey also reported patients’ sensitivities to pollution, air conditioning, computer use, long days, eye make-up, pollen/dust/hay fever, and contact lens wear.

**Study Results**

A large number of patients reported experiencing symptoms associated with environmental conditions, the vast majority of whom reported these symptoms to be either slightly or significantly bothersome. Many of the symptomatic patients had no solution to their problems irrespective of the cause (figure 1).

Analyzing the data for respondents reporting slight or significant sensitivity according to age (figure 3), showed that peak sensitivity to pollution and allergens occurred within the 20 to 30 year age group. Sensitivity to air conditioning showed a trend of increasing with age. The variation of sensitivity to computer use was less age-dependent.

Geographic location was also found to have an impact on ocular symptoms. The largest percentage of patients who reported being significantly bothered by environmental factors live in Asia (figure 4).

In addition to geographic trends, the data also highlighted gender trends. In categories of sensitivity to pollution, air conditioning, pollen, dust and hay fever, and computer use, more women reported slightly to significantly bothersome symptoms than men, particularly in relation to sensitivity to air conditioning, where 56% of women...
Environmental Factors compared to 38% of men reported sensitivity (figure 5).

How the NSIGHT Study Compares to the Dry Eye Literature

The NSIGHT study was not a study of dry eye disease; however, it is interesting to compare the results to those reported in the dry eye epidemiology literature as they are consistent in some instances. For example, the geographic differences in environmental symptoms noted in the NSIGHT study are consistent with the regional differences in prevalence of dry eye disease, which ranges from 7% in the United States to 33% in Taiwan and Japan.21-30 The gender disparity noted in the NSIGHT Study is also consistent with the dry eye literature, which shows the most marked disparity post-menopausally.21-23

Some dissimilarity is noted with regard to age, however. Although the prevalence of dry eye disease has generally been shown to increase with age, the environmental symptoms reported in the NSIGHT study showed varying trends with age depending on the environmental condition. For example, the peak age group who reported sensitivities to pollution in the NSIGHT study was between 20 and 30 years of age, whereas there was no obvious trend with age for patients reporting sensitivity to computer use.21-22

The reason for this difference is not clear from the data, but is believed to perhaps reflect the adverse environmental conditions to which participants within this age group, predominantly, are exposed.

The NSIGHT study highlighted the influence environmental factors have on ocular comfort. Indoor environmental factors, as well as outdoor environmental factors, cause ocular symptoms that are both common and bothersome. With so many patients experiencing environmental symptoms, but lacking a solution, this study's findings suggest there is a real need for eye care professionals to be more active in addressing the symptoms caused by environmental factors.

Figure 5. Percentage of respondents who reported slight or significant sensitivity to environmental conditions, according to gender.

Global Trends in Contact Lens Use in Sports

Contact lenses not only improve performance—their use is a predictor of participation. Are your patients sitting on the sidelines?

By Nick Dash, BSc, MCOptom

Figure 1: Benefits of Contact Lenses Over Spectacles

- Contact lenses provide a wider field of view and less limitation by the edge of spectacle lenses and frame.
- Object size is more ‘real-world.’
- Allow good depth perception.
- Fewer aberrations—contact lenses move with the eyes and allow viewing through the optical centers.
- Fewer lens surface reflections with contact lenses.
- Contact lenses do not fog up or become covered in rain.

Contact lenses are not only useful for professional athletes, but also for the recreational participant. As such, eye care professionals (ECPs) should highlight the advantages of contact lens use to those patients. Although patients consider many factors when selecting modes of vision correction, it has been reported that participation in sports is the second most important reason patients select contact lenses. Similarly, research shows that more than a quarter of patients who chose contact lenses reported sports as a primary motivating factor in their decision. Likewise, it has been shown that nearly half of all existing contact lens wearers take part in some sporting activity. When a patient is first fitted with contact lenses they often report a freedom that allows them to take up a sporting activity that they had previously dismissed as impractical in spectacles.

Athletes are critical of visual standard, and benefit from correction of refractive errors including small astigmatic corrections and retention of binocularity (including correcting unilateral refractive errors and anisometropic patients). Where athletes are striving for improved sports performance, there are opportunities to...
Sports RX

address visual performance issues including correcting small refractive errors inclusive of addressing astigmatic errors and higher order aberrations. Aspheric lenses not only address spherical aberration but also expand the field of clarity and improve real world vision benefits. They are best placed to customize lenses for sports for best visual performance and to advise on safety in lens wear and compliance. Additionally, we need to provide information regarding safety of the eye and adnexa while playing sports.

Global Eye Health Trends

As part of the NSIGHT Study, 3,800 vision-corrected patients were asked how often they actively participate in a variety of athletic activities. The results of the study show that contact lens wearers are 2.2 times more likely to participate actively in sports than spectacle wearers (16.6% contact lens wearers compared to 7.6% of spectacle wearers). The higher rates of participation in sports by contact lens wearers seems to be independent of the sport undertaken (Figure 2). While some activities are more popular than others, each activity is more likely to be undertaken by contact lens wearers rather than spectacle wearers.

Additionally, athletes who participate in sports more frequently are more likely to choose contact lenses. As frequency of sports participation increases, it becomes more likely that contact lenses are the chosen method of refractive correction. In one study, 75% of people who played sports more than three times a week chose contacts over spectacles. This trend was most exaggerated in frequently played (more than three times a week) team ball sports where players are 2.7 times more likely to wear contact lenses versus spectacles. These findings demonstrate that contact lens wear is associated with a more frequent participation in an active team sport.

Swimming is a Special Case

Swimming seems to be a sport that is more often a very occasional activity (i.e., less than once a month), and is probably a vacation-based activity. Although swimming in contact lenses is not recommended regardless of modality, on a case by case basis, practitioners may choose to prescribe daily disposable lenses for such activity to minimize the risk of lens-water contamination. Swimming goggles are recommended to seal out water in these cases. However, risk has led many practitioners to preclude patients from wearing contact lenses when swimming, which potentially restricted many from enjoying this activity.

NSIGHT study findings show only 27% of rigid lens wearers report they ever swim (with or without lenses) compared to 47% of soft lens wearers. Those with lower myopic prescriptions (more often soft lens wearers) have potentially better uncorrected visual acuities and are less likely to be inhibited from swimming. Soft lens wearers may potentially feel more able to swim in lenses because lenses are less likely to fall out.

Regional Variations

Of the countries surveyed in the NSIGHT Study, variations in sport activity among contact lens wearers were observed. Most notably, China shows the highest participation in sport by contact lens wearers. Of patients reporting they practice sport actively (principally individual sports such as running or cycling) compared to less than 10% for each of the other countries surveyed (Figure 3).

While China has the highest participation in sport by contact lens wearers, China shows the highest participation in sport with 25% of patients reporting they practice sport actively (principally individual sports such as running or cycling) compared to less than 10% for each of the other countries surveyed (Figure 3).
wearers, coincidentally it has one of the lowest fits of gas permeable contact lenses and a conversely high use of soft contact lenses, with reported fits of daily disposables as high as 75% in Hong Kong. Although conflicting reports put this value somewhat lower, there is a wealth of evidence to suggest daily disposable lens use is high in China. Additionally, the age of lens wearers is significantly younger than in other countries—the average age is 23 in China compared to over 30 in other countries sampled.

These national variations in contact lens use may be multi-faceted. Factors that influence these figures may be cultural and also due to the contact lens market variations, including lens affordability, availability of lens types, regulatory and prescribing habits of ECPs.

A caveat to these findings exists: cultural variations in sports, refractive demographics and contact lenses doubt have some influence over these findings. Notwithstanding, these data from China present a unique illustration of the correlation between high participation in sport and use of daily disposable contact lenses. The trends suggest that populations who are actively engaged in sports may present key opportunities for expanding contact lens penetration.

**Frequency and Modality**

The advent of daily disposable lenses has impacted the use of lenses in sports. Approximately 16% of daily disposable lens wearers participate in team ball sports more than once a week. Compare this to only 11% of bi-weekly replacement lens wearers and 9% of gas permeable lens wearers who partake in team ball sports at least once a week.

The occasional sportsperson, often called the “weekend warrior,” who only plays a sport a few times a week or month is a good candidate for increased daily disposable lens use. Of all lens wearing groups, 32% of the daily disposable lens wearers report participating in sports less than twice a week compared to only 21% of weekly or bi-weekly replacement lens wearers and 18% of hard lens wearers reporting occasional sporting activity. These findings suggest patients choose daily disposable contact lenses for sports when the potential for lens loss exists or if the individual uses lenses less than twice a week. The selection of daily disposable lens use equates to the cost neutral point compared to weekly, bi-weekly or monthly lenses which necessitate use of care solutions.

Not all sports activities share the predisposition toward daily disposables. For example, individuals who participate in fitness and gym training show an equal percentage of daily disposable, biweekly and monthly replacement lens use. This is likely due to the fact that no specific challenges exist to contact lens wear within the controlled gym environment.

**Age**

In general, participation in a sport, game or physical activity decreases with age. Contact lens trends closely match the participation in sports with the general population. The exception is teenagers, whose participation in sport is the highest, whereas the peak of contact lens wearers’ participation is in the 20-30 year age group.

The teenage population might reflect an opportunity that is not currently being addressed. Reports have illustrated that children (and teenagers) benefit from contact lens use. These studies show that teenagers and younger children experience improved quality of life with...
contact lenses compared to spectacles. In particular, it helps them feel better about themselves with regard to athletic performance, social acceptance and physical appearance.17-19 ECPs should facilitate and adopt a pragmatic approach to fitting teenagers. Early adoption of an active lifestyle can bring life-long benefits to the individual.15

Across the globe, there is overwhelming evidence that participation in sports is undertaken by a large portion of the population. This represents a significant volume of our patient base who have been under-represented in the contact lenses wearing population. All of these patients need to be advised on the most appropriate form of vision correction, especially our younger patients.

In the United States, pediatricians have a stated policy: “Every child and adolescent should have an opportunity to participate in sports and regular physical activity. Participation can be associated with both health benefits and health risks.”20 ECPs have a duty to proactively consider contact lenses for sports activities, especially in earlier years. Contact lenses should be considered a conduit to sports and daily disposable lenses among participants’ sports equipment.

5. Spinney MR. Contact lens for athletes. Optometry Clinic. 1993;3(1):57-76.
As optometrists, we took an oath to “advise [our] patients fully and honestly of all which may serve to restore, maintain or enhance their vision.” Unfortunately, correction of lower order aberrations (myopia, hyperopia and astigmatism) alone does not always provide for full restoration, maintenance, and/or enhancement of our patients’ vision. We have all experienced the patient who sits in our chair, reads 20/20 at distance and near, yet still complains of blur or halos. Previous studies have indicated that, once lower order aberrations are corrected, higher order aberrations become significant factors in visual quality.1,2 Perhaps, instead of having a conversation about “realistic expectations,” we should consider refitting such patients into an aspheric contact lens design.

Measuring and Correcting Higher Order Aberrations

Shack-Hartmann style aberrometers are the most common clinical aberrometers and have many uses, including the objective measurement of refractive error and pupil size, but are most often used to quantify higher order aberrations.3-7 Clinically meaningful higher order aberrations are generally those in the third to sixth order (Figure 1). In a normal, healthy population, spherical aberration is one of the largest of the higher order aberrations and occurs because light rays from the periphery of the pupil are bent more or less than those through the center (Figure 2).8 Ultimately, aberrometers give us a better understanding of our patients’ visual systems.

Spherical aberration can cause symptoms of blur, glare, halos and starburst effects.9 The visual effects of spherical aberration are pupil size dependent, with symptoms being less or absent in those with small pupil sizes. These symptoms are often exacerbated under low light or low contrast conditions. Fortunately, spherical aberration is relatively easy to reduce, as it is rotationally symmetric about the visual axis, unlike other higher order aberrations, which vary by...
Aspheric Designs

orientation.10,11 The popularity of “high definition” in our society has extended from television sets to refractive surgery and intraocular lens implants. One way optical devices deliver on the high definition promise is by reducing higher order aberrations; this has brought the importance of aberration correction to the fore. As primary eye care providers, we can also deliver on this promise with the use of contact lenses that correct for spherical aberration.

Aspheric Contact Lenses

Traditionally, soft contact lenses are designed with spherical surfaces, which can introduce additional spherical aberration to the eye. Aspheric contact lenses are created by altering the shape of the lens from the center to the edge. There are a number of disposable aspheric contact lenses available on the market today, including both hydrogel and silicone hydrogel materials, with replacement schedules from daily to monthly (Figure 3). It is important to note that not all aspheric designs are equal. Some aspheric contact lenses are designed to counteract the spherical aberrations introduced by the contact lens alone, while others minimize the combined aberrations of the contact lens and the population average. The latest advances in aspheric technology include more precise correction for each 0.25D step along the entire power range, as well as designs that account for the change in contact lens shape and therefore, optics, when the lens is placed on the eye. Practitioners can educate themselves on the specific attributes of various lens designs by contacting their local representatives or visiting company websites.

Putting It into Practice

Following are two examples of patients, seen at The Ohio State University in Columbus, Ohio, who had...

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**Figure 3. Disposable contact lenses with aspheric designs available in the United States**

<table>
<thead>
<tr>
<th>Company</th>
<th>Contact Lens</th>
<th>Base Curve</th>
<th>Diameter</th>
<th>Power Range</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bausch + Lomb</td>
<td>PureVision</td>
<td>8.3, 8.6</td>
<td>14.0</td>
<td>+6.00 to -12.00</td>
<td><a href="http://www.bausch.com">www.bausch.com</a></td>
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<tr>
<td></td>
<td>PureVision2</td>
<td>8.6</td>
<td>14.0</td>
<td>+6.00 to -12.00</td>
<td></td>
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<tr>
<td></td>
<td>SoftLens Daily</td>
<td>8.6</td>
<td>14.2</td>
<td>+6.50 to -9.00</td>
<td></td>
</tr>
<tr>
<td>CooperVision</td>
<td>Biomedics 55 Premier</td>
<td>8.6, 8.9, 8.8 (plus power)</td>
<td>14.2</td>
<td>+6.00 to -10.00</td>
<td><a href="http://www.coopervision.com">www.coopervision.com</a></td>
</tr>
<tr>
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<td>14.2</td>
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<td>Definition AC</td>
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<td>14.2</td>
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<td>14.2</td>
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<td>+4.00 to -8.00</td>
<td></td>
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</tbody>
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**Figure 2. Example of positive spherical aberrations in which peripheral rays are bent more than central rays.**
visual complaints with their habitual contact lenses and were interested in improving their vision. Patients were trial fitted with both spherical and aspheric contact lenses and aberrations were measured with the COAS Aberrometer (Wavefront Sciences), a Shack-Hartmann style aberrometer, using a 6mm pupil diameter for analysis (Figure 4).

**Patient 1:** A 28-year-old female with manifest refraction of –6.50 –0.50 x 147 OD and –7.25 –0.75 x 045 OS was fitted with –6.00D and –7.00D CooperVision Biofinity contact lenses. Spherical aberrations in her right eye were +0.20 µ uncorrected, increased slightly to +0.21 µ with a spherical contact lens, and decreased to +0.01 µ with a Biofinity aspheric contact lens.

**Patient 2:** A 26-year-old female with auto-refraction of –3.25 –1.00 x 156 OD and –3.50 –1.25 x 018 OS was trial fitted with spherical, aspheric, and toric contact lenses. Spherical aberrations in her right eye were +0.23 µ uncorrected, +0.25 µ with a spherical contact lens, and +0.03 µ with a PureVision2 contact lens with an aspheric design. Although spherical aberration was reduced with the aspheric contact lens as compared to the spherical lens, lower order aberrations have a greater effect on overall visual quality and should be corrected before attempting to minimize higher order errors. Therefore, even though spherical aberration can be reduced with the aspheric lens, given the magnitude of the aberration associated with astigmatism, we thought it would be best to fit her in a PureVision Toric, which would correct for the astigmatism and is designed with an aspheric front surface. Figure 5 shows the COAS Aberrometer output for Patient 2. On the left, the data from the uncorrected eye show the highest aberrations are spherical defocus (myopia) and spherical aberration. Aberrations with PureVision2 are shown in the middle and demonstrate the decrease in both spherical defocus (myopia) and spherical aberration. Finally, PureVision Toric contact lenses (right) decreases defocus, astigmatism and spherical aberration.

**Building Your Contact Lens Practice**

Fitting aspheric contact lenses is just one more way practitioners can increase patient satisfaction and retention. Often, patients complain of problems with night driving or reading the overhead in conference rooms, yet doctors dismiss these issues as being “normal.” Such complaints may be due to uncorrected spherical aberration. Doctors do not often measure patients’ aberration profiles or test their full visual function using low-illumination or low-contrast charts. Fortunately, practitioners need not change their testing routines or purchase expensive equipment to be successful fitting aspheric contact lenses. It’s more important to listen to patients’ subjective complaints and be proactive in educating ourselves and our patients on the latest technology in

(continued on page 59)
Are Corneal Infiltrates on the Rise?

Although speculations exist on the causes of contact lens-related corneal infiltrates, we have yet to establish a true culprit. Edited by Joseph P. Shovlin, O.D.

Q There has been significant discussion lately regarding an apparent increase in the number of reported cases of contact lens associated infiltrates. Although I have seen this with every MPS (and less with hydrogen peroxide usage), are these infiltrates more prevalent in patients using certain lens/solution combinations?

A William Townsend, O.D., executive board member of the Ocular Surface Society of Optometry, brings forth a quote from a study that evaluated complications of care products: “Formulators of contact lens care products face the continual dilemma of balancing antimicrobial efficacy, tissue toxicity and subjective compatibility. It may well be an easy task to design a vehicle to kill microbes, but if placing it in contact with the eye creates tissue damage or significant discomfort, the situation will be clinically unacceptable.”

Based solely on Dr. Townsend’s clinical impressions, he believes that he is diagnosing more infiltrative events in his practice. At the same time, he believes there are several potential reasons for this: “One—I am seeing more contact lens patients; two—because we, as a society, are becoming more prone to hypersensitivity; three—because of the combinations of lens materials and solutions I prescribe; or four—because of some undetermined factor(s) that I am not astute enough to identify.” Dr. Townsend believes there is more to the story than meets the eye.

Corneal infiltrates have been associated with infection, hypoxia or hypersensitivity (usually type IV), and other conditions; but in some cases, the precise cause is never actually determined, says Dr. Townsend. He recalls an anecdotal incident when he treated three siblings who wore the same type of silicone-hydrogel lenses and used the same multipurpose solution. “Over a period of months, they independently presented with moderate discomfort and corneal infiltrates. In the absence of any evidence that their problems were related to infection, I switched each of them to a different solution with dissimilar wetting agents and preservatives,” explains Dr. Townsend. “In each case the infiltrates resolved, and when I re-challenged all three individuals with the original solution, the infiltrates returned within a week.” What does this case tell us? “These isolated cases are seemingly connected by a common gene pool. Should we presume this is a bad solution?”

According to Dr. Townsend, these individuals probably developed type IV hypersensitivity to one or more component(s) of the solution. But, a large number of his patients use the product in question without any problems. In fact, his associates confirmed they had only seen a few cases of infiltrates linked to this or any other product.

“Before we assume that product X is a frequent cause of infiltrates or complications, we must consider several factors, particularly market share. The fact that product X causes 70% of the contact lens-associate infiltrates in my practice, but coincidentally is used by 80% of my patients does not prove that it is inherently a bad product, but it should make us wonder,” Dr. Townsend notes. More information is necessary to determine the true cause of infiltrative corneal events and to establish the reasons for their development in some individuals.

Dr. Townsend states that infiltrates may be associated with any solution or lens material, and currently, we have no large, well-designed study that evaluates the incidence of specific material-solution incidents. Such a study is needed and will require evaluation of the results in light of many factors including current market share.

The onus is on the practitioner to heed the signs and symptoms, diagnose the condition and initiate proper treatment for any lens wear complication. “We must routinely evaluate contact lens patients for infiltrates, staining, edema, neovascularization and other complications,” Dr. Townsend says.

When eye care practitioners provide care to patients, it is important not only to have a strong scientific body of knowledge, but also a similarly strong understanding of the patients’ needs and fundamental vision related-issues. The Needs, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) Study was designed to answer some of the basic questions surrounding patient perceptions about their visual needs.1 The NSIGHT study showed that vision is highly important to patients all around the world. Respondents to the survey even said that they would be willing to sacrifice features such as ocular comfort and personal appearance for improved visual function.1

How does this study apply to ocular disease management and therapeutic eye care? Take as an example a patient with glaucoma. While practitioners are chiefly concerned with intraocular pressure (IOP), optic disc status and visual field results, patients care most about their risk of visual disability. Patients want to know that they will continue to have good vision, allowing them to drive a car, work, enjoy their hobbies and not suffer reduced quality of life because of their disease. Such considerations are crucial in the management of glaucoma.

When selecting therapeutic options, our patients always expect that we will prescribe “the best” medication, but “best” may mean many different things, depending on the situation. At times, we may try to use the least expensive, the most convenient or the most comfortable medication. But if NSIGHT is any guide, patients want the treatment that will provide them the best vision, the best potential for sustained vision or a return to normal vision in the shortest period of time.

In the case of glaucoma management, the “best” medication is the one that will most effectively control IOP and thus preserve a patient’s remaining vision. For most, this means using a prostaglandin analog (PGA). These medications are well tolerated and usually have the best patient adherence due to the once-daily ease of dosing. Additionally, PGAs have been demonstrated to well control the IOP elevation that occurs while patients sleep, and do well to stabilize the diurnal IOP curve.2

Applying this concept to antimicrobial agents, the conclusions of NSIGHT dictate that we select the drug with the broadest spectrum of action and the most rapid bacterial eradication time.3 Without question, this suggests using one of the latest generation fluoroquinolones, such as gatifloxacin, moxifloxacin or besifloxacin. In addition though, we should choose an agent with minimal ocular toxicity, especially if the antibiotic is being used prophylactically for cataract or refractive surgery. Again, we want to protect against infection, but if we compromise vision in the process, we have done a great disservice to our patients.

Similar analogies can be made for the use of topical anti-inflammatory agents (e.g., corticosteroids and NSAIDs), anti-allergy medications and even artificial tears. Maintaining good vision and preventing progressive vision loss are inherently more important—from the patient’s perspective—than cost, comfort and other confounding factors.

The NSIGHT study can be interpreted across many subspecialties of our profession. Ultimately, the study validates something that has always been a core belief in optometry—namely, that it’s all about the quality of the vision we provide.
Study of Systems

The eye does not function in isolation. In fact, 19th century physicians skilled in the diagnosis and treatment of eye diseases branched out by adding otology (ear and vestibular diseases), rhinology (diseases of the nose, including the sinuses), and laryngology (diseases of the throat and larynx) to their repertoire. Eye and Ear Infirmary were established in Massachusetts, New York, and other large cities. These early EENT (eyes, ears, nose, and throat) physicians viewed the eye and visual system as being closely related to these other organs, so why not treat them all?

Optometrists often shared both office space and patients with audiologists (many still do so today). Several of our optometric colleagues practice in multidisciplinary health settings. Of course, the connections of the eye and visual system to the rest of the body go well beyond other tissues of the head and neck. As part of the nervous system, the eye interacts with virtually every other organ system. In our bimonthly column we attempt to illustrate the fact that many systemic conditions have ocular complications, and several ocular diseases (and treatments) have systemic implications.

Optometrists are in a position to team with providers from various other disciplines in the interest of patient health and wellness. A dentist colleague of ours once remarked, “We (optometrists and dentists) do the same thing, just in different places. You see diabetic retinopathy, I see diabetic periodontitis. You treat uveitis in a patient with Crohn’s disease; I treat their aphthous ulcers (can-ker sore). You relieve a Sjögren’s patient’s dry eye; I enhance their diminished saliva production.”

A True Review

A walk through any large ophthalmic meeting’s exhibit hall tells us that there has been a huge increase in high-tech diagnostic methods available to us. However, it is the simple case history that usually provides ninety percent of the useful information, with eye examination and diagnostic tests used to confirm the diagnosis. The clinical evaluation of any patient, no matter what the discipline, begins with a case history.

We are all familiar with the major elements of the case history, from the chief complaint to medications and allergies. The Problem-oriented Medical Record (POMR) has proven to be a useful method of documenting medical information. It provides a structure that helps us record our patient notes, and view those notes subsequently in a manner that quickly gives us a good understanding of that patient’s history.

The review of systems (ROS) has become a standard element of the history and the POMR. ROS is a list of questions, arranged by organ system, designed to uncover symptoms of dysfunction and disease. Table 1 lists the various organ systems and corresponding ROS. Keep in mind that these are just the more common symptoms and not an exhaustive list.

Applying ROS

The ROS can be applied in sev-
eral ways:
1. As a “head to toe” screening tool asked of every patient that the clinician encounters.
2. As additional questions asked only of patients who fall into particular risk categories (e.g. reserving questions designed to uncover pseudotumor cerebri to overweight females of child-bearing age.
3. As a means to describe the likely causes of a presenting symp-
tom (e.g. patients with a chief concern of “unilateral eye and head pain” would merit a detailed headache and neurologic ROS).
   Today’s clinicians incorporate the ROS into the overall patient care strategy. Patients’ responses should be interpreted within the context of the rest of their profile, including:
   • demographics
   • risk factors
   • past history

•objective data gained from the examination.
   Then, the clinician can come to an informed conclusion about the extent and cause of the patient’s symptom(s), and use it to guide their subsequent management.

- Table 1. Review of Systems (2, 3)

The following is a list of the various organ systems and corresponding ROS:

- Constitutional: weight loss or gain, general state of health, well-being, and strength.
- Ear/Nose/Throat: pain, mouth sores, change in hearing, poor swallowing, discharge.
- Respiratory: shortness of breath, chest pain, cough, hemoptysis (coughing up blood), snoring or stop breathing.
- Cardiovascular: chest pain, palpitations, syncope, dyspnea, edema, heart murmurs, varicosities.
- Gastrointestinal: appetite changes, indigestion/heartburn, abdominal pain, nausea, vomiting, hematemesis, jaundice, constipation, diarrhea.
- Genitourinary: urgency, frequency, dysuria, nocturia, hematuria, polyuria, unusual (or change in) color of urine, stones, infections, nephritis, hesitancy, incontinence, genital sores, discharge, sexually-transmitted disease.
- Endocrine: polydipsia, polyuria, hormone therapy, intolerance to heat or cold, weight changes.
- Neurologic: headache, convulsions, paralyses, paresthesias, difficulties with memory or speech, sensory or motor disturbances, poor muscular coordination (ataxia, tremor), orientation (place, time, person).
- Psychiatric: predominant mood, emotional problems, anxiety, depression, previous psychiatric care, unusual perceptions, hallucinations.
- Integumentary: hair loss, skin eruptions/rashes/growths, sores that grow and/or don’t heal, lesions changing in size, shape, or color, itching.
- Musculoskeletal: joint pain, swelling, or redness, muscle ache, back pain
- Immunology: reactions to drugs, food, insects, skin rashes, trouble breathing, anemia, bleeding tendency, lymph node enlargement or tenderness.
- Hematology/Oncology: chronic or past hematologic or oncologic disease, malignancies abnormal bleeding/bruising, new/growing lumps or bumps, hypercoagulability.
- Ob/Gyn/Breast: Chronic or past disease, dysmenorrhea, vaginal discharge, post-menopausal bleeding, dyspareunia, number and results of pregnancies, breast mass, pain or discharge.
A 31-year-old Caucasian male presented for an early follow up visit to the office with complaints of transient visual blur in both eyes in January 2011. The blur was intermittent and began approximately six weeks earlier. He also reported seeing “stroboring” light intermittently during this time as well. The episodes of photopsia and visual blur seem to last one to four hours when they occur, and may involve both eyes at the same time or one eye individually.

The patient is a long standing ocular hypertensive patient who has been followed every six months for the past four years. When initially seen for a comprehensive ophthalmic examination, he was found to be myopic and astigmatic O.U., best corrected to 20/20 O.D., O.S., O.U. Pupils were ERRLA with no afferent pupillary defect. EOMs were full in all positions of gaze. A slit lamp examination of his anterior segments was remarkable for faint bilateral Krukenberg spindles O.U. Von Herrick angles were estimated to be 4+ open O.U. There were no iris transillumination defects noted. Applanation tensions at the initial visit were 30mm Hg O.D. and 31mm Hg O.S. Pachymetry readings were 579µ O.D. and 582µ O.S. Standard threshold perimetric studies were normal O.D. and O.S. Gonioscopy demonstrated IV+ open angles to the ciliary body O.U, with moderate (grade 3) pigment in the trabecular meshwork O.U. There were no other angle abnormalities O.U. Stereoscopic optic nerve photos were obtained O.D. and O.S. HRT 3 images of both optic nerves were also obtained, which confirmed the clinically appreciated asymmetry. Both neuroretinal rims were classified as normal via the Moorfields analysis.

He was taking no current medications, and reported no allergies to medications. There was no family history of glaucoma. Subsequent to the initial glaucoma work up, the patient was seen every three months for a year, at which time the fields and neuroretinal rims remained stable. IOP varied from 27-34mm Hg O.D. and 29-34mm Hg O.S. After one year of stable follow up, we decreased the frequency of follow ups to once every six months.

He was scheduled for his six month follow up visit in February of 2011, but given the onset of visual disturbances in December of 2010, the patient presented early for his visit. During the January 2011 visit, IOPs were found to be 29mm Hg O.D. and 31mm Hg O.S. Pupils were ERRLA with no APD. Visual fields were stable and demonstrated no field defects in either eye. Close examination of his optic nerves was unchanged from previous visits. The retinal venular tree O.D. appeared slightly dilated and tortuous, especially the inferior branch of the right central retinal vein. Macular photos were obtained this day and compared to previous photos via the overlay function of the EyeScape software. There was a notable change in the venular appearance O.D. inferiorly compared to images obtained approximately six months earlier.

While IOP, visual fields, and HRT imaging had remained stable, the recent onset of visual disturbances O.D. and O.S. along with the change in the retinal vascular picture led to a diagnosis of impending retinal vein occlusion O.D. and probably O.S. as well, in all likelihood exacerbated by the ocular hypertension. The patient was given a prescription for Travatan Z (one drop O.U.) and asked to return in two weeks. The patient was also given an order for...
Discussion

This very interesting presentation highlights the relationship between intraocular pressure and optic nerve and retinal vascular perfusion. By most accounts, you would think that a young, healthy male with ocular hypertension and healthy optic nerves would be able to maintain adequate optic nerve and retinal health with IOPs in the upper 20s to low 30s, especially with concurrent relatively thick central corneal thicknesses. And in fact, this patient was followed for several years with all of the standard measures of change (IOP, visual field and neuroretinal rim) remaining stable. That is, until the patient experienced visual disturbances. And even then, IOP, fields and optic nerve characteristics remained stable. But what didn’t remain stable was his retinal perfusion. The basis of his visual complaints was related to decreased perfusion to both eyes. While perfusion was adequate most of the time to maintain normal visual functioning, there were episodes where perfusion was decreased to a threshold level where visual disturbances became a problem. Though the patient was seen at a time when his subjective vision was normal, there were tell tale retinal vascular changes indicative of decreased perfusion.

Close examination of Figure 1 taken on the day the patient presented on an urgent basis, shows very interesting findings. At the first bifurcation of both the inferior temporal and inferior nasal retinal arteries of the right eye, there appears to be obliteration of the underlying retinal vein just distal to each bifurcation. Also, the entire inferior retinal vein O.D. appears slightly dilated and tortuous—a finding that was confirmed when the images were compared to earlier images. While systemic etiologies need to be examined as possible causes of the impending retinal vein occlusion, certainly elevated IOP is a well known risk factor for the genesis of retinal vein occlusions.

On follow up two weeks after initiating therapy for ocular hypertension, IOPs were 22mm Hg O.D. and O.S. A review of lab results was unremarkable. Specifically, glucose, triglycerides and lipids were all normal, including cholesterol subtypes. Also, ESR, CRP and the CBC were normal in all respects. Unfortunately, the patient was not tolerating the Travatan Z well, as both eyes were uncomfortable, red and burning. He did however report that, since beginning therapy, he has had no further episodes of visual disturbances. Fundoscopy demonstrated less tortuous retinal veins O.D. In order to address the irritation, I asked him to discontinue the Travatan Z and begin Lumigan 0.01% (one drop O.U. h.s. after a 48 hour washout period) and to return to the clinic in two to three weeks.

When last seen in February 2011, applanation tensions were 19mm Hg O.D. and 16mm Hg O.S. while medicated with the Lumigan O.U. h.s. Both anterior segments were markedly improved as compared to previous visits. Visual fields and HRT 3 nerve scans were not performed at this visit. His retinal vascular picture O.D. has returned to baseline as compared to images from 18 months earlier.

While the right inferior retinal venular picture was somewhat asymmetric as compared to the superior retinal venules, it was markedly improved as compared to the images taken immediately prior to initiation of therapy. Furthermore, the patient reported a complete cessation of visual disturbances since initiation of ocular hypertensive therapy.

While we tend to sometimes think of glaucoma as being either pressure dependent or pressure independent, we need to realize that there is a continuum between pressure dependence and independence. Likewise, we need to keep in mind that optic nerve compromise may be wholly pressure dependent, wholly pressure independent, or more likely, a combination of both, though one factor may play more of a role in any given case.

When you look at the profile of a pigmented dispersion patient, you see a profile like our patient: young, healthy and myopic, with elevated IOPs. While the tendency might be to assume that because the patient is young and healthy, they can tolerate a more elevated and sustained IOP, this case clearly shows that even in healthy young patients, blood flow can be compromised by moderately elevated intraocular pressures. Imagine then, what similarly elevated pressures may do to the eye of someone a bit older and in not as good health.

As for our patient, he is scheduled for follow up in six weeks, sooner should he notice any changes. Currently, he is tolerating the Lumigan 0.01% well and reports no visual disturbances. Does he actually have glaucoma? Good question. I believe we are treating his risk for developing glaucoma, and certainly mitigating the risk of further retinal vein occlusion.
Seeing the Road Ahead

The importance of vision. By Diana L. Shechtman, O.D., and Paul M. Karpecki, O.D.

Evidence-based medicine allows us to sensibly use current research to make decisions about the care of our patients. However, while research is certainly crucial to the continuous growth of our profession, we must not lose sight of our roots. After all, we took an oath to “advise (our) patients fully and honestly of all which may serve to restore, maintain or enhance their vision and general health.”

David Sackett, the pioneer of evidence-based medicine, once said “Good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough.” As our role in medical optometry evolves, we continue to integrate clinical trials into clinical practice. Yet, as eye care providers, our primary goal must be to ensure the best corrective vision for our patients. In fact, that is what our patients expect.

NSIGHT

A recently published online survey conducted in seven countries (U.S., France, U.K., Italy, Japan, Korea and China) determined that vision was by far the most compelling element to all patients. The NSIGHT (Needs, Symptoms, Incidence, Global Eye Health Trends) study was conducted among 3,800 patients with visual corrective needs ranging in age from 15 to 65 years. The survey evaluated 40 different needs related to eye conditions, comfort, environment, convenience, health, vision, personal performance and appearance. The study’s primary goal was to determine the ranking associated with patients needs when it came to choosing eye-related products. Although the results were not overwhelmingly new information, they were indeed relevant. Among the eight classifications in the study, the two most persuasive categories were vision followed by eye health, while personal performance and comfort rank lowest.

Visual Impairment

Visual impairment affects 314 million people worldwide and is one of the most common disabilities, leading to a decrease in the ability to perform activities of daily living, including driving and reading. Eye-related conditions commonly seen in our practices—such as age-related macular degeneration, glaucoma, vascular retinopathies and cataracts—are often associated with visual impairment and blindness.

Patients experiencing vision loss attributed to eye-related diseases are the ones who have the greatest need for proper visual enhancement. Moreover, uncorrected refractive error has been identified as one of the leading causes of visual impairment. So even though efforts in promoting research enable the advancement of eye care delivery and the development of new treatment options, providing good vision also plays an essential role in vision care.

Our Responsibility

In order to maintain ocular health, the eye care provider takes a proactive role in preventing both the progression and prevalence of various eye diseases. Patient education is key in achieving this goal. For example, patients need to be better informed about diabetes, hypertension, smoking cessation, proper nutrition, UV protection and appropriate vitamin and supplement use. Patients also need to be cognizant of the importance of annual and routine eye exams and how it reduces the impact of various ocular conditions. Early diagnosis of ocular disease leads to prompt treatment and a better prognosis.

Surgical comanagement is equally important. Optometrists can provide access to the best treatment options and to the best surgeons. There also are countless benefits when patients receive pre and post operative care from someone who knows their ocular history and unique characteristics.

Given the importance of vision to quality of life, we must understand the importance of the fundamentals as we work toward improving our patients’ sight.

References

A 68-year-old white male presented with loss of vision in his left eye for the past 14 days. He reported flashes of light in the left eye about four weeks prior, followed by some floaters. He had assumed his vision would clear, but when it didn’t, he came in to be evaluated.

His ocular history was noncontributory, including cataract surgery in both eyes approximately one year ago. His medical history was significant for hypertension and high cholesterol, for which he was properly medicated. However, he didn’t bring the medications with him and couldn’t remember their names.

On examination, his best-corrected visual acuity measured 20/20 O.D. and 4'/200 ‘E’ O.S. His extraocular motility testing was normal. Confrontation visual fields were full to careful finger counting O.D. He could barely count fingers O.S. The pupils were equally round and reactive to light; there was a grade 3 to 4+ afferent pupillary defect O.S.

The anterior segment examination of the patient’s right eye was unremarkable, with the exception of a well-centered posterior chamber IOL. The left eye also contained a posterior chamber IOL in addition to cells in the anterior vitreous.

Fundus examination of the right eye showed a small cup, with good rim coloration and perfusion. The vessels, macula and periphery were normal. Examination of the left eye revealed the changes seen in the fundus photograph.

Take the Retina Quiz

1. What is the correct diagnosis?
   a. Total rhegmatogenous retinal detachment.
   b. Total exudative retinal detachment.
   c. Exudative retinal detachment secondary to choroidal melanoma.
   d. Harada’s disease.

2. What do the changes in the temporal retina represent?
   a. Horseshoe retinal tear.
   b. Mass below the retina.
   c. Proliferative vitreoretinopathy (PVR).
   d. Retinal dialysis.

3. How soon does the patient need to be treated?
   a. No need to be seen or treated.
   b. Immediately within 24 hours.
   c. Within 24 to 48 hours.
   d. With in the next week or so.

4. How should this patient be treated?
   a. Observation.
   b. Laser photocoagulation.
   c. Scleral buckle procedure (SBP).
   d. Pars plan vitrectomy, membrane peel, gas fluid exchange, endolaser and SBP.

5. What do you expect the final visual acuity to be?
   a. 20/20 to 20/30.
   b. 20/40 or 20/50.
   c. 20/60 to 20 20/100.
   d. 20/200 to 20/400.

For answers, go to page 59.

Discussion

Our patient has a total macula-off rhegmatogenous retinal detachment (RD). Though the RD is apparent in the montage fundus photograph, the retinal break is not visible, but was located peripherally at the one o’clock position. This process began three weeks ago when the patient began experiencing flashes of light in his left eye over four weeks ago. The flashes are typically due to focal vitreous traction on the retina. The traction continued until finally the patient experienced the sudden increase in floaters. This was likely due to the vitreous detaching, which, unfortunately, also resulted in a retinal tear. It should be fairly evident what happened next as liquefied
vitreous migrated under the retina, resulting in a detachment.

Had the patient presented at the time of his flashes, he could have been educated about their significance and warned about the possible ramifications. Even if he had come in as soon as he saw the floaters, the tear could have been identified and treated, thus avoiding a complicated RD.

The treatment is surgical. Unfortunately, however, surgery is much more complicated at this stage, and the visual outcome not nearly as good had it been diagnosed and treated before his macula became detached. How soon does our patient need to be operated on? At this point, there is no real sense of urgency. From the history, his macula has been off for at least 14 days. There are a number of factors in determining visual success following repair of retinal detachment, with preoperative visual acuity being most significant. The better the preoperative acuity, the better the outcome. In instances when the macula is involved, the preoperative acuity appears to be directly related to the height and duration of the macular detachment.

Traditionally, it was felt that if the macula was detached for less than 24 to 48 hours, the chances of having a good visual outcome (20/20 to 20/30) were still fairly good. After 48 hours, the visual outcome is not as good—20/80 to 20/200, or so. Recent data suggests that a successful outcome can be achieved with the macula being off for as long as 10 days.1 Because our patient has a very bullish macular detachment and duration of longer than 10 days, this does not bode well for good visual outcome.

Aside from recovering vision, anatomic success may also be difficult to achieve. In the far temporal periphery, there is an area where the detached retina has bunched up in a “star-shaped” configuration. This represents an area of proliferative vitreoretinopathy (PVR). PVR is nothing more than fibrosar connective tissue that grows and proliferates on the surface of the retina resulting in further traction on the retina. It is the number one cause for failure and retadetachment following RD surgery.1 When PVR is present, vitrectomy is indicated with careful removal of these membranes. However, the PVR may be extensive, or even so subtle that it may not be seen on clinical exam. There is a relationship between the chronicity of the RD and the amount and/or presence of the PVR, with more chronic RD having more PVR.

Our patient was seen by a retinal specialist and had surgery approximately one week later. The surgical procedure involved a pars plana vitrectomy, membrane peel, gas fluid exchange and SBP. The retinal tear was lasered and localized under the buckle.

He maintained face down positioning for a period of one week. His RD was successfully repaired with good anatomic success; however, his vision never recovered beyond 20/100. ■

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Raucaus Rash

By Andrew S. Gurwood, O.D.

History
A 58-year-old black female presented with a chief complaint of painful rash on the right side of her face as well as a scratchy-feeling right eye. Her systemic history was remarkable for hypertension for which she was properly medicated with lisinopril 20 mg po qd.

Diagnostic Data
Her best-corrected acuity was 20/25 O.U. at distance and near. The pertinent external examination findings are demonstrated in the photograph. Extraocular muscles and confrontational visual fields were unremarkable.

What's causing this painful rash?

Diagnostic Quiz

Retina Quiz Answers (from page 57): 1) a, 2) c, 3) d, 4) d, 5) d

(continued from page 49)

contact lens design.

Aspheric contact lens designs may be beneficial for patients with subjective complaints of blur, glare, halos or for those who have large pupils or a high refractive error. As refractive error increases, so does the magnitude of spherical aberration induced by spherically surfaced contact lenses. Aberrations also increase with increasing pupil size, so patients with pupils larger than 5mm, or patients who work or study in dimly lit environments may be more affected by spherical aberrations. However, it is important to remember that a decrease in higher order aberrations is most relevant when lower order aberrations are minimized.

There are a few caveats to keep in mind when fitting aspheric contact lenses. Decentered aspheric optics may actually degrade vision more than a spherical design, so centration should be evaluated. Also, some aspheric contact lenses correct for different amounts of spherical aberration due to limitations in design or manufacturing capability. Finally, not every patient’s higher order aberrations will fall within the normal population range. While one design may decrease aberrations and improve visual quality for a certain patient, that design may not improve vision for the next patient.

Without access to an aberrometer, it’s best to educate the patient on the benefits of aspheric contact lenses and encourage them to compare the visual quality in their own environment. Patients may need to try one or two brands to find the lens that provides their best vision quality. But, in heeding your oath to enhance patients’ vision and taking the time to address your patient’s subjective complaints of visual quality, you may gain a patient for life.

Your Diagnosis
How would you approach this case? Does this patient require additional tests? What is your diagnosis? How would you manage this patient? What is the likely prognosis?

To find out, visit Review of Optometry Online, www.revoptom.com. Click on the Supplements option on the toolbar icon and then select the icon with this project’s cover on it to view an interactive “Contents” page.

References
12. Neeld, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) Study

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Each day, we have 14 billion little reminders to continue advancing eye health.

From the moment we open our eyes and start to view the possibilities of each new day, we look at how we can improve the well-being of the world’s 14 billion eyes. Will this be the day when one of us unlocks a way to eliminate visual impairment in newborns? Or strikes upon a treatment that actually helps the eye heal itself? To us, these are not some distant hopes. They are the daily questions that add new urgency to all we do and everything we see for the future. We’re Bausch + Lomb. One company solely focused on advancing the vision and care of the world’s eyes.