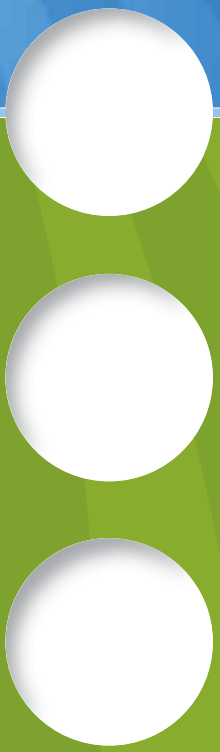
BAUSCH+LOMB

# INSIGHT



BAUSCH + LOMB

Our mission:
Helping you ***SEE*** better – to ***LIVE*** better.

# OUR MISSION STATEMENT

Bausch + Lomb is the company solely dedicated to protecting and enhancing the gift of sight for millions of people around the world – from the moment of birth through every phase of life.

We offer the world's widest and finest range of eye health products, including contact lenses and lens care products, pharmaceuticals, intraocular lenses and other eye surgery products.

Our talented and motivated colleagues work relentlessly to bring innovations to our customers and patients. Our more than 150-year heritage of improving vision has made Bausch + Lomb a global hallmark for innovation and quality.

Our highest priority is the well-being of the people we serve. By listening to our customers and patients, by constantly honing our innovation edge, by executing with integrity and excellence, we strive to earn the trust of our partners and stakeholders and to outperform our competitors. +

# Vision...

a simple word for an incredibly important and complex function. It contributes to our senses of security and freedom, but even these two attributes do not begin to scratch the surface of what vision does for us. The memories of our lives come from the images that we have seen: the faces of family and friends, the birthday and holiday gatherings, the sunsets that we always stop to admire even though we have seen a thousand of them. The significance of vision has always been great, but our eyes now have to adjust to focusing hours each day on electronic devices and changes in the environment. The mission is no longer just to find the right refraction for the best vision, it now encompasses providing patients the best vision while they go about their lives.

My commitment to providing vision care is a personal one. My grandfather was an optometrist and my father made spectacles. I wear spectacles and contact lenses and can still remember the impact of my first pair, which were made in my father's lab, and how they provided such great vision that I could see the leaves on trees again.

At Bausch + Lomb, we believe in protecting and enhancing the precious gift of sight and helping people to see better, so that they may live better.

As you can see from the timeline contained in this book on pages 8 & 9, Bausch + Lomb has a long history of helping people to see the world around them, whether that world was microscopic or light years away.


This year is the 40th anniversary of Bausch + Lomb's Soflens, the first soft contact lens. This product was truly transformational for the contact lens field because it provided unprecedented comfort and convenience, and it opened the door to the development of extended wear lenses a decade later. Our focus today remains on improving vision for patients.

The abstracts and profiles of some of our brilliant lens design team in this book reflect a small part of our commitment and dedication to the optics research being conducted at our world class Optics Center in Rochester, New York.

To learn more about the real-world needs and preferences of patients so that we can develop the products that will have the greatest impact on patients' lives, Bausch + Lomb commissioned the Needs, Symptoms, Incidence, Global Eye Health Trends (NSIGHT) study. This important study of thousands of patients from Asia, Europe, and the United States revealed that vision was the most important consideration in vision care. You can read more about NSIGHT on page 13.


*Bausch + Lomb Lens Design Team*

Bausch + Lomb is a company devoted to vision, made up of people with a vision. We are working hard to be more than just a global eye health company, we want to be the best one, because we understand the importance of vision to our patients and that there is always one more sunset that they will want to remember.

Joe Barr, OD, MS, FAAO
Vice President, Global Clinical and Medical Affairs and
Professional Services, Vision Care
Bausch + Lomb

# EVALUATING THE POWER OF **ASPHERIC MULTIFOCAL CONTACT LENSES**

**PURPOSE:** To compare advantages and disadvantages of two metrology techniques for measuring the power of aspheric multifocal contact lenses, traditional projection imaging (focimeters/lensometers) and high-resolution Hartmann-Shack wavefront sensing.

**METHODS:** Two commercially available multifocal contact lens products (balafilcon A [PureVision multi-Focal] and lotrafilcon B [Ciba Air Optix Aqua multifocal]) were characterized using a high-resolution Hartmann-Shack wavefront sensing instrument (Optocraft SHSInspect) that recorded more than 2800 unique measurements over the central 6 mm of a contact lens and a vertexometer (Nikon PL-2) using custom annular apertures. Lenses were measured in a cuvette for the wavefront sensor, but in air following lens blotting for the vertexometer.

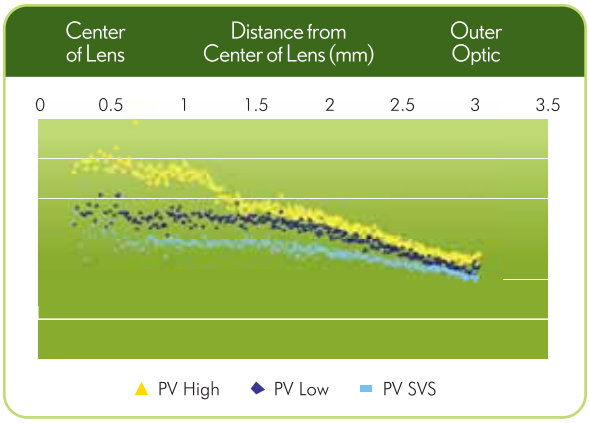
**RESULTS:** The vertexometer characterized contact lenses as the average power at zones predefined by the apertures used, but limited the data available to characterize the change in power across transition zones. Measurements across the central 1.5 mm showed larger variance compared to those from larger apertures, presumably due to the effects of diffraction over the narrow aperture. Wavefront sensing provided a continuous power profile from the lens center to the periphery and provided insight into the spherical/aspheric nature of the contact lenses. Wavefront sensing offered the advantage of characterizing the transmitted wavefront of the contact lenses, but the disadvantage that the reduced number of spots covering the central 1.0 mm of the lens introduced more measurement variation and the data was best discarded.

**CONCLUSIONS:** As the designs of multifocal contact lenses continue to improve, becoming increasingly complex to better meet the needs of presbyopes, sophisticated high-resolution Hartmann-Shack wavefront sensing offers advantages over traditional focimeters.

**POSTER PRESENTED AT:** Annual Meeting of the American Optometric Association; June 15-19, 2011; Salt Lake City, Utah, US

**AUTHORS:** Alexis K. S. Vogt, PhD; Ian G. Cox, OD, FCLSA, FAAO; Amanda C. Kingston, MS

**AFFILIATION:** Bausch + Lomb, Rochester, NY, US




Alexis K. S. Vogt, PhD, is an Optical Design Engineer at Bausch + Lomb in Rochester, New York. She earned her Doctor of Philosophy degree in Optics from the Institute of Optics at the University of Rochester. Alexis is a member of the Optical Society of America.

# INTERVIEW WITH: Alexis K. S. Vogt

Bausch + Lomb's optical design team includes a violinist with a symphony orchestra, a mountain climber, and a triathlete. They're all the same person—Alexis K.S. Vogt—an optical design engineer who relishes a challenge in both her personal and professional pursuits.

The challenge she tackles in the study presented here is a high-tech puzzle: how to accurately measure the power of aspheric multifocal contact lenses, whose power may vary from the center to the periphery of the lens (pg. 4). Conventional metrology techniques don't give a complete picture, but a technique called high-resolution Hartmann-Shack wavefront sensing can provide a continuous power profile of a lens across its entire range, including transition zones, while also determining the lens' precise add.

The study showed that wavefront sensing offered advantages over a traditional focimeter. "For one, it measures the lens while fully hydrated and also clarifies the role of the pupil size in contact lens design."

The pursuit of perfection is both work and pastime for Dr. Vogt, who plays with the University of Rochester Symphony Orchestra. "The structure and rhythm of music—it's a very mathematical way of thinking," she notes. Her other passions are family life and outdoor recreation, together if possible; she and her father have climbed Mount Kilimanjaro and with her husband have together climbed Mounts Rainier and Whitney. If that weren't enough, she and her husband are both Ironman triathletes.

In her 3 years at Bausch + Lomb, Dr. Vogt has found much reason for inspiration and optimism. "We have some terrific new multifocal designs in the pipeline, and I'm excited to see them launch after all the work we've done with wavefront sensing to help them along," she says. "Bausch + Lomb is a great place to be right now, and I'm just happy to be a part of it."

# COMPARISON OF SPHERICAL ABERRATION CONTROL AND VISUAL ACUITY WITH ASPHERIC AND **SPHERICAL CONTACT LENS OPTICS**


**PURPOSE:** Aspheric optics in contact lenses are designed to reduce inherent spherical aberration in the eye. Four studies were conducted to evaluate spherical aberration and visual acuity of two marketed silicone hydrogel lenses (Test: balafilcon A with aspheric optics; Control: senofilcon A with conventional spherical optics) across a range of powers.

**METHODS:** A single power was assessed in each study (+3.00 D, -1.00 D, -5.00 D, and -9.00 D). Cohorts of 22–25 subjects were dilated with 1% tropicamide to achieve 6-mm pupils. Baseline spherical aberration readings and high contrast logMAR visual acuities using a 6-mm artificial aperture were recorded and then repeated with lenses *in situ*. A linear mixed model was employed to analyze data across all studies and within each study, paired comparisons were conducted between Test and Control lenses. A value of $P < 0.05$ was considered statistically significant.

**RESULTS:** The results showed that, over all studies, there was a statistically significant difference in spherical aberration reduction between the lenses. The Test lenses reduced the mean spherical aberration by 0.136 µm whereas the Control lens reduced the spherical aberration by only 0.054 µm. As a corollary, there was a statistically significant difference between the Test and Control lenses for high contrast, high illumination visual acuity (HCHI VA) ($P < 0.001$). On average, the Test lenses provided 3.5 logMAR letters more than the Control lenses. For the -9.00 D, -5.00 D, and +3.00 D powers individually, the Test lenses provided significantly better visual acuity (4.5 letters, 3.5 letters, and 6.5 letters, respectively; $P < 0.05$ in each case).

**CONCLUSIONS:** Incorporating aspheric optics into contact lens designs can reduce the spherical aberration of the eye's optical system. Reduced spherical aberration can improve an individual's visual acuity. This series of studies has shown that the balafilcon A lenses with aspheric optics made significant reductions in spherical aberration and provided better vision outcomes over conventional optics.

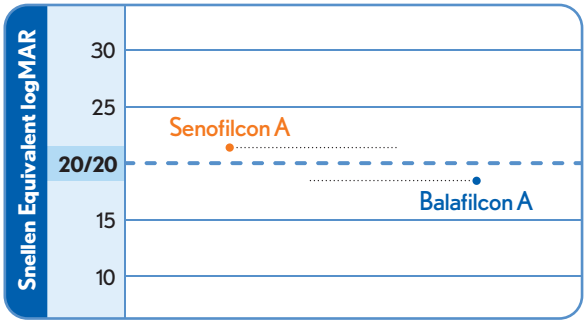


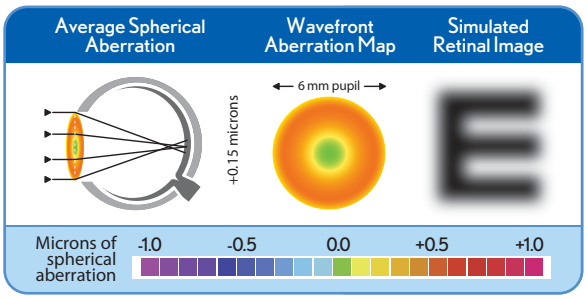
**POSTER PRESENTED AT:** Annual Meeting of the British Contact Lens Association; May 26–29, 2011; Manchester, UK



**AUTHORS:** Gerard Cairns, PhD, FBCLA, FAAO; Jeffery Schafer, OD, MS; Stephanie Su, OD; Gary Mosehauer, MS; William T. Reindel, OD, MS

**AFFILIATION:** Bausch + Lomb, Rochester, NY, US


Gerard Cairns has a Bachelor of Science in Optometry from Glasgow University in Scotland. He practiced in the UK and New Zealand before enrolling in post-graduate studies and was awarded a PhD in Ophthalmology in 2005 from the University of Auckland, New Zealand. Gerard has over 12 years of clinical and research experience. He is a Fellow of the British Contact Lens Association and a Fellow of the American Academy of Optometry.

# 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 first 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.

Facebook.com/PediatricCataract  Twitter.com/PCInitiative

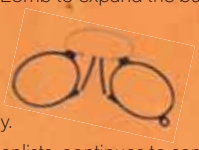
*If you would like to know more about this important initiative, please go to www.pediatriccataract.org or search for The Pediatric Cataract Initiative on Facebook.*

# 1849–1899

## 1849

★ **John Jacob Bausch and Henry Lomb independently emigrate from Germany to the United States.**

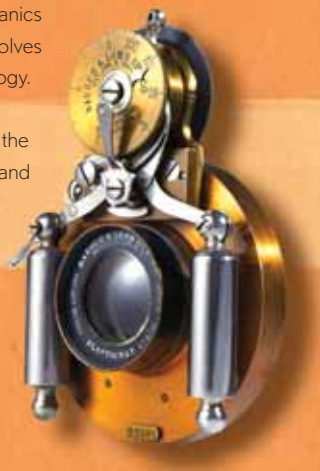
- 1853 J. J. Bausch opens an optical goods store in Rochester, New York. He borrows $60 from friend Henry Lomb to expand the business, sealing the deal with a handshake.
- ★ 1861 J. J. Bausch's revolutionary Vulcanite eyeglass frames become the first great success for the young company.



- 1861 U. S. Civil War begins. Henry Lomb enlists, continues to send a portion of his pay to J. J. Bausch to keep the business running.
- 1863 Henry Lomb becomes a partner in the business; renamed the Bausch & Lomb Optical Company.
- ★ 1874

St. Paul Street factory opens in Rochester, New York.

- 1875 B+L begins microscope production.
- 1883 First B+L photographic lens produced; primarily used in Kodak cameras.
- 1885 Henry Lomb co-founds the Mechanics Institute to train skilled workers; evolves into Rochester Institute of Technology.



- ★ 1887 Edward Bausch, J. J.'s son, patents the "between the lens" iris diaphragm and shutter, helping to give rise to snapshot photography.
- 1893 Telescope and binocular production grows, with B+L soon becoming a dominant manufacturer.

# 1900–1949

- ★ 1902 B+L introduces the Balopticon slide projector, later used by Norman Rockwell to assist with the creation of his iconic illustrations.

- 1912 J. J.'s grandson, William Bausch, begins an experimental optical-quality glass lab at the Rochester plant.
- 1917 B+L advertises its first set of trial frames and test lenses.
- 1917 U. S. government establishes glass research laboratory at B+L in Rochester. Company produces 40,000 pounds of optical glass per month for WW I effort.
- ★ 1918 Ives visual acuity meter and binocular corneal microscope introduced.
- ★ 1922 Launches the Super Cinephor projection lens for movie house use; quickly becomes the industry standard.

- 1926 The first Ray-Ban aviator goggles for military pilots are produced.
- ★ 1928 The B+L keratometer establishes a new standard of quality for ophthalmic measurement.
- 1930 B+L begins manufacturing Green's refractor and eye chart projectors, among a broad range of other ophthalmic instruments.
- ★ 1933 Introduces the B+L Honorary Science Award for high school students; hundreds of thousands of awards since bestowed.
- 1937 Provides employees with group life and health insurance, as well as paid time off.
- ★ 1937 Ray-Ban sunglasses are sold to the public for the first time.

- ★ 1941 B+L produces three million pounds of optical glass products for World War II efforts, including aerial mapping lenses, binoculars, range finders, rifle scopes and more. Devotes 70% of production to military support.


- 1949 Develops ultraviolet microscope optics for cancer research.

# 1950-1999

- 1952 CinemaScope lens introduced, which brings widescreen projection to movie theaters worldwide.


- 1953 B+L celebrates its centennial.
- 1954 Awarded the Oscar from the Motion Picture Academy of Arts & Sciences for the CinemaScope lens.
- 1958 B+L shares begin trading on the New York Stock Exchange.
- 1962 Creates a sun simulator for NASA's Jet Propulsion Laboratory.
- ★ 1965  First images of the surface of the moon are taken using B+L Super Baltar lenses.
- 1966 Acquires the rights to develop poly-HEMA, a hydrogel material that would become the first mass-produced soft contact lens.
- ★ 1971 B+L introduces Soflens, the world's first mass-produced soft contact lens. Sales top $10 million by the end of the year.

- 1974 An estimated one million patients wear Soflens contact lenses.
- ★ 1975 Bausch + Lomb becomes a Fortune 500 company.
- 1977 First Soflens television commercials aired across the U. S.
- ★ 1979 Develops its first toric contact lens.
- 1980 Waterford, Ireland contact lens manufacturing plant constructed.
- 1982 Creates the company's first bifocal contact lens.
- 1983 Greenville, South Carolina facility opens to produce contact lens solutions.
- ★ 1983 *Risky Business* features actor Tom Cruise in Ray-Bans, further propelling global recognition and sales. He wears them again three years later in *Top Gun*.
- 1983 Polymer Technology Corporation, a leader in rigid gas permeable contact lenses and solutions, is acquired; *Boston* brand joins the B+L portfolio.
- 1986 Begins contact lens production in China.
- 1986 Company expands into the ophthalmic pharmaceuticals business with the acquisition of Dr. Mann Pharma in Berlin.
- 1987 ReNu multi-purpose solution, launched in 1987, was the first broadly commercialized soft contact lens multi-purpose solution.
- 1987 Acquires Pharmafair Inc., further deepening expertise in pharmaceuticals.

- 1988 State-of-the-art research and development facility opens at Rochester's Optics Center site.
- 1992 B+L becomes one of ten global sponsors of the Olympic games.
- 1995-1999 B+L divests its binoculars/sports optics, dental, skin care and hearing aid businesses, returning to a singular focus on eye health.
- 1996 Acquires Award plc, anticipating the rise of the daily disposable lens market.
- ★ 1997 Establishes a Surgical business unit through acquisitions of Chiron Vision and Storz Ophthalmics, focusing on cataract surgery, vitreoretinal surgery, and laser vision correction.
- ★ 1998 Lotemax launched, beginning the company's emergence as a leader in ophthalmic anti-inflammatory pharmaceuticals.
- ★ 1998 ReNu MultiPlus, the world's first all-in-one multi-purpose soft contact lens cleaning solution is introduced.
- ★ 1999 PureVision, the world's first silicone hydrogel contact lens, is introduced.


- 1999 Sells sunglasses business to Luxottica Group S.p.A.

# THE 21st CENTURY

- 2000 The company expands its pharmaceuticals reach in Europe and related export markets with the acquisition of Groupe Chauvin.
- 2001 Company launches Ocuvite PreserVision to combat age-related macular degeneration.
- ★ 2002 Soflens multi-focal contact lenses launched.


- 2003 U. S. FDA approves the Zyoptix personalized laser vision correction system to treat distortions unique to each eye.
- 2003 B+L celebrates its 150th anniversary.
- ★ 2005  Retisert introduced as the world's first intravitreal drug implant for the treatment of chronic non-infectious uveitis.
- 2005 Acquires a controlling interest in Shandong Chia Tai Freda Pharm. Group, China's leading ophthalmic pharmaceuticals company.
- 2006 PureVision toric and multi-focal contact lenses introduced.
- 2007 Soothe eye drops acquired to expand dry eye portfolio; Soothe XP introduced.

- ★ 2007 The Stellaris Vision Enhancement System is launched, breaking new ground in cataract surgery.
- 2008 Soflens daily disposable contact lenses introduced.
- 2008 Eyeonics acquired, adding Crystalens - the first FDA-approved accommodating intraocular lens for the treatment of cataracts - to the B+L portfolio.

- 2008 Akreos AO intraocular lens becomes available; micro-incision version launches the following year.
- 2009 Besivance introduced for the treatment of bacterial conjunctivitis.
- 2009 Refractive surgery joint venture finalized to form Technolas Perfect Vision.
- 2009 Transparent bottle for renu fresh launched to consumer acclaim.
- 2010 B+L Early Vision Institute formed.
- 2010 Surgical portfolio expands with the introduction of Stellaris PC and Crystalens AO intraocular lens.
- 2010 Pharmaceuticals portfolio acquires Zirgan and introduces Soothe Xtra Hydration and PreserVision AREDS 2.


- ★ 2010 Biotrue multipurpose solution and PureVision 2 HD introduced.
- ★ 2011 NATURELLE, B+L's first circle/limbal ring contact lens is introduced in Korea.

# DETERMINING THE OPTIMUM SPHERICAL ABERRATION CORRECTION OF THE LOW **MYOPIC HUMAN EYE WITH CONTACT LENSES**


**PURPOSE:** To determine the optimal amount of spherical aberration correction to design in a single vision spherical contact lens.

**METHODS:** 118 clinical eye models were created in commercially available optical design software (Zemax™) based on data measured in a series of refractive surgery studies conducted under a uniform protocol. The modeling inclusion criteria were: (1) eyes had a spherical refraction between -1.00 D and -4.00 D; and (2) the eyes had less than 0.75 D of refractive cylinder with a 5.0-mm pupil diameter. A series of -3.00 D contact lens designs were created that provided a range of ±0.30 µm of spherical aberration over a 6.0-mm diameter in 0.05-µm increments. The spherical aberration contact lenses were applied to each of the 118 eye models. The retinal image quality was then assessed with each contact lens centered and decentered relative to the pupil using a novel pattern matching metric.

**RESULTS:** The average spherical aberration of the population analyzed in this study was +0.18 µm over a 6-mm pupil. Analysis of the retinal image quality metric showed that the optimal amount of spherical aberration correction was 85% of the original measured ocular value. For this population, this is approximately -0.15 µm of spherical aberration over a 6.0-mm pupil diameter.

**CONCLUSIONS:** The results of this analysis showed that there was an improvement in predicted retinal image quality when a patient's nominal spherical aberration was corrected by 85%. The percent correction is dependent on lens fitting on the eye, which is influenced by patient factors and material properties of the contact lens.

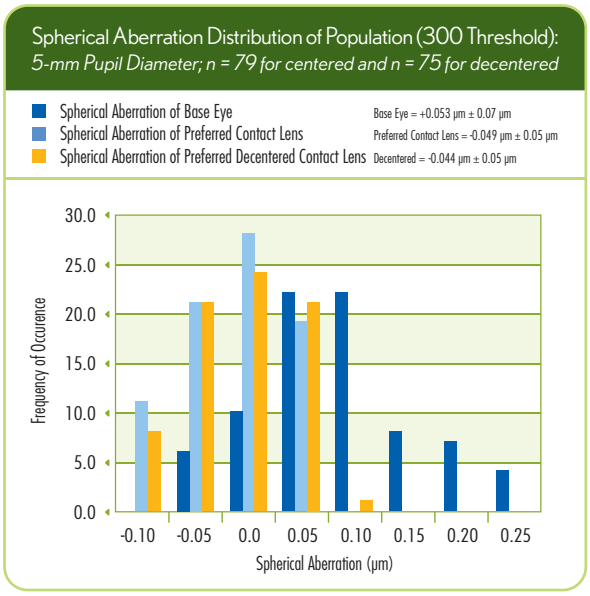


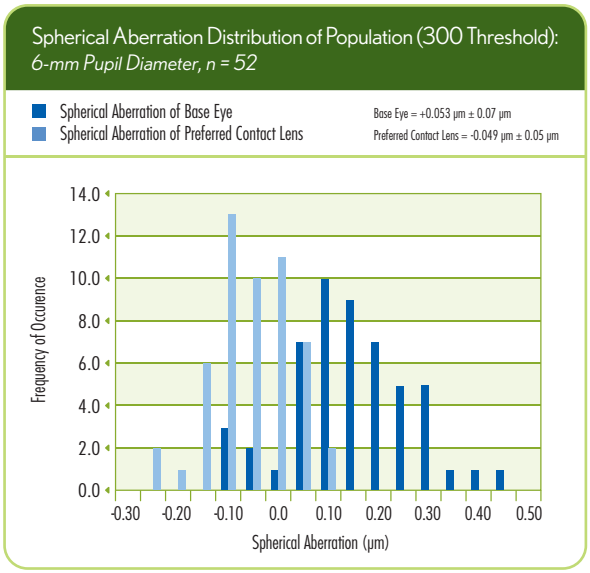
**POSTER PRESENTED AT:** Annual Meeting of the American Optometric Association; June 15-19, 2011; Salt Lake City, Utah, US



**AUTHORS:** Amanda C. Kingston, MS; Ian G. Cox, PhD, FCLSA, FAAO; Alexis K. S. Vogt, PhD

**AFFILIATION:** Bausch + Lomb, Rochester, NY, US



Amanda C. Kingston is an Optical Design Engineer, Vision Care R&D at Bausch + Lomb where she designs lenses and evaluates the optical performance based on predictive models of visual acuity. Amanda has over 6 years of experience in the ophthalmic industry. She earned her Bachelor of Sciences degree and Master of Sciences degree in Optics from the University of Rochester. She also is a Corporate Certified Ophthalmic Assistant through JCAHPO.

# INTERVIEW WITH: Amanda C. Kingston

There's no such thing as a typical work day for Amanda C. Kingston, optical design engineer at Bausch + Lomb. Some days find her fitting a novel contact lens in the company's research clinic; on others, she may scroll through so many Snellen charts "that my co-workers wonder how I don't just throw my computer through a wall," she recounts. On the tedious days, she cranks up classic rock or jazz, and unwinds after work playing saxophone in a Bausch + Lomb ensemble that includes colleague Gerard Cairns (pg. 6).

Diligence, precision and passion—for music and for optical design—characterize Amanda, who attributes her fascination with engineering to her father, a designer and builder who taught her that "it's all about physics." At Bausch + Lomb, she describes her role as "understanding how a design will hold up in the real world." Exploring the physics of the human eye through digital models is a recent innovation, and Amanda is helping Bausch + Lomb pioneer their use in predicting retinal image quality. She is pursuing the dream of every ECP who has ever fitted a contact lens: to accurately predict the best lens design and fit for every patient. Her two abstracts presented here explore different applications of a cutting-edge computer eye-modeling technology designed towards that goal.


One priority is refining the metrics to better match clinical tests of real patients, as shown in her second abstract (pg. 12). "Previous systems gave a good idea of what the average eye looks like," she explains. In her other abstract (pg. 10), the eye-modeling software was used to analyze spherical aberration in 118 low-myopic "virtual eyeballs," which were then tested while "wearing" a series of aspheric contact lens designs.

Such studies are part of Bausch + Lomb's ongoing quest to develop tools that will help ECPs determine optimal lens designs for various populations, Amanda notes, acknowledging that no computer will ever substitute for the interaction between ECP and patient.

# UTILIZING CLINICAL EYE MODELS TO PREDICT **RETINAL IMAGE QUALITY OF INDIVIDUALS**

**PURPOSE:** To correlate retinal image quality metrics output from custom Zemax™ clinical eye models with visual acuity results recorded in a multifocal lens clinical study.

**METHODS:** Clinical diagnostic measurements were used to create Zemax™ models of individual patient's eyes. These clinical eye models were then used to generate a retinal image quality metric that was correlated with the visual acuity results from a multifocal lens clinical study. Three different contrast and illumination conditions were used in the clinical study: (1) normalized high contrast, high illumination (NHCHI); (2) normalized low contrast, high illumination (NLCHI); and (3) normalized low contrast, low illumination (NLCLI). All three conditions were correlated with the retinal image quality metric (weighted pattern recognition score[1]) calculated from the Zemax™ models.

**RESULTS:** The percent correlation was calculated for each of the three clinical conditions with the weighted pattern recognition score. NHCHI yielded a correlation of 76.47%, NLCHI correlated with 82.35% and NLCLI correlated with 88.25%. Normalized 20/20 Geometrical convolved E's were also exported from Zemax™ in order to give a subjective comparison of the patient's perceived visual acuity.

**CONCLUSIONS:** Clinical eye models can be used to predict retinal image quality for a diverse population of eyes. By using this population of clinical eye models, it is now possible to model different lens design concepts to determine what a patient's visual acuity results will be with that lens.

**POSTER PRESENTED AT:** Annual Meeting of the British Contact Lens Association; May 26-29, 2011; Manchester, UK

**AUTHORS:** Amanda C. Kingston, MS; Ian G. Cox OD, FCLSA, FAAO; Alexis K. S. Vogt, PhD

**REFERENCE:** [1]Pinto C, Kingston A, Venkiteshwar M, Ludington P. Pattern recognition as a retinal image quality metric. *Invest Ophthalmol Vis Sci.* 2008;49: E-Abstract 995.

**AFFILIATION:** Bausch + Lomb, Rochester, NY, US

**TABLE 1:** Patient Preference With Outputs From Eye Models and Visual Acuity From Clinic

| Subject ID | Weighted Pattern Matching Score | NHCHI | NLCHI | NLCLI |
|---|---|---|---|---|
| 78 | B | B | B | B |
| 125 | B | B | B | B |
| 131 | B | B | B | B |
| 135 | B | A | B | B |
| 136 | B | C | B | B |
| 137 | B | B | B | B |
| 138 | B | B | C | B |
| 139 | B | B | B | B |
| 140 | B | B | B | B |
| 141 | B | C | C | C |
| 142 | B | B | B | B |
| 143 | B | B | A | B |
| 144 | B | A | B | B |
| 145 | B | B | B | A |
| 146 | B | B | B | B |
| 148 | B | B | B | B |
| 149 | B | B | B | B |

**LEGEND:**
A = 19-2 & 17-3 yielded equal visual acuity results
B = Patient preferred 19-2
C = Patient preferred 17-3

Amanda C. Kingston is an Optical Design Engineer, Vision Care R&D at Bausch + Lomb where she designs lenses and evaluates the optical performance based on predictive models of visual acuity. Amanda has over 6 years of experience in the ophthalmic industry. She earned her Bachelor of Sciences degree and Master of Sciences degree in Optics from the University of Rochester. She also is a Corporate Certified Ophthalmic Assistant through JCAHPO.

# NEEDS, SYMPTOMS, INCIDENCE,
# GLOBAL EYE HEALTH TRENDS (NSIGHT) STUDY

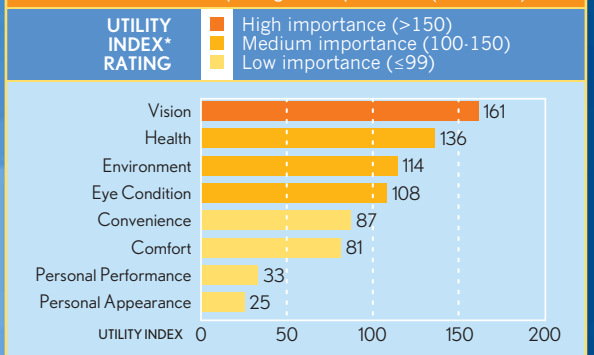
The dedicated eye health scientists whose work appears in these pages go to extraordinary lengths to achieve the ideal match between their science and innovations and the complex structure and workings of the human eye. With all the tools and resources at their disposal, however, the one thing they cannot do is experience daily life through the eyes of ordinary people throughout the world.

NSIGHT
Needs, Symptoms, Incidence, Global Eye Health Trends

To help bridge that gap, Bausch + Lomb funded the NSIGHT Study. Conducted by an independent research firm, this groundbreaking study surveyed 3800 vision-corrected patients (contact lens and spectacle wearers), 15 to 65 years of age, from 7 different countries (China, Japan, Korea, France, Italy, United Kingdom, United States). Respondents provided detailed information about their needs and preferences with regard to eye care products, as well as ocular symptoms.


The standout finding was the paramount importance patients attached to achieving the best vision possible. The preeminence of vision was unanimous across regions and vision correction type. (Fig. 1)

Figure 1. Ranking of Product Feature Categories From Most to Least Compelling to Respondents (N=3800)




*Higher scores indicate more compelling to patients. A score of 200 indicates twice as compelling as a score of 100.

The results of the NSIGHT Study, which have already begun to be disseminated at congress meetings, provide eye care professionals with new, in some cases unexpected, insights into their patients' needs and preferences. (Table 1) These findings can help eye care practitioners 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.

Table 1. NSIGHT Data Publications

PAPERS/POSTERS

Donnelly C, Koks M, Merchea M, Rah M. Vision-related symptoms in a vision lens-corrected global population survey: European findings. Poster presented at: Annual Meeting of the British Contact Lens Association; May 26-29, 2011; Manchester, UK.

Mack CJ, Merchea M, Thomas H. A global survey reveals vision needs of highest importance amongst a vision-corrected population. Poster presented at: Annual Meeting of the American Academy of Optometry; November 17-20, 2010; San Francisco, California, USA.

PUBLICATIONS

Mack C, Donnelly C. A global hierarchy of vision care needs. *Optician*. April 3, 2011.

Walline J. Visual symptoms: how common are they. *Optician*. February 2011.

ON-LINE PUBLICATIONS

Rah MJ, Mack CJ, Merchea M. Vision needs shown to be of highest importance amongst a vision-corrected population. Available at: www.academyofvisioncare.com/uk/en/info/626-vision-needs-shown-to-be-of-highest-importance-amongst-a-vision-corrected-population.

# WAVEFRONT ABERRATIONS OF THE HUMAN EYE – **A LARGE POPULATION SAMPLE**

**PURPOSE:** To investigate the wavefront aberration of a large population of physiologically normal eyes.

**METHODS:** Subjects were recruited to participate in a series of studies (12) designed to investigate the performance of clinical outcomes of wavefront-correcting and wavefront-guided LASIK procedures. As part of the preoperative biometry measurements, a Bausch + Lomb Zywave wavefront sensor was used to measure the lower and higher wavefront aberration of each eye for a 6-mm pupil size. Three Zywave measurements were collected in both eyes of each subject while fixating at infinity.

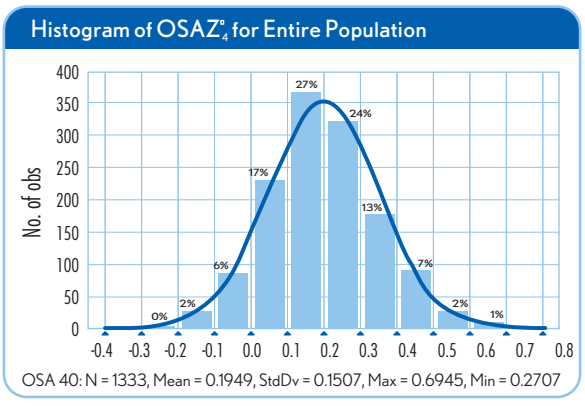
**RESULTS:** Since all studies were conducted under identical preoperative protocols, the combined results for this analysis represent the single largest population of wavefront aberration measurements in normal preoperative eyes performed under identical and controlled conditions, with a total sample size of 1333 eyes, representing 1159 myopic eyes and 174 hyperopic eyes. Myopic subjects had a mean spherical refraction of -4.03 D, with a minimum of -0.50 D, and a maximum of -10.00 D, and a mean manifest sphere power of 2.94 D, with a minimum of 1.00 D, and a maximum of 6.00 D for the hyperopic eyes. The mean age of the population was 35.01 years with a range from 19 to 70 years of age. There were 814 Caucasian eyes vs. 519 Asian eyes represented in the sample. The distribution between males and females was 533 vs. 742, respectively. A large variation in wavefront aberration was found for 2nd through 5th order Zernike coefficients, with the magnitude of variation decreasing as the order increased. The population variation for each Zernike coefficient was centered around zero for all but primary spherical aberration, which demonstrated a slightly under-corrected distribution peak with a mean value of 0.18 for the myopic eyes and 0.27 for hyperopic eyes. Primary coma showed the largest population variation after defocus and astigmatism. Spherical aberration showed the greatest correlation with age (r = 0.28), with under-corrected spherical aberration increasing with age. Refractive error was not correlated with spherical aberration (r < 0.10 for both myopia and hyperopia), whereas corneal curvature was significantly correlated with spherical aberration (r =-0.32), becoming more under-corrected with steeper corneal curvature.

**CONCLUSIONS:** The results of this large sample population study of wavefront aberration supports previous reports of smaller samples in regards to the trends seen with higher-order wavefront aberrations and the average spherical aberration value reported for myopic eyes. However, this study extends these relationships to a relatively large sample that can be subdivided into age, race, gender, and ametropia to more closely study the relationships between these variables. Contact lenses designed to correct the spherical aberration inherent in the human eye may benefit from a closer examination of these subgroups within the population as a whole.

**POSTER PRESENTED AT:** Annual Meeting of the British Contact Lens Association; May 26-29, 2011; Manchester, UK

**AUTHORS:** Ian G. Cox, OD, FCLSA, FAAO; Alexis K.S. Vogt, PhD; Amanda C. Kingston, MS

**AFFILIATION:** Bausch + Lomb, Rochester, NY, US




Ian G. Cox has a Bachelor of Optometry degree with honors and a PhD from the University of New South Wales in Sydney, Australia. In addition to being a Distinguished Research Fellow, Ocular Research, and Director of Lens Design, Optics, and Advanced Tooling – Contact Lenses at Bausch + Lomb, Ian is an Adjunct Professor at the University of Rochester, in Rochester, New York. He is a member of several ophthalmologic/optometric associations, and is a Fellow of the Contact Lens Society of Australia and American Academy of Optometry. He is a reviewer for ten ophthalmologic/optometric journals and has numerous abstracts and journal publications to his credit.

# INTERVIEW WITH: Ian G. Cox

Ian G. Cox describes himself as "the old guy with the experience, working with the young team full of energy and enthusiasm." The Australian-born Dr. Cox, who is both distinguished research fellow at Bausch + Lomb and director of the lens design group, confesses to being as excited about vision research as he was when he got his own PhD. "And I was pretty excited then," he recalls.

Hardly fitting the picture of a staid company veteran, Dr. Cox races a Ducati motorcycle in his off-hours. The racetrack isn't the only place where he's experienced dramatic acceleration. In his 25-year career, he has studied visual optics with ever more powerful tools, and he believes his field is poised for explosive growth in knowledge.

Wavefront sensors, Dr. Cox says, have changed what's possible in contact lens design. "Before, measuring subtle optics during wear was empirical; all our great calculations would go out the window as the lens got squeezed into a different shape on the eye itself. This new technology opened the door to better understanding what we're doing."

The abstract presented here (pg. 14) by Dr. Cox, Dr. Vogt, and Amanda Kingston gathers the largest array of measurements yet published documenting wavefront aberrations of the human eye. "The database of more than 1,300 eyes extends the known relationships between spherical aberration and factors like age, corneal curvature, and other factors," he explains. This type of measurement, pioneered by Bausch + Lomb and the University of Rochester to guide refractive surgery, led to the company's development of aspheric contact lenses that could correct for spherical aberration, a major advance over conventional fitting.

"Leading our lens design team has re-energized me at a time when many people start thinking about retirement," says Dr. Cox. "My team has the skills and technology to do things I only dreamed of at their age." According to Dr. Cox, the industry is on the brink of a revolution in visual correction. "It's at our fingertips: technology for measuring patients, making lenses, and bringing the two together. In the next few years, we expect to see a steady stream of impressive products as a result."

# EXPERIENTIAL FACTORS THAT INFLUENCE **MULTIFOCAL CONTACT LENS SATISFACTION**


**PURPOSE:** The importance of meeting presbyopic patient's needs grows with the aging population. Satisfaction with the overall contact lens-wearing experience can be impacted by material characteristics and optical design. The purpose of this study was to evaluate satisfaction of adapted omafilcon A (Proclear) multifocal (PM) wearers and balafilcon A (PureVision) multifocal (PVMF) wearers.

**METHODS:** 150 PVMF and 107 PM wearers that had been wearing their respective lenses for at least three months completed an online survey conducted by an independent market research firm. Experiential factors most impactful to multifocal wearers in driving them to speak to their practitioners about switching brands were assessed. Specific lens performance attributes experienced by the wearers were also queried.

**RESULTS:** The top five influencers of switching brands were comfort throughout the day; clarity of mid-range, near, and far-distance vision; and ease of transition between near and far-distance. PVMF wearers were more satisfied with their complete lens-wearing experience, PVMF 91% vs. PM 82% ($P < 0.05$). Composite ratings for vision and comfort also favored PVMF over PM, 81% vs. 68% and 91% vs. 79%, respectively ($P < 0.05$).

**CONCLUSIONS:** While satisfaction with comfort is higher than with vision quality, vision-related attributes are the most common reason patients would ask about switching brands. Most multifocal wearers were satisfied with their lenses; however, PVMF wearers were more satisfied with their complete multifocal experience when compared to PM wearers. With vision and comfort favoring PVMF, differences in material and optical design characteristics likely contributed to greater satisfaction with the multifocal experience.

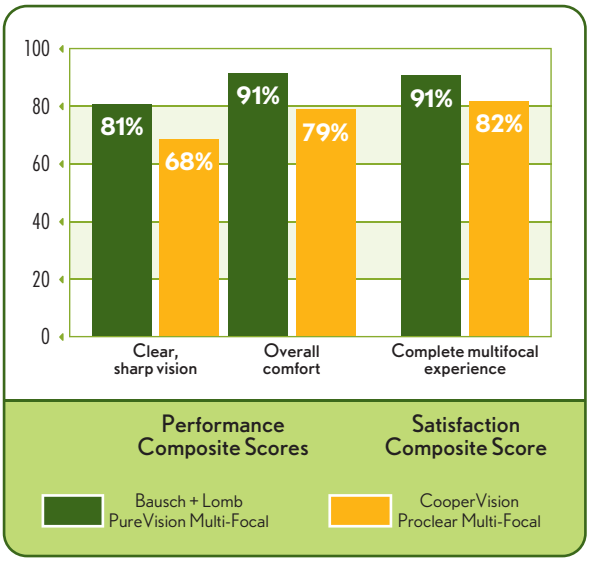


**POSTER PRESENTED AT:** Annual Meeting of the British Contact Lens Association; May 26-29, 2011; Manchester, UK



**AUTHORS:** William T. Reindel, OD, MS[1]; Elizabeth Gillmeister, MA, MLS[1]; Gary Garrelick, MSIA[2]

**AFFILIATIONS:** [1]Bausch + Lomb, Rochester, NY, US; [2]Directive Analytics, Trumbull, CT, US



William T. Reindel, OD, MS, is Director, Global Medical Affairs - Vision Care at Bausch + Lomb. He earned a Master of Science degree in physiological optics at The Ohio State University in Columbus, Ohio, and a Doctor of Optometry degree from Ferris State University in Big Rapids, Michigan, USA.

# SYMPTOMS OF GLARE, HALO, AND BLUR IN A **EUROPEAN VISION-CORRECTED POPULATION**

**PURPOSE:** To identify common ocular symptoms in a 15- to 65-year-old vision-corrected population, with respect to incidence, impact on quality of life, management strategy, and overall satisfaction with available treatments.

**METHODS:** In an online survey, vision-corrected subjects were asked if they had symptoms related to halo; glare; tired, sensitive, itchy, dry, red, or watery eyes; eye strain; puffy or swollen eyes; pain inside the eyes; headaches after near work; blurry or hazy vision; and burning sensation. Subjects were then asked how frequent and bothersome their symptoms were and their availability of and interest in a solution.

**RESULTS:** Fourteen hundred (1400) vision-corrected subjects were enrolled in this European survey. Twenty-eight percent (28%) reported experiencing halo, 34% reported experiencing blurred or hazy vision, and 53% reported experiencing glare, with approximately half experiencing these symptoms at least 3-4 times per week. Blurry vision was most frequently reported. The symptom of halo was significantly higher (38%) for contact lens wearers when compared to all subjects. At least 75% of those with symptoms reported them as bothersome. At least 84% are interested in a solution while fewer than 15% have a complete solution. Glare and halo were most prevalent with bright lights, driving, and in dark places. Blurred or hazy vision was experienced primarily when tired or focusing on near objects (computer, reading, television).

**CONCLUSIONS:** Vision-related symptoms of glare, halo, and blurred vision are very common and bothersome. There is an unmet need for better vision correction and a perceived lack of acceptable solutions in this European vision-corrected population.

**POSTER PRESENTED AT:** Annual Meeting of the British Contact Lens Association; May 26-29, 2011; Manchester, UK

**AUTHORS:** Cheryl Donnelly, FBDO CL, FBCLA[1]; Mark Koks[2]; Marjorie J. Rah, OD, PhD[3]; Alexis Vogt, PhD[3]

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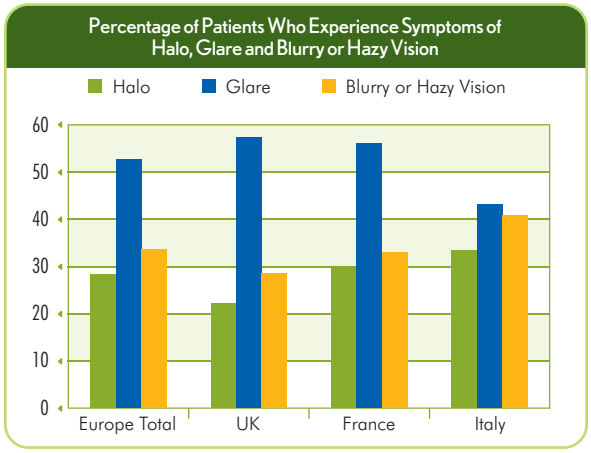


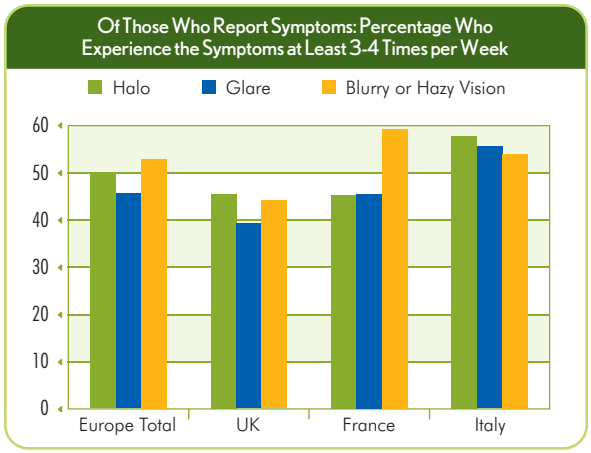


Cheryl Donnelly is Director, Medical Affairs for Bausch + Lomb Vision Care Division in Europe, the Middle East, and Africa (EMEA). Cheryl has enjoyed a varied career over her 25 years in the business, including practice in a leading UK multiple and several educational roles, such as Clinical Demonstrator at Aston University for the final year contact lens clinics. Cheryl joined the British Contact Lens Association (BCLA) Council as Dispensing Section Chair in 1997 and became President in 2000. She was awarded a Fellowship of the BCLA in 2007.

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